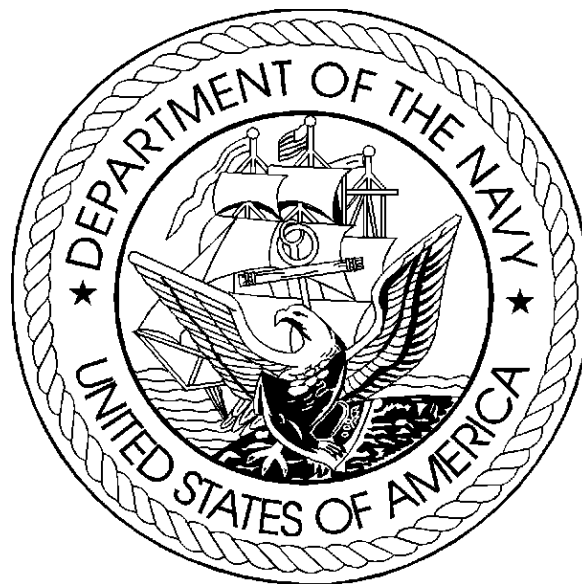


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**Department of Defense
Fiscal Year (FY) 2012 President's Budget**

February 2011



Navy

Justification Book Volume 1

Research, Development, Test & Evaluation, Navy

Budget Activity 1-3

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Department of the Navy
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 Total Obligational Authority
 (Dollars in Thousands)

24 Jan 2011

Summary Recap of Budget Activities	FY 2010 (Base & OCO)	FY 2011 Base Request with CR Adj	FY 2011 OCO Request with CR Adj	FY 2011 Total Request with CR Adj	FY 2011 Annual CR Base	FY 2011 Annual CR OCO	FY 2011 Annual CR Total
Basic Research	543,850	556,425		556,425	626,082		626,082
Total Research, Development, Test & Eval, Navy	543,850	556,425		556,425	626,082		626,082
Summary Recap of FYDP Programs							
Research and Development	543,850	556,425		556,425	626,082		626,082
Total Research, Development, Test & Eval, Navy	543,850	556,425		556,425	626,082		626,082

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Department of the Navy
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 (Dollars in Thousands)

24 Jan 2011

Summary Recap of Budget Activities	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Basic Research	577,372		577,372
Total Research, Development, Test & Eval, Navy	577,372		577,372
Summary Recap of FYDP Programs			
Research and Development	577,372		577,372
Total Research, Development, Test & Eval, Navy	577,372		577,372

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Department of the Navy
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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2010 (Base & OCO)	FY 2011 Base Request with CR Adj	FY 2011 OCO Request with CR Adj	FY 2011 Total Request with CR Adj	FY 2011 Annual CR Base	FY 2011 Annual CR OCO	FY 2011 Annual CR Total	S e c
1	0601103N	University Research Initiatives	01	99,098	108,679		108,679	122,284		122,284	U
2	0601152N	In-House Laboratory Independent Research	01	21,129	17,979		17,979	20,230		20,230	U
3	0601153N	Defense Research Sciences	01	423,623	429,767		429,767	483,568		483,568	U
		Basic Research		543,850	556,425		556,425	626,082		626,082	
Total Research, Development, Test & Eval, Navy				543,850	556,425		556,425	626,082		626,082	

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Department of the Navy
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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Element Number	Program Item	Act	FY 2012 Base	FY 2012 OCO	FY 2012 Total	Se c
1	0601103N	University Research Initiatives	01	113,157		113,157	U
2	0601152N	In-House Laboratory Independent Research	01	18,092		18,092	U
3	0601153N	Defense Research Sciences	01	446,123		446,123	U
		Basic Research		577,372		577,372	
Total Research, Development, Test & Eval, Navy				577,372		577,372	

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Summary Recap of Budget Activities -----	FY 2010 (Base & OCO)	FY 2011 Base Request with CR Adj	FY 2011 OCO Request with CR Adj	FY 2011 Total Request with CR Adj	FY 2011 Annual CR Base	FY 2011 Annual CR OCO	FY 2011 Annual CR Total
Applied Research	728,374	678,680		678,680	763,641		763,641
Total Research, Development, Test & Eval, Navy	728,374	678,680		678,680	763,641		763,641
Summary Recap of FYDP Programs -----							
Research and Development	728,374	678,680		678,680	763,641		763,641
Total Research, Development, Test & Eval, Navy	728,374	678,680		678,680	763,641		763,641

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 (Dollars in Thousands)

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Summary Recap of Budget Activities	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Applied Research	783,794		783,794
Total Research, Development, Test & Eval, Navy	783,794		783,794
Summary Recap of FYDP Programs			
Research and Development	783,794		783,794
Total Research, Development, Test & Eval, Navy	783,794		783,794

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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2010 (Base & OCO)	FY 2011 Base Request with CR Adj	FY 2011 OCO Request with CR Adj	FY 2011 Total Request with CR Adj	FY 2011 Annual CR Base	FY 2011 Annual CR OCO	FY 2011 Annual CR Total	S e c
4	0602114N	Power Projection Applied Research	02	79,762	98,150		98,150	110,437		110,437	U
5	0602123N	Force Protection Applied Research	02	154,170	107,448		107,448	120,899		120,899	U
6	0602131M	Marine Corps Landing Force Technology	02	44,452	43,776		43,776	49,256		49,256	U
7	0602234N	Materials, Electronics and Computer Technology	02	2,788							U
8	0602235N	Common Picture Applied Research	02	88,467	70,168		70,168	78,952		78,952	U
9	0602236N	Warfighter Sustainment Applied Research	02	121,588	113,724		113,724	127,961		127,961	U
10	0602271N	Electromagnetic Systems Applied Research	02	72,192	83,902		83,902	94,405		94,405	U
11	0602435N	Ocean Warfighting Environment Applied Research	02	52,363	49,491		49,491	55,687		55,687	U
12	0602651M	Joint Non-Lethal Weapons Applied Research	02	5,836	6,002		6,002	6,753		6,753	U
13	0602747N	Undersea Warfare Applied Research	02	64,000	69,186		69,186	77,847		77,847	U
14	0602782N	Mine and Expeditionary Warfare Applied Research	02	42,756	36,833		36,833	41,444		41,444	U
Applied Research				728,374	678,680		678,680	763,641		763,641	
Total Research, Development, Test & Eval, Navy				728,374	678,680		678,680	763,641		763,641	

R-1P: FY 2012 President's Budget (With FY 2011 CR Adjustments), as of January 24, 2011 at 11:18:09

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Department of the Navy
 FY 2012 President's Budget
 Exhibit R-1 FY 2012 President's Budget
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 (Dollars in Thousands)

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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2012 Base	FY 2012 OCO	FY 2012 Total	Se
4	0602114N	Power Projection Applied Research	02	104,804		104,804	U
5	0602123N	Force Protection Applied Research	02	156,901		156,901	U
6	0602131M	Marine Corps Landing Force Technology	02	44,845		44,845	U
7	0602234N	Materials, Electronics and Computer Technology	02				U
8	0602235N	Common Picture Applied Research	02	65,448		65,448	U
9	0602236N	Warfighter Sustainment Applied Research	02	101,205		101,205	U
10	0602271N	Electromagnetic Systems Applied Research	02	108,329		108,329	U
11	0602435N	Ocean Warfighting Environment Applied Research	02	50,076		50,076	U
12	0602651M	Joint Non-Lethal Weapons Applied Research	02	5,937		5,937	U
13	0602747N	Undersea Warfare Applied Research	02	108,666		108,666	U
14	0602782N	Mine and Expeditionary Warfare Applied Research	02	37,583		37,583	U
Applied Research				783,794		783,794	
Total Research, Development, Test & Eval, Navy				783,794		783,794	

R-1P: FY 2012 President's Budget (With FY 2011 CR Adjustments), as of January 24, 2011 at 11:18:09

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 (Dollars in Thousands)

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Summary Recap of Budget Activities -----	FY 2010 (Base & OCO)	FY 2011 Base Request with CR Adj	FY 2011 OCO Request with CR Adj	FY 2011 Total Request with CR Adj	FY 2011 Annual CR Base	FY 2011 Annual CR OCO	FY 2011 Annual CR Total
Advanced Technology Development	841,149	725,599	14,100	739,699	816,435	23,259	839,694
Total Research, Development, Test & Eval, Navy	841,149	725,599	14,100	739,699	816,435	23,259	839,694
Summary Recap of FYDP Programs -----							
Research and Development	841,149	725,599	14,100	739,699	816,435	23,259	839,694
Total Research, Development, Test & Eval, Navy	841,149	725,599	14,100	739,699	816,435	23,259	839,694

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Department of the Navy
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Summary Recap of Budget Activities	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Advanced Technology Development	648,217		648,217
Total Research, Development, Test & Eval, Navy	648,217		648,217
Summary Recap of FYDP Programs			
Research and Development	648,217		648,217
Total Research, Development, Test & Eval, Navy	648,217		648,217

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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2010 (Base & OCO)	FY 2011 Base Request with CR Adj	FY 2011 OCO Request with CR Adj	FY 2011 Total Request with CR Adj	FY 2011 Annual CR Base	FY 2011 Annual CR OCO	FY 2011 Annual CR Total	S e c
15	0603114N	Power Projection Advanced Technology	03	114,524	117,908		117,908	132,669		132,669	U
16	0603123N	Force Protection Advanced Technology	03	94,569	61,877		61,877	69,623		69,623	U
17	0603235N	Common Picture Advanced Technology	03	105,124	96,720		96,720	108,828		108,828	U
18	0603236N	Warfighter Sustainment Advanced Technology	03	92,138	98,261		98,261	110,562		110,562	U
19	0603271N	Electromagnetic Systems Advanced Technology	03	77,612	82,143	14,100	96,243	92,426	23,259	115,685	U
20	0603640M	USMC Advanced Technology Demonstration (ATD)	03	138,913	115,089		115,089	129,497		129,497	U
21	0603651M	Joint Non-Lethal Weapons Technology Development	03	10,688	11,131		11,131	12,524		12,524	U
22	0603729N	Warfighter Protection Advanced Technology	03	51,062	18,076		18,076	20,339		20,339	U
23	0603747N	Undersea Warfare Advanced Technology	03	74,178	49,276		49,276	55,445		55,445	U
24	0603758N	Navy Warfighting Experiments and Demonstrations	03	50,537	53,177		53,177	59,834		59,834	U
25	0603782N	Mine and Expeditionary Warfare Advanced Technology	03	31,804	21,941		21,941	24,688		24,688	U
Advanced Technology Development				841,149	725,599	14,100	739,699	816,435	23,259	839,694	
Total Research, Development, Test & Eval, Navy				841,149	725,599	14,100	739,699	816,435	23,259	839,694	

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 (Dollars in Thousands)

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Appropriation: 1319N Research, Development, Test & Eval, Navy

Line No	Program Element Number	Item	Act	FY 2012 Base	FY 2012 OCO	FY 2012 Total	Se
15	0603114N	Power Projection Advanced Technology	03	114,270		114,270	U
16	0603123N	Force Protection Advanced Technology	03	64,057		64,057	U
17	0603235N	Common Picture Advanced Technology	03	49,068		49,068	U
18	0603236N	Warfighter Sustainment Advanced Technology	03	71,232		71,232	U
19	0603271N	Electromagnetic Systems Advanced Technology	03	102,535		102,535	U
20	0603640M	USMC Advanced Technology Demonstration (ATD)	03	124,324		124,324	U
21	0603651M	Joint Non-Lethal Weapons Technology Development	03	11,286		11,286	U
22	0603729N	Warfighter Protection Advanced Technology	03	18,119		18,119	U
23	0603747N	Undersea Warfare Advanced Technology	03	37,121		37,121	U
24	0603758N	Navy Warfighting Experiments and Demonstrations	03	50,157		50,157	U
25	0603782N	Mine and Expeditionary Warfare Advanced Technology	03	6,048		6,048	U
Advanced Technology Development				648,217		648,217	
Total Research, Development, Test & Eval, Navy				648,217		648,217	

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Budget Activity 01: Basic Research
Appropriation 1319: Research, Development, Test & Evaluation, Navy

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02	01	0601152N	In-House Lab Independent Res.....	Volume 1 - 9
03	01	0601153N	Defense Research Sciences.....	Volume 1 - 25

Budget Activity 02: Applied Research
Appropriation 1319: Research, Development, Test & Evaluation, Navy

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Line Item	Budget Activity	Program Element Number	Program Element Title	Page
04	02	0602114N	Power Proj Applied Research.....	Volume 1 - 71
05	02	0602123N	Force Protection Applied Res.....	Volume 1 - 89
06	02	0602131M	Marine Corps Lndg Force Tech.....	Volume 1 - 115
07	02	0602234N	Materials, Electr & Computer Tech.....	Volume 1 - 137
08	02	0602235N	Common Picture Applied Research.....	Volume 1 - 139
09	02	0602236N	Warfighter Sustainment Applied Res.....	Volume 1 - 173

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***Budget Activity 02: Applied Research
Appropriation 1319: Research, Development, Test & Evaluation, Navy***

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10	02	0602271N	Electromagnetic Systems Applied Research.....	Volume 1 - 199
11	02	0602435N	Ocean Wrfghtg Env Applied Res.....	Volume 1 - 235
12	02	0602651M	JT Non-Lethal Wpns Applied Res.....	Volume 1 - 251
13	02	0602747N	Undersea Warfare Applied Res.....	Volume 1 - 255
14	02	0602782N	Mine & Exp Warfare Applied Res.....	Volume 1 - 271

***Budget Activity 03: Advanced Technology Development (ATD)
Appropriation 1319: Research, Development, Test & Evaluation, Navy***

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16	03	0603123N	Force Protection Advanced Technology.....	Volume 1 - 299
17	03	0603235N	Common Picture Advanced Technology.....	Volume 1 - 317
18	03	0603236N	Warfighter Sustainment Advd Tech.....	Volume 1 - 337
19	03	0603271N	Electromagnetic Systems Advanced Technology.....	Volume 1 - 355
20	03	0603640M	MC Advanced Technology Demo.....	Volume 1 - 375
21	03	0603651M	JT Non-Lethal Wpns Tech Dev.....	Volume 1 - 405

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Budget Activity 03: Advanced Technology Development (ATD)
Appropriation 1319: Research, Development, Test & Evaluation, Navy

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Line Item	Budget Activity	Program Element Number	Program Element Title	Page
22	03	0603729N	Warfighter Protection Adv Tech.....	Volume 1 - 411
23	03	0603747N	Undersea Warfare Advanced Tech.....	Volume 1 - 419
24	03	0603758N	Navy Warfighting Exp & Demo.....	Volume 1 - 431
25	03	0603782N	Mine and Expeditionary Warfare Advanced Technology.....	Volume 1 - 439

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Electromagnetic Systems Advanced Technology	0603271N	19	03.....Volume 1 - 355	
Electromagnetic Systems Applied Research	0602271N	10	02.....Volume 1 - 199	
Force Protection Advanced Technology	0603123N	16	03.....Volume 1 - 299	
Force Protection Applied Res	0602123N	05	02.....Volume 1 - 89	
In-House Lab Independent Res	0601152N	02	01..... Volume 1 - 9	
JT Non-Lethal Wpns Applied Res	0602651M	12	02.....Volume 1 - 251	
JT Non-Lethal Wpns Tech Dev	0603651M	21	03.....Volume 1 - 405	
MC Advanced Technology Demo	0603640M	20	03.....Volume 1 - 375	
Marine Corps Lndg Force Tech	0602131M	06	02.....Volume 1 - 115	
Materials, Electr & Computer Tech	0602234N	07	02.....Volume 1 - 137	
Mine & Exp Warfare Applied Res	0602782N	14	02.....Volume 1 - 271	
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Program Element Title	Program Element Number	Line Item	Budget Activity	Page
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Power Projection Advanced Technology	0603114N	15	03.....Volume 1 - 283	
Undersea Warfare Advanced Tech	0603747N	23	03.....Volume 1 - 419	
Undersea Warfare Applied Res	0602747N	13	02.....Volume 1 - 255	
University Research Initiatives	0601103N	01	01..... Volume 1 - 1	
Warfighter Protection Adv Tech	0603729N	22	03.....Volume 1 - 411	
Warfighter Sustainment Advd Tech	0603236N	18	03.....Volume 1 - 337	
Warfighter Sustainment Applied Res	0602236N	09	02.....Volume 1 - 173	

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>				PE 0601103N: <i>University Research Initiatives</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	99.098	108.679	113.157	-	113.157	121.996	121.109	123.650	125.752	Continuing	Continuing
0000: <i>University Research Initiatives</i>	95.911	108.679	113.157	-	113.157	121.996	121.109	123.650	125.752	Continuing	Continuing
9999: <i>Congressional Adds</i>	3.187	-	-	-	-	-	-	-	-	0.000	3.187

A. Mission Description and Budget Item Justification

This program includes support for multidisciplinary basic research in a wide range of scientific and engineering disciplines that enable the U.S. Navy to maintain technological superiority, and for university research infrastructure to acquire research instrumentation needed to maintain and improve the quality of university research important to the Navy. Multidisciplinary University Research Initiative (MURI) efforts involve teams of researchers investigating high priority topics and opportunities that intersect more than one traditional technical discipline. For many military problems this multidisciplinary approach serves to stimulate innovations, accelerate research progress and expedite transition of results into Naval applications. The Defense University Research Instrumentation Program (DURIP) supports university research infrastructure essential to high quality Navy relevant research. The instrumentation program complements other Navy research programs by supporting the purchase of high cost research instrumentation that is necessary to carry out cutting-edge research. The program supports Presidential Early Career Awards for Scientists and Engineers (PECASE), single investigator research efforts performed by outstanding academic scientists and engineers early in their research careers. This program provides the knowledge base, scientific concepts, and technological advances for the maintenance of Naval power and national security.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	102.246	108.679	113.157	-	113.157
Current President's Budget	99.098	108.679	113.157	-	113.157
Total Adjustments	-3.148	-	-	-	-
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.074	-			
• SBIR/STTR Transfer	-3.072	-			
• Program Adjustments	-	-			
• Congressional General Reductions Adjustments	-0.002	-			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103N: <i>University Research Initiatives</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: *Congressional Adds*

Congressional Add: *Assured Critical Apps and Infrastructure Sec Ctr*

Congressional Add: *Ship Model Testing*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.195	-
	1.992	-
Congressional Add Subtotals for Project: 9999	3.187	-
Congressional Add Totals for all Projects	3.187	-

Change Summary Explanation

Technical: N/A

Schedule: N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601103N: <i>University Research Initiatives</i>				PROJECT 0000: <i>University Research Initiatives</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>University Research Initiatives</i>	95.911	108.679	113.157	-	113.157	121.996	121.109	123.650	125.752	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project includes support for multidisciplinary basic research in a wide range of scientific and engineering disciplines that are important for maintaining the technological superiority of the U.S. Navy and for university research infrastructure to acquire instrumentation needed to maintain and improve the quality of university research important to the Navy. MURI efforts involve teams of researchers investigating high priority topics that intersect more than one traditional technical discipline. For many military problems this multidisciplinary approach serves to stimulate innovations, accelerate research progress and expedite transition of results into Naval applications. The DURIP project supports university research infrastructure essential to high quality Navy relevant research. The instrumentation project complements other Navy research programs by supporting the purchase of high cost research instrumentation that is necessary to carry out cutting-edge research. The PECASE project supports single-investigator research efforts performed by outstanding academic scientists and engineers early in their research careers. This project provides the knowledge base, scientific concepts, and technological advances for the maintenance of Naval power and national security.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: DEFENSE UNIVERSITY RESEARCH INSTRUMENTATION PROGRAM (DURIP)	21.332	16.831	18.994
<p>Description: DURIP funds are provided to universities to purchase relatively high cost research instrumentation that is normally not included in single-investigator type research grants. Individual grants range from \$50K to \$1M. The DURIP program is an Office of the Secretary of Defense (OSD) interest item and OSD directs that funding for the DURIP efforts be awarded after OSD announces the awardees, which typically takes place towards the second half of the fiscal year. In turn, universities need to purchase the instrumentation and take delivery before any billings are generated. It frequently takes several months for delivery and billing to be completed.</p> <p>FY 2011 program decreases to allow for an increase in the MURI and PECASE programs to accommodate OSD directed initiatives. FY 2012 program increases to allow for an increased number of grants in the DURIP program. In past years, more outstanding proposals have been received than could be funded.</p> <p>FY 2010 Accomplishments: - Conducted competition for 61 research instrumentation awards to universities.</p> <p>FY 2011 Plans: - Conduct competition for research instrumentation awards to universities.</p> <p>FY 2012 Plans:</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103N: <i>University Research Initiatives</i>	PROJECT 0000: <i>University Research Initiatives</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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- Conduct competition for research instrumentation awards to universities.			
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Title: MULTIDISCIPLINARY UNIVERSITY RESEARCH INITIATIVE (MURI)	70.555	86.133	87.067
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Description: Research efforts include high priority topics that intersect more than one traditional discipline. MURI topics are selected to address Naval Science and Technology (S&T) Focus Areas as described in the Naval S&T Strategic Plan. The MURI program is an OSD interest item and OSD directs that funding for the MURI efforts be awarded after OSD announces the awardees, which typically takes place towards the second half of the fiscal year. Since the MURI program funds academic researchers, execution of the efforts typically ramps up during the summer academic break months. MURI projects make significant contributions to Navy and DoD objectives by; speeding up scientific programs by cross-fertilization of ideas, hastening the transition of basic research to practical applications, and training students in cross-disciplinary approaches to science and engineering research of importance to DoD.

The increase from FY 2011 and out is due to OSD direction to increase peer-reviewed basic research in order to develop innovative solutions and to enhance the science and engineering personnel base.

FY 2010 Accomplishments:

- Conducted competition for new MURI awards to address selected high priority Naval S&T areas, transformational initiatives, and grand challenges, including strategically important DoD research areas. Ten high priority research topics were identified for publication in a BAA to solicit proposals. These topics addressed optical metamaterials, autonomous systems, propagating electromagnetic (E/M) and pressure waves, biofuels, dielectric energy storage, image understanding, electronic devices, fluid dynamics, and signatures in the littorals.
- Continued MURI projects begun in prior years.

FY 2011 Plans:

- Conduct competition for new MURI awards to address selected high priority Naval S&T areas, transformational initiatives, and grand challenges, including strategically important DoD research areas. Approximately nine high priority research topics will be identified for publication in a BAA to solicit proposals.
- Continue MURI projects begun in prior years.

FY 2012 Plans:

- Conduct competition for new MURI awards to address selected high priority Naval S&T areas, transformational initiatives, and grand challenges, including strategically important DoD research areas. Approximately eight high priority research topics will be identified for publication in a BAA to solicit proposals.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103N: <i>University Research Initiatives</i>	PROJECT 0000: <i>University Research Initiatives</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
- Continue MURI projects begun in prior years.				
Title: PRESIDENTIAL EARLY CAREER AWARDS (PECASE) Description: PECASE awards are made to academic scientists early in their research career for extremely prestigious single-investigator research in areas of vital importance to the Navy. Awards provide national recognition and research grants of up to \$200K per year for five years. OSD, with policy and oversight responsibility for the PECASE program, directed that the number of PECASE awards be increased to a maximum of six new awards per year. FY 2011 to FY 2012 funding increase reflects the fiscal impact of OSD's direction. An increase in the number of awards permits a larger number of these outstanding researchers to contribute to the DoN S&T requirements. FY 2010 Accomplishments: - Selected six outstanding university researchers to receive the five-year PECASE research award to conduct research of importance to the Navy. - Continued PECASE programs begun in earlier years. FY 2011 Plans: - Select six outstanding university researchers to receive the five-year PECASE research award to conduct research of importance to the Navy. - Continue PECASE programs begun in earlier years. FY 2012 Plans: - Select six outstanding university researchers to receive the five-year PECASE research award to conduct research of importance to the Navy. - Continue PECASE programs begun in earlier years.		4.024	5.715	7.096
Accomplishments/Planned Programs Subtotals		95.911	108.679	113.157
C. Other Program Funding Summary (\$ in Millions) N/A				
D. Acquisition Strategy Not applicable.				
E. Performance Metrics This University Research Initiative seeks to improve the quality of defense research conducted by universities and supports the education of engineers and scientists in disciplines critical to national defense needs. The initiative is a collection of specialized research programs performed by academic research institutions. Individual				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE	PROJECT
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	PE 0601103N: <i>University Research Initiatives</i>	0000: <i>University Research Initiatives</i>

project metrics are tailored to the needs of specific applied research and advanced development programs. Example metrics include extending the life of Thermal Barrier Coatings for transition to the Enterprise and Platform Enablers Future Naval Capability program. It is projected that the life time of Thermal Barrier Coating on Turbine Blades can be doubled. The National Research Council of the National Academies of Science and Engineering's Congressionally directed "Assessment of Department of Defense Basic Research" concluded that the DoD is managing its basic research program effectively.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601103N: <i>University Research Initiatives</i>				PROJECT 9999: <i>Congressional Adds</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	3.187	-	-	-	-	-	-	-	-	0.000	3.187

A. Mission Description and Budget Item Justification

This project shows Congressional Adds to this Program Element.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
<i>Congressional Add:</i> Assured Critical Apps and Infrastructure Sec Ctr <i>FY 2010 Accomplishments:</i> This effort provided for investigation into new application and infrastructure security. Results from basic research into assured critical application and infrastructure security from various universities were prototyped, and tested.	1.195	-
<i>Congressional Add:</i> Ship Model Testing <i>FY 2010 Accomplishments:</i> This effort provided basic research applicable to new hull forms the Navy is developing or fielding at the ship model testing facility at Webb Institute.	1.992	-
Congressional Adds Subtotals	3.187	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

This project shows Congressional Adds to this Program Element.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	21.129	17.979	18.092	-	18.092	18.181	18.610	19.014	19.386	Continuing	Continuing
0000: <i>In-House Lab Independent Res</i>	17.650	17.979	18.092	-	18.092	18.181	18.610	19.014	19.386	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	3.479	-	-	-	-	-	-	-	-	0.000	3.479

A. Mission Description and Budget Item Justification

This program element (PE) sustains U.S. Naval Science and Technology (S&T) superiority by providing new technological concepts for the maintenance of naval power and national security and by helping to avoid scientific surprise while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities (FNCs). The Department of Navy (DON) component responds to S&T directions of the Naval S&T Strategic Plan for long term Navy and Marine Corps improvements and is in consonance with future warfighting concepts and doctrine developed at the Naval Warfare Development Command and the Marine Corps Combat Development Command. It enables technologies to significantly improve the Joint Chiefs of Staff's Future Joint Warfighting Capabilities. The In-house Laboratory Independent Research (ILIR) program also adds increased emphasis to the revitalization of the scientist and engineer workforce component at the Navy's Warfare Centers and Laboratories by attracting superior candidates and retaining our best members through the provision of exciting and meaningful work.

This PE addresses DON Basic Research which includes scientific study and experimentation directed toward increasing knowledge and understanding in national-security related aspects of physical, engineering, environmental, and life sciences; and is the core of Discovery and Invention. Basic research projects are developed, managed, and related to more advanced aspects of research in some hundred-plus technology and capability-related 'thrusts', which are consolidated in thirteen research focus areas: Power and Energy; Operational Environments; Maritime Domain Awareness; Asymmetric and Irregular Warfare; Information, Analysis and Communication; Power Projection; Assure Access and Hold at Risk; Distributed Operations; Naval Warfighter Performance and Protection; Survivability and Self-Defense; Platform Mobility; Fleet/Force Sustainment; Affordability, Maintainability and Reliability.

This portion of the DON Basic Research Program provides participating Naval Warfare Centers and Laboratories with funding for: basic research to support the execution of their assigned missions; developing and maintaining a cadre of active researchers who can distill and extend results from worldwide research and apply them to solve Naval problems; promoting hiring and development of new scientists; and encouragement of collaboration with universities, private industry, and other Navy and Department of Defense laboratories.

ILIR efforts are selected by Naval Warfare Centers/Lab Commanding Officers and Technical Directors near the start of each Fiscal Year through internal competition. Efforts typically last three years, and are generally designed to assess the promise of new lines of research. Successful efforts attract external, competitively awarded funding. Because the Warfare Centers and Labs encompass the full range of naval technology interests, the scope of ILIR topics roughly parallels that of PE 0601153N, Defense Research Science.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
1319: <i>Research, Development, Test & Evaluation, Navy</i>	PE 0601152N: <i>In-House Lab Independent Res</i>
BA 1: <i>Basic Research</i>	

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	18.001	17.979	18.579	-	18.579
Current President's Budget	21.129	17.979	18.092	-	18.092
Total Adjustments	3.128	-	-0.487	-	-0.487
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.126	-			
• SBIR/STTR Transfer	-0.058	-			
• Program Adjustments	-	-	-0.217	-	-0.217
• Section 219 Reprogramming	3.312	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.270	-	-0.270

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>				PROJECT 0000: <i>In-House Lab Independent Res</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>In-House Lab Independent Res</i>	17.650	17.979	18.092	-	18.092	18.181	18.610	19.014	19.386	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project sustains U.S. Naval S&T superiority, provides new technological concepts for the maintenance of naval power and national security, and mitigates scientific surprises, while exploiting scientific breakthroughs and providing options for new Future Naval Capabilities (FNC's). It responds to S&T directions of the Naval S&T Strategic Plan for long term Navy and Marine Corps improvements. It is in consonance with future warfighting concepts and doctrine developed at the Naval Warfare Development Command (NWDC) and the Marine Corps Combat Development Command (MCCDC), and enables technologies to significantly improve the Joint Chiefs of Staff's Future Joint Warfighting Capabilities.

This portion of the DON Basic Research Program provides participating Naval Warfare Centers and Laboratories with funding for basic research to support the execution of their assigned missions, for developing and maintaining a cadre of active research scientists who can distill and extend results from worldwide research and apply them to naval problems, to promote hiring and development of new scientists, and to encourage collaboration with universities, private industry, and other Navy and Department of Defense laboratories.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: ADVANCED MATERIALS	FY 2010	FY 2011	FY 2012
Description: Efforts include: structural materials; functional materials; maintenance reduction, hydrodynamics; power generation; energy conservation and conversion.	3.405	3.485	3.526
FY 2010 Accomplishments: <ul style="list-style-type: none"> - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research and development on energy flow control and redirection of anisotropic cylindrical shells. - Completed research and development effort on the nature of the Cathodic Delamination (CD) problem for the Navy and determine the effectiveness of new approaches to combating CD on Naval hardware. - Completed research in the development of an algorithm that makes use of both forward and inverse modeling techniques to determine variations in static and dynamic material properties of hyperelastic materials from experimental measurement. - Completed research on mesoscale models to include dissipative particle dynamics and automata-based modeling strategies. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Sea Basing, and National Naval Responsibility initiatives in Undersea Weaponry and Naval Engineering. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Initiated research on the use of Density Functional Theory (DFT) for intelligently designing the next advancement in chromophore (dye) structures. - Initiated research to develop new narrow and wide band gap electroactive polymer materials with tunable energy levels for high power and energy density batteries. - Initiated research to develop several novel experimental techniques to understand the phenomena of mixing in energetic material in the metal-metal oxide combustion zone. - Initiated research for Acoustic Metamaterials. - Initiated research for Absorbent Materials for Fuel Desulfurization. - Initiated research on Phase Equilibria and High-Temperature Ceramics for Zirconium Based Systems. - Initiated research on the Atomic Structure and Lattice Dynamics of Thermoelectric Materials. - Initiated research for the Fundamental Understanding of the Thermodynamic Properties of Metamaterials. - Initiated research for the Internal Behavior of Electromagnetic Properties of Metamaterials and Wideband Tunability. - Initiated research for Liquid-Crystalline Polymers for Broadband Noise Attenuation in Towed Array SONAR Systems. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Sea Basing, and National Naval Responsibility initiatives in Undersea Weaponry and Naval Engineering. - Initiate research to develop a process to quickly and reliably fabricate large areas of Carbon Nanotubes (CNTs) without the need of costly chemical vapor deposition systems. This process will be studied and optimized and resulting CNT's will be characterized, applications could improve size, weight, and power in DoD and commercial systems. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as complete above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on the use of Density Functional Theory (DFT) for intelligently designing the next advancement in chromophore (dye) structures. - Complete research to develop new narrow and wide band gap electroactive polymer materials with tunable energy levels for high power and energy density batteries. - Complete research to develop several novel experimental techniques to understand the phenomena of mixing in energetic material in the metal-metal oxide combustion zone. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Complete research for Acoustic Metamaterials. - Complete research for Absorbent Materials for Fuel Desulfurization. - Complete research on Phase Equilibria and High-Temperature Ceramics for Zirconium Based Systems. - Complete research on the Atomic Structure and Lattice Dynamics of Thermoelectric Materials. - Complete research for the Fundamental Understanding of the Thermodynamic Properties of Metamaterials. - Complete research for the Internal Behavior of Electromagnetic Properties of Metamaterials and Wideband Tunability. - Complete research for Liquid-Crystalline Polymers for Broadband Noise Attenuation in Towed Array SONAR Systems. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Materials by Design and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Sea Basing, and National Naval Responsibility initiatives in Undersea Weaponry and Naval Engineering. 			
<p>Title: ELECTRONICS SENSOR SCIENCES</p> <p>Description: Efforts include: sensing, diagnostics, and detectors; navigation and timekeeping; nano electronics; real time targeting, Electro Optical/InfraRed (EO/IR) electronics; EO/IR electronic warfare; and EO/IR sensors for surface and subsurface surveillance.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research into the Space-Charge-Limited (SCL) transport of charge carriers across a potential difference. - Completed research into the twin concepts of post-selection of wave function in quantum mechanics and the Aharonov-Vaidman formula which has opened up new avenues in what can and cannot be measured in quantum mechanics. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Electric Power Sources and Multifunctional Electronics for Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Persistent Surveillance, and the National Naval Responsibility in Undersea Weaponry. - Initiated research efforts in basic understanding of electromagnetic scattering in the nano-regime. - Initiated research investigation for Millimeter Wave Spectroscopy. - Initiated research for Underwater Coherent Target Detection in Sonar Imagery in Clutter. - Initiated research on Non-Traditional Sensors for Surveillance. - Initiated research for Analog Photonic Amplification. - Initiated research in the Investigation of Acoustic Cloaking. 	2.493	2.562	2.596

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiated research for Scattered Acoustic Vector Fields in the Near Field Resonance Region. - Initiated research efforts for Magnetoelastic/Piezoelectric Layered Composite Structures. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Electric Power Sources and Multifunctional Electronics for Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Persistent Surveillance, and the National Naval Responsibility in Undersea Weaponry. - Initiate research on an application of Green's function technique to explore exotic and unexpected nano-phenomena in the electromagnetic scattering of finite-length nanowires. This effort has broad applicability to a variety of nano devices such as, nano-antennas, nano-lasers, nano-sensors, subwavelength photonic integration, and metamaterial designs. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as complete above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research efforts in basic understanding of electromagnetic scattering in the nano-regime. - Complete research investigation for Millimeter Wave Spectroscopy. - Complete research for Underwater Coherent Target Detection in Sonar Imagery in Clutter. - Complete research on Non-Traditional Sensors for Surveillance. - Complete research for Analog Photonic Amplification. - Complete research in the Investigation of Acoustic Cloaking. - Complete research for Scattered Acoustic Vector Fields in the Near Field Resonance Region. - Complete research efforts for Magnetoelastic/Piezoelectric Layered Composite Structures. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Electric Power Sources and Multifunctional Electronics for Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Electromagnetic Gun and Persistent Surveillance, and the National Naval Responsibility in Undersea Weaponry. 				
Title: ENERGY SCIENCES		1.306	1.342	1.359
Description: Efforts include: undersea weaponry; energetic materials and propulsion; directed energy; and TeraHertz Time-Domain Spectroscopy (THz-TDS) technology that addresses overseas contingency operations and Counter Improvised Explosive Device (C-IED) detection by detecting and spectroscopically identifying military and home-made explosives and formulations.				

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research to develop Computational Fluid Dynamic (CFD) modeling techniques to support flow optimization in diving, fire fighting, Chemical, Biological, Radiological, and Nuclear (CBRN) protection, and aeronautical and aerospace life support helmets. The goal of this research is to improve CO2 transport from life support helmets to optimize performance without resorting to an oral-nasal mask. - Completed research to develop a theory to describe vibrational energy transfer between a shock wave and the local vibrations/ electrons of explosive molecules. The goal of this research is to provide a simplified theoretical expression for the rate of energy transfer into an explosive molecule, without lengthy molecular dynamics or quantum chemical calculations. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiated the research on Molecular Switching of Explosive Molecules. - Initiated the research on the Synthesis of Non-toxic High-energy Explosive Materials. - Initiated research and understanding of Modified Energy Released Weapons. - Initiated research for the Analytical Ballistic Penetration Study of the Adaptable High-Speed Underwater Munitions. - Initiated research effort for the understand of Sulfur Hexafluoride as a Oxidant for Unmanned Underwater Vehicle (UUV) Electrochemical Power Systems. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiate research to investigate the dispersion and control of electromagnetic (EM) waves in the microwave (RF) region using fabricated metamaterial structures. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as complete above. - Complete FY 2010 initiated ILIR projects during FY 2012. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Complete the research on Molecular Switching of Explosive Molecules. - Complete the research on the Synthesis of Non-toxic High-energy Explosive Materials. - Complete research and understanding of Modified Energy Released Weapons. - Complete research for the Analytical Ballistic Penetration Study of the Adaptable High-Speed Underwater Munitions. - Complete research effort for the understand of Sulfur Hexafluoride as a Oxidant for Unmanned Underwater Vehicle (UUV) Electrochemical Power Systems. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. 			
<p>Title: HUMAN PERFORMANCE SCIENCES</p> <p>Description: Efforts include: biosensors, biomaterial, bioprocesses; marine mammals; casualty care management, undersea medicine; human factors and organizational design; manpower, personnel and advanced cockpit; and operational training and education. These efforts are coordinated with the Navy Medical Research Center (NMRC).</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research in the area of understanding of vection in relation to contact. The goal of this research is identify the threshold for vection as a function of stimulus and understand when a pilot is susceptible to disorientation due to vection in critical environment conditions. - Completed research to examine whether or not various forms of visuospatial attention are a manifestation of a single cognitive process. - Completed research in the area of exhaled nitric oxide measurements to provide a reliable and sensitive noninvasive marker of pulmonary oxygen toxicity in humans. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiated research on Exhaled Nitric Oxide (NO) and Carbon Monoxide (CO) as Noninvasive Markers of Hyperbaric Oxidative Stress in Humans (decompression treatment, carbon monoxide poisoning, wound healing, and crush injuries for which pulmonary oxygen toxicity is a potential side effect). 		2.087	2.147
		2.169	

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiated research on Characterization of Mesenchymal Stem Cell Contribution to the Formation of Heterotopic Ossifications (understanding treatment/recovery of devastating injury patterns - involving massive zones of injury that violate soft tissue). - Initiated research on the Evaluation and Training of Institution Using Individual Differences - Initiated research on the study to identify the Underlying Mechanisms Resulting from IR Exposure. - Initiated research for Advanced Adsorbent Materials for Chemical, Biological, Radiological Filtration and/or Detection. - Initiated research on Mission Defined Language and Unmanned Vehicle (UV) Capacitance Using Predictive Tools. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiate research to characterize the naturalistic decision making processes used in Naval Aviation acquisition programs to assess cost, schedule and performance tradeoffs within and between Human Systems Integration (HSI) domains. Content analysis will be performed to identify knowledge, skills, abilities, heuristics, and biases associated with HSI decision making. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as complete above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on Exhaled Nitric Oxide (NO) and Carbon Monoxide (CO) as Noninvasive Markers of Hyperbaric Oxidative Stress in Humans (decompression treatment, carbon monoxide poisoning, wound healing, and crush injuries for which pulmonary oxygen toxicity is a potential side effect). - Complete research on Characterization of Mesenchymal Stem Cell Contribution to the Formation of Heterotopic Ossifications (understanding treatment/recovery of devastating injury patterns - involving massive zones of injury that violate soft tissue). - Complete research on the Evaluation and Training of Institution Using Individual Differences - Complete research on the study to identify the Underlying Mechanisms Resulting from IR Exposure. - Complete research for Advanced Adsorbent Materials for Chemical, Biological, Radiological Filtration and/or Detection. - Complete research on Mission Defined Language and Unmanned Vehicle (UV) Capacitance Using Predictive Tools. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Battlespace Awareness and 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.			
<p>Title: INFORMATION SCIENCES</p> <p>Description: Efforts include: mathematical foundation and computational theory and tools for design communications; decision support theory; algorithm and tools, information assurance, secure and reliable infrastructure for command and control; mathematical optimization for optimal resource allocation and usage; modeling and computational propagation; seamless, robust connectivity and networking and cyber warfare.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research into the connection between graphs and commutative algebra, and construction of fast algorithms to compute interesting new invariants. - Completed research into recent advances in Commercial Off The Shelf (COTS) microprocessor performance that have largely been achieved via added parallelism (adding additional microprocessor "cores" on the system), rather than by the more familiar method of increasing the clock speed. - Completed research to improve the methodology of time series summarization by utilizing the framework of second generation wavelets and on-off system models, and by inventing and utilizing better pre-processing strategies, segmentation algorithms, data transforms and dissimilarity functions. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiated research on Novel Image Processing Algorithms for Matrix Completion, Automated Scene Understanding, and Biotechnology Algorithms for Genetic and Proteomic analysis. - Initiated research for the use of Neural Networks in Clustering Classification. - Initiated research on the Relationship of Quantum Random Walk and Search Efficiency. - Initiated research for Statistical Modeling and Analysis of Object Shapes in Sonar Imagery. - Initiated research on Cognitive Correlators for Cyber Operations. - Initiated research on Off-Hull Intermittent Connectivity Network Management using Computational Intelligence. - Initiated research for Vision-Capable Unmanned Vehicle (UxV) Calibration, Environment Mapping, and Obstacle Avoidance. <p>FY 2011 Plans:</p>		2.111	2.172
			2.195

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as complete above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiate research to develop a theory of Systems-of-Systems (SoS) network engineering and analysis based on the theory of time series of attributed graphs to understand how such systems can be mathematically formulated, simulated, analyzed, and tested. <p>FY 2012 Plans: Continue all efforts of FY 2011, less those noted as complete above.</p> <ul style="list-style-type: none"> - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on Novel Image Processing Algorithms for Matrix Completion, Automated Scene Understanding, and Biotechnology Algorithms for Genetic and Proteomic analysis. - Complete research for the use of Neural Networks in Clustering Classification. - Complete research on the Relationship of Quantum Random Walk and Search Efficiency. - Complete research for Statistical Modeling and Analysis of Object Shapes in Sonar Imagery. - Complete research on Cognitive Correlators for Cyber Operations. - Complete research on Off-Hull Intermittent Connectivity Network Management using Computational Intelligence. - Complete research for Vision-Capable Unmanned Vehicle (UxV) Calibration, Environment Mapping, and Obstacle Avoidance. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. 				
Title: NAVAL PLATFORM DESIGN SCIENCES		1.438	1.481	1.498
<p>Description: Efforts include: novel hull forms, materials, structures and signatures; and virtual shaping concepts for structures and platforms.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Completed research on breaking wave loads utilizing the computational Reynolds Average Navier Stokes (RANS) codes. The research will investigate four general phases: creating consistent, repeatable breaking waves; creating these waves so that they 				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>break on the surface to analyze impact forces; validating those impact forces with existing and additional experimental data; and exploring the scaling effects of the impact forces.</p> <ul style="list-style-type: none"> - Completed research on a virtual shaping concept for structures and platforms. - Completed research to develop the next generation prediction tools based on RANS such that arbitrary complex geometries including non-circular body can be handled and the reliance on empiricism can be minimized. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiated research on Hydrodynamic Self-cleaning and Ship Performance use Flow Generated Forces. - Initiated research on New Approach to Dynamic Similarity for Surface Ship Scale Modeling. - Initiated research on Internal Actuation for Marine Sensor Platforms. - Initiated research on High Accuracy Inertial Measurement Unit from an Array of Low Cost Sensors. - Initiated research on the Applications of Hydrofoils with Leading Edge Protuberances. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry. - Initiate research to characterize the biaxial fatigue behavior of carrier-based aircraft in a corrosive environment, identify the basic mechanism of environment assisted biaxial fatigue cracking, develop an accurate model for corrosion fatigue crack growth under biaxial loading, and demonstrate and validate the model in the application to aircraft structure. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on Hydrodynamic Self-cleaning and Ship Performance use Flow Generated Forces. - Complete research on New Approach to Dynamic Similarity for Surface Ship Scale Modeling. - Complete research on Internal Actuation for Marine Sensor Platforms. - Complete research on High Accuracy Inertial Measurement Unit from an Array of Low Cost Sensors. - Complete research on the Applications of Hydrofoils with Leading Edge Protuberances. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
- Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Battlespace Awareness and Intelligent Naval Sensors, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and the National Naval Responsibility in Undersea Weaponry.			
<p>Title: OCEAN/SPACE SCIENCES</p> <p>Description: Efforts include: Littoral Geosciences, Optics, and biology; Marine Mammals; Ocean Acoustics; and autonomous systems.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. - Continued Naval Research Enterprise Intern Program (NREIP) to support undergraduate and graduate students performing Navy-related research at Naval Warfare Centers under the supervision and mentorship of DON Scientists, thus exposing them to interesting and challenging work done at the centers. NREIP is a continuing Navy education program. - Completed research into the development of a pentacene based neutron detector. - Completed research into the phenomenon of Core-Valence Luminescence (CVL) in scintillators that have the potential for radiation discrimination. - Completed research into the relative performance of Probabilistic Multi-Hypothesis Tracker (PMHT) and Joint Probabilistic Data Association (JPDA) and methods for integrating the best aspects of both into a single multi-target tracking and data fusion algorithm. - Completed research and development into a new scalable Computational Fluid Dynamics (CFD) tool to simulate the propulsion and maneuvering hydrodynamics of a biomimetic Autonomous Underwater Vehicles (AUV) employing multiple flapping foils as the primary propulsor and control surfaces. - Initiated ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2010 will focus on supporting Naval Battlespace Awareness, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility initiatives in Ocean Acoustics and Undersea Weaponry. - Initiated research on Free-Surface Interface Capturing Algorithm for CFD in the Understanding/Modeling of Autonomous Undersea Systems. - Initiated research for Coherent Terrain Navigation. - Initiated research on Multipath Signal Processing Cancellation Techniques for Mine Hunting. - Initiated research for Optical Integration Algorithm for Global Positioning System (GPS). 	4.810	4.790	4.749

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiated research for Flight Behavior and Surveillance for Unmanned Underwater Systems for Anti-Submarine Warfare (ASW) Mission. - Initiated research for Full Spectrum Propagation Prediction. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete FY 2009 initiated ILIR projects during FY 2011. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2011 will focus on supporting Naval Battlespace Awareness, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility initiatives in Ocean Acoustics and Undersea Weaponry. - Initiate research to assess the effects of Mid-Frequency Active (MFA) sonar on the movement of fish species in a natural environment to compare the behavior and movement of fish prior to exposure to sonar, during exposure, and for a significant amount of time post-exposure to provide valuable data on fish behavior, movement, and survival following exposure to high-intensity tactical MFA sonar. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete FY 2010 initiated ILIR projects during FY 2012. - Complete research on Free-Surface Interface Capturing Algorithm for CFD in the Understanding/Modeling of Autonomous Undersea Systems. - Complete research for Coherent Terrain Navigation. - Complete research on Multipath Signal Processing Cancellation Techniques for Mine Hunting. - Complete research for Optical Integration Algorithm for Global Positioning System (GPS). - Complete research for Flight Behavior and Surveillance for Unmanned Underwater Systems for Anti-Submarine Warfare (ASW) Mission. - Complete research for Full Spectrum Propagation Prediction. - Initiate ILIR projects that are intended to be approximately three years in length. Based on historical trends approximately 30% of ILIR projects will turn over each year. Projects selected for FY 2012 will focus on supporting Naval Battlespace Awareness, Innovative Naval Prototype initiatives in Persistent Surveillance and Sea Basing, and National Naval Responsibility initiatives in Ocean Acoustics and Undersea Weaponry. 				
Accomplishments/Planned Programs Subtotals		17.650	17.979	18.092

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601152N: <i>In-House Lab Independent Res</i>	PROJECT 0000: <i>In-House Lab Independent Res</i>

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The ILIR initiative seeks to improve the quality of defense research conducted predominantly through the Naval Warfare Centers/Laboratories. It also supports the development of technical intellect and education of engineers and scientists in disciplines critical to national defense needs through the development of new knowledge in a military laboratory environment. Initial research focus is often conducted in an unfettered environment since it is basic research, but many projects focus on applying recently developed theoretical knowledge to real world military problems with the intention of developing new capabilities and improving the performance of existing systems. Individual project metrics then become more tailored to the needs of specific applied research and advanced development programs. The National Research Council of the National Academies of Science and Engineering's Congressionally directed "Assessment of Department of Defense Basic Research" concluded that the DoD is managing its basic research program effectively.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>				PE 0601152N: <i>In-House Lab Independent Res</i>				4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	3.479	-	-	-	-	-	-	-	-	0.000	3.479

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: Naval Innovative Science and Engineering	3.479	-	-
Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.			
FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:			
<ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 			
Accomplishments/Planned Programs Subtotals	3.479	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	423.623	429.767	446.123	-	446.123	459.221	482.591	503.415	525.618	Continuing	Continuing
0000: <i>Defense Research Sciences</i>	396.907	429.767	446.123	-	446.123	459.221	482.591	503.415	525.618	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	9.628	-	-	-	-	-	-	-	-	0.000	9.628
9999: <i>Congressional Adds</i>	17.088	-	-	-	-	-	-	-	-	0.000	17.088

A. Mission Description and Budget Item Justification

This program element (PE) sustains U.S. Naval Science and Technology (S&T) superiority, provides new technological concepts for the maintenance of naval power and national security, and helps avoid scientific surprise. It is based on investment directions as defined in the Naval Science & Technology Strategy approved by the S&T Corporate Board (Feb 2009). This new strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It exploits scientific breakthroughs and provides options for new Future Naval Capabilities (FNCs) and Innovative Naval Prototypes (INPs).

This PE addresses basic research efforts including scientific study and experimentation directed toward increasing knowledge and understanding in national security related aspects of physical, engineering, environmental and life sciences. Basic research efforts are developed, managed, and related to more advanced aspects of research on the order of a hundred technology and capability-related 'thrusts', which are consolidated into about fifteen research areas. These in turn support the major research areas of the Navy and Marine Corps: Autonomous Systems; Command, Control, Communications and Computers (C4); Countermeasures and Counterweapons; Marine as a System; Information Analysis and Decision Support; Intelligence, Surveillance and Reconnaissance; Logistics; Materials; Operational Environments; Platforms; Power and Energy Technology; Sensors and Electronics; Warrior Performance and Protection; Weapons and Support (Education and Outreach).

S&T investment in basic research also includes the National Naval Responsibilities (NNRs), fields upon which a wide range of fundamental Naval capabilities depend. There are currently four NNRs.

S&T investment in basic research also includes the Basic Research Challenge program which was established to competitively select and fund promising research programs in new areas not addressed by the current basic research program. The Basic Research Challenge Program stimulates new, high-risk basic research projects in multi-disciplinary and departmental collaborative efforts, and funds topics that foster leading edge science and attracts new principal investigators and organizations. Basic Research Challenge awards are for a period of four years.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
1319: <i>Research, Development, Test & Evaluation, Navy</i>	PE 0601153N: <i>Defense Research Sciences</i>
BA 1: <i>Basic Research</i>	

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	429.107	429.767	443.593	-	443.593
Current President's Budget	423.623	429.767	446.123	-	446.123
Total Adjustments	-5.484	-	2.530	-	2.530
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-3.694	-			
• SBIR/STTR Transfer	-8.350	-			
• Program Adjustments	-	-	2.172	-	2.172
• Section 219 Reprogramming	6.573	-	-	-	-
• Rate/Misc Adjustments	-	-	0.358	-	0.358
• Congressional General Reductions Adjustments	-0.013	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *Magnetic and Elec Fields in Ocean Env*
- Congressional Add: *Energetics S&T Workforce Development*
- Congressional Add: *Human Neural Cell-Based Biosensor*
- Congressional Add: *Next Generation Manufacturing Processes and Systems*
- Congressional Add: *ONAMI Initiatives*
- Congressional Add: *Shock and Vibration Modeling of Marine Composites*
- Congressional Add: *Texas Microfactory*
- Congressional Add: *Next Gen Renew Energy Sources*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.992	-
	3.485	-
	1.095	-
	1.195	-
	3.824	-
	1.912	-
	1.593	-
	1.992	-
	17.088	-
	17.088	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy

DATE: February 2011

APPROPRIATION/BUDGET ACTIVITY

1319: *Research, Development, Test & Evaluation, Navy*
BA 1: *Basic Research*

R-1 ITEM NOMENCLATURE

PE 0601153N: *Defense Research Sciences*

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>	PROJECT 0000: <i>Defense Research Sciences</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>Defense Research Sciences</i>	396.907	429.767	446.123	-	446.123	459.221	482.591	503.415	525.618	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element (PE) sustains U.S. Naval Science and Technology (S&T) superiority, provides new technological concepts for the maintenance of naval power and national security, and helps avoid scientific surprise. It is based on investment directions as defined in the Naval Science & Technology Strategy. This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It exploits scientific breakthroughs and provides options for new Future Naval Capabilities (FNCs) and Innovative Naval Prototypes (INPs).

This PE addresses basic research efforts including scientific study and experimentation directed toward increasing knowledge and understanding in national security related aspects of physical, engineering, environmental and life sciences. Basic research efforts are developed, managed, and related to more advanced aspects of research on the order of a hundred technology and capability-related 'thrusts', which are consolidated into about fifteen research areas. These in turn support the major research areas of the Navy and Marine Corps: Autonomous Systems; Command, Control, Communications and Computers (C4); Countermeasures and Counterweapons; Marine as a System; Information Analysis and Decision Support; Intelligence, Surveillance and Reconnaissance; Logistics; Materials; Operational Environments; Platforms; Power and Energy Technology; Sensors and Electronics; Warrior Performance and Protection; Weapons and Support (Education and Outreach).

S&T investment in basic research also includes the National Naval Responsibilities (NNRs), fields upon which a wide range of fundamental Naval capabilities depend. There are currently four NNRs.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: AIR, GROUND AND SEA VEHICLES</p> <p>Description: Efforts include: Surface/subsurface reduced signatures; free-surface, subsurface, and propulsor hydrodynamics; hull life assurance; advanced ship concepts; distributed intelligence for automated survivability; advanced electrical power systems; air vehicles; air platforms propulsion and power; air platforms survivability and signature control; special aviation projects; Unmanned Air Vehicle/Unmanned Combat Air Vehicle (UAV/UCAV); environmental quality; logistics; and power generation, energy conversion, and storage.</p> <p>The funding increase in FY 2011 and out reflects increased investment in mobility research.</p> <p>FY 2010 Accomplishments: Air Vehicles</p>	50.044	56.511	58.318

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>	PROJECT 0000: <i>Defense Research Sciences</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued investigations into controlled initiation and recovery from aggressive non-linear aero-maneuvers conducted by unmanned air vehicles. - Continued university research in rotorcraft technology areas such as tilt rotor aeromechanics, rotor flow field/ship air wake coupling during shipboard operations, flight simulation of advanced ducted fan air vehicles, active rotor control for enhanced ship board operations, autonomous rotorcraft operations in shipboard environment, and innovative rotor design concepts for naval applications. - Continued research in computational simulation of rotorcraft operations in shipboard environment. - Continued investigation of advanced structural concepts providing a high degree of crew protection during crashes. - Initiated research into new analytical methods for high-fidelity prediction of rotorcraft performance, loads, and vibration. - Initiated university and Navy Lab research in basic rotorcraft science with emphasis on enabling concepts for variable geometry/variable rotor-speed aircraft. <p>Ship Concepts and Hydrodynamics</p> <ul style="list-style-type: none"> - Continued modeling and optimization techniques for Naval design of multi-hulls, optimal functional arrangements for both ship and submarine design, and optimization for semi-displacement craft. - Continued implementation of nationwide program to increase interest in naval engineering education. - Continued further examination of computational mechanics to address prediction of acoustic signatures in complex structures, modeling of structural failures and optimization, sensitivity analysis and error control. - Continued propeller tip vortex cavitation and sheet-to-cloud cavitation. - Continued computational and experimental investigation into complex three-dimensional flow separation problems. - Continued modeling and understanding of full-scale circulation control bow planes design. - Continued validation of Unsteady Reynolds Averaged Navier Stokes (URANS) prediction on maneuvering effects on ship motion in waves. - Continued modeling of hydroacoustics of advanced materials propulsor. - Continued program to investigate renewable energy technologies for navy applications. - Continued computational and experimental investigations of wakes in stratified fluids. - Continued Large Eddy Simulation (LES) modeling of crashback of underwater vehicle with propulsor. - Initiated measurement and modeling of unsteady high-speed craft hydrodynamics. - Initiated high-fidelity fluid-structure interaction program. <p>Ship Signatures, Structures, and Materials</p> <ul style="list-style-type: none"> - Continued the structural performance of hybrid ship hulls and hybrid joints subject to sea loads and weapons effects for application to high speed, low signature vessels. 			

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>	PROJECT 0000: <i>Defense Research Sciences</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued modeling of alternating current sources and propagation. - Continued Particle Image Velocimetry (PIV)/Laser Doppler Velocimetry (LDV) studies of multiphase bubble flows and interaction with elastic plates in a small quiet water tunnel. - Continued LDV of scaling effects studies of unsteady elastic duct and propulsor interaction in a wind tunnel. - Continued effort on much higher strain rate loading and constitutive behavior of Explosion Resistant Coating (ERC) for strain rates appropriate to ballistic events. - Continued work on cohesive elements for dynamic fracture under combined mode for application to failure in joints in ship structures under blast loading. - Continued work on hybrid ship (no-magnetic stainless steel/composite) hull concepts. - Continued further examination of computational mechanics in order to address prediction of acoustic signatures in complex structures, modeling of structural failures and optimization, sensitivity analysis, and error control. - Continued concept for photonic band gap waveguide. - Continued methods to model the mechanisms of interaction between an elastic duct wall and fluid-flow in a duct with a propeller. - Continued development of advanced multispectral InfraRed (IR) materials. - Continued development of computational mechanics to provide predictive capabilities of acoustics, linear and nonlinear dynamic response and failure mechanisms of structures. - Continued development of mmWave material characterization system. - Continued efforts in alternative hull for fast ships and hybrid ship hull structures. - Continued efforts in understanding of explosion resistant coating under extreme loads and its interaction with other armor and structural materials. - Continued investigation into methods to control airborne noise transmission using active control. - Continued development of metamaterial concepts for radio frequency (RF) signature control and photonic and acoustic applications. - Continued experimental facility for sea-slamming loads in fast ships, and considering hydro-elasticity and structural details in composites panels and scale effects. Measurements are used developing new theoretical models. - Continued study of droplet & volume scattering phenomena. - Continued the development of predictive models for infrared emission and reflection from breaking waves. - Continued development of computational electromagnetic tools for electromagnetic materials design & optimization. - Continued development of a methodology for highly reliable composite to metallic joints. - Continued fundamental efforts in multi-scale, time-varying, hull structural reliability models and processes for structural performance analysis. - Continued basic research challenge on elastomeric polymer by design to protect the warfighter against traumatic brain injury by diverting the blast induced shock waves from the head. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Completed development of photonic crystal waveguide and radiating systems. - Initiated the development and understanding of elastomeric polymers for multi functionality in protection systems/armor and structural acoustics with superior properties against environmental effects and extreme temperature. <p>Ship and Air Platform Machinery and Systems</p> <ul style="list-style-type: none"> - Continued efforts to understand and control the generation and propagation of far-field jet noise. - Continued development of Pulsed Detonation Engine (PDE) Technology. - Continued development and understanding of control capabilities and distributed intelligence strategies for shipboard systems. - Continued propulsion system cost-reduction efforts through reduction of vibration, noise and thermal fluctuation at the source by controlling combustion. - Continued passive and active high speed noise control. - Continued studies of alternate propulsion systems for PDE and generated prediction models. - Continued investigation of thermal management approaches for cooling high power electronic devices. - Continued research on non-vapor compression based refrigeration cycles. - Continued studies of advanced air-breathing propulsion concepts. - Continued study of advanced materials for Pulsed Detonation Engine (PDE) applications. - Continued efforts to expand the model based reasoning control algorithm approach to multiple heterogeneous systems. - Continued studies of complexity in heterogeneous distributed control systems. - Continued efforts to investigate a market based control approach to distributed control. - Continued efforts to perform physics based modeling of fluid actuation systems. <p>Power Generation, Energy Conversion and Storage</p> <ul style="list-style-type: none"> - Continued evaluation of stability and control of electrical power systems. - Continued analyzing synchronization of 19 diode lasers to produce intense beams. - Continued efforts in nanostructures, novel electrolytes, and electrode materials to enable new 3D power source architectures and to improve capacity of rechargeable lithium and lithium-ion batteries. - Continued exploration and development of materials for high energy density passive power electronics (Capacitors). - Continued expanding the fundamental understanding of direct electrochemical oxidation and the use of logistic fuels in solid oxide fuel cells. - Continued research into new functional materials and new concepts to efficiently convert thermal, photonic, or vibrational energy to electric energy from primary or secondary sources. - Continued development of phase change cooling approaches for high power electronic devices. - Continued efforts developing science base for optimized combustion of alternative fuels. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<ul style="list-style-type: none"> - Continued research on the scientific basis of nanostructure enhancement of semiconductor and functional materials performance for power generation and thermal management. - Continued the investigation of the long-term durability effects of coating/substrate systems from combustion chemistries and products derived from current petroleum-based fuel and from petroleum-based/synthetic fuel blends that lead to predictive models. - Continued effort in energy and power management to include understanding and reliability of high power electronics. <p>FY 2011 Plans:</p> <p>Air Vehicles</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>Science of Autonomy</p> <p>This new sub-activity will begin in FY 2011 and include on-going efforts that were not mentioned specifically in previous years.</p> <ul style="list-style-type: none"> - Continue multi-disciplinary research in the science of autonomy including multi-vehicle collaboration, intelligence, and human interaction. - Continue research in scalable and robust distributed collaboration among autonomous systems. - Continue research in human/unmanned system collaboration. - Continue research in autonomous perception and intelligent decision-making. - Continue research in intelligent architectures for autonomous systems. <p>Ship Concepts and Hydrodynamics</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate computational prediction and validation of damaged ship maneuvering. <p>Ship Signatures, Structures, and Materials</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete development of advanced multispectral IR materials. - Complete development of mmWave material characterization system. - Complete validation of infrared ship signature models. - Initiate development of advanced electro magnetic energy absorbing composite materials. - Initiate and perform measurements of sea-slamming loads in fast ships at various sea states and speeds for composites panels on the experimental facility and develop/verify theoretical/computational models considering hydro elasticity and structural details and scale effects. 			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Ship and Air Platform Machinery and Systems - Continue all efforts of FY 2010.</p> <p>Power Generation, Energy Conversion and Storage - Continue all efforts of FY 2010.</p> <p>FY 2012 Plans: Air Vehicles - Continue all efforts of FY 2011.</p> <p>Science of Autonomy - Continue all efforts of FY 2011.</p> <p>Ship Concepts and Hydrodynamics - Continue all efforts of FY 2011. - Initiate research efforts on multi objective optimization of hull shapes using hybrid hull concept to achieve high efficiency, reduced slamming loads and hydrodynamic / structural performance. - Initiate development of understanding of shockwave propagation and failure mechanisms of high strain rate sensitive polymers and their interaction in composite with structural and armor materials.</p> <p>Ship Signatures, Structures, and Materials - Continue all efforts of FY 2011, less those noted as completed above. - Initiate efforts to further the physics based understanding of structural acoustics for the next generation submarine. - Initiate improvements for predictive capabilities of surface ship propulsion system and underwater acoustic signatures. - Initiate efforts to generate a greater physics based understanding of Electric Drive and its impact on platform acoustic signatures. - Initiate development of advanced electro magnetic energy absorbing composite materials. - Initiate exploration of chiral metamaterials for advanced infrared property control. - Initiate polymer chemistry and structural study of low dielectric and impedance matched composite materials.</p> <p>Ship and Air Platform Machinery and Systems - Continue all efforts of FY 2011.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>Power Generation, Energy Conversion and Storage</p> <ul style="list-style-type: none"> - Continue all efforts of FY11. - Complete research into new functional materials and new concepts to efficiently convert thermal, photonic, or vibrational energy to electric energy from primary or secondary sources. - Complete research on the scientific basis of nanostructure enhancement of semiconductor and functional materials performance for power generation and thermal management. - Initiate investigation into rare earth-free permanent magnet materials. - Initiate modeling of positron confinement for ultra high-density energy storage and convene international positron confinement workshop. - Initiate investigating thermodynamic cycle analogy for harvesting waste heat using multiferroic (pyromagnetic & pyroelectric) materials. - Initiate research into thermionic energy conversion using inter-gap molecular species in a heat cell with low work function materials. - Initiate research into cyber-physical, real-time distribution and control of power & energy networks, physics-based models, hardware-in-the-loop simulation. - Initiate development of novel approaches to deposition of ultra high quality SiC epilayers needed to enable high-voltage, high-frequency, high-power wide bandgap semiconductor devices. - Initiate study of fault tolerant electromechanical energy converter concepts for naval applications. - Initiate experimental and computational investigation of dynamic response of marine gas turbines for on-demand and flexible power supply. - Initiate research to understand new energy conversion methods (pyroelectrics, thermionics, combustion). - Initiate power and energy management science particularly understanding new magnetic materials and sliding electrical contacts). - Initiate basic research in next generation wide bandgap semiconductors. 				
<p>Title: ATMOSPHERE AND SPACE SCIENCES</p> <p>Description: Efforts include: Marine Meteorology and Prediction, Space Sciences and the Basic Research Challenge, which is a competitive investment based on proposed scientific activities.</p> <p>Accomplishments and plans described below are examples for each effort category.</p> <p>FY 2010 Accomplishments: Marine Meteorology and Prediction</p>		29.509	29.938	30.239

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued analysis of results from major field projects on air-sea interaction and transition improvements into applied research to improve the treatment of fluxes in coupled atmosphere-ocean prediction systems. - Continued the development of next-generation ocean-atmosphere coupled models. - Continued effort to investigate and better understand the bulk exchanges, aerosol-cloud interaction, and physical processes that take place at the atmospheric boundary layer interface. - Continued theoretical and observational effort to improve understanding of the fundamental dynamics of mountain waves, including generation, propagation, nonlinear interaction, and wave breaking. - Continued effort to gain a fundamental understanding of the flow-dependent limits of predictability by combining research in data assimilation and atmospheric instability. - Continued investigation into the near-earth environmental effects on electromagnetic propagation. - Continued investigation of sub-grid-scale processes that influence marine boundary layer turbulence, aerosol production and removal, and marine stratocumulus cloud and drizzle formation and dissipation with the goal of improving the predictability of these phenomena in high-resolution mesoscale prediction systems. - Continued investigation of Western Pacific tropical cyclone dynamics in order to improve the predictability of storm genesis, structure and intensity changes, radii of maximum winds and effects on sea surface waves. - Continued effort to assimilate WindSat wind vector, Ozone Mapping and Profiler Suite (OMPS) ozone profiles, and Global Positioning System (GPS) temperature and water vapor profile retrievals into NOGAPS (Navy Operational Prediction System). - Continued assessment of the status of aerosol observation, prediction, and understanding for use in slant-range visibility and electro-optical performance prediction models. - Continued development of new soil moisture retrieval algorithm that addresses the basic modeling issues pertinent to soil moisture retrieval using passive microwave data from the WindSat instrument. - Continued demonstration and validated a new data assimilation capability in NOGAPS ALPHA to generate the first global atmospheric analysis fields that extend from the ground to the edge of space. - Continued effort to derive and test advanced nonlinear atmospheric data assimilation algorithms using variational and ensemble techniques that are firmly based on modern inverse problem theory. - Continued effort to understand the fundamental physics and dynamics that control cloud and aerosol variability in the marine boundary layer. - Completed analysis of results from major field projects on air-sea interaction and transition improvements into applied research to improve the treatment of fluxes in coupled atmosphere-ocean prediction systems. - Completed theoretical and observational effort to improve understanding of the fundamental dynamics of mountain waves, including generation, propagation, nonlinear interaction, and wave breaking. - Completed assessment of the status of aerosol observation, prediction, and understanding for use in slant-range visibility and electro-optical performance prediction models. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Completed effort to derive sea foam coverage from WindSat and to use this information in microphysical aerosol models to derive marine optical properties. - Initiated field project to increase understanding of air-sea exchange of enthalpy (heat and moisture) to improve high-resolution coupled atmosphere-wave-ocean tropical cyclone prediction systems. <p>Space Sciences</p> <ul style="list-style-type: none"> - Continued effort to exploit the polarametric aspect of WindSat for non-ocean surface wind vector Meteorological and Oceanographic Command (METOC) retrievals. Effort this year focused on soil moisture and sea ice. - Continued assessment of advanced techniques and algorithms for remote sensing of ocean and atmospheric properties including winds, waves, currents, and surface topography. - Continued program to develop advanced improvements to specification and prediction of the space environment to improve space system performance and their on-call availability. - Continued monitoring of other-agency efforts for 'Naval Harvest' of advanced techniques and algorithms for remote sensing of ocean and atmospheric properties including winds, waves, currents, and surface topography. - Continued a focused program to develop a predictive, operational capability for the onset and evolution of equatorial spread-F that limits space-based communications and navigation capabilities. - Continued a program to use large high frequency/very high frequency (HF/VHF) arrays to investigate fine scale ionospheric phenomena with associated improvements in ionospheric modeling and the performance of current and future DoD capabilities impacted by ionospheric disturbances. - Continued program to extend magnetohydrodynamic models of solar activity, and related effects on the near-Earth space environment, toward an improved predictive capability on communication and navigation systems, and other related effects on DoD operations. - Continued effort to develop better physical understanding of small-scale atmospheric wave dynamics in the middle and upper atmosphere. - Continued effort to develop understanding of how multi-scale interactions impact the predictability of tropical cyclones and their downstream effects. - Continued effort to develop understanding to forecast the sun's changing extreme ultraviolet (EUV) radiation and the responses of the upper atmosphere and ionosphere one-to-ten days in advance. - Continued effort to develop and validate numerical models of high-energy solar energetic particle (SEP) and solar gamma-ray (SGR) emissions. - Continued effort to develop a quantitative standard model for solar flares that satisfies UV-X-ray observations; understand the origin, dynamics, and evolution of plasma in active region magnetic flux tubes. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Completed the development of 3D magnetohydrodynamic code for simulations of solar filament eruptions leading to flare and coronal mass ejection (CME) activity. - Continued effort to develop the basis for an observational technique potentially enabling the first physics-based prediction of the severity of the largest energetic particle events generated by the Sun. - Continued investigation in the feasibility of using Thompson scattering to directly and globally image the near-Earth electron density distributions and their variations driven by the solar wind to enable space environment forecasting and comprehensive space domain awareness for the Navy and DoD. - Continued investigation of the driving mechanisms, mode characteristics, and impact on space plasmas of electromagnetic waves relevant to radiation belt remediation and auroral ionospheric space weather. - Continued research on advanced EUV/X-ray optics and associated spectral modeling and data analysis, to improve the precision of solar irradiance monitoring and enable accurate irradiance forecasts. - Initiated effort to assemble individual databases and model components of the Sun-Earth System. <p>FY 2011 Plans: Marine Meteorology and Prediction</p> <ul style="list-style-type: none"> - Continue all efforts of 2010, less those noted as completed above. <p>Space Sciences</p> <ul style="list-style-type: none"> - Continue all efforts of 2010, less those noted as completed above. <p>FY 2012 Plans: Marine Meteorology and Prediction</p> <ul style="list-style-type: none"> - Continue all efforts of 2011. - Complete field project to increase understanding of air-sea exchange of enthalpy (heat and moisture) to improve high-resolution coupled atmosphere-wave-ocean TC prediction systems. <p>Space Sciences</p> <ul style="list-style-type: none"> - Continue all efforts of 2011. <p>Complete effort to exploit the polarimetric aspect of WindSat for non-ocean surface wind vector - Meteorological and Oceanographic Command (METOC) retrievals. Effort this year focused on soil moisture and sea ice.</p> <ul style="list-style-type: none"> - Complete effort to develop understanding of how multi-scale interactions impact the predictability of tropical cyclones and their downstream effects. 				

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
- Complete investigation in the feasibility of using Thompson scattering to directly and globally image the near-Earth electron density distributions and their variations driven by the solar wind to enable space environment forecasting and comprehensive space domain awareness for the Navy and DoD.			
<p>Title: COUNTER IMPROVISED EXPLOSIVE DEVICE (IED) SCIENCES</p> <p>Description: The Basic Research Counter IED program seeks to develop innovative scientific concepts that will form the foundation for future technologies that may be developed and implemented to efficiently and effectively address the IED threat. The effort will emphasize fundamental scientific concepts that can be applied to the detection, neutralization, destruction and mitigation of the effects of these devices, to advance anticipation, and affect the occurrence or potential occurrence of IED events. The program also seeks to establish and nurture a multidisciplinary counter-IED Science and Technology community of Government, academic and industry researchers to accelerate the transition of new science and technology into fielded systems.</p> <p>This activity also includes Secretary of Defense directed peer-review basic research to develop innovative solutions and enhance the science and engineering base.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued effort in the area of Prediction to develop theoretical and technical approaches that permit prediction and analysis of IED emplacement as well as the assembly of IEDs. This included recognition of emplacement patterns, human activity recognition from video and other sensing systems, human intelligence and social network analysis of terrorist networks, modeling and simulation of the full spectrum of IED activities, analysis of communications, and knowledge management systems to combine diverse data sources. - Continued effort in the area of Detection to develop concepts that would permit stand-off detection and localization of the explosive, the case materials, the environment in which the device is located, and other components of the IED. - Continued effort in the area of Neutralization to develop scientific concepts that may be applied to remotely render an IED ineffective without necessarily having to detect or destroy it. - Continued effort in the area of Destruction to develop scientific concepts that may be applied to quickly and remotely destroy IEDs without necessarily having to detect them. - Continued effort in the area of Mitigation to develop scientific concepts that may be applied to protect people and/or equipment from the destructive effects of an IED that may be detonated. - Continued creation of new spectroscopy for sensitive characterization of semiconductor nanostructures, ultrathin molecular films and chemical/biological threat materials and explosives. - Continued development of product that will provide the warfighter protection against blast pressure wave and complements efforts in ballistic/projectile protection and combat casualty care communities. 	21.503	22.526	22.581

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued development of a new chemical explosive detection concept based on pump/probe ultrashort pulse lasers. - Continued research on characterizing background noise in urban and riverine environments in support of IED signature detection. - Completed flame suppression mechanism investigation of additives to fine water mist to provide the scientific basis to guide search for suitable fine water mist based fire suppression strategies for DoD platforms, and to mitigate explosive blast effects. - Completed computational fluid dynamics (CFD) CT-Analyst technology study that provides a sensitive operational-quality capability to backtrack airborne detections of the chemical signatures and taggants of explosives instantly to their source. - Completed reactive flow dynamics study of multiphase reactive flow modeling and simulation that can be applied to investigate mitigation strategies to counter the IED threat. - Completed investigation and development of nonlinear methods to more effectively describe and analyze hyperspectral and multi-sensor data to improve characterization using nonlinear (manifold) methods. - Completed development of nonlinear methods to significantly improve the differentiation of targets from background scenes in multivariate data sets of hyperspectral imagery. - Completed development of high-power mid-Infrared (IR) lasers for IR countermeasures, explosives detection (ED), biological detection, remote chemical sensing, etc. - Completed effort to develop a chemically strengthened visible infrared (Vis-IR) composite window made from Spinel ceramic and germanate glass. - Initiated a Counter-IED Grand Challenge effort to pursue innovative device neutralization modalities, augmented by device detection technologies. - Initiated development of high performance polymer materials for armor applications. - Initiated effort to directly observe lattice deformations in explosives under shock impact. - Initiated analytical study to detect an intruder in proximity to an underwater pipeline using structure-guided acoustic waves. - Initiated increased emphasis on sociological and cultural aspects of defeating insurgent networks. - Initiated increased emphasis on standoff wide area neutralization and pre-detonation of IEDs. - Initiated increased emphasis on stronger lightweight armor including nanoparticle designs. - Initiated increased emphasis on detection of physical and temporal device characteristics. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all effort of FY 2011. - Initiate increased emphasis on challenges within the Riverine environment. - Initiate increased emphasis on challenges in the temporal domain in various land environments. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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- Initiate increased emphasis on an integrated anticipate/affect, detection, neutralization, and mitigation specific to the suicide bomber threat.			
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Title: HUMAN SYSTEMS	15.911	17.289	17.511
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Description: Efforts include: Human factors and organizational design; manpower, personnel, and training; integrated avionics, displays, and advanced cockpit; and pattern recognition.

FY 2010 Accomplishments:

- Continued research of social networks for counterterrorism.
- Continued expansion of the cognitive architectural modeling capability to increase coverage, including spatial reasoning, multi-tasking, and impact of physiological and stress variables.
- Continued research of human cognition and performance to create more realistic simulations for training.
- Continued program to combine cognitive architectures with computational neuroscience to better predict human performance.
- Continued program on implantable electronics for performance enhancement.
- Continued research of hierarchical, cellular, and hybrid organization structures for command and control.
- Continued schema theory applications to multi-echelon command decision making.
- Continued investment in natural language interaction capability for artificially intelligent training systems.
- Continued research of neuro-control of high-lift bioinspired Unmanned Underwater Vehicles and active vision and cognitive navigation skills in mobile robots.
- Continued computational neuroscience for novel pattern recognition and sensory augmentation.
- Continued social-science based computational toolsets for terror network analysis at U.S. Pacific Command's Joint Intelligence Center and on the USS TARAWA (LHA-1) to support Expeditionary Strike Group One in Overseas Contingency Operations.
- Continued investigations to support new missions for Expeditionary Strike Groups in three areas: 1) analysis and diagnosis of Command and Control Organizational structures; 2) effects-based operations and development of reach-back capability for course of actions analysis; and 3) decision support systems for management of Battle Rhythm.
- Continued research of human-robot interaction to support team collaboration.
- Continued computational and agent-base modeling and experimentation to explore options for Effects-Based Operations.
- Continued models of operational decision making for component commanders of an Expeditionary Strike Group with special emphasis on elaboration and planning knowledge.
- Continued research of integrated parallel optimization models of adaptive function and responsibility reallocation between commanders/staff and reconfiguration of the command, control, and communication organizational structures.
- Continued the output human performance usability models with actual human performance results obtained in usability testing on systems under development. These systems include future Naval Combat Systems and Homeland Security Operation Centers.

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued investigation of human sensory performance for optimizing video and audio human-electronic device interfaces. - Continued research to create new social modeling tools for understanding the responses of adversaries, determining the best practices for containing and deterring the adversary, and developing effective course of action in non-Western environments for humanitarian and civilian-military operations. - Continued research of advanced biometrics such as biodynamic signatures to support spirals 2 and 3 of the Navy Identity Dominance System - Maritime Domain. - Continued efforts to extend the representational capabilities of cognitive architectures to accommodate aspects of social cognition and teamwork. - Continued efforts to develop an empirical understanding and prediction of the behaviors of individuals and social groups and networks, computational approaches to social network theory and the co-evolution of adversarial tactics and strategies, algorithms for exploring scenarios that take into account socio-cultural factors; political and economic factors; local attitudes, values, and social structure. - Initiated research of human activity and intend recognition and dynamic biometrics for improved human system interfaces and force protection. - Initiated research into probabilistic reasoning in computation cognitive architectures. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate research into computational social neuroscience to provide new models for manpower assignment and incentivization and new social models of cross-cultural interactions. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Initiate cognitive and neuroscience research on event representation and episodic memory for efficient storage and automatic recall of episodes from massive data stores of audio-visual data. - Initiate research on models of social dynamics and culture in small scale societies. 				
Title: INFORMATION SCIENCES		30.170	34.572	35.714
Description: Efforts include: Mathematical foundation and computational theory and tools for design, communication, and control of intelligent autonomous systems; theory, algorithms and tools for decision support; decision theory, algorithms, and tools; heterogeneous information integration, management, and presentation; information assurance, secure and reliable information infrastructure for command and control; mathematical optimization for optimal resource allocation and usage; modeling and computation of complex physical phenomena; modeling and computation for electromagnetic and acoustic wave propagation and				

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>scattering; seamless, robust connectivity and networking; and expeditionary operations Command, Control, Communications, Computers Intelligence Surveillance and Reconnaissance (C4ISR).</p> <p>The funding increase in FY 2011 and out reflects increased investment in information sciences.</p> <p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued development of mathematical optimization framework and heuristic algorithms that serve as theoretical and computational basis for network design, resource allocation, and logistics. - Continued development of improved tactical and battlespace decision aids. - Continued to refine techniques for extracting maximum knowledge from multi-modal imagery, text, and multisource signal data. - Continued to investigate methods to deal with light dispersion on image formation underwater to enable precise navigation, station keeping, and mapping capabilities for unmanned underwater vehicles. - Continued efforts for enabling teams of autonomous systems to work together and work on representations for evolution of cooperative behaviors, including efforts in multi-modal interactions with autonomous systems. - Continued developing framework for dealing with effect of variable latencies in communication within teams of humans and autonomous systems. - Continued efforts on quantum computing and cryptography. - Continued efforts on model checking and automated theorem prover technologies. - Continued efforts in mathematical modeling of complex physical phenomena. - Continued efforts in mathematical techniques for inverse problems, including reliable approximate solutions in 3 dimensions (3D); adequate representation of the physics of the media and the scatterer; and improved resolution of structural and material properties. - Continued focused efforts in development of mathematical foundations for image understanding on a number of key challenges, such as multi-modal imagery representation and metrics, object recognition, scene analysis and understanding. - Continued development of mathematical, statistical, and computational framework leading to robust underlying approaches for automated information integration of disparate sources of data. - Continued research in cognitive radio and networking protocols. - Continued research on novel switched mode techniques to overcome radiation efficiency limit in electrically small antennas. - Continued research in cross-layer wireless protocols for delay sensitive network traffic. - Continued multidisciplinary research efforts to focus on intelligent control systems, cooperative behavior modeling and response, UxV-human interactions and adaptive mission methodologies. - Continued development of an interaction model of how users characterize visual content and context to improve video surveillance. 			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued development of improved formal foundations, methods, and tools for compositional verification and construction of high assurance software systems. - Continued investigation of relational constructive induction, semi-supervised learning, and classifier ensembles to improve collective classification technology and operations based automated decision aids. - Continued research aiming to develop principled, trustworthy, yet practical and usable approaches to address the issue of software producibility and the development of complex software systems with ensured interoperability. - Continued research into anti-tamper and information assurance: research focused on protection techniques, architectures, algorithms, protocols that allow for security and cyber situational awareness. - Continued research to develop mathematical and computational tools for compressive sensing. - Continued the development of theory and algorithms for quantum communications. - Completed efforts on Ferrite-based broadband circulators. - Completed development of the mathematical framework and algorithms for a new Multi-Scale timekeeping and Synchronization (MSTS) technique as an enabling technology for synchronous operation of disparate battlespace systems. - Initiated efforts addressing the representation, computation, and analysis of information from large diverse data sets. - Initiated research efforts to develop tools for proactive information assurance and cyber space security. - Initiated multidisciplinary research efforts on reasoning for image understanding in uncertain environments. - Initiated multidisciplinary research efforts to provide information assurance foundations for countering the Botnet threats. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Initiate research efforts addressing computational complexity arising from network-enabled computing, such as cyber security, information integration, and intelligent autonomy of networked, cooperative systems. - Initiate research efforts to develop methods and algorithms for computing with natural language. - Initiate mathematical studies to understand the micro-physics of a liquid-solid-gas interaction in turbulent flow conditions. - Initiate research efforts for mathematical development of physics-based computational and signal processing techniques for understanding and characterizing biological-acoustical coupling in acoustic wave propagation and scattering. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Complete efforts on switched mode techniques for overcome radiation efficiency limit in electrically small antennas. - Complete efforts on Ferrite-based broadband circulators. - Initiate research on mathematical and computational building blocks for machine reasoning and intelligence. - Initiate multidisciplinary research efforts on knowledge representation and reasoning for decentralized autonomy. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
- Initiate research efforts on algorithmic solutions and explicit measurement schemes for networks inference and monitoring.				
Title: MATERIALS/PROCESSES		58.123	64.021	64.537
<p>Description: Efforts include: Structural Materials; functional materials; maintenance reduction; Environmental Sciences; and Manufacturing Science. Accomplishments and plans described below are examples for each effort category.</p> <p>This activity also includes Secretary of Defense directed peer-review basic research to develop innovative solutions and enhance the science and engineering base.</p> <p>The funding increase in FY 2011 and out reflects increased investment in materials and processes research.</p> <p>FY 2010 Accomplishments: Structural Materials</p> <ul style="list-style-type: none"> - Continued development of first-principles based methodologies for predicting the thermodynamics and kinetics controlling microstructural evolution for the design of advanced weldable, naval steels. - Continued development of models and simulations to understand and predict high deformation rate blast behavior for engineered topological structures. - Continued development of materials and fabrication science for fugitive phase processes for engineered topological structures for ship blast protection. - Continued quantification of the corrosion effects on fatigue to be incorporated into the Unified Damage Model and validate in a few environmental cases on P-3 aircraft real loads data. - Continued developing carbon nanotubes growth and mechanical behavior in advanced composites for next generation ship and aircraft structures. - Continued development of theoretical basis for composite materials behavior based on x-ray computed microtomography. - Continued development of understanding and constitutive models of dynamic behavior of naval steels. - Continued evaluating environmental effects on marine composites and sandwich structures. - Continued exploration of composition, processing and microstructural evolution in titanium alloys for marine structures. - Continued exploration of multienergy processes for zero maintenance coatings. - Continued first lubrication-by-design experiments. - Continued high temperature, low frictional sliding coefficient materials for elevated operating temperature gas turbine engine bearings. - Continued investigation of a rapid annealing of surface layers and their effects. 				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued multi-scale (atomic to microscopic) physics/chemistry-modeling of friction, wear, and lubrication for the rational design of high performance bearings, gears, seals, and lubricants. - Continued the investigation of processing science (single crystals, coatings, thermal barrier coatings (TBC), heat treatment, etc) to materials performance for turbine engine components to develop relevant process protocols to optimize and control quality. - Continued to advance the understanding of processing and deformation mechanisms in nanostructured ceramic composites and metal alloys to provide new high strength-high toughness materials for Naval platforms. - Continued to develop the science of sliding contact and lubrication using physical and chemical first principles. - Continued to investigate the use of photorefractive crystals for the demodulation of a distributed fiber optic Bragg gratings structural health monitoring system. - Continued research on new hybrid composites that integrate polymers, structural fibers, carbon nanotubes, ceramics and metals, with improved blast, ballistic, fire resistance and mechanical characteristics with special emphasis at the interfacial aspects of the new materials. - Continued efforts to understand and predict salt chemistry effects on high temperature coatings and materials in naval gas turbine environments. - Continued understanding for development of modeling tools for enhancing dynamic response and projectile resistance for sandwich structures. - Continued the fatigue life prediction model analysis on high temperature engine materials. - Continued development of new methods for room temperature curing and processing of polymer composites with high temperature thermoxidative stability and fire resistance. - Continued assessment of the blast resistance of cellular structures as functions of soil characteristics. - Continued materials and fabrication science for fugitive phase processes for engineered topological structures for vehicle blast and fragmentation protection. - Initiated exploration of fundamental mechanisms and initiate development of physics-based models of electrophoretic deposition of ceramic nanoparticles and subsequent sintering. - Initiated physics based models for coupled phenomena in marine composite structures (thermo-mechanical loads, environmental effects, and fluid-structure interactions.) <p>Functional Materials</p> <ul style="list-style-type: none"> - Continued research tools design efforts in electromagnetic and acoustic bandgap materials. - Continued study of new transduction mechanisms. - Continued development of the science and technology base for a highly efficient and stable flexible organic solar cell. - Continued examination of the effects of acoustic perturbations and interactions in reacting flows and determine how they can be used. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued exploration and prediction of new sonar materials based on first principle methods. - Continued extension of first principle calculations of sonar materials tensor piezoelectric and dielectric properties to complex solid solutions to provide the basic understanding and predictive capability for ultra high strain materials. - Continued investigation into the properties and fabrication of novel ceramics which have potential to combine hardness, strength, and high transmission in the long wave infrared (LWIR) spectral region. - Continued effort to synthesize beta-SiC power suitable for subsequent densification into transparent beta-SiC ceramic. - Continued meta-materials effort to develop negative index materials with dynamic frequency response. - Continued synthesis and property measurement of new sonar materials predicted by first principle methods. - Continued expansion of first-principles methods devised to calculate piezoelectric properties of materials for sonar transducers to calculate additional materials properties for other applications. - Continued design, processing, and measurements to fashion the new generation of high-strain, high coupling piezoelectric single crystals into high-performance acoustic transducers for naval sonar systems. - Continued basic research into material technology associated with the development of active and conventional armor. - Continued effort to characterize regenerative bacterial nanowires. - Continued effort to synthesize cyclic peptide ring modules and polymerize them into peptide nanotube polymers. - Continued efforts to utilize chemically modified virus proteins as a scaffold to assemble nanostructured metamaterials with unique optical properties including negative index of refraction. - Continued effort to develop surface electrons on diamond. - Completed first principle methods to calculate second and third rank tensor properties of sonar materials such as lead zirconate titanate and lead magnesium niobate. - Completed development of methods for the intentional, controlled, impurity doping of semiconductor nanocrystal wires. - Initiated efforts to develop oxide materials for power management, sensors, and information storage/processing. <p>Maintenance Reduction</p> <ul style="list-style-type: none"> - Continued development of corrosion models. - Continued mechanistic studies of materials deterioration under chemical environment for ship materials and their interfaces. - Continued mechanism-based modeling of H-assisted cracking in ultra high strength steels. - Continued stainless steel carburization study to enhance corrosion performance. - Continued studies on understanding and modeling sea water corrosion effects of thermal cycling of AA 5XXX series. - Continued the concept study of multiscale corrosion modeling on naval ship materials. - Continued fundamental theoretical and experimental studies on nanoscale corrosion of metals and alloys. - Continued corrosion prediction using an integrated deterministic-based model. - Continued grain boundary engineering to improve corrosion resistance of marine grade aluminum alloys. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued modeling and simulation of corrosion phenomena. - Continued studies of surface microstructure optimization to enhance corrosion properties of navy marine alloys - Continued sensor development for monitoring microstructural changes on alloys under thermal and mechanical stresses. - Continued research focused on modeling and simulation for platform and system affordability, lifetime materials, shipboard wireless capability, automation to reduce manning. - Initiated development of ab initio models of corrosion reactions. - Initiated development of coatings capable of actively responding to environmental stresses. - Initiated study of coating failure mechanism on coating-substrate interface. - Initiated research on innovative concepts for effective radiation barrier coatings and ultra-low thermal conductivity barrier coatings. <p>Environmental Science</p> <ul style="list-style-type: none"> - Continued examination of scientific methods for pollution prevention, waste reduction, and hazardous material reduction for Naval Operations. - Continued broad based program in anti-fouling and fouling release coatings including investigation of effect of new polymers, materials, processes, and novel testing methodologies for coating efficacy. - Continued effort to determine most promising foul-release approaches based on silicones to meet Navy durability requirements. - Continued effort to develop Reverse Osmosis (RO) pre-treatment strategies to allow water recycling on ships. - Continued efforts on treatment strategies of oily water containing synthetic lubricants. <p>Manufacturing Science</p> <ul style="list-style-type: none"> - Continued a multidisciplinary research task into furthering the sciences associated with advances in manufacturing processes. <p>FY 2011 Plans:</p> <p>Structural Materials</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete multi-energy processing approaches for the room temperature cure of polymeric materials with high temperature thermoxidative stability and fire resistance. - Terminate effort to develop the science of sliding contact and lubrication using physical and chemical first principles. - Terminate effort for multi-scale (atomic to microscopic) physics/chemistry-modeling of friction, wear, and lubrication for the rational design of high performance bearings, gears, seals, and lubricants. - Terminate effort for first lubrication-by-design experiments. - Initiate Computer-Aided Materials Design (CAMD) for synthesis and testing of various materials. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>Functional Materials</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Initiate efforts to synthesize and characterize new materials with enhanced properties predicted by first principles methods. <p>Maintenance Reduction</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete studies on mechanism based modeling of hydrogen assisted cracking in high strength alloys for marine applications. - Complete studies on understanding and modeling sea water corrosion effects of thermal cycling of AA 5XXX series. - Initiate development of environmental corrosivity modeling. - Initiate development of nanoscale modeling of corrosion kinetics. - Initiate development of surface tolerant coatings. <p>Environmental Science</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>Manufacturing Science</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p><i>FY 2012 Plans:</i></p> <p>Structural Materials</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete high temperature, low frictional sliding coefficient materials for elevated operating temperature gas turbine engine bearings. - Initiate structure and properties of liquid and glassy metals. - Initiate scientific basis for the rational engineering design of Al-alloys for Naval applications. <p>Functional Materials</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Complete development of methods for the intentional, controlled, impurity doping of semiconductor nanocrystal wires. - Complete efforts to synthesize and characterize new materials with enhanced properties predicted by first principles methods. - Complete exploration and prediction of new sonar materials based on first principle methods. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Complete extension of first principle calculations of sonar materials tensor piezoelectric and dielectric properties to complex solid solutions to provide the basic understanding and predictive capability for ultra high strain materials.</p> <p>Maintenance Reduction - Continue all efforts of FY 2011, less those noted as completed above.</p> <p>Environmental Science - Continue all efforts of FY 2011.</p> <p>Manufacturing Science - Continue all efforts of FY 2011.</p>				
<p>Title: MEDICAL/BIOLOGY</p> <p>Description: Efforts include: Bioinspired autonomous and surveillance systems, and bio-inspired processes, materials and sensors; synthetic biology for Naval applications; casualty care and management; casualty prevention; undersea medicine/ hyperbaric physiology; biorobotics; expeditionary operations training; and stress physiology. These efforts are coordinated with the Army and Air Force through joint program reviews and are complementary, not duplicative.</p> <p>This activity also includes Secretary of Defense directed peer-review basic research to develop innovative solutions and enhance the science and engineering base.</p> <p>The funding increase in FY 2011 and out reflects increased investment in bio-inspired sciences.</p> <p>FY 2010 Accomplishments: Medical Sciences - Continued work on stress physiology, hyperbaric physiology, and biological effects of Naval operational exposures (e.g. directed energy). - Continued work in understanding the mechanisms of decompression illness and hyperbaric oxygen toxicity. - Continued work on genomics/genetics of infectious organisms of military relevance and signal of transduction. - Continued research in casualty care and management and casualty prevention, including investigations of mechanisms of hemorrhagic shock, blast injury, tissue repair, and the biomedical effects of military operational exposures such as directed energy, hazardous chemicals, and sound.</p>		16.365	19.345	20.298

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued research to explore systematic relationships between cognitive and physiological responses to laboratory tasks under operational conditions. - Continued research in the mechanism/effects of underwater thermal stress. - Continued research in understanding skull bones injury and healing dynamics. - Continued research to discriminate fatigue and stress performance effects. - Initiated research on long-term effects of exposure to submarine environments. - Initiated research to explore mechanisms of "ultrasonic" hearing in divers. - Initiated research to explore a novel opiod that will produce analgesia as effective as morphine, with minimal side effects. <p>Biological Sciences</p> <ul style="list-style-type: none"> - Continued efforts focused on microbe-materials interfacial interactions for detection of materials defects/failures, including corrosion, and for improved energy harvesting. - Continued work on microbial synthesis of energetic materials. - Continued research on biofouling with emphasis on barnacle adhesion studies using molecular biology tools. - Continued efforts focused on microbe-materials interfacial interactions to detect materials defects/failures. - Continued research to understand physiological effects of sound exposure on marine mammals from Navy sound sources other than sonar. - Continued efforts in "smart cell engineering" to design microbes that can sense and destroy other microbes through antibiotic production, or can "sense" and qualify their surrounding environment and provide information back to the user. - Continued combinatorial chemical screens for bacterial communication pathway inhibitors as potential antibiotics or fouling-control agents. - Continued efforts to engineer plants to produce high value naval materials. - Continued efforts utilizing metagenomic screens to identify novel bacterial activities related to nitration or synthesis of high-N heterocycles. - Continued efforts to develop ultra-fast methodology for selecting DNA biosensor molecules. - Continued research to generate label-free assays for biosensing at biointerfaces. - Continued research to identify inhibitors of lateral DNA transfer in bacteria. - Continued research on invertebrate larval settlement and metamorphosis in response to biofilms and various inhibitors of adhesion. - Continued work to identify plasma biomarkers of domoic acid toxicosis and leptospirosis in California sea lions, and develop a multiplexed assay to measure those plasma biomarkers. - Continued efforts to identify molecular biomarkers for battlefield injuries, and high-fidelity biosensors for detection in vivo. - Continued research into biomolecular 'logic controllers' for in vivo biosensor and in vivo drug delivery systems. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued research on engineered cells for infection detection and treatment in wounds. - Continued research efforts focused on developing bio-inspired sensors, vehicles and systems for local ISR, WMD detection, personnel protection and affordability. Research elements include advances in microfabrication, biological materials, processing techniques, robustness and efficiency of systems - Continued research on stem cells in marine mammals and their potential clinical role. - Initiated efforts to ascertain potential human health and environmental risks of novel nanomaterial-based ammunition primers. - Initiated research on stem cells in marine mammals and their potential clinical role. - Initiated development of a second set of molecular diagnostic tests for recently discovered viral pathogens of marine mammals. - Initiated research in elucidation of mechanisms of fish electric sense and near field low frequency acoustic perception. - Initiated research in mitigation of the effects of sleep deprivation. - Initiated research in stress effects on immune system. - Initiated research in cellular effects of high frequency EM fields. <p><i>FY 2011 Plans:</i></p> <p>Medical Sciences</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate interventions to mitigate underwater sound/blast effects. - Initiate research on improved trauma management in submarine Special Forces operators. - Initiate research on physiological and genetic effects of long-term diving. - Initiate research on heterotopic ossifications; injuries to bone material in soft tissue. - Initiate research in genetic basis of psychological stress. <p>Biological Sciences</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete efforts to ascertain potential human health and environmental risks of novel nanomaterial-based ammunition primers - Complete work on microbial synthesis of energetic materials. - Complete efforts to engineer plants to produce energetic materials. - Complete efforts to develop ultra-fast methodology for selecting DNA biosensor molecules. - Complete research to generate label-free assays for biosensing at biointerfaces. - Complete research to identify inhibitors of lateral DNA transfer in bacteria. - Initiate synthetic biology and microbiological bioenergy efforts. - Initiate research in self-assembly of proteins in water. - Initiate research on bacterial/cellular controllers for nano/micro-systems 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiate efforts to investigate DNA-scaffold-directed assembly of protein nanoarrays for control over orientation and position of proteins, and investigate triggered isothermal assembly of DNA nanostructures.</p> <p>- Initiate efforts in comparing commensal/pathogenic microbiomes in to Atlantic bottlenose dolphin and California sea lion, and for the dolphin diagnosed with chronic/active gastritis.</p> <p>FY 2012 Plans: Medical Sciences Continue all efforts of FY 2011.</p> <p>- Initiate research on individual susceptibilities in extreme environments to include hypoxic and/or hypobaric conditions.</p> <p>- Initiate research on individual susceptibility to chronic hyperbaric oxygen exposure.</p> <p>Biological Sciences</p> <p>- Continue all efforts of FY 2011, less those noted as completed above.</p> <p>- Initiate research on characterizing/manipulating human gut microbiome to understand and/or add specific functions (i.e., stress mitigation, N2 bubble mitigation, and digestion of non-traditional 'foods').</p>				
<p>Title: OCEAN SCIENCES</p> <p>Description: Efforts include: Littoral Geosciences and Optics; Marine Mammals and Biology; Physical Oceanography and Prediction; and Ocean Acoustics. Accomplishments and plans described below are examples for each effort category.</p> <p>This activity also includes Secretary of Defense directed peer-review basic research to develop innovative solutions and enhance the science and engineering base. The funding increase in FY 2011 and out reflects increased investment in ocean science research.</p> <p>FY 2010 Accomplishments: Littoral Geosciences and Optics</p> <p>- Continued field programs to understand physical and biological processes responsible for the formation, maintenance, and breakdown of thin oceanographic layers which have a significant impact on undersea warfare sensors and weapons.</p> <p>- Continued efforts to investigate the effects of oceanic biota on the propagation and inversion of multifrequency acoustical energy.</p> <p>- Continued investigations of sources and properties of light scatter within the coastal ocean.</p> <p>- Continued to investigate the physical processes that control re-suspension of bottom sediments and the resulting impact on optical and acoustical propagation.</p>		75.409	81.941	86.008

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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- Continued investigations of oceanic processes within the surface boundary layer that control high-frequency variability in image propagation and distortion.
- Continued to investigate and characterize the impact of riverine sources of optically-important matter on underwater visibility, navigation, and surveillance.
- Continued field program to infer sea floor characteristics from observations of surface gravity waves.
- Continued effort to understand the extent and intensity of seafloor gas hydrate accumulations and coastal biooptical response to air-ocean forcing.
- Continued programs to estimate optical properties of coastal ocean water from above-surface sensing, using insitu data for validation.
- Continued studies to predict tidal flat evolution in coastal/riverine/estuarine systems.
- Continued incorporation of improved understanding of tropospheric and stratospheric bulk exchanges, air-sea interface, boundary layer interface, coastal ocean dynamics, gas hydrate accumulation, and biological responses into atmospheric and ocean prediction models and tactical aids.
- Continued development of prediction models for distributaries deltaic coastal environments.
- Continued studies of tidal flat evolution in wave dominated environments.
- Completed study of incorporation of improved understanding of tropospheric and stratospheric bulk exchanges, air-sea interface, boundary layer interface, coastal ocean dynamics, gas hydrate accumulation, and biological responses into atmospheric and ocean prediction models and tactical aids.
- Completed field, laboratory, and numerical studies of seafloor sand ripple genesis, evolution, and destruction and their effect on acoustical penetration of the sea floor.
- Initiated studies of dissipation of surface gravity waves by muddy seabed sediments.

- Marine Mammals and Biology
- Continued field trials of an integrative ecosystem study to provide environmental predictors of whale presence or absence to reduce impacts of Naval systems to marine mammals.
 - Continued new efforts on tracking of marine mammals using data fusion based on tags and remote sensing.
 - Initiated new efforts to examine physiology of marine mammals in situ and to predict consequences of physiological and auditory stress to populations.

- Physical Oceanography and Prediction
- Continued field studies/modeling to predict propagation and effect on acoustics of non-linear internal waves in the western Pacific.

FY 2010	FY 2011	FY 2012

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>	PROJECT 0000: <i>Defense Research Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued development of a ship wave radar driven wave model to allow high resolution studies of near surface ocean processes and to support Sea Basing. - Continued extensive internal wave field program off the New Jersey Shelf; field work coincided with and complemented the Shallow Water Acoustics Program. - Continued an assessment of the role of emerging sub-mesoscale parameterization techniques for improving next generation high resolution/high accuracy environmental models. - Continued design evaluation for a persistent mobile sampling network based on autonomous undersea vehicle platform and sensor technologies. - Continued extensive 3-year field program on prediction of internal waves. - Continued first field test of the Optimal Deployment DRI (ODDAS) in the South China Sea. - Continued 5-year program on the analysis of coherent structures in rivers and estuaries in support of the prediction and characterization of denied areas. - Continued a field and modeling program to predict mesoscale structures and rapidly-varying currents in the Philippine Archipelago using Synthetic Aperture Radar (SAR), Hyperspectral and other remote data together with new data assimilation methods. - Continued field programs that demonstrate persistent monitoring and measurement of environmental structures using gliders. - Continued workshops to define science needs for Sea Basing. - Continued a Coupled Oceanographic-Acoustics modeling and field program to demonstrate the use of a fully coupled system in optimizing tactical reduction of uncertainty. - Continued an integrated modeling and field experiment on determining custom self-learning wave databases and forecast systems/ship-movement and engineering systems for Sea Basing. - Continued an Estuarine-Littoral Processes Interaction field study in muddy and tidal flat dominated regimes including a data assimilative prediction capability. - Continued studies of complex ocean currents in the Indian Ocean using gliders and remote sensing methods being developed to support tactical oceanography. - Continued studies of internal waves and strait dynamics emphasizing field studies in the Celebes, Philippine, and Sulu Seas. - Continued studies to understand how to sample ocean processes with gliders and other autonomous and remote sensing systems to support tactical oceanography. - Continued the field experiment in Monterey Bay to examine the role of unresolved processes in model parameterizations. - Continued to develop state of the art numerical model assimilation and initialization techniques, improved physical parameterizations, air-sea interactions, and fidelity for atmospheric and ocean prediction systems. - Continued development of expert system methods to characterize and predict Riverine/estuarine systems to support Naval Special Warfare, Marine Expeditionary Forces and new Riverine units. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued studies of complex ocean currents in the Indian Ocean using gliders and remote sensing methods being developed to support tactical oceanography. - Continued studies of ocean and wave response to typhoons and monsoons in the Western Pacific. - Continued studies of how to predict the 'full battle space environmental cube' using networked sensors and multiply coupled ocean/wave/atmosphere/acoustic prediction systems to provide sea base and fleet force protection. - Completed the pilot test of the novel data Synthetic Aperture Radar (SAR) and Hyper-spectral assimilation forecast system developed under Philippine experiment. <p>Ocean Acoustics</p> <ul style="list-style-type: none"> - Continued analysis of deep-water acoustic transmissions made in the North Pacific to understand the scattered sound field due to ocean volume variability and bathymetric features. - Continued field experiments and modeling efforts to examine the performance of Acoustic Vector Sensors. - Continued a field and modeling effort to simultaneously study shallow-water medium fluctuations and develop time-reversal communications using adaptive channel equalizers. - Continued analysis and modeling to understand the physics of buried mine detection through broadband and synthetic aperture sonar. - Continued shallow-water, shelf-break measurements and analysis to characterize the effects of the ocean water column and seabed variability on low- and mid-frequency acoustic propagation and scattering. - Continued a field and modeling effort to establish the capabilities of underwater acoustic communications for FORCEnet and persistent undersea surveillance. - Continued the development and testing of geo-acoustic inversion and extrapolation methods. - Continued investigations into quantifying, predicting and exploiting uncertainty in acoustic prediction models. - Continued to research effect of solitons and internal wave bores on acoustic propagation and buoyancy. - Continued research to develop complex analytic equations that couple oceanographic modes, both horizontal and vertical, to their corresponding frequency-dependent acoustic modes to give direct acoustic prediction capability. - Continued research to quantify uncertainty in acoustic field computations for multi-scale ocean environments using novel approaches involving Bayesian prediction and polynomial chaos expansions to embed environmental uncertainty into multi-scale ocean dynamics and acoustic propagation. - Continued assessment of "time-reversal" propagation techniques for mitigation of environmental variability. - Continued effort to understand synoptic scale ocean variability in the strategic Turkish Straits System including water mass exchange between basins and vertical mixing. - Continued field work on adaptive beam-forming using mobile, autonomous sensors. - Continued deep-water acoustic transmission measurements with emphasis on the Northern Philippine Sea. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued research effect of solitons and internal wave bores on acoustic propagation and buoyancy. - Completed development of algorithms for accurate acoustic predictions in dispersive, turbulent, turbid water. - Completed development of source waveform design for rough littoral seafloors. - Completed effort to develop a methodology for expressing the semantics of physics-based environmental models to support automated computer applications. - Completed effort to understand how mudflat sediments respond to dynamic processes. - Completed research to enhance understanding of the vibrational response of elastic structures to flow induced excitation while developing a first-principles model for the induced structural acoustic response and reradiated acoustic field. - Initiated data collection and analysis of deep water ambient noise with emphasis on the Philippine Sea. <p>FY 2011 Plans:</p> <p>Littoral Geosciences and Optics</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. <p>Marine Mammals and Biology</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>Physical Oceanography and Prediction</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete extensive internal wave field program off the New Jersey Shelf; field work will coincide with and complement the Shallow Water Acoustics program. - Complete an assessment of the role of emerging sub-mesoscale parameterization techniques for improving next generation high resolution/high accuracy environmental models. - Complete a field and modeling program to predict mesoscale structures and rapidly-varying currents in the Philippine Archipelago using Synthetic Aperture Radar (SAR), hyper-spectral and other remote data together with new data assimilation methods. - Complete a coupled oceanographic acoustics modeling and field program to demonstrate the use of a fully coupled system in optimizing tactical reduction of uncertainty. - Complete extensive 3-year field program on prediction of internal waves, acoustics in internal wave fields, transmission loss, and dissipation in areas of internal wave breaking. - Complete first field test of the Optimal Deployment DRI (ODDAS) in the South China Sea. - Complete 5-year program on the analysis of coherent structures in rivers and estuaries in support of the prediction and characterization of denied areas. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<ul style="list-style-type: none"> - Complete the field experiment in Monterey Bay to examine the role of unresolved processes in model parameterizations. - Initiate studies of complex ocean currents in the Indian Ocean using gliders and remote sensing methods being developed to support tactical oceanography. - Initiate the field and modeling experiments to determine the lateral dispersion and maxing parameterization needed to understand model turbulence and to model ocean circulation. <p>Ocean Acoustics</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete field experiments and modeling efforts to examine the performance of acoustic vector sensors. - Complete field work on adaptive beam-forming using mobile, autonomous sensors. - Complete research effect of solitons and internal wave bores on acoustic propagation and buoyancy. - Complete assessment of "time-reversal" propagation techniques for mitigation of environmental variability. - Complete field work on adaptive beam-forming using mobile, autonomous sensors. - Initiate reverberation and clutter modeling studies. <p>FY 2012 Plans:</p> <p>Littoral Geosciences and Optics</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Initiate Field, modeling and remote sensing studies of currents, waves, sediment transport and bathymetric evolution of river mouth and inlet environments. - Initiate Investigations of radar, hyperspectral and electro-optical remote sensing signatures in littoral environments. <p>Marine Mammals and Biology</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Physical Oceanography and Prediction</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Initiate a field and modeling effort to understand and predict the generation and variability of western boundary currents in the Pacific Ocean. - Initiate a field and modeling effort to understand the coupled physical processes that result in the propagation of the air-sea mode known as the Madden-Julian Oscillation in the Indian Ocean. - Initiate field experiments to study the generation of sub-mesoscale features in the ocean due to topographic interactions with islands, coasts, and coral reefs. 			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiate a field and modeling program to investigate the structure and circulation of the South China Sea and oceanographic variability along the coast of Vietnam. - Initiate studies of the coupled atmosphere-ocean-cryosphere-wave physics from the submesoscale to decadal climate scales to permit development of new global coupled modeling systems. - Initiate studies of changes in the Arctic oceanography, meteorology and cryosphere and associated processes to allow permit development of new prediction models for the Arctic. - Initiate arctic research to develop a new generation of ocean-ice-atmosphere dynamic prediction models, including process studies involving remote sensing and in-situ observations. <p>Ocean Acoustics</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above - Complete field work on adaptive beam-forming using mobile, autonomous sensors. - Complete deep-water acoustic transmission measurements with emphasis on the Northern Philippine Sea. - Initiate investigation of acoustic propagation in the Arctic. 				
<p>Title: SCIENCE AND ENGINEERING EDUCATION, CAREER DEVELOPMENT AND OUTREACH</p> <p>Description: Science and Engineering Education and Career Development activities include DON participation in science fairs, summer research interns/fellows at Navy laboratories, graduate fellowships for individuals expected to become members of the engineering faculty at Historically Black Colleges and Universities and Minority Institutions (HBCU/MIs), and curricular enrichment programs. Outreach includes the encouragement, promotion, planning, coordination and administration of Naval Science and Technology.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued awarding prizes at 400 regional high school science fairs and three national competitions. - Continued supporting high school summer interns at Navy laboratories. - Continued supporting undergraduate/graduate students as summer research interns at Navy laboratories. - Continued providing graduate fellowship support to HBCU engineering faculty candidates. - Continued funding Young Investigator research grants. - Continued encouraging, promoting, planning, coordinating and administering naval Science and Technology programs. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>FY 2012 Plans:</p>		31.186	29.328	32.150

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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- Continue all efforts of FY 2011.			
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Title: SENSORS, ELECTRONICS AND ELECTRONIC WARFARE (EW)	50.036	53.604	53.939
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Description: Efforts include the basic research portions of: Sensing, diagnostics, and detectors; navigation and timekeeping; nano-electronics; wide band gap power devices; real-time targeting; Electro-Optical/Infra Red (EO/IR) electronics; EO/IR electronic warfare; EO/IR sensors for surface/aerospace surveillance; Radio Frequency (RF) sensors for surface/aerospace surveillance; solid state electronics; vacuum electronics; Integrated Topside (InTop) Innovative Naval Prototype (INP); and RF electronic warfare.

FY 2010 Accomplishments:

- Continued monolithic integration of multifunctional materials to enable passive devices and sensors into wide bandgap semiconductor circuits.
- Continued investigation of physical basis for improved time and frequency standards using quantum-entangled ions and atoms.
- Continued investigation of ultra high speed logic and multiple-quantum-well devices with a goal of >500 gigahertz (GHz) samplers, in support of mixed signal circuits for receiver analog-to-digital converters (ADC's).
- Continued program to extend device performance and architectures to frequencies approaching terahertz (THz).
- Continued program to incorporate Magnesium Diboride (MgB2) tunnel junctions into simple electronic logic structures.
- Continued study to determine if the coupling between spins in quantum dots mediated by the virtual excitons is sufficiently strong for use in solid state implementations for quantum information.
- Continued program on advanced epitaxial growth for novel Si-based detector applications.
- Continued development of a blind adaptive beamforming approach for the High Frequency (HF) radar case and compare with both the conventional and traditional approaches.
- Continued development of approaches for probability of detection for deterministic signals in stationary noise and quantify for non-stationary noise.
- Continued development of electromagnetic ultra-near-field holography.
- Continued development of sensitive miniature fluxgate magnetometers.
- Continued project to lower thermal gradients between active circuit elements and heat sinks.
- Continued projects to explore physical behavior of full arrays of nanoscale devices for logic, memory, and imaging.
- Continued a program to apply innovative mass nanofabrication techniques to previously developed nanodevice arrays.
- Continued a program on the control of deleterious defects in silicon carbide (SiC).
- Continued a program on the study of Quantum Dots and their application to coherent wave function control and quantum information.

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued a program on the tailoring of the optical, structural and electronic properties of semiconductor quantum wires. - Continued a program to demonstrate non-volatile memory, based on spin-torque Magnetic Random Access Memory (MRAM), with switching speed > 1 GHz and write currents small enough (<1 mA) to be driven by superconducting Rapid Single Flux Quantum (RSFQ) logic. - Continued a program to determine if the newly invented Reciprocal Flux Quantum Logic in fact delivers 2x higher speeds with 5x fewer Josephson junctions and power, while using the same underlying devices so that single chip hybrid circuits between it and the dominant RSFQ logic are feasible. - Continued a program to investigate whether pattern dependent RF currents during plasma etching are responsible for observed variability in Josephson junction characteristics in complex circuits and, if so, define design rule changes to avoid the effects. - Continued demonstrations of tunable analog filters made in a digital Nb device foundry. - Continued development of techniques to observe directly the electrical properties of pair states in high temperature superconductors. - Continued work on optical manipulation of ultra-cold atoms. - Continued investigation of temporal-spatial noise shaping circuits and architectures for high power digital-to-analog conversion with objectives of doubling spectral bandwidth, reduction of element density (15%), and extension of multidimensional Nyquist limits to both linear and planar arrays. - Continued the evaluation and assessment of hardware-compatible space-time algorithms for Digital Signal Processor (DSP) applications to Transmit/Receive (T/R) arrays. - Continued research to improve mixed signal III-V device and circuit modeling with objectives of achieving a 30 dB dynamic range improvement for complex circuits containing over 100,000 devices. - Continued project to explore graphene based nanoelectronic devices. - Continued program in chip-scale quantum architectures. - Continued project to reduce heat transfer through electrical leads in cryogenic packaging. - Continued project to explore development of devices, sigma delta and time encoder circuits for near THz switching with objectives of enabling analog and digital conversion at millimeter wave frequencies. - Continued high-sensitivity magnetometry using quantum logic. - Continued materials studies of low temperature regenerator (high thermal capacity) materials and/or controlled flow microstructures with the goal of improving energy efficiency of cryocoolers. - Continued research into fundamental concepts and mathematics for digital array architectures. - Continued research to apply carbon nano-tube technology to acoustic sensing. - Continued research to investigate two-dimensional electron gases in perovskite oxide heterostructures. - Continued project to investigate self-assembled one-dimensional GaN channels in AlGaIn/GaN structures. - Continued spin-based electronics research 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued graphene physics and bandgap engineering research - Continued semiconducting nanowire synthesis and characterization research - Continued research on strain engineering in graphene - Continued work on spin properties of graphene - Continued research on focused electron beam based angstrom-scale nano-patterning - Completed research effort to investigate target and signal characteristics based on non-Archimedean geometry. - Completed the 6.1 portion of study of RQL digital superconducting logic with the conclusion its performance warrants 6.2 development. - Completed research effort to investigate target and signal characteristics based on non-Archimedean geometry. - Completed the study of RQL digital superconducting logic. - Initiated research effort to determine the most appropriate tunnel barrier for MgB2 Josephson junctions. - Initiated an effort to grow low defect density, high purity epitaxial 4H-SiC at high growth rates suitable for high power electronic device applications. - Initiated design, construction, and testing of sonic crystals that can be tuned to have specific acoustic properties. - Initiated effort to create a physics-based understanding of epitaxial oxides and insulators for use in applications for advanced electronics. - Initiated investigation into stabilizing in-phase coherent state of coupled systems for coherent power generation. - Initiated high output impedance solid state device technologies and materials. - Initiated effort to fabricate functionalized micro-opto-mechanical systems for the measurement of micromechanical photothermal spectra of adsorbed chemical vapor analytes. - Initiated research effort on chemical synthesis and bandgap tailoring in graphene nanoribbons. - Initiated research on spin dynamics in Group IV semiconductors and related device concepts. - Initiated research efforts on non-conventional nanofabrication that hold promise for sub-10nm resolution. - Initiated studies of the physics origin of noise and behavioral fluctuations in superconducting circuits, especially analog to digital converters, and incorporate the understanding into computer aided circuit simulators. - Initiated studies of the generation and recombination dynamics of non-equilibrium quasiparticles associated with digital switching events in superconducting logic. - Initiated investigation of metamaterials with embedded active devices to better understand multidimensional signal processing from RF through THz frequencies. - Initiated effort on nuclear optical frequency standard in thorium 229. - Initiated studies of intraband transitions in wide bandgap quantum wells. - Initiated studies of the use of non-linear optical (phonon-photon interactions) phenomena as a method of cooling to cryogenic temperatures. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Initiated effort to investigate statistical representations of target and signal techniques. - Initiated studies of chemical vapor deposition (CVD) of graphene on copper - Initiated research on dual-STM characterization of graphene film - Initiated research on defect engineering and characterization in graphene. - Initiated studies of how to prevent flux trapping and diagnose its occurrence in complex superconducting circuits and to design real time expert measurement systems in general for testing of new designs defined in VHSIC (Very High Speed Integrated Circuits) Hardware Description Language (VHDL). <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Initiate high output impedance solid state amplifier technologies. - Initiate program of ultraprecise gravitational measurements using atom interferometry. - Initiate research on graphene based high performance flexible electronics - Initiate research on DNA based carbon nanotube sorting and placement - Continue MgB2 Josephson junction work with first tests of 10 device logic cells to determine likely clock speeds of this new materials technology. - Complete first demonstrations of miniature but low loss HF and Ka band filters constructed as objects manufactured by whole wafer techniques in a mixed analog and digital Nb process technology. - Initiate investigation of electrical stress characterization and Gallium Nitride transistor stability. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Initiate research on characterization and control of graphene edge effects - Initiate research on electronic functionality in DNA nanostructures - Initiate research on chemical functionalization and self-assembly of graphene nanostructures - Initiate studies of how best to densify superconducting circuits using new third generation Nb devices including what new layers devoted to resistors, filters, power distribution or wiring would provide the greatest system benefit. 			
Title: WEAPONS		18.651	20.692
Description: Efforts include: Undersea Weaponry; Energetic Materials and Propulsion; Expeditionary Operations (communications, materials for forensic sensing, landmine detection, human sensory enhancements, lightweight power sources and information efficiency); Directed Energy; ; Counter Directed Energy and Applied Electromagnetics.			24.828

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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This activity also includes Secretary of Defense directed peer-review basic research to develop innovative solutions and enhance the science and engineering base.

The increase in FY 2011 is due to funding related to the completion of an advanced energetics research effort. The increase in FY 2012 is due to increased basic research in support of the EM Railgun.

FY 2010 Accomplishments:

- Undersea Weaponry
- Continued conducting basic research related to critical S&T (including vehicle control, maneuverability, and stability) associated with the development of High-Speed Supercavitating Vehicles (HSSV).
 - Continued expansion of the University Laboratory Initiative (ULI) Program to provide a further infusion of educated and career-minded scientists and engineers in support of the National Naval Responsibility (NNR) for Undersea Weapons Research.
 - Continued computer code refinements and investigation of supercavitating vehicle dynamics and instability.
 - Continued evaluation of viable synthesis methodologies and characterization of candidate explosive ingredients suitable for undersea weapons applications.
 - Continued development of diagnostic capabilities to accurately determine aluminum combustion characteristics in oxidizing environments.
 - Continued an Otto Fuel II characterization study for undersea weapons.
 - Continued studies of low probability of intercept sonar, metalized explosives, lattice deformation of crystalline explosives, high thermal conductivity nanocomposites for vehicle arrays, microplasma fuels reforming and biomimetic propulsion mechanisms for underwater vehicles exploiting flutter instability.
 - Continued the novel signal processing approach for detection and classification of countermeasures.
 - Continued development of concept for weaponized Unmanned Undersea Vehicles (UUVs) based on gametheoretic approach.
 - Continued validation of hydroacoustic models and test and evaluate acoustic array signal processing algorithms.
 - Continued study on propulsion and its interaction with supercavitating cavity, and control surfaces.
 - Continued acoustic concepts formulation and modeling for low-noise bio-inspired propulsion systems.
 - Continued concept development on inversion of swarm dynamics for underwater tactical applications.
 - Continued new coating concepts for corrosion and anti-fouling protection of UUVs.
 - Completed a proof of concept demonstration of a potential electro-optical technology enhancement capability for undersea warhead fuzing systems.
 - Completed isolation and characterization of the tetranitroborate anion as a candidate ingredient suitable for undersea warheads applications.

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Completed development of an acoustic propagation model for rapid and accurate calculations for undersea weaponry applications. <p>Energetic Materials and Propulsion</p> <ul style="list-style-type: none"> - Continued development of a fundamental understanding of initiation mechanisms of explosive crystals subjected to shock stimulus. - Continued exploring the use of quantum mechanics and molecular dynamics to provide fundamental properties for energetic materials to predict initiation/detonation criteria for insensitive munitions applications. - Continued investigation of JP-10 combustion-based Proton-Exchange-Membrane (PEM) fuel cells. - Continued investigation of multi-tube multi-nozzle Pulse Detonation Engines (PDEs) and multi-tube common nozzle PDEs. - Continued investigation of nanometallic-hydrocarbon hybrid catalytic combustion for increased energy release rates. - Continued investigation of novel initiation techniques, including optimized injection parameters, and integrated single tube operation for PDEs. - Continued Advanced Energetics research in reactive, explosive, and propulsive energetic materials, including high energy ingredient synthesis & characterization, and fundamentals of initiation and decomposition mechanisms, to tailor energy release processes in order to achieve substantial performance gains and/or enhanced survivability in harsh environments. - Continued to develop fundamental understanding of nitramine and perchlorate decomposition mechanisms for propellant applications. - Continued to develop organometallic-based highly energetic ingredients. - Continued efforts to explore alternative fuel concepts for Naval applications to include hydrogen, synthetic diesel, and biodiesel. - Continued development of multi-parameter sensor for multi-phase combustion flows (UAV and underwater PDEs). - Continued implementation of new & nanostructured materials design concepts for direct energy conversion and waste energy conversion. - Continued investigation of integrated pulse detonation engine-airframe for autonomous vehicles, and pulse detonation for passive weapons (noise, jamming). - Continued studies to determine the best investment of technologies for Unmanned Undersea Vehicle (UUV) Guidance and Control (G&C). - Continued hydroacoustics models and experiments to reduce the self noise on cavitator acoustic array. - Continued acoustic signal processing algorithms for HSSV guidance and control. - Continued development of new concepts for underwater power generation. - Continued development of non-lethal undersea warheads for Overseas Contingency Operations. - Continued development of PDE for underwater applications. - Initiated new thrust on the design, synthesis and characterization of high energy dense oxidizers. 			

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>	PROJECT 0000: <i>Defense Research Sciences</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Initiated structure property relationship studies on advanced propellant systems and high blast energetic compositions. - Initiated synthesis and characterization of cluster complexes between reactive metals and energetic oxidizers and explosives. <p>Expeditionary Operations</p> <ul style="list-style-type: none"> - Continued investigation of catalysts that reduce the pre-processing requirements for using logistic fuels in solid oxide fuel cells. - Continued research in quantum optics, nano-microscale self assembly and molecular recognition for active forensic sensing. <p>Directed Energy</p> <ul style="list-style-type: none"> - Continued research thrust in directed energy weapons. - Continued directed energy development in the areas of advanced optical components and coatings for high energy lasers, high power injector and photocathode development, beam control and tracking research, terahertz source development and applications, femtosecond laser application studies, and the modeling and simulation of high power laser operation. - Continued basic research into mechanisms and concepts supporting the defeat of and protection against speed of light weapons. - Continued basic research into mechanisms and concepts supporting the defeat of and protection against speed of light weapons for light tactical aerial vehicles and unmanned systems to include research into atmospheric propagation and extinction to support increased understanding of operational impacts which may affect utility of directed energy systems. - Completed investigation of catalysts that reduce the pre-processing requirements for using logistic fuels in solid oxide fuel cells. - Initiated research into advanced theoretical research and modeling of superconducting laser elements as used in advanced high energy accelerators. <p>Applied Electromagnetics:</p> <ul style="list-style-type: none"> - Continued basic research and theoretical analysis in electromagnetic phenomena in the spectrum from microwaves to visible light. Areas of research will be in microwave directed energy, optical directed energy (lasers), terahertz sources, and related nanometer-scale electronics and sensors. <p>FY 2011 Plans:</p> <p>Undersea Weaponry</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete the novel signal processing approach for detection and classification of countermeasures. <p>Energetic Materials and Propulsion</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>	PROJECT 0000: <i>Defense Research Sciences</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Expeditionary Operations - Continue all efforts of FY 2010.</p> <p>Directed Energy - Continue all efforts of FY 2010.</p> <p>Counter Directed Energy - Identify the most promising physics, science, and mathematic solutions to protect naval assets against directed energy threats - Establish the basic science and technology issues relevant to the propagation of directed energy in the atmosphere and its interaction with sensors, electronics and structural materials.</p> <p>Applied Electromagnetics: - Continue all efforts of FY 2010. - Initiate program to conduct basic research and theoretical analysis in electromagnetic phenomena in the spectrum from microwaves to visible light. Areas of research will be in microwave directed energy, optical directed energy (lasers), terahertz sources, and related nanometer-scale electronics and sensors.</p> <p><i>FY 2012 Plans:</i> Undersea Weaponry - Continue all efforts of FY 2011. - Initiate high energy density power system research for under water vehicles.</p> <p>Energetic Materials and Propulsion - Continue all efforts of FY 2011.</p> <p>Expeditionary Operations - Continue all efforts of FY 2011. - Complete basic research in quantum optics, nano-microscale self assembly and molecular recognition for active forensic sensing. - Initiate basic materials research to explore and improve high strain and stress rate performance of high performance fibers, armor inserts, and structural materials. - Initiate basic research into automated reasoning and data fusion for distributed surveillance.</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>	PROJECT 0000: <i>Defense Research Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiate basic research into the optimization of individual physical performance, cognitive performance, and resilience to stress. - Initiate fundamental chemistry and materials science research to advance water purification technologies. - Initiate basic research to advance electrochemical energy conversion and storage. <p>Directed Energy</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Counter Directed Energy</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Applied Electromagnetics:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 			
Accomplishments/Planned Programs Subtotals	396.907	429.767	446.123

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Defense Basic Research seeks to improve the quality of defense research conducted predominantly through universities and government laboratories. It also supports the education of engineers and scientists in disciplines critical to national defense needs through the development of new knowledge in an academic environment. Initial research focus is generally conducted in an unfettered environment because of the nature of basic research, but as more is learned and applications emerge, individual research projects take on a more applied focus. Individual project metrics then become more tailored to the needs of specific applied research and advanced development programs. Example metrics include a biporous wick structure for thermal management of power electric modules capable of removing 900 watts per square centimeter which was recently developed by an academia/industry team. The National Research Council of the National Academies of Science and Engineering's congressionally directed "Assessment of Department of Defense Basic Research" concluded that the DoD is managing its basic research program effectively.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>				PE 0601153N: <i>Defense Research Sciences</i>				4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	9.628	-	-	-	-	-	-	-	-	0.000	9.628

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: Naval Innovative Science and Engineering	9.628	-	-
Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.			
FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:			
<ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 			
Accomplishments/Planned Programs Subtotals	9.628	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy									DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>				PROJECT 9999: <i>Congressional Adds</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	17.088	-	-	-	-	-	-	-	-	0.000	17.088

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: Magnetic and Elec Fields in Ocean Env <i>FY 2010 Accomplishments:</i> This effort supported investigation of physical oceanographic and magnetic relationships via measurable physical and magnetic properties to determine how magnetic and electric fields respond to physical forcing under various oceanic conditions on a narrow continental shelf (deep water close to shore) off the east coast of the United States.	1.992	-
Congressional Add: Energetics S&T Workforce Development <i>FY 2010 Accomplishments:</i> This effort conducted applied research in the areas of energetic material synthesis, energetic systems engineering, traumatic brain injury, and autonomous technology.	3.485	-
Congressional Add: Human Neural Cell-Based Biosensor <i>FY 2010 Accomplishments:</i> This effort developed a monolayer culture of adherent human neural progenitor cells that can be reliably and quantitatively differentiated into primary cultures of human neurons.	1.095	-
Congressional Add: Next Generation Manufacturing Processes and Systems <i>FY 2010 Accomplishments:</i> This effort established a research and education program in flexible rapid response manufacturing which enhanced the manpower, technology and knowledge base for quick response, high technology precision manufacturing.	1.195	-
Congressional Add: ONAMI Initiatives <i>FY 2010 Accomplishments:</i> This effort provided basic research to explore novel measurement techniques and metrology tools to build and characterize nanostructures and devices. New nanometrology tools to image and measure the structure and composition of nanomaterial heterostructures and interfaces were studied and built, and techniques for evaluation of nanoscale devices for logic and biosensing applications were explored.	3.824	-
Congressional Add: Shock and Vibration Modeling of Marine Composites	1.912	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601153N: <i>Defense Research Sciences</i>	PROJECT 9999: <i>Congressional Adds</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011
<i>FY 2010 Accomplishments:</i> This effort investigated and developed new composite materials, analytical tools and processing methods that can be used on all types of naval vessels. In particular, research was conducted into shock and vibration modeling of marine composites.		
<i>Congressional Add:</i> Texas Microfactory	1.593	-
<i>FY 2010 Accomplishments:</i> This effort supported Texas Microfactory research.		
<i>Congressional Add:</i> Next Gen Renew Energy Sources	1.992	-
<i>FY 2010 Accomplishments:</i> This effort funded basic research to support development of prototypes of next generation renewable energy systems for naval applications.		
Congressional Adds Subtotals	17.088	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	79.762	98.150	104.804	-	104.804	106.752	105.973	113.806	125.106	Continuing	Continuing
0000: <i>Power Proj Applied Research</i>	57.793	98.150	104.804	-	104.804	106.752	105.973	113.806	125.106	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	0.300	-	-	-	-	-	-	-	-	0.000	.300
9999: <i>Congressional Adds</i>	21.669	-	-	-	-	-	-	-	-	0.000	21.669

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE supports both advanced technology research and near to mid-term transition opportunities. The advanced research focus is primarily on High Energy Lasers (HEL), Electromagnetic railgun development, high speed weapon propulsion, and electro-optic/infrared (EO/IR) sensor technologies. The mid-term effort is focused on developing and demonstrating technologies supporting the Future Naval Capability (FNC) Program Enabling Capabilities (ECs) for Marine and Unmanned Vehicle Tactical Intelligence, Surveillance and Reconnaissance (ISR), Advanced Naval Fires Technology, Hostile Fire Detection and Response, Maritime Weapons of Mass Destruction Detection (MWMD-D), and Dynamic Target Engagement & Enhanced Sensor Capabilities. Within the Naval Transformation Roadmap, this investment will achieve two of four key transformational capabilities required by Sea Strike as well as technically enable the Littoral Sea Control key transformational capability within Sea Shield.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	77.210	98.150	138.620	-	138.620
Current President's Budget	79.762	98.150	104.804	-	104.804
Total Adjustments	2.552	-	-33.816	-	-33.816
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	3.482	-			
• SBIR/STTR Transfer	-0.667	-			
• Program Adjustments	-	-	-33.445	-	-33.445
• Section 219 Reprogramming	-0.255	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.371	-	-0.371
• Congressional General Reductions Adjustments	-0.008	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *Advanced Helicopter Landing Aid*
- Congressional Add: *Aging Military Aircraft Fleet Support*
- Congressional Add: *Combustion Light Gas Gun Projectile*
- Congressional Add: *Electronic Motion Actuation Systems*
- Congressional Add: *Enhanced EO/IR Sensors*
- Congressional Add: *Millimeter Wave Imaging*
- Congressional Add: *Multifunctional Materials, Devices, and Applications*
- Congressional Add: *Naval Advanced Electric Launcher System*
- Congressional Add: *Strike Weapon Propulsion*
- Congressional Add: *Guidance, Navigation, Control, and Targeting*

Congressional Add Subtotals for Project: 9999

	FY 2010	FY 2011
	0.797	-
	1.593	-
	3.983	-
	0.797	-
	2.390	-
	1.354	-
	1.593	-
	1.992	-
	3.187	-
	3.983	-
Congressional Add Subtotals for Project: 9999	21.669	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)		FY 2010		FY 2011
Congressional Add Totals for all Projects		21.669		-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>				PROJECT 0000: <i>Power Proj Applied Research</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>Power Proj Applied Research</i>	57.793	98.150	104.804	-	104.804	106.752	105.973	113.806	125.106	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project addresses the technology issues involving the Navy's capability to project naval power on the broad seas and in the littoral regions.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: DIRECTED ENERGY</p> <p>Description: The goal of this activity is to develop Directed Energy (DE) technology for Navy applications. The DE program address the requirements of future Navy combatants to provide ship defense against the high speed, high maneuverability Cruise Missiles that are proliferating throughout the Navies of the world. The Directed Energy portion of this activity consists of two elements. The first element involves applied research and development of technologies supporting advanced accelerators with applications to directed energy weapons. This activity also includes the Free Electron Laser (FEL) Innovative Naval Prototype (INP) which if successful could be utilized for shipboard applications as a defensive weapon against advanced cruise missiles and asymmetric threats.</p> <p>FY10 to FY12 increase in funding is primarily due to the start of the second contractual phase of the FEL INP program. As a result of the Phase 1A competition, a single contractor was awarded the contract in late FY10 and in FY11 the selected contractor will begin the critical design, development and installation portion of the FEL INP 100kW test and demonstration program. In addition long lead item procurement for the 100 kW FEL will begin in FY11/12. These long lead items require approximately 15 to 18 months for manufacturing and delivery to the test facility. The other element influencing the funding increase is the additional S&T investment required to develop compact, high performance FEL components such as the high power injector (super conducting and normal conducting radio frequency), the mirror/optical components and oscillator system, and the high power amplifiers. Additional development of these components is extremely critical for operation at required INP power levels and also to minimize the FEL footprint in anticipation of eventual ship integration.</p> <p>FY 2010 Accomplishments: Directed Energy and Accelerator Research:</p> <ul style="list-style-type: none"> - Continued cryomodule and FEL component development at the FEL testing and integration facility. - Continued investigation into the application of FEL technology to other areas including advanced materials, optics, bioscience, medical, manufacturing, weaponization, and solid state physics. - Continued 1 micron filamentation, halo limitation, and short Rayleigh range studies. - Continued testing of Radio Frequency (RF) gun High Voltage Power Supply (HVPS) components 	28.893	41.797	60.418

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>		PROJECT 0000: <i>Power Proj Applied Research</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>which are required for the 100 kW high current injector.</p> <ul style="list-style-type: none"> - Continued applied directed energy and accelerator research in: Compton radiation scattering, multiple dielectric thin film coatings, bunch characteristics of electron beam emittance, high grade electromagnetic field generators, electron beam lattice configuration, novel electron beam generation, novel high flux subatomic particle emission, high gain photonic amplification, fundamental power efficiency conversion. - Continued the development of physics based models for: characterization of subatomic particle interaction and propagation and modeling for validation of photon control structures. - Continued Innovative Prototype (INP) program for the FEL. Held Preliminary Design Review (PDR) for both contractors who were selected to participate in Phase 1A of the FEL INP program. Review proposals from the Phase 1A contractors. Downselect and award a contract to a single contractor to proceed forward in Phase 1B and the Critical Design Review (CDR) to be held in FY11. <p>Applied Electromagnetics for High Power Weapons:</p> <ul style="list-style-type: none"> - Initiated a program to conduct applied research into applied electromagnetics as it relates to lasers, high power microwaves, and advanced sensors for Directed Energy Weapons. <p>FY 2011 Plans:</p> <p>Directed Energy and Accelerator Research:</p> <ul style="list-style-type: none"> - Continue detailed design efforts required for presentation at the CDR for Phase 1B of the FEL program, including preparation of design, materials and parts, analyses and trade study, safety and supportability reports, and initial orders for long lead item components. In addition some preliminary preparations will begin at the test facility selected for installation of the 100 kW FEL system. - Continue development of components required for the successful testing of the 100 kW FEL, to support the scale up of the 100 kW FEL into a megawatt class weapon, and to reduce the overall footprint of the system to support the eventual ship integration of the FEL, including normal conducting and super conducting RF electron beam injectors, advanced high power cathode technologies, high power compact amplifiers, and advanced mirrors, coatings and optical components capable of handling the significantly higher energies that are present in a 100 kW level FEL. <p>Applied Electromagnetics for High Power Weapons:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>FY 2012 Plans:</p>				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>	PROJECT 0000: <i>Power Proj Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Complete execution of Phase 1B of 100 kW FEL demonstration program. Initiate Phase II of the 100 kW FEL program. Phase II will include the fabrication, integration, and acceptance testing of a 100 kW FEL prototype . - Continue S&T development of high power, compact components required for megawatt class FELs. - Conduct analysis, design, development and testing of photocathodes, thermionic cathodes, field emission array cathodes, Radio Frequency (RF) sources and input couplers, and cryomodules for Superconducting RF electron guns for high power FELs. <p>Applied Electromagnetics for High Power Weapons:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 				
<p>Title: HIGH SPEED PROPULSION AND ADVANCED WEAPON TECHNOLOGIES</p> <p>Description: The high speed weapons work in this activity is focused on demonstrating propulsion and vehicle technologies for Mach3+ to Mach8 capable weapons. The solid rocket motor Integrated High Performance Rocket Propulsion Technology (IHRPT) technology development activities will provide improved rocket based weapon performance. The rocket technologies apply to both air dominance and strike weapons and will provide both improved range and speed.</p> <p>This work includes technologies associated with high acceleration capable projectile structures, high temperature and high strength materials to enable projectiles to survive high speed launch environment, improved thermal prediction methodologies and test techniques, wide dynamic pressure adaptable projectile controls and non-explosively launched lethal mechanisms. The high speed projectile technologies are intended to support long range Naval Fire Support weapons. Increase from FY10 to FY11 is due to increased investment in the development of advanced guidance and control technologies for high speed weapons.</p> <p>FY 2010 Accomplishments: High Speed Projectile & Advanced Weapon Technologies (Formerly Asymmetric Threat & Laser Control Technologies):</p> <ul style="list-style-type: none"> - Continued high speed projectile technology development. - Completed IHRPT program with final testing. <p>FY 2011 Plans: High Speed Projectile & Advanced Weapon Technologies (Formerly Asymmetric Threat & Laser Control Technologies):</p> <ul style="list-style-type: none"> - Continue high speed projectile technology development. - Initiate effort to develop advanced guidance and control technologies for high speed weapons. <p>FY 2012 Plans: High Speed Projectile & Advanced Weapons</p>		1.512	5.446	6.400

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiate investigations into advanced material solutions to high speed airframes and air systems operating in maritime environments. Areas of research will include advanced lightweight structures, high thermal conductivity materials, corrosion resistant components and systems, and high temperature resistant materials and structures. - Initiate high speed propulsion and integrated airframe technology development to enhance system range, responsiveness and reliability. - Continue advanced guidance and control technology development. 				
<p>Title: NAVIGATION, ELECTRO OPTIC/INFRARED (EO/IR), AND SENSOR TECHNOLOGIES</p> <p>Description: This activity describes Navy Science and Technology (S&T) investments in the areas of EO/IR devices and advanced sensors and includes NRL investment/performance in the technology areas of Electronics, Electronic Warfare, and Communications.</p> <p>FY 2010 Accomplishments:</p> <p>Electro Optic/Infrared:</p> <ul style="list-style-type: none"> - Continued development of tunable narrowband infrared absorption technology. - Completed development of new processes/methodologies to enable construction of composite countermeasures that fit the engagement timeline while maintaining effectiveness against existing and emerging IR guided threats. <p>Autonomous Systems:</p> <ul style="list-style-type: none"> - Completed the development of a novel beam steering method in phased array radar using optical fiber based slow light techniques. - Completed the development of machine-vision algorithms and guidance strategies to enable the precision autonomous recovery of small sensor platforms on moving naval vessels. - Completed the development of an autonomous soaring capability and intelligent path planning for extracting energy from the environment thereby conserving onboard fuel stores of autonomous air vehicles. <p>Electronic Warfare:</p> <ul style="list-style-type: none"> - Continued development of ultra low noise uncooled nanotechnology infrared sensors. - Continued development nanoatomic sensor nonvolatile memories. - Continued development of electronic field of view and zoom imagers. - Continued the development of an active optics system that can survey a wide area and instantly, non-mechanically zoom-in on an area of interest for target tracking/identification. - Continued development of new processes/methodologies to enable construction of composite 		3.730	3.437	3.707

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>	PROJECT 0000: <i>Power Proj Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>countermeasures that fit the engagement timeline while maintaining effectiveness against existing and emerging IR guided threats.</p> <ul style="list-style-type: none"> - Completed development of high power fiber lasers in mid-IR (2-5 micro-m) based upon highly nonlinear IR transmitting chalcogenide photonic crystal fibers. - Initiated effort to develop mid & long wave IR focal plane arrays using graded-bandgap W-type-II superlattices w/much higher detectivity than that of state-of-the-art HgCdTe (MCT). - Initiated development of tunable narrowband infrared absorption technology. <p>FY 2011 Plans: Electro Optic/Infrared: - Complete development of tunable narrowband infrared absorption technology.</p> <p>Electronic Warfare: - Continue all efforts of FY 2010 unless completed above. - Complete development of an ultra-lean combustor for recuperated gas turbines.</p> <p>FY 2012 Plans: Electronic Warfare: - Continue all efforts of FY 2011 unless completed above.</p>				
<p>Title: STRIKE AND LITTORAL COMBAT TECHNOLOGIES</p> <p>Description: The focus of this activity is on those technologies that will support Naval Precision Strike Operations and provide the Navy of the future the ability to quickly locate, target, and strike critical targets ashore.</p> <p>FY10 to FY12 increase is due to the initiation of Strike Accelerator Program and FNC new starts.</p> <p>FY 2010 Accomplishments: Increased Capability Against Moving and Stationary Targets: - Continued the Direct Attack Seeker Head (DASH) project by developing and testing of the radar sensor and procurement of the IIR sensor. - Continued the Multi-Mode Sensor/Seeker (MMSS) project.</p> <p>Enhanced Weapon Technologies:</p>		7.118	12.013	17.116

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>	PROJECT 0000: <i>Power Proj Applied Research</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>- Continued three new products to expand current Counter Air / Counter Air Defense capabilities by providing improved range and end-game maneuverability while decreasing Time-of-Flight. Specific tasks to begin design and development phase are: Counter Air Advanced Medium-Range Air-to-Air Missile (AMRAAM) Improvements / Counter Air Defense Improvement / High Speed Components.</p> <p>- Continued development and apply emerging technologies that support delivery of Technology Oversight Group approved FNC enabling capabilities structured to close operational capability gaps in power projection; package emerging power projection technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period; and mature power projection technologies that support naval requirements identified within the Sea Strike and FORCENet naval capability pillars.</p> <p>- Completed development of passive interferometric imaging system to detect millimeter wave RF anomalies within the background environment by using exotic signal processing techniques.</p> <p>FY 2011 Plans: Increased Capability Against Moving and Stationary Targets: - Continue the (DASH) and (MMSS) projects.</p> <p>Strike Accelerator: - Initiate Strike Accelerator program. This effort will provide an advanced airborne capability to accurately identify targets using Advanced Target Recognition (ATR). These capabilities utilizing the F/A-18 E/F, AESA (Active Electronically Scanned Array) Radar and ATFLIR (Advanced Targeting Forward Looking Infrared) sensors.</p> <p>Multi-Target Laser Designator: - Initiate research for advanced optical techniques to enable multiple simultaneous target designation in order to defeat multiple simultaneous targets or SWARM attacks.</p> <p>Selectable Output Weapon: - Initiate Selectable Output Weapon Sea Strike Project. This project will develop and integrate new technologies to enable real time selection of a munitions energetic output.</p> <p>Enhanced Weapon Technologies: - Continue all efforts of FY 2010, less those noted as completed above.</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>	PROJECT 0000: <i>Power Proj Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiate development and apply emerging technologies that support delivery of Technology Oversight Group approved FNC enabling capabilities structured to close operational capability gaps in power projection.</p> <p>FY 2012 Plans: Increased Capability Against Moving and Stationary Targets: - Continue DASH and MMSS projects. Enhanced Weapon Technologies: - Continue Counter Air Advanced Medium-Range Air-to-Air Missile (AMRAAM) Improvements, Counter Air Defense Improvement, and High Speed Components efforts. Multi-Target Laser Designator: - Continue research for advanced optical techniques to defeat SWARM attacks. Selectable Output Weapon: - Continue Selectable Output Weapon Sea Strike Project Strike Accelerator program: - Continue Strike Accelerator Project</p> <p>High Energy Fiber Laser System: - Initiate development an advanced laser beam control, pointing mechanism and power subsystem to support an airborne laser weapon system. This system will provide the detection and defeat of current and future threats.</p> <p>- Continue development and apply emerging technologies that support delivery of Technology Oversight Group (TOG) approved FNC enabling capabilities structured to close operational capability gaps in power projection.</p>				
<p>Title: WMD DETECTION</p> <p>Description: The Chief of Naval Operations (CNO) in the Navy Strategic Plan (NSP) has directed that the Navy be able to combat Weapons of Mass Destruction (WMD) at sea and Maritime domain. This activity addresses the development of key technologies for standoff detection of WMD's and component nuclear materials on ships at sea. The program will develop and demonstrate technology for actively detecting fissile material and other weapons of mass destruction.</p> <p>FY10 to FY11 funding increase represent the ramping up of the program as continuing technological efforts evolve. The testing of the equipment in realistic maritime environments significantly increases the cost of testing. FY11 to FY12 funding decrease is due to the completion of the test exercises and re-alignment of funds for higher priority requirements. The Maritime WMD Detection program in FY11 is moving from limited scale laboratory and field experimentation, into more complex, large scale demonstrations</p>		9.611	24.953	6.215

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>of Special Nuclear Material detection technologies. These tests must be conducted in a representative "Navy unique" maritime environment which include both over-water and in-water applications, and which require the expansion of required safety, environmental protocols simulation and evaluation of passive and active detection approaches. Additionally, severe shortages of helium-3 material required for neutron detection has forced an urgent technology development investment in alternative detection technologies.</p> <p><i>FY 2010 Accomplishments:</i> Weapons Mass Destruction Detection:</p> <ul style="list-style-type: none"> - Continued using particle beam (neutrons, gamma rays, muons, and others) to perform standoff detection of fissile material. - Continued investigations into the use of Free Electron Laser (FEL) accelerator technologies for the detection of WMD's and nuclear components & materials. Conducted experiments to determine the ability of the FEL to perform remote detection of nuclear material on surfaces, and chemical biological agents in aerosol clouds. - Continued development of hand-held and portable radiation detector technology to support maritime interdiction operations. - Continued modeling and simulation efforts to determine the ability to use neutron activation analysis to locate smuggled nuclear weapons and material through underwater detection. - Continued planning for a maritime demonstration of standoff detection of fissile materials. This effort will involve formation of a team comprised of DoD, interagency, and international partners to support the demonstration. <p><i>FY 2011 Plans:</i> Weapons Mass Destruction Detection:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete investigations of hand held and portable detector technology for maritime interdiction, transition to demonstrations of available technologies in prototypes and other suitable formats. - Complete standoff detection of fissile materials with a demonstration in a maritime environment from a suitable Naval vessel or surrogate. Demonstration will involve a team from DoD, DoE, interagency, and academia partners to support the full demonstration. - Initiate the technical development and testing of solid state high energy neutron detector without Helium 3. - Initiate the development of technologies for remote real time imaging of suspected WMD in a maritime environment for both Passive Detection and Active Interrogation, including laboratory and field testing. - Initiate a laboratory demonstration of short range active interrogation for WMD detection. - Initiate the development of technology for and conduct "at sea" testing of in-water radiological WMD Detection from unmanned underwater vehicles (UUVs). - Initiate the development and laboratory testing of a compact Neutron Generator without need for cryogenic cooling. - Acquire WMD Special Nuclear Materials (SNM) simulator from DoE and conduct high fidelity field testing. 			
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>	PROJECT 0000: <i>Power Proj Applied Research</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiate the development of technology for and conduct radiological WMD Detection from Naval aviation platforms. - Examine system human dose limits and health effects of various Remote Stand Off Detection techniques. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue modeling and simulation efforts to determine the ability of proposed detection systems and operational concepts to detect and locate smuggled nuclear weapons and material in both above surface and in-water maritime environments. - Continue technology development of high energy neutron detector without Helium-3, real time imaging of WMD's, and lab demonstration of short range active interrogation. - Continue "at sea" UUV detection technology, development and laboratory testing of compact neutron generator, acquisition of SNM simulator, development of radiological detection from aviation platforms, and human dose limits of standoff detection techniques. 			
<p><i>Title:</i> ELECTROMAGNETIC GUNS</p> <p><i>Description:</i> This activity is the Electro Magnetic (EM) railgun program that is focused on developing the technology to launch a long range projectile from Navy ships. The requirement for the EM railgun is the result of a Naval Fire Support Requirements study in late 1990s that identified the need to provide Naval fire support ranges of up to 200 miles in order to support the increased transport range of the V-22 tiltrotor. This activity also includes NRL investment/performance in these research areas. FY10 to FY11 increase is due to increase in investment to support Phase II of the EM gun demonstration program.</p> <p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued material, physics and thermal property research for both launchers and projectiles. - Continued launcher and projectile development. - Continued preliminary design and lethality studies of projectile, design of next generation pulse power systems, IPT and Bore Life Consortium collaborations. - Continued development of modeling and simulation capability to support bore life development and testing. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue material, physics and thermal property research for single shot launchers, pulsed power and projectiles for 32MJ muzzle energy launch. - Continue lethality studies of projectile, design of next generation pulse power systems, Integrated Product Team (IPT) and Bore Life Consortium collaborations for 32 MJ launchers. - Continue development of modeling and simulation capability to support bore life development and testing. - Continue analysis to verify the models and simulations correlate to results achieved in testing for launchers, 	6.929	10.504	10.948

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>	PROJECT 0000: <i>Power Proj Applied Research</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
pulsed power and projectiles at 32MJ launch.			
<i>FY 2012 Plans:</i>			
- Initiate material applications and component design assessments for next generation repetitive fires			
- Continue assessments of material, physics and thermal property research for single shot launchers, pulsed power and projectiles for 32MJ muzzle energy launch; and initiate assessments from next generation, rep rate, and operational environments.			
- Continue IPT and Bore Life Consortium collaborations for 32 MJ launchers.			
- Complete lethality studies of projectile, design studies of next generation pulse power systems,			
- Complete development of modeling and simulation capability to support bore life development and testing for single shot bore life assessments			
- Complete analysis to verify the models and simulations correlate to results achieved in single shot testing for launchers, pulsed power and projectiles at 32MJ launch.			
Accomplishments/Planned Programs Subtotals	57.793	98.150	104.804

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0603114N: POWER	23.240	10.759	15.228	0.000	15.228	20.172	19.299	15.568	7.555	0.000	111.821
<i>PROJECTION ADVANCED TECHNOLOGY</i>											
• 0602131M: MARINE CORPS	0.000	0.119	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.119
<i>LANDING FORCE TECHNOLOGY</i>											

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

This PE develops early components technologies that if successful can be integrated into weapon systems that meet warfighter requirements. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments). The metrics used to evaluate 6.2 programs are necessarily less precise than those used in 6.3 programs.

The metrics for this PE can be divided into two categories: technological and organizational/functional. Technological metrics address the success of the work performed. The primary technological metrics used in this PE involve laboratory experiments/tests demonstrating proof of the concept for the technology. This demonstration is frequently a hand-assembled functioning breadboard of the concept. The organizational/functional metrics applied to this PE include: transition of the

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE	PROJECT
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	PE 0602114N: <i>Power Proj Applied Research</i>	0000: <i>Power Proj Applied Research</i>

technology to advanced development in a 6.3 PE and applicability of the technology to documented warfighter problems or requirements. Successful implementation of these categories would result in the application of a pass/fail metric and further evaluation for possible transition to a 6.3 development/demonstration program.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602114N: <i>Power Proj Applied Research</i>				4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	0.300	-	-	-	-	-	-	-	-	0.000	.300

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	0.300	-	-
Accomplishments/Planned Programs Subtotals	0.300	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>	PROJECT 9999: <i>Congressional Adds</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	21.669	-	-	-	-	-	-	-	-	0.000	21.669

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: Advanced Helicopter Landing Aid <i>FY 2010 Accomplishments:</i> This effort adapted existing software to develop and test novel 3D imaging technologies to help helicopters land during severe brownout conditions.	0.797	-
Congressional Add: Aging Military Aircraft Fleet Support <i>FY 2010 Accomplishments:</i> This effort provided a quantifiable, risk based assessment methodology for determining the capability for life extension in composite structures.	1.593	-
Congressional Add: Combustion Light Gas Gun Projectile <i>FY 2010 Accomplishments:</i> This effort provided applied research for the design and evaluation of a heavy projectile capable of launch and flight to 100+ km while carrying significant payloads. The final aspects of a rapid-fire propellant loading system using direct cold or cryogenic propellant loading were investigated and a transportable 155mm Combustion Light Gas Gun system capable of demonstrating projectile ranges in excess of 100 km was designed.	3.983	-
Congressional Add: Electronic Motion Actuation Systems <i>FY 2010 Accomplishments:</i> This effort further developed electric actuation systems for submarine use incorporating system integration issues.	0.797	-
Congressional Add: Enhanced EO/IR Sensors <i>FY 2010 Accomplishments:</i> This effort provided enhancement of high performance EO/IR sensors for both naval ship and ship-based unmanned aircraft in order give U.S. naval assets extended surveillance, situational awareness, and force protection. This capability will greatly enhance the ability of naval assets to detect and identify targets at significantly greater distances than the current system.	2.390	-
Congressional Add: Millimeter Wave Imaging	1.354	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602114N: <i>Power Proj Applied Research</i>	PROJECT 9999: <i>Congressional Adds</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011
<i>FY 2010 Accomplishments:</i> This effort funded fabrication and demonstration of the operation of a traveling-wave optical phase-locked detector.		
<i>Congressional Add:</i> Multifunctional Materials, Devices, and Applications	1.593	-
<i>FY 2010 Accomplishments:</i> This effort supported development of materials growth technology for multi-functional oxides.		
<i>Congressional Add:</i> Naval Advanced Electric Launcher System	1.992	-
<i>FY 2010 Accomplishments:</i> This effort provided applied research on launcher-related technologies, including power generation, energy storage, high-current sliding contacts, high-temperature superconductors, plasma dynamics, payload guidance and control, and high-acceleration payload effects.		
<i>Congressional Add:</i> Strike Weapon Propulsion	3.187	-
<i>FY 2010 Accomplishments:</i> This effort supported Strike Weapon Propulsion research.		
<i>Congressional Add:</i> Guidance, Navigation, Control, and Targeting	3.983	-
<i>FY 2010 Accomplishments:</i> This effort supported the development system design and preliminary hardware and software design for a high performance GNC&T System with capability to guide a future Navy and Marine Corps projectile to within 1M of a maneuvering surface target in adverse weather conditions. GNC&T will be compatible with 155MM, 105MM, and 5" projectiles.		
Congressional Adds Subtotals	21.669	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Add

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	154.170	107.448	156.901	-	156.901	156.391	146.367	146.023	133.105	Continuing	Continuing
0000: <i>Force Protection Applied Res</i>	88.359	107.448	156.901	-	156.901	156.391	146.367	146.023	133.105	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	9.748	-	-	-	-	-	-	-	-	0.000	9.748
9999: <i>Congressional Adds</i>	56.063	-	-	-	-	-	-	-	-	0.000	56.063

A. Mission Description and Budget Item Justification

The efforts described in this program element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. It supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. The goal is to provide the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage while preserving operational capability. Within the Naval Transformational Roadmap, this investment directly supports the Theater Air and Missile Defense transformational capability required by Sea Shield and the Ship to Objective Maneuver key transformational capability. This is accomplished by improvements in platform offensive performance, stealth, and self defense. This PE supports the Future Naval Capabilities (FNC) Program in the areas of Sea Shield, Sea Strike, Cross Pillar Enablers and Enterprise and Platform Enablers (EPE).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	146.045	107.448	111.156	-	111.156
Current President's Budget	154.170	107.448	156.901	-	156.901
Total Adjustments	8.125	-	45.745	-	45.745
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.028	-			
• SBIR/STTR Transfer	-1.550	-			
• Program Adjustments	-	-	46.714	-	46.714
• Section 219 Reprogramming	8.724	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.969	-	-0.969
• Congressional General Reductions Adjustments	-0.021	-	-	-	-
• Congressional Add Adjustments	1.000	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *Advanced Battery System for Military Avionics Power Systems*
- Congressional Add: *Advanced Composite Manufacturing for Composite High-Speed Boat Design*
- Congressional Add: *Advanced Energetics Initiative*
- Congressional Add: *Advanced Simulation Tools for Composite Aircraft Structures*
- Congressional Add: *Alternative Energy Research*
- Congressional Add: *Power Generation Carbon Comp Thin Films*
- Congressional Add: *Center for Autonomous Solar Power*
- Congressional Add: *Energetic Nano-Materials Agent Defeat Initiative*
- Congressional Add: *Fuel Efficient, High Specific Power Free Piston Engine for USSVs*
- Congressional Add: *Harbor Shield - Homeland Defense Port Security Initiative*
- Congressional Add: *Integration of Electro-Kinetic Weapons Into Next Generation Navy Ships*

	FY 2010	FY 2011
	1.593	-
	1.593	-
	3.983	-
	1.593	-
	18.423	-
	1.593	-
	3.983	-
	1.593	-
	1.593	-
	1.593	-
	3.983	-

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2010	FY 2011
Congressional Add: <i>Lithium Ion Storage Advancement for Aircraft Applications</i>	1.992	-
Congressional Add: <i>Magnetic Refrigeration Technology for Naval Applications</i>	3.983	-
Congressional Add: <i>Multi-Mission Unmanned Surface Vessel</i>	1.992	-
Congressional Add: <i>Non Traditional Ballistic Fiber and Fabric Weaving for Force Protection</i>	1.992	-
Congressional Add: <i>Hybrid Power Systems</i>	1.992	-
Congressional Add: <i>Proton Exchange Membrane Fuel Cell for Underwater Vehicles</i>	1.593	-
Congressional Add: <i>Joint Heavy-Lift Rotocraft Research</i>	0.996	-
Congressional Add Subtotals for Project: 9999		-
Congressional Add Totals for all Projects		-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>Force Protection Applied Res</i>	88.359	107.448	156.901	-	156.901	156.391	146.367	146.023	133.105	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. It supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. The goal is to provide the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage while preserving operational capability. Within the Naval Transformational Roadmap, this investment directly supports the Theater Air and Missile Defense transformational capability required by Sea Shield and the Ship to Objective Maneuver key transformational capability by virtue of improvements in platform offensive performance, stealth, and self defense. This effort supports the FNC in the areas of Sea Shield, Cross Pillar Enablers, and Enterprise and Platform Enablers (EPE).

This project reflects the alignment of Future Naval Capability (FNC) program investments for the following Enabling Capabilities (ECs): Anti-Ship Missile Defense Technologies, Sea Based Missile Defense of Ships & Littoral Installations, Advanced Threat Aircraft Countermeasures, Helicopter Low-Level Operation, Four Torpedo Salvo Defense, Shipboard Force Protection in Port and Restricted Waters - Detection and Classification, Underwater Total Ship Survivability, Compact Power Conversion Technologies and Affordable Submarine Propulsion and Control Actuation.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: ADVANCED ENERGETICS	2.242	2.120	0.201
Description: Advanced Energetics efforts address technology development to provide substantial improvements in energetic material systems and subsystems, primarily in terms of performance, but also addressing safety, reliability, and affordability concerns. Goals include: advanced energetic materials for warheads, propellants, and reactive material based subsystems for both defensive and offensive applications. Efforts include: development of new fuels, oxidizers, explosive ingredients and formulations; and reliable simulation tools and diagnostics to develop and design superior-performance, and/or reduced-vulnerability systems tailored to specific warfighter missions.			
FY 2011 to FY 2012 funding decrease is due to the conclusion and transition of Advanced Energetics efforts in the areas of enhanced performance formulations, insensitive explosives, detonation merging techniques, and reactive materials. Remaining funding will be used to complete transition efforts and to develop next generation concepts as described below.			
FY 2010 Accomplishments:			
- Continued Advanced Energetics research in technology development for the next generation reactive material warhead concepts (formulations, material properties, target interaction, lethality models, and experiments) for highly reactive materials, high density reactive materials and novel reactive structural materials.			
- Continued Advanced Energetics research in development and evaluation of advanced explosive/			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>propellant/reactive ingredients and formulations for next generation higher performing systems.</p> <ul style="list-style-type: none"> - Continued Advanced Energetics research in development of advanced directed hydro-reactive material warhead concepts to enhance performance of undersea warheads. - Continued proof of concept efforts to develop insensitive explosives, propellants, and munitions without compromising performance. This work involves development of high quality, small particle energetic ingredients, novel processing techniques, and advanced energy conversion concepts; and involves both theoretical and experimental efforts. - Continued Advanced Energetics research in advanced multiphase blast concepts employing dense metalized explosives to enhance performance of air and underwater blast warheads. - Continued Advanced Energetics research in development and diagnostics of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target for air, surface, and underwater warhead application- Continued research in technology development for the next generation reactive material warhead concepts (formulations, material properties, and energy release experiments) for highly reactive materials, high density reactive materials and novel reactive structural materials. Transition application specific target interaction, lethality modeling and ordnance specific experiments and demonstrations to Electromagnetic Rail Gun, PE 0603114N. - Continued development of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target. Limit efforts to analytical and laboratory scale proof of concept experimental efforts. - Continued development and evaluation of energetic ingredients and formulations for next generation higher performance applications. Conclude scale-up development and testing. <p>FY 2011 Plans: - Continue all efforts of FY 2010.</p> <p>FY 2012 Plans: -Complete or terminate efforts associated with Energetics Applied Research due to cessation of funding in FY12.</p>			
Title: AIRCRAFT TECHNOLOGY		13.134	14.086
Description: The Aircraft Technology activity develops technologies for enhanced capability of naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scaleable naval air vehicle technologies, such as - autonomous air vehicle command and control, helicopter and tiltrotor rotor drive systems, aerodynamics, propulsion systems, materials, structures			42.264

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>and flight controls for future and legacy air vehicles. This activity directly supports the Naval Aviation Enterprise Science and Technology Objectives and the Naval Science and Technology Strategic Plan, principally in the Platform Mobility, Survivability and Self-defense, Affordability/Maintainability/Reliability and Power Projection Focus Areas.</p> <p>FY 2011 and FY 2012 funding increase is due to two programs beginning in FY12: Variable Cycle Advanced Technology (VCAT) and Autonomous Aerial Cargo/Utility System (AACUS). VCAT will identify and mature critical, relevant variable/adaptive cycle propulsion system technologies for the next generation carrier-based TACAIR/ISR systems. AACUS will develop advanced autonomous capabilities to enable sea based resupply of distributed forces and casualty evacuation, in response to Navy/Marine Corps needs in Operation Iraqi Freedom/Operation Enduring Freedom/Counter Insurgency Operations (OIF/OEF/COIN).</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of survivability/reduced observables technology. Metrics are classified. - Continued development of flight control, intelligent autonomy, command & control, and multi-vehicle cooperation technologies for Unmanned Air Vehicle (UAV). - Continued development of a Computational Fluid Dynamics (CFD) based integration system to maximize operational capability of autonomous aircraft by choosing optimal flight pattern for any environmental condition including low speed operations and brownout. - Continued vertical lift technology investments. - Continued research in fixed wing aircraft/vertical lift/rotorcraft technology areas such as aeromechanics, propulsion, active rotor control for enhanced ship board operations, structural concepts compatible with shipboard operations, autonomous operations in the shipboard and austere environment, and innovative vehicle concepts for naval application. - Initiated research in vertical lift aircraft /rotorcraft technology areas such as aeromechanics, propulsion, active rotor control for enhanced ship board operations, structural concepts compatible with shipboard operations, autonomous operations in the shipboard and austere environment, and innovative vehicle concepts for naval application. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Initiate the Variable Cycle Advanced Technology (VCAT) Program. Critical technology development efforts will begin with major engine manufacturers and weapon system contractors to develop and mature to TRL 4/5 the highest priority, long-lead, 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>propulsion system technologies, including variable/adaptive cycle engine components, for next generation carrier-based TACAIR/ISR systems.</p> <ul style="list-style-type: none"> - Initiate Autonomous Aerial Cargo/Utility System (AACUS) advanced autonomous capability technologies for sea based resupply of distributed forces and casualty evacuation. - Initiate maturation of Science of Autonomy basic research into applied research to reduce manning for unmanned system operations in shipboard and expeditionary operations, enable safe and sustainable unmanned air system operations in challenging environmental/weather conditions, and provide robust cooperation between unmanned systems that can adapt to changes in the battlespace and environment. 			
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Title: FLEET FORCE PROTECTION AND DEFENSE AGAINST UNDERSEA THREATS	10.934	11.723	13.362
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<p>Description: Fleet Force Protection and Defense against Undersea Threats efforts include applied research for complementary sensor and processing technologies for platform protection and shipboard technologies to increase the survivability of surface ship and submarine platforms against torpedo threats and to develop the capability to interdict underwater asymmetric threats to ships and infrastructure in harbors. Current small platforms (both surface and airborne) have little to no situational awareness (SA) or self-protection against air, surface, and asymmetric threats. (Asymmetric threat efforts are co-funded by PE 0602131M.) A goal of this activity is to provide these platforms with effective self-protection. The technology areas specific to platform protection will develop individual, multispectral electro-optical (EO), infrared (IR), radio frequency (RF), electro-magnetic (EM), visual and acoustic or chemical sensors/biosensors and associated processing. To defend platforms from current and advanced threats in at-sea littoral environments and in port, these technologies must improve multispectral detection and distribution of specific threat information.</p> <p>Another goal of this activity is to develop a torpedo defense capability to fill Sea Shield Warfighting Capability Gap/Enabling Capability: Platform Defense against Undersea Threats, including Four Torpedo Salvo Defense. This provides a capability to prevent any of the torpedoes, in up to four-torpedo salvos fired at high value units, from hitting those units.</p> <p>This activity supports the Fleet and Force Protection FNC and includes support to Sea Shield and Sea Strike Pillars and FNC Enabling Capabilities for: Aircraft Integrated Self-protection Suite; Fortified Position Security; Advanced Electronic Sensor Systems for Missile Defense; and Shipboard Force Protection in Port and Restricted Waters - Detection and Classification.</p> <p>This activity supports the development of technologies that aid the helicopter pilot when operating in degraded visual cue environments (brown-out).</p> <p>FY 2010 Accomplishments:</p>			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Sensors & Associated Processing</p> <ul style="list-style-type: none"> - Continued efforts in biomimetic sonar systems for operation in air and aquatic environments based on bat echolocation neurophysiology and information processing algorithms. - Continued efforts in biomimetic signal processing: panoramic periscope for submarines and temporal pattern recognition for Systems for Security Breaching Noise Detection. - Continued efforts in bioinspired quiet, efficient and maneuverable self-propelled line array using high-lift propulsors based on insect biomechanics. - Continued studies to develop catalytic activity profile of bioactive coatings against chemical agents. Designed and initiated fabrication of coatings to degrade both, chemical and biological agents. - Continued advanced concept development to integrate object recognition and tracking algorithms, machine vision, multiple networked video streams into different classes of EO/IR sensors within the Intelligent Video Surveillance FNC product (transferred from PE 0602131M). - Continued FNC EC Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. This project will develop mission specific electro-optic/infrared sensors to detect, classify, and determine the intent of potential terrorist and special operations force threats to ships and craft import and transiting restricted waters. - Continued the Countermeasures for Advanced Imaging Infrared (IIR) Guided Missiles FNC effort by initiating IIR threat model development. - Continued the Countermeasures for Millimeter Wave Guided Missiles FNC effort by initiating requirements analysis. - Continued the Multifunction Capabilities for Missile Warning Sensors FNC effort by commencing data collection and analysis. - Continued efforts to design microfabricated system for 3-color fluorescence measurements using integrated waveguides. - Continued effort to develop new, highly selective, preferential oxidation catalysts for the generation of power from the reformat gas purification process. - Continued effort to develop aspheric gradient index optics. - Continued the Helicopter Laser-Based Landing Aids FNC effort by commencing experimentation, data collection and analysis. Brown-out testing was successfully completed at Yuma Proving Grounds in April. - Completed the design and fabrication of self-reporting coatings for system failure detection. <p>Underwater Platform Self-Defense</p> <ul style="list-style-type: none"> - Continued development of low-cost, light weight swimmer detection and localization technologies. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>- Continued development of software encoded algorithms for the Anti-Torpedo Torpedo (ATT) sensor and controller that will enable ATT's to successfully engage torpedo salvos of up to four attacking units.</p> <p><i>FY 2011 Plans:</i> Sensors & Associated Processing</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 unless completed above. - Continue the Helicopter Laser-Based Landing Aids FNC effort by development of a ladar capable of sensing through degraded visual cue environments (brown-out) and providing a display format that is usable to the pilot. - Complete FNC EC Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. This project develops mission specific electro-optic/infrared sensors to detect, classify, and determine the intent of potential terrorist and special operations force threats to ships and craft in port and transiting restricted waters. <p>Underwater Platform Self-Defense</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete development of optimized microfluidic components suitable for explosive, chemical, and biological sensing applications, and initiate the development of models required to apply existing automated design tools to components with more complex physics and more general geometries. <p>In support of FNC (Force Projection Applied Research), perform the following efforts:</p> <ul style="list-style-type: none"> - Initiate the development and application of emerging technologies that support delivery of Navy approved FNC enabling capabilities structured to close operational capability gaps in force projection. - Initiate the packaging of emerging force projection technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period. - Initiate the development of force projection technologies that support naval requirements identified within the Sea Shield and Sea Strike naval capability pillars as well as those applicable to specific naval platforms and those that apply across the naval enterprise. <p><i>FY 2012 Plans:</i> Sensors & Associated Processing</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete the Multifunction Capabilities for Missile Warning Sensors FNC effort. - Complete the Helicopter Laser-Based Landing Aids FNC effort by development of a ladar capable of sensing through degraded visual cue environments (brown-out) and providing a display format that is usable to the pilot. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
Underwater Platform Self-Defense - Continue all efforts of FY 2011, less those noted as completed above.			
Title: MISSILE DEFENSE (MD)		9.960	9.898
Description: This activity describes Missile Defense S&T projects of the Sea Shield FNC program, and non-FNC-related Navy research. - Naval Interceptor Improvements (NII) technology upgrades for STANDARD Missile (SM) future fleet air defense missile. Metrics are to achieve SM performance requirements in specified tactical rain environments and achieve SM performance requirements in all specified electronic countermeasures environments. - Extended Distributed Weapons Coordination (EDWC) algorithms for an Automated Battle Management Aid (ABMA) that recommends hard kill weapons, soft kill countermeasures, and emission control measures to reduce the probability of being hit or to optimally engage threats with self-defense weapons. Metric is improved probability of negation (Pneg) against advanced ballistic & cruise missile anti-ship threats that may be susceptible to decoys and jamming. - Positive Control of Naval Weapons (PCNW) - additional technology upgrades for SM to enable forward relay, remote launch & potentially forward pass engagements. Metrics are classified. - Midcourse and Terminal Algorithms (MTA) for prototype state-of-the art weapon system algorithms for STANDARD Missile (SM) engagements vs modern anti-ship missile threats. Specific metrics are classified. - Enhanced Lethality Guidance Algorithms (ELGA) to increase Navy shipboard missile probability of kill versus an expanded threat set including ASBMs and advanced ASCMs. Metrics for this project are classified. - Enhanced Maneuverability Missile Airframe (EMMA) technology for Navy shipboard missile systems to intercept highly agile maneuvering ASCMs and ASBMs. Metrics for this project are classified. - Integrated Active & Electronic Defense (IAED) technology basis for response combinations of active and electronic weapons & systems to optimize Pneg against ASBMs and ASCMs, including potential interactions. Metrics are classified. - Radar Resource Manager (RRM) algorithms and software for weapon control system capability to provide dynamic platform and force-level radar management and coordination of radar resources for integrated air and missile defense (IAMD). Metrics will be classified. - Non-FNC-related investigation of effects of charged particle layers on UHF to S-Band radars used to track space vehicles and initiate development of advanced electromagnetic decoy launchers and payloads. FY 2011 to FY 2012 funding increase reflects initiation of the RRM project.			13.222
FY 2010 Accomplishments:			

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B. Accomplishments/Planned Programs (\$ in Millions)				
				FY 2010
				FY 2011
				FY 2012
<ul style="list-style-type: none"> - Continued development of advanced electromagnetic decoy launchers and payloads. - Initiated ELGA and EMMA project efforts. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Complete EDWC, NII and PCNW development efforts. - Continue all efforts of FY 2010 less those noted as completed above. - Initiate IAED project effort. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Initiate RRM project effort. 				
<p>Title: STOPPAGE OF LARGE SURFACE VESSELS AT SEA</p> <p>Description: The Chief of Naval Operations (CNO) in the Navy Strategic Plan (NSP) has specified that the Navy must combat Weapons of Mass Destruction (WMD) at sea and ashore. To support this requirement, the Navy must be able to temporarily stop ships that are suspected of carrying WMDs or their component materials. This activity addresses the development of key technologies that will enable the Navy to use non-lethal methods for temporarily stopping and delaying non-cooperative large, greater than 20 meters or 300 gross tons, vessels at sea that will not comply with voice commands or warning devices. The technologies will be deployable by ship or aircraft and should be capable of disabling the vessel at safe distances from high-valued assets and infrastructures.</p> <p>FY 2010 to FY 2011 funding increase is due to large-scale demonstrations of various stages of the systems. FY 2011 to FY 2012 funding decrease is due to completion of large-scale demonstrations.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued analysis and modeling of hydrodynamic forces generated between a large vessel and much smaller intercept craft or Unmanned Surface Vehicle (USV). - Completed prototype development and fabrication for a large-scale propeller entanglement device. - Completed design and fabrication of device and emplacement system to externally inhibit seawater cooling flow to ship propulsion equipment. - Completed the evaluation of technologies capable of remotely exploiting the electronic vulnerabilities identified within critical propulsion and steering systems. - Completed the design and evaluation of a large-scale large vessel momentum reduction device and delivery system. - Completed tactical system engineering and defined the operational parameters for a large vessel momentum reduction device. 				6.312
				14.870
				4.877

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Completed large-scale demonstration of propeller entanglement device. - Completed testing of common large vessel exhaust system components to assess the risk to structural integrity of the exhaust system under elevated pressures associated with blocking exhaust outlets. - Initiated a study to evaluate the required performance parameters of a vehicle capable of emplacing a package to externally inhibit seawater cooling flow to ship propulsion equipment. - Initiated development of a submergible autonomous delivery and deployment capability for a device emplacement package to externally inhibit seawater cooling flow to ship propulsion equipment. - Initiated fabrication of a large-scale demonstration system for a large vessel momentum reduction device. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete a study to evaluate the required performance parameters of a vehicle capable of emplacing a package to externally inhibit seawater cooling flow to ship propulsion equipment. - Complete development of a submergible autonomous delivery and deployment capability for a device emplacement package to externally inhibit seawater cooling flow to ship propulsion equipment. - Complete fabrication of a large-scale demonstration system for a large vessel momentum reduction device. - Complete analysis and modeling of hydrodynamic forces generated between a large vessel and much smaller intercept craft or Unmanned Surface Vehicle (USV). - Complete demonstration of a large-scale system for a large vessel momentum reduction device. - Initiate large-scale demonstrations of submergible autonomous device components to externally inhibit seawater cooling flow to ship propulsion equipment. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Complete large-scale demonstrations of submergible autonomous device components to externally inhibit seawater cooling flow to ship propulsion equipment. 			
Title: SURFACE SHIP & SUBMARINE HULL MECHANIC & ELECTRICAL (HM&E)		45.777	54.751
Description: : Efforts include: signature reduction, hull life assurance, hydromechanics, distributed control for automated survivability (includes damage control), and advanced naval power systems. Signature reduction addresses electromagnetic, infrared, and acoustic signature tailoring, both topside and underwater. Hull life assurance addresses development of new structural system approaches for surface ships and submarines, including the management of weapons effects to control structural damage and the improvement of structural materials. Hydromechanics addresses hydrodynamic technologies, including the signature aspects of the hull-propulsor interface and maneuvering. Distributed intelligence for automated survivability addresses both the basic technology of automating damage control systems, as well as, distributed control of systems utilizing			82.975

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>self-healing capability. Advanced naval power systems efforts address electrical and auxiliary system and component technology to provide improvement in energy and power density, operating efficiency and recoverability from casualties. Advanced Naval Power efforts include: Compact Power Conversion Technologies that reduce the cost of high power conversion equipment required to enable more-electric and all-electric ships. This activity also supports the Overseas Contingency Operations (OCO) Counter IED - Extramural activity which supports applied research for force protection of Naval platforms. Technologies are being developed that focus on prediction, prevention, detection, neutralization, and mitigation of improvised explosive devices in the maritime/littoral environment.</p> <p>FY 2010 to FY 2011 funding increase is due to the start up and initiation of modeling of hydroacoustics of turbulence propulsor interaction; the effort on exploitation of polymers for the deflection of dissipation of shock wave impact on ship and submarine hull structures; transition of small scale hardware-in-the-loop demonstrator to the academic community for challenge problem formulation and demonstrations of developed model based reasoning control algorithms on full scale hardware test beds. FY 2011 to FY 2012 funding increase is due to expansion of the Counter-Improvised Explosive Devices (C-IED) program, initiation of FNCs in support of Enterprise and Platform Enablers (EPE) and Expeditionary Maneuver Warfare (EMW) pillars, UUV Power and Energy efforts and development of damage control technologies.</p> <p><i>FY 2010 Accomplishments:</i> Survivable Platforms - Reduced Signatures</p> <ul style="list-style-type: none"> - Continued advanced numerical acoustic codes (and gridding methods for those codes) for submarines. - Continued mmWave Signatures measurement to identify key signature characteristics. - Continued Alternating Current (AC) propagation experiments. - Continued the next generation Infrared Electro-Optic Visual (IR/EO/VIS) model for surface ships by development of mitigation strategy supporting low observable infrared platforms, development of supporting physics, and prototype measurement techniques. - Continued development of quiet control surface design tool based on control surface flow noise studies. - Continued IR and radar detectability prediction capability. - Continued surface ship super-conductive degaussing with laboratory demonstration loop for Electromagnetic (EM) field accuracy measurements and control methods. - Continued testing on Advanced Electric Ship Demonstrator (AESD) to assess energy propagation and acoustic radiation mechanisms and to develop mitigation concepts for surface ships. - Continued IR assessment of two advanced treatments. - Continued first of a series of IR validation experiments and critical sensitivity analysis. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued Improved Corrosion Related Magnetic (CRM) Field Prediction Model to design compensation systems to reduce ship's CRM signature. - Continued assessment of ship biostatic Radar Cross Section (RCS). - Continued large-scale tests on AESD to develop signature prediction and design tools for surface ship incorporating a variety of propulsion technologies including external podded propulsion. - Continued experimental effort to characterize electric drive motor signature mechanisms and verify modeling and simulation approaches for signature prediction. - Continued development of modeling methods and noise control concepts for modular/reconfigurable submarine architectures. - Continued investigation into hull treatment concepts for acoustic signature/vibration control for surface ships. - Continued development of advanced RF metamaterials for platform signature control. - Continued development of LPI technologies for surface ship emissions including communication, navigation, electronic warfare, and combat systems. - Continued development of modeling methods and noise control concepts for modular/reconfigurable submarine architectures. - Continued investigation into hull treatment concepts for acoustic signature/vibration control for surface ships. - Continued development of advanced RF metamaterials for platform signature control. - Continued development of LPI technologies for surface ship emissions including communication, navigation, electronic warfare, and combat systems. - Continued development of signature modeling approaches for electric actuation and alternate electric drive system architectures. - Continued development of Low probability Intercept (LPI) technologies for surface ship emissions including communication, navigation, electronic warfare, and combat systems. <p>Survivable Platforms - Hull Life Assurance</p> <ul style="list-style-type: none"> - Continued development of global surface wave measurement capability for ship models. - Continued Dynamic Behavior of Composite Ship Structures (DYCOSS) (joint effort with Dutch Navy). - Continued development of structural analysis codes describing failure mechanism of sandwich composites. - Continued Explosion Resistant Coatings (ERC) effort, providing US input to trilateral agreement with UK and Australia. - Continued Joint US/Japan Advanced Hull Materials & Structures Technology (AHM&ST) addressing hybrid hull concept and hybrid (steel/composite) joints in ship construction. - Continued composite and composite-metal hull performance characterization and testing including structural loading, thermal stress and signatures. - Continued effort on an advanced class of polymers as a follow-on to current ERC for application against advanced threats, Overseas Contingency Operations (OCO). - Continued Payload Implosion and Platform Damage Avoidance efforts. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued development of reliability-based recoverability methods for assessing damaged ship structures. - Continued development of advanced analytical, numerical and experimental methods in support of platform signature reduction. <p>Survivable Platforms - Distributed Intelligence for Automated Survivability</p> <ul style="list-style-type: none"> - Continued development of modeling and simulation methods for robust design and virtual testing of integration of shipboard auxiliary systems including their control systems. - Continued research into advanced HM&E system reconfiguration approaches, including agent-based control systems and algorithms, and model-based reasoning. - Continued Second Generation distributed systems model development. - Continued demonstration of real-time modeling of multiple distributed systems - utilizing small scale demonstrator. - Continued demonstration of Genetic Algorithm(s) for determining optimal distributed system control strategy. - Continued development of a hardware in-the-loop small scale demonstrator for fluid/thermal/electrical distributed systems. - Continued development of Survivability Analysis Algorithms Operable on a Total Ship Modeling Environment. <p>Advanced Platforms - Advanced Platform Concepts and Designs</p> <ul style="list-style-type: none"> - Continued validation of asymmetric hull forms with experimental data. - Continued development of analytical models to further define submarine modular hull concepts. - Continued development of reliability based design and structural analysis code development. - Continued development design tools for integrated antenna and composite topside. - Continued circulation control analysis for three-dimensional flow effects. - Continued aperstructures microwave communication system. - Continued concept for Ultra High Frequency (UHF)/Very High Frequency (VHF) aperstructures opportunistic array (Advanced Hull-form Inshore Demonstrator - AHFID). - Continued development of methods for determining reliability and vulnerability of aluminum ship structures. <p>Advanced Platforms - Hydromechanics</p> <ul style="list-style-type: none"> - Continued experimental database/computational tools development for extreme submarine maneuvers (e.g., crashback). - Continued the validation of circulation control and advanced control surfaces with experiments. - Continued to investigate improved maneuvering simulation capability for submarines. - Continued validation of Reynolds Average Navier-Stokes (RANS) code for advanced waterjet propulsor performance predictions. - Continued development of two-phase flow waterjet concept, Detached Eddy Simulation (DES) method for crashback prediction and numerical prediction method(s) of waterjet cavitation. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>	PROJECT 0000: <i>Force Protection Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<ul style="list-style-type: none"> - Continued modeling of turbulent flow interaction with propeller Leading Edge (LE) and Trailing Edge (TE) and modeling and simulation of rough-wall boundary layer noise. - Continued development of podded propulsor design/analysis tools. - Continued prediction and validation of damaged stability and capsizes. - Continued non-body-of-revolution tool development for advanced submarine configurations. - Continued the multi-platform interaction analysis and tool development. <p>Advanced Naval Power Systems</p> <ul style="list-style-type: none"> - Continued demonstration of dynamic stability of an advanced intelligent, reconfigurable, solid-state-based, zonal-electrical power system that reconfigures within 10 milliseconds. - Continued designing software for the system manager for the Universal Control Architecture (UCA). - Continued development of thermal management technology for shipboard power distribution. - Continued investigation of potential applications of silicon-carbide in future high voltage and high power applications. - Continued improvements in electrical component and device technology allowing a reduction in motor propulsion and motor controllers weight and volume. - Continued development of technologies to support dynamic reconfiguration of shipboard systems under conditions of stressing scenarios and/or system degradation. - Continued multi-year program to directly convert thermal energy to electricity. Such a capability would allow elimination of the steam cycle on an electric warship. - Continued studies of alternative cooling systems for future shipboard radar systems. - Continued development of structural macroscopic 3-dimensional battery. - Continued development of pulsed power technologies to include pulsed alternators and capacitors. - Continued electromechanical actuator noise source characterization activities. - Continued torque measurements on reduced scale models in support of electromechanical actuators. - Continued control surface actuator project focused on the technologies needed to define the design space for control surface actuators supporting submarines. - Continued development of automated HVAC system architectures for future Naval platforms. - Continued development of common universal stator design to accommodate varying rotor topologies to improve affordability of motor design and development. - Continued ship service fuel cell development. - Continued development of shipboard waste heat driven chiller systems. 			
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>	PROJECT 0000: <i>Force Protection Applied Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued program to develop and demonstrate 3 - 50 kW class solid oxide fuel cell onboard mobile power generation capabilities having compatibility with future logistics fuels to enable rapid recharge of batteries and direct power for C4ISR equipment. - Continued analytical model and reduced scale component development of power conversion technologies for multi-function motor drives, bi-directional power conversion modules, and power management controllers focusing on closing technology gaps associated with Alternative Integrated Power System (IPS) Architectures. - Continued preliminary designs of control surface actuator systems. - Continued studies of advanced heating, ventilation, and air-conditioning architectures, including studies of alternative (non-vapor-compression) refrigeration systems and concepts for waste heat reuse, to enhance ship cooling and provide thermal energy storage. - Continued research into the development of fuel chemistries, materials, and energy conversion technologies for optimal performance in Naval power systems. - Initiated Electrically Actuated Submarine Control Surfaces FNC to develop electric actuation for submarine control surfaces. <p>Surface Ship & Submarine HM&E Applied Research</p> <ul style="list-style-type: none"> - Continued development of heterojunction power switching devices. - Continued the computational design, synthesis and evaluation of new, high capacity, high-rate anode materials for Li-ion batteries. - Completed development of heterojunction power switching devices. - Completed the computational design, synthesis and evaluation of new, high capacity, high-rate anode materials for Li-ion batteries. <p><i>FY 2011 Plans:</i></p> <p>Survivable Platforms - Reduced Signatures</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate advanced EM modeling tools development and validation. - Initiate next generation deckhouse integration technology development. - Initiate modeling of hydroacoustics of turbulence-propulsor interaction. <p>Survivable Platforms - Hull Life Assurance</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate effort on exploitation of polymers for the deflection and dissipation of shock wave impact on ship and submarine hull structures. 				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>	PROJECT 0000: <i>Force Protection Applied Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Survivable Platforms - Distributed Intelligence for Automated Survivability</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete initial demonstration of real-time modeling of multiple distributed systems - utilizing the small scale demonstrator. - Complete development of a hardware in-the-loop small scale demonstrator for fluid/thermal/electrical distributed systems. - Complete Second Generation distributed systems model development. - Initiate the transition of the small scale hardware-in-the-loop demonstrator to the academic community for challenge problem formulation. - Initiate demonstration of the developed model based reasoning control algorithms on full scale hardware test beds. <p>Advanced Platforms - Advanced Platform Concepts and Designs</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>Advanced Platforms - Hydromechanics</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete optimization for waterjet-hull interaction. - Complete tip-vortex cavitation inception and scaling modeling. - Complete modeling of shock performance on composite propeller. - Initiate modeling of performance of composite propellers in extreme maneuvers. <p>Advanced Naval Power Systems</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete detailed design and breadboard demonstration of control surface actuator systems. - Complete electromechanical actuator noise source characterization activities. - Complete torque measurements on reduced scale models in support of electromechanical actuators. - Initiate fabrication of scaled control surface actuator systems under the Future Naval Capabilities (FNC) program. - Initiate fuel cell propulsion for unmanned systems. - Initiate energy programs in support of SECNAV Energy Goals including biofuels and ship energy efficiencies. <p>Surface Ship & Submarine HM&E Applied Research</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. <p>FY 2012 Plans:</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>	PROJECT 0000: <i>Force Protection Applied Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Survivable Platforms - Reduced Signatures - Continue all efforts of FY 2011.</p> <p>Survivable Platforms - Hull Life Assurance - Continue all efforts of FY 2011. - Initiate effort on DDG51 hull modification for flight IV using hybrid hull concept to increase efficiency and provide BMD capability, larger Radar loads and additional power requirements.</p> <p>Survivable Platforms - Distributed Intelligence for Automated Survivability - Continue all efforts of FY 2011, less those noted as completed above. - Initiate development of simulations for optimal distribution of control objectives amongst computational resources. - Initiate development of simulations for the decomposition of control objectives for distributed solutions. - Initiate development of simulations for complexity and control for multiple, heterogeneous, interdependent, HM&E systems. - Initiate development of simulations for Information Theory and Information Entropy for control of HM&E systems.</p> <p>Advanced Platforms - Advanced Platform Concepts and Designs - Continue all efforts of FY 2011.</p> <p>Advanced Platforms - Hydromechanics - Continue all efforts of FY 2011, less those noted as completed above. - Complete non-body-of-revolution tool development for advanced submarine configurations.</p> <p>Advanced Naval Power Systems - Continue all efforts of FY 2011, less those noted as completed above. - Initiate development and demonstration of technology options for UUV energy systems. - Initiate efforts in support of Renewable-Sustainable Expeditionary Power FNC. - Initiate efforts in support of Long Endurance Undersea Vehicle Propulsion FNC.</p> <p>Surface Ship & Submarine HM&E Applied Research - Continue all efforts of FY 2011. - Continue efforts to expand the Counter-Improvised Explosive Devices (C-IED) enhancement to support urgent operational needs.</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>	PROJECT 0000: <i>Force Protection Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
- Initiate development of autonomous system to navigate through ship interior to locate and apply advanced damage control technologies.			
Accomplishments/Planned Programs Subtotals	88.359	107.448	156.901

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0603123N: <i>FORCE PROTECTION ADVANCED TECHNOLOGY</i>	32.668	44.995	40.818	0.000	40.818	36.487	24.714	6.843	0.000	0.000	186.525

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

This PE supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial and air) and the protection of those platforms. Each PE Activity has unique goals and metrics, some of which include classified quantitative measurements. Overall metric goals are focused on achieving sufficient improvement in component or system capability such that the 6.2 applied research projects meet the need of or produce a demand for inclusion in advanced technology that may lead to incorporation into acquisition programs or industry products available to acquisition programs.

Specific examples of metrics under this PE include:

- Reduce electromagnetic vulnerability of ship hulls by 50% by FY 2011.
- Torpedo defense thresholds will be validated by modeling and simulation to satisfy the overall system performance specification of a Probability of Survival (PS) of the US Navy platform as specified in the draft Capabilities Development Document (CDD) for Surface Ship Torpedo Defense.
- Additional metrics are included within the Missile Defense Activity description.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>				PROJECT 4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	9.748	-	-	-	-	-	-	-	-	0.000	9.748

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: Naval Innovative Science and Engineering	9.748	-	-
Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.			
FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:			
<ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 			
Accomplishments/Planned Programs Subtotals	9.748	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>	PROJECT 9999: <i>Congressional Adds</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	56.063	-	-	-	-	-	-	-	-	0.000	56.063

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: Advanced Battery System for Military Avionics Power Systems FY 2010 Accomplishments: This effort provided for the study of safety and performance characteristics of lithium batteries in military avionics at the systems level in order to assess the use of advanced lithium battery technology for military aircraft.	1.593	-
Congressional Add: Advanced Composite Manufacturing for Composite High-Speed Boat Design FY 2010 Accomplishments: This effort established a basic set of criteria for the design and specification of advanced composite high speed boats. When used, these criteria will allow engineers to better utilize advanced composites in high-speed boat design, resulting in lighter, more efficient, and more reliable high-speed craft.	1.593	-
Congressional Add: Advanced Energetics Initiative FY 2010 Accomplishments: This effort provided for research into; energetic processes, conventional energetic materials to enhance blast from novel formulations and reactive casings, modulation of propellant reactions, and pursuit of novel smart and multifunctional materials that traditionally have non-energetic function to make them energetic.	3.983	-
Congressional Add: Advanced Simulation Tools for Composite Aircraft Structures FY 2010 Accomplishments: This effort developed and validated advanced computational tools and guidelines for the simulation of the structural and strength responses of airframe components made of fiber-reinforced composites.	1.593	-
Congressional Add: Alternative Energy Research FY 2010 Accomplishments: This effort provided for alternative energy research, specifically for participation in the 2010 International Methane Hydrate Expedition in the Arctic Ocean, to develop a thorough understanding of the properties and potential energy applications of oceanic methane hydrates through this joint international	18.423	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>	PROJECT 9999: <i>Congressional Adds</i>
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011
program in order to develop improved models for the creation and disassociation of natural gas hydrates and to quantify the impact of these processes on the geophysical and geotechnical properties of marine sediments.		
Congressional Add: Power Generation Carbon Comp Thin Films FY 2010 Accomplishments: This effort funded research leading to development of a wide variety of new nanomaterials (polymers/epoxy/resin and fillers) that will broaden capabilities in key areas of energy generation and storage. The potential use of organic nanomaterials in the proposed concentrator cells will result in lightweight plastic solar cells, new controlled high performance blades for harnessing wind energy and lightweight high efficiency batteries with high storage capabilities.	1.593	-
Congressional Add: Center for Autonomous Solar Power FY 2010 Accomplishments: This effort provided for research and development of large area, flexible, light weight solar cells to meet scientific challenges in reducing the cost of solar power and enhancing energy efficiency. Solar cells were integrated with novel high energy density supercapacitors for a complete collection and storage capability.	3.983	-
Congressional Add: Energetic Nano-Materials Agent Defeat Initiative FY 2010 Accomplishments: This effort provided applied research to develop technology to disable chemical and biological (CB) agent munitions stockpiles while minimizing dispersion of CB agents and increasing efficiency of CB agent defeat during a short time event.	1.593	-
Congressional Add: Fuel Efficient, High Specific Power Free Piston Engine for USSVs FY 2010 Accomplishments: This effort provided applied research to develop a free-piston engine. Operation at varying load and speed was studied to explore power, output range and capability, focusing on engine cooling system design and verification of operation in compression ignition mode with a heavy fuel.	1.593	-
Congressional Add: Harbor Shield - Homeland Defense Port Security Initiative FY 2010 Accomplishments: This effort provided applied research for design and manufacture of underwater components for a prototype ship hull scanning sonar system, mounting fixtures, cabling, and interfaces.	1.593	-
Congressional Add: Integration of Electro-Kinetic Weapons Into Next Generation Navy Ships FY 2010 Accomplishments: This effort investigated the energy delivery technologies for electro-kinetic weapons systems and the integration and interface issues of these weapons.	3.983	-
Congressional Add: Lithium Ion Storage Advancement for Aircraft Applications	1.992	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>	PROJECT 9999: <i>Congressional Adds</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011
<i>FY 2010 Accomplishments:</i> This effort supported lithium ion storage advancement for aircraft applications research.		
<i>Congressional Add:</i> Magnetic Refrigeration Technology for Naval Applications <i>FY 2010 Accomplishments:</i> This effort studied the feasibility of materials and assisted in the development of a transition strategy for magnetic refrigeration technology for naval application. New amorphous magnetic alloys were designed, characterized, and optimized for use in magnetic refrigeration applications. Enhanced (Fe,Co,Mn)-based amorphous magnetocaloric materials were synthesized by rapid solidification processing and their structural and magnetic properties were characterized. The newly developed alloys will provide better magnetic entropy change and higher refrigeration capacity than conventional amorphous magnetocaloric effect materials near room temperature.	3.983	-
<i>Congressional Add:</i> Multi-Mission Unmanned Surface Vessel <i>FY 2010 Accomplishments:</i> This effort enabled testing and evaluation of the use and effectiveness of a large Unmanned Surface Vessel (USV) with multiple capabilities including surface warfare, persistent electronic surveillance for dull, dirty, dangerous missions typical of unmanned vessels. The first large, stealthy, attack USV with a combat suite was integrated into the US Navy enterprise network (FORCEnet), reducing risk to personnel conducting high risk, covert, intelligence/surveillance operations.	1.992	-
<i>Congressional Add:</i> Non Traditional Ballistic Fiber and Fabric Weaving for Force Protection <i>FY 2010 Accomplishments:</i> This effort evaluated non traditional weave designs of Aramid (ballistic) fiber coupled with new applications of microwave plasma treatments to enhance the strength of the fiber. The new technology may result in enhanced mobility, ease of medical access, reduced weight, increased ballistic protection, cost savings and weight reduction compared to current ballistic materials.	1.992	-
<i>Congressional Add:</i> Hybrid Power Systems <i>FY 2010 Accomplishments:</i> This effort investigated aluminum/seawater combustion systems using a balanced program that addresses technologies that can be inserted in UUV power plants in the near-, mid- and long-term time frames.	1.992	-
<i>Congressional Add:</i> Proton Exchange Membrane Fuel Cell for Underwater Vehicles	1.593	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602123N: <i>Force Protection Applied Res</i>	PROJECT 9999: <i>Congressional Adds</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011
<i>FY 2010 Accomplishments:</i> This effort provided for development of a proton exchange membrane fuel cell for underwater vehicles that assisted with the development of a hybrid fuel cell/lithium ion battery power system that combines the advantages of each to create an ideal solution for mobile power applications.		
<i>Congressional Add:</i> Joint Heavy-Lift Rotocraft Research	0.996	-
<i>FY 2010 Accomplishments:</i> This effort developed a comprehensive aeromechanics research program to support the development of efficient heavy-lift rotorcraft concepts. The work involved innovative rotor designs, variable rotor speed capability, swashplateless flight and active vibration control, lightweight airframe with body armor, condition-based maintenance of advanced flight control system, acoustic prediction with high-fidelity computational tools, and flight controls of mission adaptive rotors. This research program provided risk reduction guidance and design solutions as well as strategic directions for the next-generation of heavy-lift V/STOL systems.		
Congressional Adds Subtotals	56.063	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	44.452	43.776	44.845	-	44.845	46.095	47.181	48.200	49.058	Continuing	Continuing
3001: <i>Marine Corps Landing Force Tech</i>	37.979	43.776	44.845	-	44.845	46.095	47.181	48.200	49.058	Continuing	Continuing
9999: <i>Congressional Adds</i>	6.473	-	-	-	-	-	-	-	-	0.000	6.473

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval Science and Technology (S&T) Strategic Plan approved by the S&T Corporate Board (Mar 2010). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE is organized into nine activities which are represented as seven Expeditionary Warfighting Capability Areas, as well as Future Concepts, Technology Assessment and Roadmapping, and the Littoral Combat/Power Projection (LC/PP) FNC. The primary objective of this PE is to develop and demonstrate the technologies needed to meet the Marine Corps' unique responsibility of training and equipping the Marine Air/Ground Task Force (MAGTF) for Expeditionary Maneuver Warfare. In the post-September 11 world, irregular warfare (IW) has emerged as the dominant form of warfare confronting the United States, its allies and its partners; accordingly, this PE has been structured to account for distributed, long-duration operations, including unconventional warfare, counterterrorism, counterinsurgency, and stabilization and reconstruction operations. IW emphasizes the use of indirect, non-conventional methods and means to subvert, attrite, and exhaust an adversary, or render irrelevant, rather than defeat him through direct conventional military confrontation. IW is now institutionalized in the Marine Corps' planning, investment, and capability development. This PE provides the knowledge base to support Advanced Technology Development (6.3) and is the technology base for future expeditionary warfare capabilities. This PE supports the Expeditionary Force Development System of the Marine Corps Combat Development Command (MCCDC) and responds directly to the Marine Corps Science and Technology (S&T) process as well as supporting related Littoral and Expeditionary Maneuver Warfare capabilities developed by the Navy's Mission Capability Program. The Future Naval Capabilities (FNC) process is supported and funds are programmed accordingly. The FNC program explores and demonstrates technologies that enable Sea Strike, Sea Shield, Sea Basing, FORCEnet and Force Health Protection pillars, Space, Naval Expeditionary Maneuver Warfare and the Enterprise and Platform Enablers. The FNC program is composed of Enabling Capabilities (ECs) which develop and deliver quantifiable products (i.e., prototype systems, knowledge products, and technology improvements) in response to validated requirements for insertion into acquisition programs of record after meeting agreed upon exit criteria within five years. The core 6.2 program also supports Discovery and Invention (D&I) and Innovation and Transformation (I&T). Within the Naval Transformation Roadmap, this investment will achieve key transformational capabilities required by the Sea Power 21 Pillars, as well as enable Ship to Objective Maneuver (STOM), Persistent Intelligence, Surveillance and Reconnaissance and Overseas Contingency Operations (OCO).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	45.607	43.776	45.099	-	45.099
Current President's Budget	44.452	43.776	44.845	-	44.845
Total Adjustments	-1.155	-	-0.254	-	-0.254
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.150	-			
• Program Adjustments	-	-	-0.021	-	-0.021
• Rate/Misc Adjustments	-	-	-0.233	-	-0.233
• Congressional General Reductions Adjustments	-0.005	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

Congressional Add: *High Power Ultra Lightweight Zinc-Air Battery*

Congressional Add: *Warfighter Rapid Awareness Processing Technologies*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.992	-
	4.481	-
Congressional Add Subtotals for Project: 9999	6.473	-
Congressional Add Totals for all Projects	6.473	-

Change Summary Explanation

Technical: FY 2010 and out reflects funding for a DoD directed integrated capability demonstration supporting the Protection of Ground Forces and Systems to meet the imposing security threats that challenge our Nation, and it may not be adequately postured to take advantage of key scientific and technological opportunities that offer breakthrough advantages to our warfighters. This broad, multi-year (through the FYDP) initiative will expand existing technology integration and increase/spur the application of more fundamental technologies to force and platform protection. The goal is multiple broad phased force protection applications and technologies, with off-ramps for fielding successes; therefore, funding associated with this DoD initiative is reflected throughout the PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	PE 0602131M: <i>Marine Corps Lndg Force Tech</i>

In FY 2011 efforts continue in areas of technology that are ready for major, integrated technology demonstration. All technical work is being coordinated throughout DoD on these demonstrations. In areas such as vehicle technology demonstrations, the goal is to deliver multiple classes of advanced technology ground vehicle demonstrations leading to new classes of protective, efficient, ground vehicles.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602131M: <i>Marine Corps Lndg Force Tech</i>				3001: <i>Marine Corps Landing Force Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
3001: <i>Marine Corps Landing Force Tech</i>	37.979	43.776	44.845	-	44.845	46.095	47.181	48.200	49.058	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project is organized into nine activities which are represented as seven Expeditionary Warfighting Capability Areas, as well as Future Concepts; Technology Assessment and Roadmapping; and the Littoral Combat/Power Projection (LC/PP) FNC. The seven Expeditionary Warfighting Areas support the Discovery and Invention (D&I) and the Innovation and Transformation (I&T) investment. The LC/PP FNC supports the Exploitation and Deployment (E&D) investment.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTERS (C4)</p> <p>Description: This activity supports S&T investment in Command and Control and is focused in three main areas. (1) Implementing the FORCEnet concept. FORCEnet is the operational construct and architectural framework for naval warfare in the information age that integrates warriors, networks, command and control, and weapons into a networked, distributed, combat force that is scalable across all levels of conflict from the seabed to space and sea to land. The Marine Corps instantiation of FORCEnet is Marine Air Ground Task Force Command and Control (MAGTF C2), with technologies to exchange data and information with and among distributed tactical forces. (2) Developing decision support systems that enable warfighters to take advantage of the FORCEnet and MAGTF C2 and tactically extend Net-Enabled Command and Control (NECC) for shared situational awareness. (3) Providing effective combat identification of enemy combatants, friendly forces, and non-combatants. Activities in this activity provide technologies for secure, robust, self-forming, mobile communications networks distributed computing to support information dissemination to all echelons; and sensors, software and data processing to support formation of appropriate common picture. Marine Corps specific efforts include power management, low detect ability, size and weight constraints, and interoperability within the joint environment.</p> <p>FY 2010 to FY 2011 increase in funding results from the acceleration of efforts to complete and transition Adaptable Antennas Technologies, Field Programmable Gate Array Communications Architectures, and Information on Demand efforts.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of urban/restricted environment communications technologies. - Continued new efforts in Over-the-Horizon Communications which include the development of an airborne software-defined communications, networking, Electronic Signals Intelligence (ELINT) and Electronic Warfare (EW) capability. - Completed Free Space Optical Communications Technologies efforts. - Completed development of C3 for the Distributed Operations Marine technologies. This includes development of technologies to allow small units to share Position and Location Information (PLI) in GPS-denied or restricted environments thereby enhancing 	3.196	3.851	3.929

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>	PROJECT 3001: <i>Marine Corps Landing Force Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>current blue force situational awareness. This includes completion of an Assured Connectivity effort to develop waveforms suited to maintaining low data rate links under extreme conditions.</p> <ul style="list-style-type: none"> - Initiated Adaptable Antennas, Self-Adapting Radio Prototype and RF Technologies efforts. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete Adaptable Antennas Technologies, Field Programmable Gate Array Communications Architectures, and Information on Demand efforts. (Relates to FY 2009 plan to initiate new efforts in Over-the-Horizon Communications). - Initiate Cognitive Networking Technologies, Mobile Security Architecture Technologies, and Small Unit Blue Force tracking/ Position Location Information/Combat Identification Technologies efforts. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete RF Technologies, Adaptable Antennas and Info on Demand Technologies efforts. Other priorities shifted these completions from FY 2011. - Initiate Cognitive Networking and Trusted Computing Technology efforts. These technologies were planned for initiation in FY 2011 but will be delayed until FY 2012 due to unforeseen technical delays. 				
<p>Title: FIREPOWER</p> <p>Description: This activity develops technology for application on current and future expeditionary weapons and elements of the kill chain. It includes, but is not limited to, the following technologies: Fuze, fire control, launch/propulsion, lethality, and accuracy.</p> <p>FY 2010 to FY 2011 increase in funding is due to an expansion in the scope of E&D efforts for precision urban attack driven by affordability issues. The efforts address technologies needed to acquire, track, and designate Forward Observer (FO) identified targets, from an Unmanned Aircraft System (UAS), for urban and other complex terrain attack by mortar rounds with advanced trajectory shaping capabilities.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of a concept for an insensitive munitions propulsion system to enable firing a shoulder launched rocket from an enclosed space. - Continued investigation of the scalability of variable effects conventional munitions technology for improving firepower effectiveness while increasing affordability and decreasing logistics burden in support of expeditionary warfare. - Continued development of collaborative fires coordination technologies. - Continued development of precision fires engagement technologies, to include trajectory shaped 81mm mortars. 		3.451	4.314	4.535

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>	PROJECT 3001: <i>Marine Corps Landing Force Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued expanded efforts in lightweight weapons and ammunition (crew served weapons, small arms ammunition, and packaging), to include Caseless (CL) Ammunition. This includes priority USMC fires efforts in Micro-electromechanical Systems (MEMS) Safe and Arm (S&A), to develop a Military Standard (MilStd) 1316 compliant S&A for incorporation into developmental precision 81mm mortar munitions and MEMS Initiation Safety Device (ISD), to develop MilStd 1901A compliant igniters for current and developmental weapons propulsion systems as well as a Revolutionary Target Effects project, to develop conventional warhead concepts for breaching specific urban targets. - Continued Targeting & Engagement and Precision Target Location efforts that include Non-Magnetic Azimuth Sensing (NMAS) Technology. NMAS will continue to develop various technologies to achieve higher performance than previously possible while decreasing size and weight. - Continued development of eye-safe micro-pulse laser designator (MPLD) technology, pushing state of the art technology development to meet the program's low energy, designator and seeker objective capabilities. - Continued design and development of lightweight technologies to provide individual Marines enhanced capabilities to detect and identify man-sized targets at least out to the maximum effective ranges of their individual weapons, during all conditions (daylight, limited visibility, & darkness), by integrating multiple optics capabilities into a single system. - Completed development of Distributed Operations Precision Engagement collaborative fires coordination technologies. - Completed E&D portion of development of enhanced range mortar munitions for more effective fire support. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete development of Non-Magnetic Azimuth Sensing technology. - Complete development of eye-safe Micro Pulse Laser Designation technology. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Continue E&D portion of NMAS technology development to reduce size, weight and power (SWaP) while increasing performance. - Continue E&D portion of MPLD technology development, pushing state of the art technology development to meet the program's objective capabilities. - Complete D&I portion of Flight Controlled Mortar (81mm), having trajectory shaped flight path. - Initiate Hypervelocity Gun Propulsion project, to investigate hypervelocity gun technologies for Marine expeditionary weapons systems as possible artillery, tank main gun, and/or naval surface fire support replacement systems. - Initiate Semi-Autonomous Fires Technology. 				
Title: FORCE PROTECTION		4.024	4.764	5.122

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>	PROJECT 3001: <i>Marine Corps Landing Force Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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Description: This activity supports the Force Protection Thrust's applied research program. Technologies are being developed that focus on the following: Landmine avoidance, detection, and breaching/neutralization; Counter Improvised Explosive Devices; Counter Rocket, Artillery, Mortar, and Sniper; Technologies for improved protection for individuals including Marine Personnel Protective Equipment against blast, ballistic and blunt impact threats and in chemical, radiological, and biological environments; and physical installation and checkpoint security. Beginning in FY 2009, Mine Counter Measure (MCM) efforts are funded within this activity. Force Protection (FP) related technologies, including all MCM and counter Improvised Explosive Device (IED) related technology development are now reflected in this thrust area's submission.

FY 2010 to FY 2011 increase results from accelerating efforts required to complete development of shape charge, safe and arm, and non-energetic launch and delivery technologies to support scalable explosive neutralization.

FY 2011 to FY 2012 increase results from implementation of a program for sensor fields development to identify and classify mine threats and accelerated efforts in personal protection - specifically modeling and simulation for ballistic fabric optimization and development.

- FY 2010 Accomplishments:**
- Continued development of technologies for stand-off detection and neutralization of mines, IEDs, and Unexploded Ordnance (UXO) (Transitioned from Maneuver activity).
 - Continued development of technologies to defeat side/top attack and advanced mine fuzes (seismic, acoustic, and infrared) through advanced signature reduction, duplication, and projection. (Transitioned from Maneuver activity)
 - Continued spectral signature classification efforts for MCM applications (Transitioned from Maneuver activity).
 - Continued development of computational models to scale the effects of small-scale explosives tests to full-scale landmine explosions in order to study mine blast effects on advanced vehicle geometry.
 - Continued technology development programs to address force protection personal protective equipment capability gaps (Transitioned from Maneuver activity).
 - Continued development of technologies to defeat advanced mine fuzes (seismic, acoustic, and infrared) (Transitioned from Maneuver activity).
 - Continued studies of sensor fields to identify and classify mine threats.
 - Continued evaluation of active wideband double notch filters for a wide spur-free dynamic range in specific frequencies of interest to cover a variety of threats.
 - Continued an Explosive Hazard Defeat for IED Neutralization effort focused on applying passive infrared phenomenology understanding to a capability enabling defeat of PIR devices from significant stand-off distances.

	FY 2010	FY 2011	FY 2012

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>	PROJECT 3001: <i>Marine Corps Landing Force Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued Counter Rockets, Artillery, Mortars, and Sniper efforts addressing indications and warnings for pre-shot sniper detection and enabling detection of sniper observation and targeting in advance of a ballistic event. - Completed magnetic and seismic portion of development of technologies to defeat side/top attack and advanced mine fuzes. - Completed high-speed syntactic landmine detection algorithm development to support ground penetrating radars. (Relates to FY 2009 plan to continue development of technologies for stand-off detection and neutralization of mines, IEDs, and UXO). - Completed Neutralization effort focused on applying passive infrared phenomenology understanding to a capability enabling defeat of PIR devices from significant stand-off distances. - Completed vulnerability analysis of selected munitions and targets. (Relates to FY 2009 plan to initiate Counter Rockets, Artillery, Mortars, and Sniper efforts). - Initiated technology development efforts to detect and defeat incoming rocket, artillery, and mortar threats via non-kinetic means. - Initiated multi-spectral protection efforts against battlefield directed energy weapons. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete spectral signature classification efforts for neutralization confirmation. - Complete development of shape charge, safe and arm, and non-energetic launch and delivery technologies to support scalable explosive neutralization. (Relates to FY 2009 plan to continue development of technologies for stand-off detection and neutralization of mines, IEDs, and UXO). - Complete multi-material fiber level modeling and simulation for ballistic fabric optimization and development. (Relates to FY 2009 plan to continue technology development programs to address force protection personal protective equipment capability gaps). - Initiate studies of sensor fields to identify and classify mine threats (see FY 2012 narrative clarification). <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Continue technology development programs to address force protection personal protective equipment capability gaps. (Transitioned from Maneuver activity). - Continue a study regarding the feasibility of detecting and locating sniper weapons using the return of their unique radar signatures that will initiate in FY 2011 due to operational urgency. - Continue a study of automated human detection via spectral imaging during low-light level operation conditions (e.g. dusk/dawn/moonlit/starlit night) that will initiate in FY 2011, due to operational urgency. - Continue the development of develop technologies that will detect and classify optics (sniper scopes, ccds, eyeball, etc) from a moving platform due from an effort that will initiate in FY 2011 due to an urgent operational need. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continue the development of technologies that will detect Rocket Propelled Grenades (RPGs) and Anti-Tank Guided Missiles (ATGMs) prior to launch and countermeasures after launch from a new effort that will initiate in FY 2011 due to operational urgency. - Continue the demonstration of the feasibility of a deployable mission package consisting of technologies capable of screening multiple individuals rapidly over a wide area to detect, classify and track suicide bombers at relevant distances within a critical time frame. Due to an urgent Naval operational need, this effort will now initiate in FY 2011. - Continue a scientific study of laser technology readiness, performing technology roadmapping, and conducting system level simulations. This effort was initiated in FY 2011 due to an urgent operational need. This effort continues in FY 2012 and will assess the suitability of lasers on the battlefield and drive future HEL technology investment plans and support the acquisition process. - Complete the high-speed syntactic landmine detection algorithm development to support ground penetrating radars in FY 2011. This effort was planned for completion in FY 2010 but was delayed due to technical setbacks. - Complete development of shape charge, safe and arm, and non-energetic launch and delivery technologies to support scalable explosive neutralization (Relates to FY 2009 plan to continue development of technologies for stand-off detection and neutralization of mines, IEDs, and UXO). - Complete multi-material fiber level modeling and simulation for ballistic fabric optimization and development (Relates to FY 2009 plan to continue technology development programs to address force protection personal protective equipment capability gaps). - Initiate studies of sensor fields to identify and classify mine threats. This effort was planned for initiation in FY2011 but was delayed due to emerging higher priority requirements. 				
<p>Title: FUTURE CONCEPTS, TECHNOLOGY ASSESSMENT, AND ROADMAPPING</p> <p>Description: This activity supports the planning and integration of technology development efforts across the entire PE. In conjunction with the Concepts Based Capabilities System and the Marine Corps Warfighting Laboratory, unique and novel concepts for advanced warfighting are developed and validated. Effectiveness analyses are conducted to identify the synergistic effects that can be achieved through the integration of emerging technology with innovative tactics, doctrine, and techniques. Technology assessments are conducted to determine the supporting technologies that have the highest impact across the warfare areas, and warrant further investment within this PE. Technology Roadmapping is conducted to help identify opportunities to leverage technology development within the Department of the Navy and the Department of Defense, as well as, with the commercial sector and university communities. The resultant technology investment strategy is developed and used to guide out-year technology development efforts.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued assessments in Lightening the Marine's Load and Enhancing the Capabilities of the Marine Corps Rifle Squad. 		1.006	1.116	1.337

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued assessments in Asymmetric / Irregular Warfare and Distributed Operations. - Continued new planning and integration of technology development efforts to meet imposing security threats that challenge our Nation. - Completed the assessment of the technical requirements of the MARSOC. - Completed assessments of all new and emerging Counter Sniper Technologies. - Completed Technology Assessment of the Combating Terrorism portfolio. - Completed Technology Assessments associated with the Urban Asymmetric and Expeditionary Warfare Capability Gap. - Completed the integrated planning of concepts and technology development. - Completed development of the Expeditionary Maneuver Warfare Investment Strategy. - Completed Technology Assessments and Roadmapping within Command, Control, Communication, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR); and Firepower Thrust Areas of the PE. - Initiated an assessment of the S&T impacts of Marine Corps' concept of force employment to meet the need for counterinsurgency and building partnership capacity. How the Marine Corps will support the National Defense Strategy (NDS) and multinational efforts in the Global War on Terrorism/Long War will have long-term S&T impacts. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2010, less those noted as completed above. - Complete the assessment of the Distributed Operations S&T Strategic Focus Area and portfolios. - Complete the assessment of the DoD directed integrated capability demonstration supporting the DoD Protection of Ground Forces and Systems initiative as well Quadrennial Defense Review (QDR) impacts. The QDR is a legislatively-mandated review of Department of Defense strategy and priorities (Note: This is specifically includes an assessment of the S&T Expeditionary Operations impacts of Naval Operations Concept 2010 (NOC 10) which describes when, where and how U.S. Naval forces will contribute to enhancing security, preventing conflict and prevailing in war.) <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2011, less those noted as completed above. - Complete an assessment of the S&T impacts of Marine Corps' concept of force employment to meet the need for counterinsurgency and building partnership capacity. How the Marine Corps will support the National Defense Strategy (NDS) and multinational efforts in the Global War on Terrorism/Long War will have long-term S&T impacts. - Initiate a Cargo Unmanned Aerial study focused on Ship-to-Objective Maneuver (STOM) and developmental technologies for expeditionary operations to include ground autonomous capabilities. - Initiate an assessment of Unmanned Ground Systems Affordability, Experimentation and Rapid Prototyping Investments and formulate a USMC S&T future strategy. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
- Initiate an effort focused on the suitability of lasers on the battlefield and formulate future High Energy Laser technology investment plans that support the acquisition process.			
Title: HUMAN PERFORMANCE, TRAINING AND EDUCATION		3.800	4.662
<p>Description: The Human Performance Training and Education thrust develops advanced training technology and technologies that enhance neural, cognitive and physical aspects of human performance including mental resilience, cognitive agility, expertise development and enhanced physical readiness in extreme combat environments. Also included are advanced technologies in customized training interventions, stress training and crisis decision making to support warfighter tactical decision-making, optimal physical conditioning and sustainment, modeling, simulation, range instrumentation, and synthetic environment generation.</p> <p>FY 2010 to FY 2011 funding increase results from accelerated development of enhanced physical readiness technologies and squad-level team training mitigation strategies.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued the development of foundational learning theories extended to complex tasks for a range of expertise levels, training mitigation strategies triggered by neurophysiological markers of learning, cognition and expertise, and principles of expertise development on a continuum of novice to expert. - Continued development of training mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition and expertise. - Continued additional Human Performance and Training efforts (Cognitive and physical enhancement, modeling and simulation, and virtual reality squad level training in support of Distributed Operations). - Continued additional efforts to incorporate effects of nutrition and functional fitness into models and simulations in the Distributed Operations Virtual Toolkit. - Continued Advanced Mobile Assessment and Field Readiness Technologies to improve the capability to assess situational awareness in the field and predict physical performance by developing mobile, rugged tools, algorithms, and models. - Continued a Mind-Body Integration Systems effort to improve team training by developing and validating Electroencephalogram (EEG) (and other physiological and performance measures) for use in assessing team performance, coordination, and cohesion in training environments. - Continued studies into next generation physical performance enhancement methodologies and technologies (enhanced warfighter psycho-physical performance). - Continued research to evaluate the feasibility of integrating augmented reality technologies into current and emerging training systems (Smart Tutoring Systems). - Completed research on combat feeding and hydration. 		4.535	

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Completed research on physiological correlates for the strategic corporal assessment. - Completed development into a Marine performance optimization model. - Completed the development of training effectiveness measures and techniques as applied to disparate, multi-platform, multi-mission team training. - Completed research into distributed operations peak neural and cognitive performance. - Completed research into next generation survivability enhancement technologies. - Completed Distributed Operations training system investigations to perceptual skills enhancement that lead to enhanced cognition and decision making. - Initiated evaluations of asymmetric distributed learning techniques for distributed operations, language, and cultural training. - Initiated development of team training mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition, and expertise. - Initiated development of team training/immersive approaches towards language and culture training that incorporate foundational learning theories and other advanced educational methods. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Initiate development of squad-level team training mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition, and expertise. - Initiate development of field team performance mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition, and expertise. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Continue research into acclimatization parameters to enhance warfighter performance. This effort initiated in FY 2011 due to urgent operational needs. - Complete research into distributed operations peak neural and cognitive performance. (Relates to the advanced technology efforts to demonstrate and evaluate mobile field technologies for assessing situational awareness and predicting readiness and performance initiated in FY 2012 and resourced in PE 0603640M.) - Complete research into workload stress and performance, and brain dynamics of coordinated teams in immersive training - Complete studies into next generation physical performance enhancement methodologies and technologies (Brain Dynamics of Coordinated Teams). - Complete research on biomarkers of heat stress and resilience - Complete research to evaluate the feasibility of integrating augmented reality technologies into current and emerging training systems (expressive interactions in the virtual environment). 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiate research into heat stress mitigations for the individual warfighter and develop intervention strategies to improve performance in hot environments. - Initiate research into distributed mobile architectures to support US Marine Corps training. - Initiate research into mobile field technologies for predicting readiness and performance. 				
<p>Title: INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR)</p> <p>Description: This activity develops ISR technologies for applications in future intelligence, surveillance, and reconnaissance. Technologies being pursued enhance situational awareness, persistent surveillance, and tactical decision making through automated analysis of data and rapid integration of information and acquired knowledge. Specific technologies in this activity effectively present actionable information to decision-makers, especially those at the lower command levels. This includes biometrics for expeditionary operations, complete future automation of options and persistent surveillance in support of distributed operations.</p> <p>FY 2010 to FY 2011 increase results from accelerated efforts to complete the development of urban sensing technologies to detect enemy weapons at greater distances.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of information fusion technologies to allow automated construction of a common tactical picture from various sources of sensor data. - Continued development of low power consumption urban sensing technologies. - Continued development of tagging, tracking and locating technologies to monitor adversary movement. - Continued development of information on demand technologies to provide warfighter with the right information at the right time. - Continued development of urban sensing technologies to detect weapons at distance. - Continued development of advanced tactical sensor technologies to improve unit awareness. - Continued development of distributed information architecture technologies. - Continued the decision prediction, manipulation, stimulation and learning detection capability to add tools that enable the warfighter to operate inside the OODA loop of an irregular actor. The Observe, Orient, Decide, Act (OODA) Loop provides a standard description of decision making cycles that is widely understood and accepted throughout the U.S. military. - Continued development of a single integrated battlespace picture with tactical and strategic injects that begins to close the gap between ISR and C2. - Continued Actionable Intelligence for Expeditionary and Irregular Warfare effort which includes real-time methods for Identifying Human Networks. - Continued tagging, tracking, and locating technologies development to address development of multi-INT track continuity. 		2.124	2.571	2.619

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued development of advanced tactical nets to include additional phenomenologies and the netting of C2, Sensors and Analysis nodes. - Continued efforts addressing "battlespace awareness" of human networks, improving the accuracy of classification decisions and enabling a human network predictive capability. Once a human network sensor can be defined and dynamically observed in a common feature space, predictive capabilities are realized. If one network is observed to be moving towards at risk behavior, a generalized force warning may be enabled addressing the threat associated with all networks with similar human network sensors. When combined, research into human network awareness, network classification and network prediction, will be a powerful tool for warfare against the irregular actor. - Continued development of adaptable enemy course of action engine to manipulate adversary decisions. - Completed development of urban sensing technologies to detect weapons at distance. - Initiated new Sensor Fields efforts such as Nanotechnology Enabled Witness Fields, development of sensors that provide near real time decision support to distributed operations by detecting specific interactions, and nanotechnology efforts which offer the potential to revolutionize tactical sensors. To enable this capability, nanomaterials that change state in the presence of another nanomaterial will be developed. - Initiated efforts to track entities of interest in a high clutter environment via geolocation of optical tags from a UAV platform. - Initiated development of capabilities to integrate socio-cultural models of human behavior with the ability to forecast the processes of decision making through predictive forecasting models. - Initiated development of approach to model and expose enemy networks, actions, and reactions through statistical models with techniques for probabilistic forecasting of behaviors of interest with consideration for open source information and conventional intelligence data sources. - Initiated development of sensors that provide near-real-time decision support to distributed operations by detecting specific interactions utilizing nanotechnology. - Initiated efforts to derive high resolution models of human networks statistically with associated behavior attributes. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2010, less those noted as completed above. - Complete optical tag geolocation from a UAV effort. - Complete development of advanced tactical sensor technologies to improve unit awareness by demonstrating the feasibility of voice recognition and facial identification from a battery powered processor. - Initiate work on specific nanomaterial triggers and receptors. - Initiate work on new optical taggants with improved producibility. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>		PROJECT 3001: <i>Marine Corps Landing Force Tech</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiate work on influencing, disrupting, and stimulating behavior by fusing high resolution models of decisions with models of human networks. This includes work to provide an accurate decision tool to the warfighter that is relevant to irregular warfare and development of tools to enable robust facial recognition in poor conditions and difficult environments.</p> <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2011, less those noted as completed above. - Complete tagging, tracking, and locating technologies development to address development of multi-INT track continuity. - Complete the decision prediction, manipulation, stimulation and learning detection capability to add tools that enable the warfighter to operate inside the OODA loop of an irregular actor. The Observe, Orient, Decide, Act (OODA) Loop provides a standard description of decision making cycles that is widely understood and accepted throughout the U.S. military. - Initiate development of model based adversarial decision making stimulus and manipulation that will assist in the influence of decisions made by adversaries to our benefit. 				
<p>Title: LITTORAL COMBAT/POWER PROJECTION</p> <p>Description: This activity funds the Marine Corps participation in the Future Naval Capabilities (FNC) program. It is aligned with the Sea Strike, Sea Shield, Sea Basing and FORCENet and Expeditionary Maneuver Warfare (EMW) pillars as well as Force Health Protection and the Enterprise & Platform Enablers. It provides the capability for the demonstration and transition of technologies developed through the related Marine Corps S&T programs directly to an acquisition program of record.</p> <p>The funding profile reflects the alignment of the FNC program investments into ECs. Funding for each EC is aligned to a 6.2 or 6.3 Budget Activity (BA) as appropriate. The focus of the ECs within this PE will be on technology related to Urban, Asymmetric, Littoral and Expeditionary Operations. The related science and technology development is of the highest importance to Marine Corps operations in Iraq, Afghanistan and the OCO. The technologies associated with these gaps are being pursued as part of an overall effort that addresses Sea Strike, Sea Shield, Sea Basing and FORCENet and Expeditionary Maneuver warfare Capability Gaps. Warfighter Capability Gaps are made up of ECs and supporting products. This activity includes support to the Urban, Asymmetric Operations-related EC's for IED's, Modular Scalable Effects Weapons, Advanced Naval Fires Technology, Dynamic Target Engagement, Position Location Information, Transparent Urban Structures, Hostile Fire Detection and Response, Lightweight Protective Systems, and Lightening the Load of Dismounted Combatants.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development and began transitioning EFV obstacle detection capability to EFV Direct Reporting Program Manager. - Continued development of integrated vehicle self-defense system to defeat incoming RPGs. - Continued transparent urban structure 'see thru the wall', image and mapping technologies development. 		9.750	9.800	9.925

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>	PROJECT 3001: <i>Marine Corps Landing Force Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued development of an integrated company level Urban Sensor Suite. (Automated Control of Large Sensor Networks) (Transitions to PE 0602235N) - Continued detect and identify facilities technology development. (Transparent Urban Structures). - Continued decision aids technology development. (Transparent Urban Structures) - Continued indirect prototype technology development. (Modular Scalable Effects Weapon) - Continued development of Modular Scalable Effects weapons technologies. (Concurrent funding in PE 0603640M.) - Continued development of counter Improvised Explosive Device (IED) technologies. (Concurrent funding in PE 0603640M) - Continued development of tactical urban breaching technologies. Due to required program necessities resourcing of continued development of tactical urban breaching technologies has been realigned to PE 0603640M. - Continued development of individual Warfighter protection technologies. (Concurrent funding in PE 0603640M) - Continued development of advanced survivability and mobility technologies for Marine Corps tactical and combat vehicles. (Concurrent funding in PE 0603640M and 0603236N) - Completed development and transitioning of improved fire control technologies based on small-scale hardened Non-Magnetic Azimuth Sensor to improve timeliness and accuracy of mortars/howitzers. (Concurrent funding provided by PE 0602114N) <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as complete above. - Complete development of individual warfighter lightweight protective system technologies that will reduce body armor weight, improve survivability, and increase the mobility of the warfighter (concurrent funding provided by PE 0603640M). - Complete development and transition transparent urban structures technologies which will enable tactical units to detect, classify and discriminate between friendly and enemy personnel in urban structures, and to gather ground data to dynamically develop 3D models to map urban areas using an Unmanned Air Vehicle (UAV)/Unmanned Ground Vehicle (UGV)-based system. (Concurrent funding provided by PE 0603640M) - Initiate development of technologies to lighten-the-load of warfighters by 1) reducing the weight and improving the capability of the day/night weapon sight 2) eliminating battery incompatibility, 3) providing Graphical User Interface (GUI)-based software for tradeoff analyses based on Military Operational Posture. (Concurrent funding provided by PE 0603064M and PR 0603236N) <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as complete above. - Complete development of counter Improvised Explosive Device (IED) technologies. (Concurrent funding in PE 0603640M) - Complete development of advanced survivability and mobility technologies for Marine Corps tactical and combat vehicles. (Concurrent funding provided by PE 0603640M and 0603236N) 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>	PROJECT 3001: <i>Marine Corps Landing Force Tech</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
- Initiate development of wide area surgical and persistent surveillance technologies. (Concurrent funding provided by PE 0602271N and PE 0603640M)			
<p>Title: LOGISTICS</p> <p>Description: This activity supports Marine Corps Expeditionary Logistics which is the practical discipline and real world application of the deployment, sustainment, reconstitution, and re-deployment of forces engaged in expeditionary operations. Expeditionary Logistics replaces mass with assured knowledge and speed, is equally capable ashore or afloat in austere environments, and is fully scalable to meet uncertain requirements. Expeditionary Logistics logically divides into five pillars: deployment support, force closure, sustainment, reconstitution/redeployment, and command and control. These pillars are thoroughly integrated and perpetually related in execution.</p> <p>FY 2010 to FY 2011 funding increase is due to the acceleration and completion of applied research in novel electrochemical capacitors for meeting the peak power requirements of USMC squad level equipment and USMC Distributed Operations.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued advancement of high specific energy electrochemical capacitors to function as peak electric load-leveling buffers in advanced lightweight portable power applications. - Continued applications of advanced material surface treatments and coatings for reducing required maintenance and enhancing operational readiness of expeditionary warfare vehicles, machinery, and electrical systems (Note: This also includes development of alternative human load carrying concepts to lighten the load carried by the Marine and reduce structural damage to the human body). - Continued advancement of a solid oxide fuel cell capable of directly oxidizing liquid logistic fuels such as JP-8, thus eliminating the necessity for both reforming and sulfur removal pre-processing of the fuel. - Completed developing and assessing concepts that permit precision delivery of logistics assets while also reducing the logistics footprint ashore. - Completed development of an alternate power source to reduce logistics footprint and increase sustainability of Marine expeditionary forces. - Completed assessment of 20W Stirling Engine for increased efficiency during distributed operations. - Completed assessment of portable, alternative water purification systems. - Completed development of wireless vehicle health diagnosis and reporting. - Completed development of advanced logistics distribution system. - Completed development of lightweight electrical energy (ultracapacitor) to enhance energy self sufficiency at the squad level. - Completed development of media enhanced polymer electrolyte supercapacitor to enhance energy self sufficiency. 		4.601	5.559
			5.170

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>		PROJECT 3001: <i>Marine Corps Landing Force Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)			FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Completed future logistics workshops designed to outline best possible logistics investment. - Initiated applied research toward producing a light weight device for converting hydrocarbon fuels to electrical energy. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete applied research in novel electrochemical capacitors for meeting the peak power requirements of USMC squad level equipment. - Complete applied research in novel electrochemical capacitors for meeting the peak power requirements of USMC squad level equipment. (Relates to FY 2008 accomplishment of continued analysis of Personal Power Network/Centralized Distributed Operations Power Generation System.) - Complete the development of a micro-encapsulation approach for self healing primer paint coatings to minimize corrosion at paint damage locations. - Complete applied research toward the direct oxidation of JP-8 fuel, without prior reforming or sulfur removal, in a solid oxide fuel cell. - Initiate applied research toward an extremely high specific energy metal-air primary battery and research toward an advanced electrochemical ultracapacitor based on down-selection of prior research approaches. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as complete above. - Complete development of self lubricating coatings that will reduce maintenance expense and down time of systems and equipment. - Initiate development of water purification applied research focused toward small personal water purification devices. This includes previous work in an energy recovery system for enhancing the efficiency of small reverse osmosis water purification devices. - Initiate applied research into electrochemical methods of converting diverse hydrocarbon fuels to electrical energy. - Initiate applied research toward materials that will reduce or prevent wear and corrosion on systems and equipment. 					
Title: MANEUVER			6.027	7.139	7.673
Description: The Maneuver thrust area focuses on the development, demonstration, and transition of technologies that will increase the warfighting capabilities and effectiveness of the Marine Air-Ground Task Force (MAGTF). This thrust aims at capturing emerging and "leap ahead" technologies in the areas of mobility, materials, propulsion, survivability, durability, signature reduction, modularity, and unmanned systems. Special emphasis on survivability technologies for the defeat of small arms, IEDs, mine blast, and RPGs continue to be incorporated into this thrust area. Efforts also continue in the development of modeling and simulation tools that integrate many different physics based modeling systems with rigorous operational analysis simulations					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>	PROJECT 3001: <i>Marine Corps Landing Force Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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to accurately define a system's performance characteristics. These tools will aid in defining the trade space for emerging technologies and assist in providing the program manager insight and guidance into pursuing future technologies. Finally, this technology thrust area also seeks to develop technologies to enhance combat vehicle crewman effectiveness and situational awareness through the incorporation of advanced autonomous vehicle functions triggered directly by the cognitive state of the operator.

FY 2010 to FY 2011 funding increase is for initiation of programs to address and enhance maneuver capability gaps in mobility such as multiple efforts aimed at the development of an autonomous vehicle capability that will provide mobility and logistics support to the dismounted Marine during distributed operations, now referred to as Enhanced Company Operations (ECO).

FY 2011 to FY 2012 funding increase is for initiation of programs to address maneuver capability gaps in survivability such as efforts to begin development of Advanced Blast Mitigation techniques and more effective Active Protection Systems; and to address gaps in mobility such as efforts to improve vehicle fuel efficiency through improvements in drive train and engine efficiencies and the development of alternative fuel capabilities to enhance tactical mobility in support of Distributed Operations.

FY 2010 Accomplishments:

- Continued lightweight Expeditionary Systems Materials (ESM) efforts to determine feasibility of scaling and producing candidate structural armor.
- Continued development of Advanced Interfaces and Ground Control technologies for combat vehicle crewmen (formerly Cognitive Assessment and Task Management (CATM) Augmented Cognition effort).
- Continued development of Advanced Electro-Magnetic Armor (AEMA) for ground vehicle survivability.
- Continued mobility enhancement development effort for current and future light and medium weight Marine Corps vehicle programs.
- Continued and completed development of materials to promote Combat Science and Technology Vehicle (CSTV) survivability.
- Continued integration of CSTV capabilities.
- Continued development of fuel efficiency and battlefield power technologies for the CSTV and ground vehicles.
- Continued efforts addressing survivability and technologies to mitigate acceleration and traumatic brain injuries to vehicle occupants to enhance tactical mobility.
- Continued efforts addressing advanced suspension systems with ride height adjustment capabilities, adjustable ride quality capabilities, rollover prevention, and load equalizing systems to enhance tactical mobility and survivability.
- Continued efforts addressing improvements in vehicle fuel efficiency by improvements in drive train efficiencies, engine efficiencies and alternative fuels capabilities to enhance tactical mobility.

FY 2010	FY 2011	FY 2012

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued technology development programs to address maneuver capability gaps in Survivability such as an Advanced Seat Technology effort to improve/increase occupant protection within the platform by reducing injury due to the effects of dynamic blast events and accidental vehicle rollover. - Continued technology development programs to address maneuver capability gaps in Mobility such as a Vehicle Stability effort to improve/increase vehicle performance characteristics such as reducing vehicle rollover tendencies. - Initiated efforts in advanced perception and context-based reasoning aimed at the development of an autonomous vehicle capability that will provide mobility and logistics support to the dismounted Marine during Enhanced Company Operations (ECO) <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate Survivability efforts in Advanced Blast Mitigation to develop solutions that mitigate injuries to vehicle occupants while reducing the weight burden thereby enhancing tactical mobility and survivability in support of Distributed Operations. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Complete development of Advanced Interfaces and Ground Control technologies for combat vehicle crewmen (formerly Cognitive Assessment and Task Management (CATM) Augmented Cognition effort). - Initiate Survivability efforts in Advanced Blast Mitigation to develop solutions that mitigate injuries to vehicle occupants while reducing the weight burden, thereby enhancing tactical mobility and survivability. These efforts were delayed from FY 2011 due to a shift in program priorities which necessitated allocating the funds to the development of autonomous vehicle capabilities. - Initiate Advanced Mobility efforts in Future Fuel Alternatives and Advanced Propulsion and Suspension Technologies to improve vehicle fuel efficiency through improvements in drive train and engine efficiencies and alternative fuels capabilities to enhance tactical mobility. 			
Accomplishments/Planned Programs Subtotals	37.979	43.776	44.845

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2012</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	<u>Total Cost</u>
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	
• 0602114N: <i>POWER</i>	0.000	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.044
<i>PROJECTION APPLIED</i>											
<i>RESEARCH</i>											
• 0603236N: <i>WARFIGHTER</i>	0.000	2.042	2.141	0.000	2.141	0.000	0.000	0.000	0.000	0.000	4.183
<i>SUSTAINMENT ADVANCED</i>											
<i>TECHNOLOGY</i>											

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>	PROJECT 3001: <i>Marine Corps Landing Force Tech</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• 0603640M: <i>USMC</i> <i>ADVANCED TECHNOLOGY</i> <i>DEMONSTRATION (ATD)</i>	15.523	15.244	16.030	0.000	16.030	13.142	10.742	6.778	0.000	0.000	77.459

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The primary objective of this PE is the development of technologies to meet unique Marine Corps needs in conducting Expeditionary Maneuver Warfare and Combating Terrorism. The program consists of a collection of projects categorized by critical warfighting function. Individual project metrics reflect the technical goals of each specific project. Typical metrics include the advancement of related Technology Readiness Levels, the degree to which project investments are leveraged with other performers, reduction in life cycle cost upon application of the technology, and the identification of opportunities to transition technology to higher categories of development.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602131M: <i>Marine Corps Lndg Force Tech</i>	PROJECT 9999: <i>Congressional Adds</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	6.473	-	-	-	-	-	-	-	-	0.000	6.473

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
<i>Congressional Add:</i> High Power Ultra Lightweight Zinc-Air Battery	1.992	-
<i>FY 2010 Accomplishments:</i> This effort provided applied research to significantly increase the power capability of existing air electrodes in existing zinc-air batteries which will significantly reduce the weight of batteries carried by Marine Corps expeditionary personnel in the field while maintaining the same footprint as the existing BA 5590 primary battery.		
<i>Congressional Add:</i> Warfighter Rapid Awareness Processing Technologies	4.481	-
<i>FY 2010 Accomplishments:</i> This effort addressed key elements of rapid awareness processing technologies: - Validated sleep/fatigue monitor (in the field). - Completed work on viability of a non-invasive physiological estimate of a subjects stress level . - Completed work on the field deployable PANOS hardware hub (personal area network of sensors) along with VivoSense software suite. - Developed new non-intrusive hardware to predict muscle state. - Defined and developed new metrics for estimation of a war fighter physical reserve. - Validated the new physical reserve metric in the field.		
Congressional Adds Subtotals	6.473	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional adds.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602234N: <i>Materials, Electr & Computer Tech</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	2.788	-	-	-	-	-	-	-	-	0.000	2.788
9999: <i>Congressional Adds</i>	2.788	-	-	-	-	-	-	-	-	0.000	2.788

A. Mission Description and Budget Item Justification

This Program Element was funded in its entirety by one Congressional Add.

B. Program Change Summary (\$ in Millions)

	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>
Previous President's Budget	2.788	-	-	-	-
Current President's Budget	2.788	-	-	-	-
Total Adjustments	-	-	-	-	-
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: *Congressional Adds*

Congressional Add: *Infrared Materials Laboratory*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	2.788	-
	2.788	-
	2.788	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>			PE 0602234N: <i>Materials, Electr & Computer Tech</i>				9999: <i>Congressional Adds</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	2.788	-	-	-	-	-	-	-	-	0.000	2.788

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
<i>Congressional Add:</i> Infrared Materials Laboratory	2.788	-
<i>FY 2010 Accomplishments:</i> This effort supported Infrared Materials Laboratory research focusing on technologies associated with materials processing and device development for improved operability and reliability of infrared focal plan arrays (IRFPAs); specifically the improvement of technology for long wavelength mercury cadmium telluride based infra-red focal plane arrays (FPAs).		
Congressional Adds Subtotals	2.788	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	88.467	70.168	65.448	-	65.448	62.408	59.693	63.238	65.522	Continuing	Continuing
0000: <i>Common Picture Applied Research</i>	80.007	70.168	65.448	-	65.448	62.408	59.693	63.238	65.522	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	2.345	-	-	-	-	-	-	-	-	0.000	2.345
9999: <i>Congressional Adds</i>	6.115	-	-	-	-	-	-	-	-	0.000	6.115

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval Science and Technology (S&T) Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

Activities and efforts in this program examine concepts and technologies that enable the transformation to network centric warfare. Network centric capabilities rely on information to connect assets and provide timely and accurate understanding of the environment. The mission area requirements for rapid, accurate decision-making; dynamic, efficient, mission-focused communications and networks; and pervasive and persistent sensing drive network centric S&T investments. The program focus is investments in the following Enabling Capabilities (ECs): Combat Identification (ID) Information Management of Coordinated Electronic Surveillance, Automated Control of Large Sensor Networks, OCO Focused Tactical Persistent Surveillance, Globally Netted Joint/Coalition Force Maritime Component Commander, Dynamic Tactical Communications Networks, Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC), High-bandwidth Free-space Lasercomm, Actionable Intelligence Enabled by Persistent Surveillance, Pro-Active Computer Network Defense and Information Assurance, Fast Magic, Naval Research Laboratory (NRL) Space; Advanced Tactical Data Link; and Autonomous Tactical Persistent Surveillance. In the context of the Naval Transformation Roadmap construct, this investment will achieve capabilities required by FORCEnet (Persistent Intelligence, Surveillance, and Reconnaissance; Time Sensitive Strike; and Sea Based Information Operations), Sea Strike (Ship-to-Objective Maneuver), and Sea Shield (Theater Air and Missile Defense).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	90.440	70.168	67.281	-	67.281
Current President's Budget	88.467	70.168	65.448	-	65.448
Total Adjustments	-1.973	-	-1.833	-	-1.833
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-2.038	-			
• SBIR/STTR Transfer	-1.570	-			
• Program Adjustments	-	-	-1.906	-	-1.906
• Section 219 Reprogramming	1.670	-	-	-	-
• Rate/Misc Adjustments	-	-	0.073	-	0.073
• Congressional General Reductions Adjustments	-0.035	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *Cognitive Radio Institute*
- Congressional Add: *Intelligent Decision Exploration*
- Congressional Add: *Sensor Integration Framework*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	0.797	-
	3.884	-
	1.434	-
Congressional Add Subtotals for Project: 9999	6.115	-
Congressional Add Totals for all Projects	6.115	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602235N: <i>Common Picture Applied Research</i>				0000: <i>Common Picture Applied Research</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>Common Picture Applied Research</i>	80.007	70.168	65.448	-	65.448	62.408	59.693	63.238	65.522	Continuing	Continuing

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval Science and Technology (S&T) Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

Activities and efforts in this program examine concepts and technologies that enable the transformation to network centric warfare. Network centric capabilities rely on information to connect assets and provide timely and accurate understanding of the environment. The mission area requirements for rapid, accurate decision-making; dynamic, efficient, mission-focused communications and networks; and pervasive and persistent sensing drive network centric S&T investments. The program focus is investments in the following Enabling Capabilities (ECs): Combat Identification (ID) Information Management of Coordinated Electronic Surveillance, Automated Control of Large Sensor Networks, OCO Focused Tactical Persistent Surveillance, Globally Netted Joint/Coalition Force Maritime Component Commander, Dynamic Tactical Communications Networks, Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC), High-bandwidth Free-space Lasercomm, Actionable Intelligence Enabled by Persistent Surveillance, Pro-Active Computer Network Defense and Information Assurance, Fast Magic, Naval Research Laboratory (NRL) Space; Advanced Tactical Data Link; and Autonomous Tactical Persistent Surveillance. In the context of the Naval Transformation Roadmap construct, this investment will achieve capabilities required by FORCEnet (Persistent Intelligence, Surveillance, and Reconnaissance; Time Sensitive Strike; and Sea Based Information Operations), Sea Strike (Ship-to-Objective Maneuver), and Sea Shield (Theater Air and Missile Defense).

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: COMMUNICATION AND NETWORKS	7.319	8.811	7.400
Description: The overarching objective of this activity is to develop high throughput dynamic wireless communications and networks technologies critical to the mission performance and robustness of naval communications for widely dispersed mobile air, land, surface and submerged platforms. These platforms are often size, weight and power (SWaP) limited, and will operate under constraints of cluttered RF spectrum, harsh electro-magnetic interference (EMI) and Beyond Line Of Sight (BLOS) conditions. The technical payoff is increased network data rates, interoperability across heterogeneous radios, dynamic bandwidth management, and greater mobile network connectivity. The operational payoff is that warfighters from the operational command to the tactical edge have near real-time access to information, knowledge and decision-making necessary to perform their tasks, including coalition and allied forces. Emphasis is on tactical edge communications and networks			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>to fully realize net-centric warfare, bridging the Global Information Grid (GIG) and the 'disadvantaged user', e.g., small-deck combatants, submarines, unmanned vehicles, distributed sensors and ground units in urban and radio frequency (RF) challenged environments. The current specific objectives are:</p> <p>a) Radios and Apertures: Develop technologies for high band radio, electrically-small and actively-scanned antennas, addressing critical issue of radio spectrum bandwidth efficiency, spectrum contention and clutter, agile frequency communications with dynamic spectrum access, all-digital front-end with wide dynamic range, power amplifier efficiency, multipath effects, saltwater propagation and BLOS communications. Develop algorithms and signal processing for space-time-frequency diversity communications, including measures for electronic protection, such as low-intercept anti-jam waveforms and modulation. Develop affordable antenna technologies for small size and weight, high radiation efficiency, and wideband operation with rapid beam-steering. Develop alternatives to RF communications in airborne and terrestrial environments as well as high data rate underwater communications for undersea warfare (distributed sensors netting, unmanned underwater vehicle data exfiltration, submarine Communications at Speed and Depth) using electro-optic/infra-red (EO/IR) technologies. Develop secure, high bandwidth communications systems and the exploitation of existing and emerging network protocols that will avail development of new Low Earth Orbit (LEO) based data transport mechanisms.</p> <p>b) Tactical Networking and Network Control/Management: Develop advanced networking techniques for robust, highly dynamic environments; interoperable networks for secure communications and protocols, bandwidth and network management techniques that manage and allocate bandwidth across tactical and theater levels in support of net-centric operations. Develop rapidly auto-configuring and self-organizing networks with efficient and survivable routing, secure authentication, mobility management and Quality-of-Service guarantee while optimizing network resources. Address low bandwidth, synchronization and reliability for Service Oriented Architecture (SOA)/middleware architecture in both mobile ad-hoc networks (MANET) and infrastructure-based Internet Protocol (IP) backbone networks. Develop cognitive network planning and operations engines whose criteria are based directly on mission objectives while self-adapting and managing the spectrum allocation and radio resources in such a way that network operations, SOA community of interest, and computer network defense are integrated to form a single common tactical network picture that requires a minimum of human intervention and skill. Develop technology for improving tactical edge networking and for improving voice communications.</p> <p>FY 2010 to FY 2011 funding increase reflects new program research to support increased focus and attention on anti-jam communications. FY 2011 to FY 2012 reduction reflects reduced efforts in Communications and Network basic research.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>The decrease from FY 2011 to FY 2012 is associated with reduced efforts in Intelligence, Surveillance, and Reconnaissance Targeting (ISRT)- Electro-Optic/Infrared (EO/IR), EW Attack, and Communication and Networks.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p><i>FY 2010 Accomplishments:</i> Radios and Apertures: - Continued development of underwater Extremely Low Frequency (ELF) antenna and RF technology for submarine comms at speed and depth. - Continued metamaterials based dish antennas development for Ka-Ku band satellite communications (SATCOM). - Continued development of low intercept and low probability of Detection (LPD), jam resistant communications/networks for distributed nodes. - Continued blue-green fiber laser technology development for space-based submarine communications. - Completed development of Line of Sight (LOS) high data rate UAV-sensor communications for expeditionary forces. - Completed development of advanced signal processing, coding and switching amplifier techniques for high power amplification. - Completed development of digital beam forming and steering for small UAVs in upper Ka band (38GHz), including Risley prism conformal antennas and lightweight switched beam antennas made of composite materials. - Completed development of submarine to unmanned underwater vehicle (UUV)/unmanned surface vehicle (USV)/sensor comms using underwater Modulating Retroreflector technology. -Completed development of low-cost integrated stub antenna and ferroelectric phased array technology for directional communications. - Completed development of metamaterial structures and periodic inductive and capacitive loading for submarine High-Frequency Internet Protocol (HF-IP) buoy-cable antennas (BCA). - Completed ultra wideband time reversal technique improvement, up to a factor of 2 compared to when channel estimation techniques are not used. - Completed demonstrations of pattern recognition algorithms to allow detection and identification of intruders into remote or urban areas. - Completed the development of technical characteristics of a Communications Electronic Attack (EA) system that consists of a master Electronic Attack (EA) platform that operates in concert with a network of simple subordinate platforms. - Completed the development wireless-ready, reliable data transport technologies suitable for tactical-edge and afloat networks. - Completed investigation of the feasibility of performing emissive hyperspectral imaging for detection and recognition of targets at night with high search rates and high resolution ground samples.</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>- Initiated development and demonstrate electrically small antennas at Very Low Frequency/High Frequency (VLF/HF), as well as lightweight beam steering antennas for UAVs using switched (ferrite) multi-horns and Risley prisms with 15-30 dB gain and 1.5 GHz bandwidth in the 38 GHz band.</p> <p>- Initiated design and development of low observable jam resistant waveform, including directionalization, for advanced tactical data links.</p> <p>- Initiated design and development of electronic protection for HF communications.</p> <p>Tactical Networking and Network Control/Management:</p> <p>- Completed development of Robust Airborne Networking Extensions (RANGE) for joint battlespace networking, networking UAVs, and hybrid mobile ad hoc networking (MANET)/satellite operation. Implemented MANET protocols for cross-layer optimized routing, including disruption tolerant networking to sensors and platforms.</p> <p>- Initiated development of a SOA-based secure tactical wide area network for coalition forces, showing independence of coalition tactical communications from satellite backhaul, bandwidth management and service discovery.</p> <p>- Initiated development of topology control, discovery mechanisms and directional networking for free space optical links.</p> <p>- Initiated design and development of cognitive netops for tactical communications.</p> <p>FY 2011 Plans:</p> <p>Radios and Apertures:</p> <p>- Continue all efforts of FY 2010 less those noted as completed above.</p> <p>- Complete development of underwater ELF antenna and RF technology for submarine comms at speed and depth.</p> <p>- Initiate development of structurally integrated HF antennas</p> <p>- Initiate development of integrated metamaterial antennas for ship and ground platforms.</p> <p>- Initiate demonstrations of high peak power short pulse operation of fiber lasers in blue-green region.</p> <p>- Initiate development of optical wavefront modulation techniques and optical phased array beam steering methods for terrestrial EO/IR Lasercomm.</p> <p>- Initiate new architecture and modes of operation for advanced tactical data link operation in both contested and anti-access regions.</p> <p>Tactical Networking and Network Control/Management:</p> <p>- Continue all efforts of FY 2010 less those noted as completed above.</p> <p>- Initiate the development of social network analysis algorithms for protecting wireless networks.</p> <p>- Initiate development of agent based communications, control and distributed authentication techniques in dynamic MANET networks.</p>			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Initiate cognitive networking, cross-layer optimization protocols for light SOA for tactical networks.</p> <p>FY 2012 Plans: Radios and Apertures:</p> <ul style="list-style-type: none"> - Continue all efforts of FY2011 less those noted as complete. - Complete metamaterials based dish antennas development for Ka-Ku band satellite communications (SATCOM). - Initiate effort to develop a novel fiber technology that enables tunable, energy-scalable emissions at a user-defined/desired wavelength, particularly in the blue-green spectral range. - Initiate research and development to explore the use of novel metamaterials and metastructures that enable conformal antenna designs with ultra-wideband performance. - Initiate program for a novel blade antenna payload for wideband Ku/UHF communications that is light weight, has lower power consumption, and is very low cost. <p>Tactical Networking and Network Control/Management</p> <ul style="list-style-type: none"> - Continue all efforts of FY2011 less those noted as complete. - Complete design and development of cognitive netops for tactical communications. - Complete development of agent based communications, control and distributed authentication techniques in dynamic MANET networks. - Initiate program that leverages topology discovery, content modeling, and resource scheduling to support content management functions at the Tactical Edge. - Initiate research and development for managing and controlling functions within a protected routing core at the Tactical Edge. 			
Title: COMPUTATIONAL FRAMEWORK AND METHODS FOR RAPID ACCURATE DECISION MAKING		23.071	15.516
Description: The goal of this activity is to support FORCEnet by developing enablers for decision making and mission execution to achieve battlespace superiority. It focuses on the development of algorithms and software technologies that identify and integrate informational content from multiple sources, leading to decision aids that support user-cognitive processes. Because persistent sensors are generating massive amounts of data, the focus is on technologies that not only integrate information from diverse sources, but also provide indications of information significance in ways that support the user's decision needs regardless of location and operational situation. To achieve this, it must be possible to automate understanding of the battlespace by identifying objects, determining relationships among the objects, assessing intent, and automatically generating courses of action with associated risks and uncertainty. Effort will also be devoted to developing technology for increasing assurance and security for C3 information systems and technology for improving information discovery and information presentation in such systems. The current specific objectives are:			15.006

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>a) Automated Intelligence Tools: Develop automated image and signal intelligence understanding tools based on rigorous mathematical and statistical methods that lead to improved change detection, improve object and activity detection and recognition capabilities, context and scene understanding, and inferring of the threat levels to support decision making and persistent and adaptive surveillance.</p> <p>b) Battlespace Sensor and Intelligence Integration: Develop innovative methods for combining traditional and non-traditional data from sensors and disparate sources to provide the best estimate of objects, events, and conditions in the battlespace, in terms of their identity, associated error or uncertainty, context, impact, and infer relationships and their intentions.</p> <p>c) Automated Reasoning Methods and Models for Situational Analysis: Develop rigorous and efficient methods for building sophisticated situational models, develop automated reasoning techniques to categorize and recognize situations under a variety of conditions leading to methods that predict situations under different settings.</p> <p>d) Automated Decision Tools: Develop automated decision tools based on mathematically rigorous techniques (e.g., mathematical optimization) that support decision-making to ensure the best use of scarce and/or expensive resources to achieve optimal allocations for large complex scenarios, including ones that contain uncertainty, in drastically reduced amounts of time. Develop methods that support decision making in networked sensor management and allocation to ensure sensor assets are deployed in an optimal or near optimal manner.</p> <p>e) Secure Sensor Networks: Develop tools and methods to securely handle information without exposing intelligence information about the networks or systems to adversaries.</p> <p>FY 2010 and FY 2011 significant decrease is the result of the completion of activities and discontinuation of funding associated with the Joint Integrated Fires Control effort.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p><i>FY 2010 Accomplishments:</i> Automated Intelligence Tools: - Continued the demonstration and conducted image registration error analysis for the multi-resolution and multi-scale image processing effort.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued development of semi-supervised detection algorithms for multi-sensor imagery, video and human intelligence that will enable self-deploying sensor networks. - Continued the development of a new radar signature analysis technique based on nonlinear dynamics. - Continued the development of a novel particle filter-based elevation angle tracking algorithm to improve the capability to track low-angle targets over the sea surface under multipath conditions using passive sensors. - Continued the development of the theory and technology for near-field electromagnetic (EM) phenomenology relevant to high resolution, through-the-wall imaging at close ranges in urban operations. - Continued development of coordinated multi-platform, multi-component waveforms. - Continued development of a real-time electronic warfare support deinterleaving capability. - Continued development of advanced communications emitter identification. - Completed the development of a new radar signature analysis technique based on nonlinear dynamics. - Completed development of interactive image/video-based surveillance systems for perimeter protection, and port protection. - Initiated development techniques for image coding based on shapes and regions and their temporal evolution to facilitate image analysis as well as to enable efficient image transmission and restoration. Develop methods for efficient search of large image and video databases to facilitate automated, realtime image/video registration for surveillance applications, threat detection, and target geo-location. - Initiated development of mathematically rigorous techniques and algorithms for automated understanding of surveillance imagery, including background modeling to assist image context interpretation and multi-sensor characterization of complex scenes. <p>Battlespace Sensor and Intelligence Integration:</p> <ul style="list-style-type: none"> - Continued demonstration of a trusted data store which maintains data pedigree and detects anomalies in a limited objective experiment. - Continued development of an interface between the Level 1 and Level 2/3 data fusion processes across federated service oriented architectures. - Continued development of new data schemas and methods to allow more efficient assembly of a common operational picture (COP) integrating informational content from images, track data, intelligence and incomplete track data. - Continued Level 1 fusion algorithm and architecture design with associated ontology to manage information from automated sensors to provide a more dynamic and accurate battlespace picture through improved object refinement. - Continued the development of software and algorithms for integrating the functions of target acquisition, tracking, data computation, and engagement control across multiple platforms for engaging multiple threats. - Continued the investigation of service oriented methods to automatically retrieve relevant information for a community of interest. - Continued the development and testing of the Joint Integrated Fires Control effort. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued approaches and tools for (semi)-automated data integration and reasoning about information from diverse sources in ways that support decision makers with timely, actionable information at operational and tactical levels of command, with an emphasis on missions that are related to OCO and force protection. - Initiated development of tools and processes including higher level statistical methods, game theory, first order logic form, Bayesian networks, and fusion algorithms, to model enemy behavior and provide threat assessment, represent complex data patterns, and model the structure of context to improve the data fusion process. - Initiated demonstrations of ontologies in a maritime environment using an experimental testbed or limited technology experiments to validate new approaches to inference and higher-level fusion capabilities. - Initiated development of algorithms to generalize the characterization of ontologies and to integrate them, including machine processing compatibility to effectively link methods for visualization and human processing (UML methods) with machine and information exchange and processing (XML methods). <p>Automated Reasoning Methods and Models for Situational Analysis:</p> <ul style="list-style-type: none"> - Continued demonstration of predictive surface platform threat behavior algorithms and software employing techniques using pattern recognition on geospatial and attribute data. Also developed autonomous monitoring and reporting of high interest and anomalous maritime vessels. - Continued development of methods for automated generation of courses of action, including techniques for automated planning and reasoning in uncertain environments. - Continued demonstration of anomaly detection, feature-based target tracking, track-to-pattern association and scoring, track-to-group clustering, pattern discovery and learning, pattern templates/descriptions and predictive modeling tools in a limited objective experiment. - Initiated development of techniques to uncover trends, links, hidden models, and relationships of behavior/activity that will lead to inferring intent and developing course-of-action (COA) alternatives. - Initiated development of robust reasoning methods supporting automated situational understanding for maritime domain awareness under time-critical constraints and uncertainty. - Initiated development of methods of grouping situations to categorize algorithms for reuse under a variety of conditions, including Naval situation recognition and categorization (used to group similar situational types); situation characterization to define threshold qualifications to "bin" situations within categories (abductive development as a threshold process); situation projection to develop techniques to characterize features necessary to classify a situation - counterfactuals and inductive development. <p>Automated Decision Tools:</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>- Continued the development of methods for selecting sensors and platforms for search and surveillance operations in a theater, allocating the selected sensors and platforms to specific missions, operating the allocated sensors during a mission, and fusing the information from the sensors and other sources.</p> <p>- Continued development of algorithms to optimize the selection from disparate and multiple information sources as well as the characterization of related pedigree over multiple user processing requests within extremely large data sets, including checks and balances between assignment, storage, search, quality, reliability, completeness, and latency.</p> <p>- Completed the development of methods for selecting sensors and platforms for search and surveillance operations in a theater, allocating the selected sensors and platforms to specific missions, operating the allocated sensors during a mission, and fusing the information from the sensors and other sources.</p> <p>Secure Sensor Networks:</p> <p>- Continued development of technology to improve reliability of systems to survive Information Warfare attacks.</p> <p>- Continued development of improved separation technology for shared-hardware host execution environments to increase information security.</p> <p>- Initiated development of algorithms, secure protocols, architectures, software tools, languages, certification technologies, standards, guidelines to assure safe, secure, policy-compliant, interoperable systems for information transfer.</p> <p><i>FY 2011 Plans:</i></p> <p>Automated Intelligence Tools:</p> <p>- Continue all efforts from FY 2010 less those noted as completed above.</p> <p>- Complete the development of a novel particle filter-based elevation angle tracking algorithm to improve the capability to track low-angle targets over the sea surface under multipath conditions using passive sensors.</p> <p>- Complete the development of the theory and technology for near-field EM phenomenology relevant to high resolution, through-the-wall imaging at close ranges in urban operations.</p> <p>- Complete the demonstration and conducted image registration error analysis for the multi-resolution and multi-scale image processing effort.</p> <p>- Complete development of semi-supervised detection algorithms for multi-sensor imagery, video and human intelligence that will enable self-deploying sensor networks.</p> <p>- Complete development techniques for image coding based on shapes and regions and their temporal evolution to facilitate image analysis as well as to enable efficient image transmission and restoration. Develop methods for efficient search of large image and video databases to facilitate automated, realtime image/video registration for surveillance applications, threat detection, and target geo-location.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Complete development of mathematically rigorous techniques and algorithms for automated understanding of surveillance imagery, including background modeling to assist image context interpretation and multi-sensor characterization of complex scenes. - Initiate development of methods for integration of low-level image processing and high-level knowledge for simultaneous image segmentation and object recognition, and visual reasoning for image understanding. - Initiate 3D image processing for object recognition and meaningful change detection. - Initiate development of modular, interactive, intelligent video-based surveillance systems. <p>Battlespace Sensor and Intelligence Integration:</p> <ul style="list-style-type: none"> - Complete the development and testing of the Joint Integrated Fires Control effort. - Complete demonstration of a trusted data store which maintains data pedigree and detects anomalies in a limited objective experiment. - Complete development of an interface between the Level 1 and Level 2/3 data fusion processes across federated service oriented architectures. - Complete development of new data schemas and methods to allow more efficient assembly of a common operational picture (COP) integrating informational content from images, track data, intelligence and incomplete track data. - Complete Level 1 fusion algorithm and architecture design with associated ontology to manage information from automated sensors to provide a more dynamic and accurate battlespace picture through improved object refinement. - Complete the development of software and algorithms for integrating the functions of target acquisition, tracking, data computation, and engagement control across multiple platforms for engaging multiple threats. - Complete the investigation of service oriented methods to automatically retrieve relevant information for a community of interest. - Complete approaches and tools for (semi)-automated data integration and reasoning about information from diverse sources in ways that support decision makers with timely, actionable information at operational and tactical levels of command, with an emphasis on missions that are related to OCO and force protection. - Complete development of tools and processes including higher level statistical methods, game theory, first order logic form, Bayesian networks, and fusion algorithms, to model enemy behavior and provide threat assessment, represent complex data patterns, and model the structure of context to improve the data fusion process. - Complete demonstrations of ontologies in a maritime environment using an experimental testbed or limited technology experiments to validate new approaches to inference and higher-level fusion capabilities. - Complete development of algorithms to generalize the characterization of ontologies and to integrate them, including machine processing compatibility to effectively link methods for visualization and human processing (UML methods) with machine and information exchange and processing (XML methods). 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Initiate development of algorithms and tools for information representation of unstructured data and structured data in a way that shared concepts/relationships in disparate data sets can be automatically compared, matched, or associated and in a way that can facilitate and improve information fusion. - Initiate development of algorithms and tools for information fusion of heterogeneous data for classification and reconstruction based on high-level features inherent in each data source with the goal to form a more complete picture of battlespace environment. - Initiate development of algorithms and tools for discovering and extracting higher-level features -- objects, events, patterns, intents, relations, anomalies -- from various data types in support of future asymmetric warfare. <p>Automated Reasoning Methods and Models for Situational Analysis:</p> <ul style="list-style-type: none"> - Complete demonstration of predictive surface platform threat behavior algorithms and software employing techniques using pattern recognition on geospatial and attribute data. Also developed autonomous monitoring and reporting of high interest and anomalous maritime vessels. - Complete development of methods for automated generation of courses of action, including techniques for automated planning and reasoning in uncertain environments. - Complete demonstration of anomaly detection, feature-based target tracking, track-to-pattern association and scoring, track-to-group clustering, pattern discovery and learning, pattern templates/descriptions and predictive modeling tools in a limited objective experiment. - Complete development of techniques to uncover trends, links, hidden models, and relationships of behavior/activity that will lead to inferring intent and developing course-of-action (COA) alternatives. - Complete development of robust reasoning methods supporting automated situational understanding for maritime domain awareness under time-critical constraints and uncertainty. - Complete development of methods of grouping situations to categorize algorithms for reuse under a variety of conditions, including Naval situation recognition and categorization (used to group similar situational types); situation characterization to define threshold qualifications to "bin" situations within categories (abductive development as a threshold process); situation projection to develop techniques to characterize features necessary to classify a situation - counterfactuals and inductive development. <p>Automated Decision Tools:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2010 less those noted as completed above. - Complete the development of algorithms to optimize the selection from disparate and multiple information sources as well as the characterization of related pedigree over multiple user processing requests within extremely large data sets, including checks and balances between assignment, storage, search, quality, reliability, completeness, and latency. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiate the development of optimization-based decision aids for resource allocation such as those required for mission planning at the strategic, operational, and tactical level.</p> <p>Secure Sensor Networks:</p> <ul style="list-style-type: none"> - Complete development of technology to improve reliability of systems to survive Information Warfare attacks. - Complete development of improved separation technology for shared-hardware host execution environments to increase information security. - Complete development of algorithms, secure protocols, architectures, software tools, languages, certification technologies, standards, guidelines to assure safe, secure, policy-compliant, interoperable systems for information transfer. - Initiate the development of anti-tamper methods that are capable of lengthy operation in unattended and un-powered environments, have very high probability of tamper detection and very low probability of false alarm, and remain undetected in the host system. <p><i>FY 2012 Plans:</i></p> <p>Automated Intelligence Tools:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2011 less those noted as completed above. - Initiate development of methods for building sophisticated visual knowledge bases, development of methods for visual reasoning and integrating them in image/video understanding, and development of methods for image description. <p>Battle-space Sensor and Intelligence Integration:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2011 less those noted as completed above. <p>Automated Reasoning Methods and Models for Situational Analysis:</p> <p>Initiate the development of mission-focused autonomy and reasoning methods; expand autonomy from simple platform kinematics to include all-source information exploitation and surrounding cultural and social influences.</p> <p>Automated Decision Tools:</p> <ul style="list-style-type: none"> -Continue all efforts from FY 2011 less those noted as completed above. <p>Secure Sensor Networks:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2011 less those noted as completed above. 				
Title: HUMAN FACTORS AND ORGANIZATIONAL DESIGN		5.712	6.285	6.465

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>Description: The overarching objective of this activity is the achievement of FORCEnet and Sea Power 21 goals by developing human factors principles and cognitive models for human centric design, decision support systems for collaborative decision making, and adaptive command and control structures. The CNO's new Maritime Strategy and the Commander Fleet Forces Command complementary plan to revise organization of Maritime Operations Centers (MOC) place high priority on the aforementioned FORCEnet and Sea Power 21 goals. Specific objectives focus on improving small team, platform, task force, and battle group operations by developing advanced human factors technologies for incorporation into operational systems. The goals and payoffs are to enhance human performance effectiveness; improve the timeliness and quality of decision making; develop strategies to mitigate high workload and ambiguity; reduce manning; improve situational awareness and speed of command through a deeper understanding of human capabilities and limitations; and improvement of team decision making in ad-hoc, complex problem solving scenarios. The current specific objectives are:</p> <p>a) Human Computer Interaction/Visualization: Develop an understanding of the limitations of human perceptual and attentional systems in relation to maximizing user performance when interacting with complex Naval displays. A combination of computational cognitive modeling and psychological studies are employed to determine the capacity limitations on human performance that will undoubtedly have impact in reduced manning requirements, including information-rich weapons platforms. Develop technology for improving human interaction with autonomous systems and for improving virtual reality systems for training purposes.</p> <p>b) Collaboration and Knowledge Interoperability: Develop an understanding of the high-level cognitive processes underlying team knowledge processing, decision making and collaboration in order to improve team performance in the autonomous, agile, quick-response combat team of the future. Develop cognitive science-based tools, models, computational methods, and human-agent interfaces to enhance team collaboration effectiveness and team performance in complex problem solving teams. Specific objectives include application of discourse analysis methods and other process metrics to assess team performance. A conceptual model of team collaboration will be constructed and computational relationships among processes and team performance will be developed. Findings will be validated and demonstrated in operationally oriented testbeds by addressing issues including: rapid team analysis of large volume, uncertain data; knowledge interoperability in coalition ops; measures of team situational awareness; accelerated team synchronization; improved heterogeneous team performance; team collaboration performance metrics; cultural/language/experience-free representation and transfer of meaning.</p> <p>c) Organizational Design and Decision Support Systems: Develop quantitative executable models, task graphs and optimization algorithms for the organizational design of MOC consistent with the Navy's New Maritime Strategy. Investigate through modeling</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>and simulation human competency requirements for staffing MOC. Develop quantitative formalisms for monitoring and assessing the completeness, consistency and accuracy of rules of engagement (ROE).</p> <p>d) Social Network Analysis: Develop computational models and algorithms for the analysis of terrorist threats and counter-measures and strategies against terrorist threats. Develop new computational algorithms for the discovery of missing and hidden nodes in complex graphs applicable to the problem of understanding hidden information in terror networks. Develop new approaches to calculation of network completeness. Develop computational approaches to the study of factionalism in social movements using Islamist movements as exemplar data collectivities.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p>FY 2010 Accomplishments:</p> <p>Human Computer Interaction/Visualization:</p> <ul style="list-style-type: none"> - Continued application of cognitive architecture modeling to the design of interface analysis tools. - Continued research on the application of information architectures (DOD Architectures Framework), executable models (Petri Nets) and cognitive models to the systematic design of Human-Computer Integration. - Continued effort to develop tools for more automated, cost-efficient modeling of human system interaction. - Continued methods to introduce key cognitive abilities to autonomous vehicles that will enable warfighters and vehicles to work together more collaboratively. - Initiated development of a testbed for validating cognitive models of operator performance in crossmodal (audio/visual) task environments. <p>Collaboration and Knowledge Interoperability:</p> <ul style="list-style-type: none"> - Continued evaluation of Latent Semantic Analysis (LSA) of operator communications as an effective metric of shared situational awareness in unmanned aerial vehicle control teams. - Continued demonstration of Electronic Card Wall (EWALL) (a computational human cognitive processing system) for representation and transfer of meaning among heterogeneous and distributed team members engaged in complex problem solving. - Continued developing jointly with the Naval Air Systems Command, a FORCEnet-based test bed to identify and evaluate the cognitive processes to be employed to optimize collaborative decisionmaking in a geographically distributed and time-delayed situation. - Continued effort to improve response speed of the LSA tool to a near-interactive level and incorporate into a fleet experiment. Collected and evaluated data to validate improved speed and effectiveness of developing situational awareness. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued effort to incorporate the EWALL prototype into a simulation of the Tactical Operations Center of the Special Operations Forces and collected performance data to validate effectiveness. - Continued Sea Basing research on rehearsal for Expeditionary Strike Groups in the conduct of Maritime Interdiction Operations (MIO) and developed reach-back capability for computationally intense analysis for evaluating courses of action. - Continued development of metrics to identify and measure the contribution to team performance of the cognitive processes underlying ad-hoc team decision making. - Continued effort to improve the model of ad-hoc team decision making by including collaborative agent-based contribution to team performance. - Continued development of a computational model of subjective reasoning for course of action selection activity in distributed, asynchronous teams. - Continued test and validation of a cognitive processes model of team collaboration in a Maritime Interdiction Operations domain. - Continued integration of high-level planning and computational cognition with low-level to enhance situational awareness via swarm-based sensor platforms. - Initiated research on the use of metaphors and temporal mental models to improve representation and transfer of meaning in ad-hoc, complex team problem solving with the objective of enhancing team collaboration effectiveness and team performance. - Initiated validation of a conceptual model of macrocognition in teams. Scenario-based experimentation will define the presence, persistence and relevance of individual and team cognitive processes and relationships among those processes. Deliverable will be a computational understanding of how teams collaborate to reach consensus. <p>Organizational Design and Decision Support Systems:</p> <ul style="list-style-type: none"> - Continued model-based simulations and experiments to investigate the effectiveness of hierarchical organizational structures in network-centric operational environments in order to evaluate the implementation of FORCEnet concepts. - Continued deployment of models for Effects-Based Operations (EBO) aboard naval vessels to support Expeditionary Group One to conduct kinetic and non-kinetic tactical operations in a measured manner. - Continued jointly with the Air Force applied research on the integration of Information Operations in Air Control Centers. - Continued applied research on command and control adaptive architectures for Expeditionary Strike Groups working with OPNAV and Expeditionary Strike Group ONE, San Diego. - Continued research on adaptive command and control architectures in support of the Navy's new Maritime Strategy. - Continued research on quantitative formalisms for developing and assessing the completeness, consistency and accuracy of rules of engagement (ROEs). - Continued research on executable models and optimization algorithms for adaptive command structures that are congruent with mission requirements to support the design of Maritime Headquarters with Maritime Operations Centers (MHQ/MOC) organizations. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Continued research on models to support the design of scalable joint and coalition Maritime Operations Centers that allocate responsibilities to elements afloat and ashore.</p> <p>- Initiated, in cooperation with the Air Force, the capability to examine human competency requirement in offensive and defensive cyber operations and the effects of courses of action at the tactical and operational level. The research was conducted using DoD and academic laboratories capable of high fidelity mission simulation and precise measurements of independent and dependent measures.</p> <p>Social Network Analysis:</p> <p>- Continued development of new threat scenarios incorporating Joint Force Maritime Component Commander operations, counter-insurgency and humanitarian operations with the staff of the Naval War College. These new threat scenarios will provide the basis for Limited Objective Experiments in the Innovation Laboratory at the Naval War College.</p> <p>- Continued development of Dynamic Network analysis (a terrorist network analysis tool) in operational command setting at U.S. Pacific Command.</p> <p>- Continued the improvement of terror network analysis decision tools for combatant command use and military planning, including testing of tools, development of metrics, and validation.</p> <p>- Continued the development of advanced computational models capable of analyzing multidimensional networks of thousands of nodes. Current capabilities enable the analysis of networks consisting of hundred of nodes.</p> <p>- Continued the development of computational models of influence that incorporate the social structure, values and cultural processes of urban non-western communities for achieving post-conflict stabilization.</p> <p>- Continued the development of social network models to model the human element in maritime domain awareness.</p> <p>- Continued research on advanced computational models to incorporate additional capabilities in the analysis of terror networks and on various types of flow in these networks (such as the flow of expertise, resources).</p> <p>- Continued effort to improve social network models to analyze merchant marine traffic.</p> <p>- Continued human cultural and social modeling to improve warfighting, civilian military operations and humanitarian operations in non-Western environments.</p> <p>FY 2011 Plans:</p> <p>Human Computer Interaction/Visualization:</p> <p>- Continue all efforts of FY 2010.</p> <p>- Complete methods to introduce key cognitive abilities to autonomous vehicles that will enable warfighters and vehicles to work together more collaboratively.</p> <p>- Initiate the development of the multitasking and metacognitive components of the Tactical Action Officer (TAO) model, especially as they apply to dual-tasks involving "chat" style instant-messaging interleaved with other watchstanding duties.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Initiate the development of spatialized 3D-audio displays to mitigate cognitive load during the performance of dual-tasks. - Initiate the investigation of human attentional limitations in understanding sped-up and serialized speech over multiple radio channels. - Initiate the development of cognitive-model-based predictors of operator error in procedural tasks. - Initiate the development of cognitive models of the TAO to be utilized within a virtual Combat Information Center (CIC) simulated environment. - Initiate the investigation of auditory attentional effects on watchstanding activities, especially in the context of monitoring multiple radio channels. Results will be used to provide recommendations for new communications protocols. <p>Collaboration and Knowledge Interoperability:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate development of a performance measurement testbed for assessing the contribution of highlevel cognitive (macrocognitive) processes to collaboration effectiveness and team performance in special operations intelligence analysis. - Initiate validation of computational team collaboration performance metrics for quick response teams such as maritime interdiction operations and non-combatant evacuation operations. <p>Organizational Design and Decision Support Systems:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate cooperative development with the Air Force of a series of networked laboratories for hybrid human-agent experimentation on multi-echelon decision making and adaptive architectures for large maritime operations centers. - Initiate investigations on Battlespace on Demand Decision Making: Operational Application of Meteorological and Oceanographic Data in Command Decision Making. <p>Social Network Analysis:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>FY 2012 Plans:</p> <p>Human Computer Interaction/Visualization:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less noted above as complete. - Initiate research on cognitive models of user interface affordance that could form the basis of usability analysis and evaluation. <p>Collaboration and Knowledge Interoperability:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Complete development of the Electronic Card Wall (EWALL) and introduced a prototype into NAVAIR. - Initiate development of the computational aspects of a model of tactical team decision making - Initiate inclusion of the theoretical aspects of group cognition and knowledge building into the model of macrocognition. <p>Organizational Design and Decision Support Systems:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Complete model-based simulations and experiments to investigate the effectiveness of hierarchical organizational structures in network-centric operational environments in order to evaluate the implementation of FORCEnet concepts. - Complete deployment of models for Effects-Based Operations (EBO) aboard naval vessels to support Expeditionary Group One to conduct kinetic and non-kinetic tactical operations in a measured manner. <p>Social Network Analysis:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 - Complete the development of models capable of analyzing multidimensional networks with thousands of nodes. - Complete social network models of maritime domain. Completed social network analysis of merchant marine domain. - Initiate support social complexity modeling for community dynamics (Stabilization, Security, Transition and Reconstruction problems (SSTR) and Humanitarian Assistance/Disaster Relief (HA/DR)), an outgrowth of computational social science/social network analysis in non-Western settings. Develop new techniques for model development fundamentals. Develop geo-spatial aspects of data presentation, modeling and visualization for improving decision tools in SSTR and HA/DR. - Initiate information operations research on non-Western communities. 				
<p>Title: KNOWLEDGE SUPERIORITY AND ASSURANCE</p> <p>Description: This activity is devoted to midterm technology development in close concert with programs of record. The products of these efforts are expected to transition at the end of their schedule into the associated program of record.</p> <p>The Future Naval Enabling Capabilities in this activity span across the Information Infrastructure, Applications/Tools/Decision Aids, Command and Control, Apertures and Radios, Tactical Networks and Network Control/Management, and Computer Network Defense and Information Assurance technology areas. Technologies being developed will integrate sensors, networks, decision aids, weapons and supporting systems into a highly adaptive, human-centric, comprehensive maritime system. This system will operate from the sea bed to space in a Service Oriented Architecture that can be used in a Joint Environment. The current specific objectives are:</p>		25.093	34.334	31.617

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>a) Combat ID Information Management of Coordinated Electronic Surveillance - Develop software algorithms and techniques for the purpose of dynamically re-tasking organic sensors in conjunction with fused intelligence products to support Command Control and Combat Systems. Efforts will include developed capability for automated integration of multi-intelligence surveillance & reconnaissance of red, white, and blue force locations for Combat Identification by providing software integrated into Navy and Marine Corps Command Control and Combat Systems.</p> <p>b) Automated Control of Large Sensor Networks - Develop smart tactical sensors/platforms and software algorithms for automated and mission specific tactical sensor fields capable of fulfilling specific mission objectives with smart sensors that forward knowledge vice raw data.</p> <p>c) OCO Focused Tactical Persistent Surveillance - Develop agile and enhance tactical sensors for a netted, organically controlled, adaptive sensor field that is capable of detecting and classifying features relevant to other contingency operations to include organic sensors for small tactical expeditionary units, capable of supporting the dynamic character of modern operations from the highly mobile to the long-term.</p> <p>d) Globally Netted Joint/Coalition Force Maritime Component Commander - Develop automated tools and software to capture and share information for 'globally-networked, theater-focused' maritime capabilities that will enhance Joint Task Force (JTF) and COCOMs' ability to execute their intentions.</p> <p>e) Dynamic Tactical Communications Networks - Develop dynamically adaptive automated software algorithms, protocols, and network management techniques that provide a self-organizing networking capability. This capability will adapt to available links of opportunity at lower echelons and assure priority movement of critical data intra-network and through reachback gateway networks that interface with the Global Information Grid (GIG).</p> <p>f) Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC) - Develop software for command control and combat systems that will provide the maritime commander agile and responsive control and management of tactical Antisubmarine Warfare (ASW) and interactions in a net centric enterprise environment. Focus will address classified ASW requirements for command and control at the tactical level.</p> <p>g) High-bandwidth Free-space Lasercomm - Develop, integrate and demonstrate free-space optical terminals and retro-reflector optics that are designed to provide an affordable, reliable and highbandwidth Free-Space Laser Communications (Lasercomm) capability which is adaptive and agile in mitigating a wide range of atmospheric and maritime turbulence, precipitation and</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>obscuration conditions. This capability will enable surface and airborne platforms to exchange very high bandwidth information in Navy Tactical Networks, even with limited SATCOM or RF spectrum access.</p> <p>h) Actionable Intelligence Enabled by Persistent Surveillance - Develop analysis tools and software that will provide accurate threat detection by exposing the enemy's vulnerabilities, unmasking their latent networks, discovering their tactics, techniques, procedures and exploiting in new ways the vast amount of sensor data available today against an irregular threat. Also develop the following: An electrooptical, infrared and laser Intelligence, Surveillance, and Reconnaissance Targeting (ISRT) optics technology, capable of wide Field of View/Field of Range (FOV/FOR) at variable resolution & pointing direction, for installation in mobile platforms without gimbals; a light weight, low cost sensor suite and autonomy algorithms to enable detection and avoidance of all classes of aircraft or Unmanned Aerial Vehicles (UAV).</p> <p>i) Pro-Active Computer Network Defense and Information Assurance - Develop algorithms, protocols, and software that will allow the warfighter to 1) identify and counter real-time threats to the network during mission execution, 2) provide dynamic security management and component management of networked-based assets to support mission execution, and 3) ensure mission essential capabilities and data exist despite malicious cyber actions.</p> <p>j) Fast Magic - Develop algorithms and computer and information technologies for Naval forces to respond quickly against multiple threats. Details are classified.</p> <p>k) NRL Space - Develop vessel tracking fusion algorithms and software to integrate multiple modalities of informational elements including literal and non-literal information. Develop algorithms and techniques for handling incorrect, out of sequence and intermittent sensor data to provide persistent situational awareness.</p> <p>l) Advanced Tactical Data Link - Develop the Low Probability /Low Probability of Detection /Anti-Jam waveforms and aperture management functions needed to support Advanced Tactical Data Link operations in permissive, contested, and anti-access environments as well as the real-time network operations capabilities needed to dynamically add/remove participants, allocate Advanced Tactical Data Link resources to each participant, and add/remove network partitions in support of dynamic mission execution.</p> <p>m) Autonomous Tactical Persistent Surveillance - Develop the architecture, algorithms, software and knowledge product tools to allow autonomous control of persistent, tactical networks of sensors; enable ISR assets to provide an "Information Bubble" to the mobile user; provide revolutionary sensor and data support to agile tactical missions by anticipating information needs;</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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and provide sensor planning and management relevant to a higher order knowledge model. This will provide the capability to autonomously maintain persistent surveillance of activities and entities over a region of interest, 24/7, while providing underlying context for real time adaptive surveillance in support of tactical mission objectives.

The increase from FY 2010 to FY 2011 is due to the initiation of new FNC Enabling Capability efforts Pro-Active Computer Network Defense and Information Assurance, Fast Magic, and NRL Space.

The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.

FY 2010 Accomplishments:

Combat ID Information Management of Coordinated Electronic Surveillance:

- Completed the Electronic Warfare Integrated System for Small Platforms (EWISSP) effort by exploration and refinement of the subsystem interface software that will operate via Versa Module Eurocard (VME)-64 and Recommend Standard (RS)-422 buses.
- Completed development of Actionable Information from Multiple Intel Sources in a Global Information Grid Enterprise Services (GIG-ES) Environment. Provides automated integration of multi-INT surveillance and reconnaissance of red, white, and blue force locations for Combat ID by providing software integrated into Navy and Marine Corps Command Control & Combat Systems; order of magnitude less false recognition; and identification of significant military entities consistent with sensor capabilities.
- Completed development and testing of airborne and shipboard battle manager platforms for UAVs operating from Littoral Combat Ships.
- Completed development and testing of an open architecture airborne control station that can be used onboard a P-3 type aircraft for the control of multiple UAVs.
- Completed the all-source track and identity fusion effort integrating a broad range of intelligence product information including: Kinematic Radar Reports, Organic and UAV imagery, electronic and communications emissions and human spot reports for tactical and organic sensors to be augmented with national sensors.
- Initiated and completed demonstrations of the adaptation of fusion and resource management capabilities directly into Distributed Information Operations-Service (DIO-S).

Automated Control of Large Sensor Networks:

- Continued design of tools enabling mission-specific tactical sensor fields for at least two separate mission areas.
- Continued design of tactical distributed data analysis and automated indications and warnings for 50% of tactical data.
- Continued design of automated tactical platform and sensor planning and management sufficient for one operator to control multiple sensors.

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued investigation of human to tactical sensor field interface to enable the user to locate relevant knowledge within 3 minutes. - Continued development of automated and mission aware large tactical sensor management engines and irregular threat and tactical sensor ontologies. - Continued development of the agents and other analysis applications enabling a fully netted tactical battlespace. - Initiated demonstrations of mission-aware planning tools that allow large sensor networks to support tactical operations. <p>OCO Focused Tactical Persistent Surveillance:</p> <ul style="list-style-type: none"> - Initiated development of high information tactical agile sensors, including tactical RF sensors, sensors to sense the state of a person and smart tactical imagers and acoustic sensors. <p>Globally Netted Joint/Coalition Force Maritime Component Commander:</p> <ul style="list-style-type: none"> - Continued effort to develop and apply emerging technologies that support delivery of Navy-approved FNC enabling capabilities structured to close operational capability gaps that involve the common picture. - Continued packaging of emerging common picture technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period. - Continued efforts for the mature common picture technologies that support naval requirements identified within the FORCENet naval capability pillar. - Initiated development of fusion algorithms and methods that support building and maintaining large distributed databases; implementing GIG-compliant data strategies; mediating and integrating across heterogeneous databases; accessing and discovering authenticated users and brokering agents; and identifying ambiguities or inconsistencies for additional sensing and processing. <p>Dynamic Tactical Communications Networks:</p> <ul style="list-style-type: none"> - Continued effort to develop and apply emerging technologies that support self organizing networking and assured communications exchange in tactical communications networks. - Initiated development of distributed-and dynamic policy based network management, secure mobility management solutions, and network service discovery mechanisms. - Initiated development of robust and bandwidth efficient group communication protocols for the tactical environment, including disruption tolerance and inter-domain (security and routing) protocols for fullyconnected domains. <p>Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC):</p>			

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>	PROJECT 0000: <i>Common Picture Applied Research</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>- Continued effort to develop new, and leverage emerging, technologies that support dynamic and response management and control of net-centric enterprise theater and tactical ASW operations. This includes automation support for synchronized planning of resources and multi-mission execution, and access and shared awareness of data activities and status among Maritime Operation Centers and tactical forces in a tactical, netted service-oriented architecture (SOA) environment.</p> <p>- Initiated development of tools and algorithms that support automated data access, shared awareness, and automated synchronized planning, coordination and execution of network enterprise resources among tactical units with limited/degraded communications.</p> <p>High-bandwidth Free-space Lasercomm:</p> <p>- Initiated development of mitigation techniques for laser beam propagation through atmospheric turbulence and aerosol obscuration.</p> <p>- Initiated development of and demonstrate technologies that support high bandwidth laser communications, including fast acquisition and fine beam steering/tracking algorithms; wide-area avalanche photo-diode receive array techniques; and high bandwidth wide field-of-view retro-reflector optics.</p> <p>Actionable Intelligence Enabled by Persistent Surveillance:</p> <p>- Initiated development of advanced analysis tools that are relevant to the information needs of tactical warfighters engaged against irregular actors.</p> <p>- Initiated development of a multi-modal tactical wide area surveillance payload and sensors relevant to tier-2 UAVs that can detect other airborne platforms.</p> <p>FY 2011 Plans:</p> <p>Automated Control of Large Sensor Networks:</p> <p>- Complete all efforts of FY 2010.</p> <p>OCO Focused Tactical Persistent Surveillance:</p> <p>- Continue all efforts of FY 2010.</p> <p>Globally Netted Joint/Coalition Force Maritime Component Commander:</p> <p>- Continue all efforts of FY 2010.</p> <p>- Initiate demonstration of the dynamic distributed data layer, role-relevant representation and visualization, and adaptive collaboration assistant in a series of Limited Technology Experiments and Limited Technology Objectives to verify the ability to provide information flow in real time across theaters.</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>	PROJECT 0000: <i>Common Picture Applied Research</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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Dynamic Tactical Communications Networks:
 - Continue all efforts of FY 2010.
 - Initiate demonstration of distributed-and dynamic policy based network management and secure mobility management solutions, network service discovery mechanisms, and robust and bandwidth efficient group communication protocols for the tactical environment, including disruption tolerance.

Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC):
 - Continue all efforts of FY 2010.
 - Initiate development of automated capabilities for generating multiple alternative course of action (COA) recommendations to the commander including automated development of force plans and allocation of related resources (e.g. sensors, platforms, weapons) and processes; and dynamic management and re-planning of tactical force goals, activities and resources.

High-bandwidth Free-space Lasercomm:
 - Continue all efforts of FY 2010.
 - Initiate development of and demonstrate error correction methods and adaptive optics techniques for turbulence mitigation; and ultra-fast pulsing for obsuration.

Actionable Intelligence Enabled by Persistent Surveillance:
 - Continue all efforts of FY 2010.

Pro-Active Computer Network Defense and Information Assurance:
 - Initiate development of Next Generation Sensors and Gateways to provide security and control mechanisms to protect networks, data and systems from attacks (e.g., malicious code, data exfiltration).
 - Initiate development of Next Generation Security Protocols and Security Management Protocols to provide hardened, highly survivable, stealthy, reconfigurable overlay of protocols onto networks to ensure network-base configuration and control of security components essential to mission operations, as well as provide data provenance to support dynamic resource management and decision support.
 - Initiate development of Common Operational Security Decision System to aggregate, correlate, fuse and visualize network security posture information to support integrated warfighting decisions.

Fast Magic:

FY 2010	FY 2011	FY 2012

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>		PROJECT 0000: <i>Common Picture Applied Research</i>
B. Accomplishments/Planned Programs (\$ in Millions)				FY 2010
<p>- Initiate the development of algorithms and computer and information technologies for Naval forces to respond quickly against multiple threats. Details are classified.</p> <p>NRL Space:</p> <ul style="list-style-type: none"> - Initiate the development of vessel tracking fusion algorithms and software to integrate multiple modalities of informational elements including literal and non-literal information. - Initiate the development of algorithms and techniques for handling incorrect, out of sequence and intermittent sensor data to provide persistent situational awareness. <p>FY 2012 Plans:</p> <p>OCO Focused Tactical Persistent Surveillance:</p> <ul style="list-style-type: none"> - Complete all efforts of FY 2011. <p>Globally Netted Joint/Coalition Force Maritime Component Commander:</p> <ul style="list-style-type: none"> - Complete all efforts of FY 2011. <p>Dynamic Tactical Communications Networks:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC):</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>High-bandwidth Free-space Lasercomm:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Actionable Intelligence Enabled by Persistent Surveillance:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Pro-Active Computer Network Defense and Information Assurance:</p> <ul style="list-style-type: none"> - Continue all efforts of FY2011. <p>Fast Magic:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. Details are classified. 				FY 2011
				FY 2012

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>	PROJECT 0000: <i>Common Picture Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>NRL Space: - Continue all efforts of FY 2011. Details are classified.</p> <p>Advanced Tactical Data Link: - Initiate the development of low observable, low latency ad-hoc wideband networking waveforms for software defined radios.</p> <p>Autonomous Tactical Persistent Surveillance: - Initiate the development of a scalable, dynamic and distributed common architecture for ISR and C2 that allows sensors and data analysis nodes to anticipate the information needs of the tactical warfighter. - Initiate the development of algorithms to automate entropy-based control of a diverse body of collection assets - Initiate the development of algorithms for bandwidth-limited exploitation of multi-modal sensors across the distributed information space. - Initiate the development of automation tools that enable the understanding of entities, events, and relationships, ultimately leading to intent hypotheses. - Initiate the development of algorithms for automatic exploitation of domain knowledge within/between classes of environments - Initiate the development of algorithms to extract & synthesize adversary target information & quantify information gaps - Initiate the development of algorithms to automatically fuse enterprise archived information with dynamic contextual information - Initiate the development of algorithms to manage behavioral hypotheses based on regional activity history - Initiate the development of credibility models to aid inferencing process & characterize background normalcy</p>				
<p>Title: MULTI-SOURCE INTEGRATION AND COMBAT IDENTIFICATION</p> <p>Description: This activity addresses theater air and missile defense (TAMD), and responds to warfighter needs for rapid, high confidence Combat Identification (CID) of air and missile threats at long range using real time and non-real time threat attributes and intelligence information.</p> <p>The decrease from FY 2011 to FY 2012 is due to completion of improvements in the resolution of the High Frequency Relocatable Over-the-Horizon Radar (HF-ROTHR) more than two orders of magnitude using time-reversal methods.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p>FY 2010 Accomplishments:</p>		1.050	1.090	0.682

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>	PROJECT 0000: <i>Common Picture Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Continued effort to improve the resolution of the High Frequency Relocatable Over-the-Horizon Radar (HF-ROTHR) more than two orders of magnitude using time-reversal methods.</p> <p>- Initiated developing and demonstrating Multiple Input Multiple Output (MIMO) radar concepts and technology using High Frequency (HF) Skywave radar.</p> <p>FY 2011 Plans:</p> <p>- Continue to develop and demonstrate Multiple Input Multiple Output (MIMO) radar concepts and technology using High Frequency (HF) Skywave radar.</p> <p>- Complete improvements in the resolution of the High Frequency Relocatable Over-the-Horizon Radar (HF-ROTHR) more than two orders of magnitude using time-reversal methods.</p> <p>FY 2012 Plans:</p> <p>- Continue to develop and demonstrate Multiple Input Multiple Output (MIMO) radar concepts and technology using High Frequency (HF) Skywave radar.</p>				
<p>Title: TACTICAL SPACE EXPLOITATION</p> <p>Description: The Tactical Space Exploitation initiative explores the application of new space craft technologies on small, light-weight and low-cost satellites to enhance naval warfighting capabilities; taking advantage of the global access, revisit and connectivity provided by orbital platforms.</p> <p>a) Tactical Space Exploitation Innovative Naval Prototypes: Initial efforts will be aimed at developing integrated signals electronics packages to test new concepts for global ship tracking and two-way data exfiltration using next-generation Internet Protocol (IP) technology from an array of sea-based and land-based sensors. Advanced multispectral/hyperspectral electro-optical sensors will be developed to demonstrate new warfighting constructs and communications payload technology deployed on satellites to demonstrate augmented mobile satcom capabilities over a theater.</p> <p>b) Spacecraft Technology: Affordably expendable payload and bus technologies will be developed, which will serve as building blocks for future responsive space systems: payloads, bus technologies and significant space robotic technologies that address on-orbit inspection, servicing, repair and assembly, and mission-life extension.</p> <p>FY 2010 to FY 2011 funding decrease is the result of investments in this activity being curtailed in response to completion of the efforts associated with the Comm-X payload development and launch aboard TACSAT 4 satellite.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p>		17.762	4.132	4.278

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>		PROJECT 0000: <i>Common Picture Applied Research</i>	
B. Accomplishments/Planned Programs (\$ in Millions)			FY 2010	FY 2011
<p><i>FY 2010 Accomplishments:</i> Tactical Space Exploitation Innovative Naval Prototypes: - Continued development of integration plans, algorithms, and satellite concept of operations to demonstrate integrated signals payload. - Continued development of small multifunctional integrated signals electronics systems for ship tracking from space and two-way data exfiltration from distributed global sensors. - Completed Comm-X payload and launch it aboard TACSAT 4 satellite.</p> <p>Spacecraft Technology: - Continued program to use chemical release from satellites launched into selected low-Earth orbits to de-populate intense trapped electrons in radiation belts following a low-altitude nuclear explosion in space. - Continued effort to develop technologies using autonomous bi-dexterous manipulation for closeproximity operations in space. - Continued the development of a preliminary design for electrodynamic propulsion technology demonstration spacecraft. - Completed the development of a highly capable self-inspection vehicle for spacecraft with large complex deployables. - Completed program to use chemical release from satellites launched into selected low-Earth orbits to de-populate intense trapped electrons in radiation belts following a low-altitude nuclear explosion inspace. - Initiated developing the underlying fluid transfer technologies for steerable radiators that will enable spacecraft thermal radiators to be pointed away from the sun. - Initiated developing a proof-of-concept, reliable touch sensitive skin for robotic arms with emphasis on space applications, and the associated fault detection and model identification algorithms required to utilize it.</p> <p><i>FY 2011 Plans:</i> Tactical Space Exploitation Innovative Naval Prototypes: - Complete development of integration plans, algorithms, and satellite concept of operations to demonstrate integrated signals payload. - Complete development of small multifunctional integrated signals electronics systems for ship tracking from space and two-way data exfiltration from distributed global sensors.</p> <p>Spacecraft Technology: - Continue all efforts in FY 2010 less noted above as complete. - Complete the development of a preliminary design for electrodynamic propulsion technology demonstration spacecraft.</p>				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>	PROJECT 0000: <i>Common Picture Applied Research</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
- Initiate development of artificially generating and maintaining a dust layer in the near-earth plasma environment to induce enhanced drag on space debris towards debris mitigation.			
<i>FY 2012 Plans:</i> Spacecraft Technology: - Continue all efforts in FY 2011 less noted above as complete.			
Accomplishments/Planned Programs Subtotals	80.007	70.168	65.448

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0603235N: <i>COMMON PICTURE ADVANCED TECHNOLOGY</i>	31.136	42.477	44.878	0.000	44.878	49.742	34.581	28.932	12.769	0.000	244.515

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

This PE supports the development of technologies that enable the transformation to network centric warfare. Net-centric operations include communications and information assurance capabilities to enable all-source data access, tailored dissemination of information to Command and Control (C2) and Intelligence, Surveillance and Reconnaissance (ISR) users across the network, and rapid, accurate decision making based on this information. The operational benefits sought are increased speed of response, accuracy, and precision of command; distributed self-synchronization; flexibility and adaptability to an operational situation; and decision superiority.

Specific examples of metrics under this PE include:

- Increase network data rates and interoperability across heterogeneous radios; improve dynamic bandwidth management and mobile network connectivity.
- Increase the understanding of the battlespace by the development of automated tools for extracting information from images and signals, identifying objects, determining relationships among the objects, assessing intent, and generating courses of action.
- Improve human-factors design principles resulting in enhanced human performance effectiveness, improved timeliness and quality of decision making, reduced manning, and improved team decision making in ad-hoc, complex problem solving scenarios.
- Improve the integration of sensors, networks, decision aids, weapons, and supporting systems into a highly adaptive, human-centric, comprehensive maritime system.
- Improve integrated signals electronics packages small, light-weight, and low-cost satellites to test new concepts for global ship tracking and two-way data exfiltration.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>			PE 0602235N: <i>Common Picture Applied Research</i>				4027: <i>Naval Innovative Science and Engineering</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	2.345	-	-	-	-	-	-	-	-	0.000	2.345

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: Naval Innovative Science and Engineering	2.345	-	-
Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.			
FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:			
<ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 			
Accomplishments/Planned Programs Subtotals	2.345	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602235N: <i>Common Picture Applied Research</i>	PROJECT 9999: <i>Congressional Adds</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	6.115	-	-	-	-	-	-	-	-	0.000	6.115

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: Cognitive Radio Institute <i>FY 2010 Accomplishments:</i> This effort provided for design of radio experimental models and system test-beds that utilize multi-GHz spectrum sensing, which is resistant to conventional jamming techniques and provided for development of cognitive radio, a new paradigm in wireless communications that can opportunistically take advantage of unused radio frequency spectrum.	0.797	-
Congressional Add: Intelligent Decision Exploration <i>FY 2010 Accomplishments:</i> This effort provided for the development of a net-centric, unmanned systems testbed toolset to improve the effectiveness and coalition interoperability of expeditionary forces in order to enhance force protection during asymmetric and coalition operations.	3.884	-
Congressional Add: Sensor Integration Framework <i>FY 2010 Accomplishments:</i> This effort supported sensor integration framework research.	1.434	-
Congressional Adds Subtotals	6.115	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602236N: <i>Warfighter Sustainment Applied Res</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	121.588	113.724	101.205	-	101.205	94.994	90.172	93.558	91.348	Continuing	Continuing
0000: <i>Warfighter Sustainment Applied Res</i>	99.740	113.724	101.205	-	101.205	94.994	90.172	93.558	91.348	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	5.591	-	-	-	-	-	-	-	-	0.000	5.591
9999: <i>Congressional Adds</i>	16.257	-	-	-	-	-	-	-	-	0.000	16.257

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE supports the Future Naval Capabilities (FNCs) of Littoral Combat/Power Projection, Capable Manpower, Force Health Protection Future Capability, Seabasing and Enterprise and Platform Enablers (EPE) FNC; and innovation-based efforts that will provide technology options for future Navy and Marine Corps capabilities. Efforts focus on manpower and personnel; naval systems training; littoral combat and power projection capabilities; advanced naval materials; medical technologies; environmental quality; biocentric technologies; high speed sealift; cost reduction technologies; and seabasing technologies. Within the Naval Transformation Roadmap, this investment supports eight transformational capabilities within the "Sea Strike", "Sea Shield", and "Sea Basing" operational concepts; the critical human system, "Sea Warrior"; and Naval business efficiencies within "Sea Enterprise."

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602236N: <i>Warfighter Sustainment Applied Res</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	118.783	113.724	97.518	-	97.518
Current President's Budget	121.588	113.724	101.205	-	101.205
Total Adjustments	2.805	-	3.687	-	3.687
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	0.437	-			
• SBIR/STTR Transfer	-2.786	-			
• Program Adjustments	-	-	4.092	-	4.092
• Section 219 Reprogramming	5.161	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.405	-	-0.405
• Congressional General Reductions Adjustments	-0.007	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *Advanced Composite Maritime Manufacturing*
- Congressional Add: *Assistive Technologies for Injured Service Members*
- Congressional Add: *Biosensors for Defense Applications*
- Congressional Add: *Composite Materials Enhancements through Polymer Science R&D*
- Congressional Add: *Managing and Extending DoD Asset Lifecycles*
- Congressional Add: *Nanotechnology for Anti-Reverse Engineering*
- Congressional Add: *Productization of Anti-fouling and Fouling Release Coating Systems*
- Congressional Add: *ENV SAFE DECON AGENTS*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.593	-
	0.797	-
	0.797	-
	5.099	-
	1.593	-
	2.390	-
	2.788	-
	1.200	-
Congressional Add Subtotals for Project: 9999	16.257	-
Congressional Add Totals for all Projects	16.257	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy

DATE: February 2011

APPROPRIATION/BUDGET ACTIVITY

1319: *Research, Development, Test & Evaluation, Navy*
BA 2: *Applied Research*

R-1 ITEM NOMENCLATURE

PE 0602236N: *Warfighter Sustainment Applied Res*

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602236N: <i>Warfighter Sustainment Applied Res</i>				0000: <i>Warfighter Sustainment Applied Res</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>Warfighter Sustainment Applied Res</i>	99.740	113.724	101.205	-	101.205	94.994	90.172	93.558	91.348	Continuing	Continuing

A. Mission Description and Budget Item Justification

This PE supports the FNC's of Littoral Combat/Power Projection, Capable Manpower, Force Health Protection Future Capability, Enterprise and Platform Enablers (EPE) FNC; and innovation-based efforts that will provide technology options for future Navy and Marine Corps capabilities. Efforts focus on manpower and personnel; Naval systems training and education; human systems integration; littoral combat and power projection capabilities; advanced naval materials; medical technologies; environmental quality; biocentric technologies; high speed sealift; cost reduction technologies; and Sea Basing technologies. Within the Naval Transformation Roadmap, this investment supports eight transformational capabilities within the "Sea Strike", "Sea Shield", and "Sea Basing" operational concepts; the critical human system, "Sea Warrior"; and Naval business efficiencies within "Sea Enterprise."

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: ADVANCED NAVAL MATERIALS	16.247	23.876	24.191
<p>Description: Advanced Naval Materials efforts include: developing advanced, high-performance materials; processes to reduce weight and cost; and enhanced sonar transducers.</p> <p>FY 2010 and FY 2011 funding increase is due to Energy initiative. FY 2011 and FY 2012 funding increase is to support FNC EPE-FY11-01 Flight Deck Thermal Management.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued multi-laser-processing technique development for the fabrication of ultra hard materials for wear resistance applications. - Continued development of advanced, cost-efficient joining of titanium for >25% weight reduction of large seaborne structures. - Continued development of advanced composites and polymers with fire resistance for ship structures. - Continued development of nanotube reinforced composite materials for next generation air and naval platforms. - Continued development of acceptance testing methodologies for advanced transducer single-crystal high-strain materials and definition of standardized materials properties and composition ranges. - Continued development of compositional tuning of single-crystal, high-strain transducer materials, for 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602236N: <i>Warfighter Sustainment Applied Res</i>	PROJECT 0000: <i>Warfighter Sustainment Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>specialized naval system applications.</p> <ul style="list-style-type: none"> - Continued development of cavitation resistant ship rudder coatings based on the FY 2004 shipboard coating study. - Continued marine titanium alloy design and processing development, exploiting anticipated cost reductions for high performance, reduced maintenance naval applications. - Continued development of continuous single wall carbon nanotube composite materials for next generation air and naval platforms. - Continued stainless steel carburization study to enhance corrosion performance. - Continued development of surface preparation methods and characterization of corrosion performance for future naval ship materials. - Continued evaluation of low temperature carburized materials for marine application. - Continued development of coating performance and knowledge database for Naval use. - Continued development of mechanistic model for stress corrosion cracking in Nickel Aluminum Bronze (NAB). - Continued friction stir welding development for control of residual stresses and elimination of distortion in naval steels. - Continued development of innovative sonar transducers based on high-strain, high-coupling piezoelectric single crystals. - Continued development of integrated structural composites with blast resistance, manufacturing technologies, and low-cost organic resins with improved fire resistance. - Continued development of novel processing technologies for increasing the fatigue strength and corrosion resistance of weldments for ship structures with reduced weight and maintenance requirements. - Continued development of materials processing methods for single crystal piezoelectrics to make strong, robust sonar transducers. - Continued development of models and characterization methods for dynamic loading (water slamming and blast loading) in polymer composite materials. - Continued acoustic damping coatings for ship tank application. - Continued development of portable, real-time, Non-Destructive Examination (NDE)/Non-Destructive Inspection (NDI) technology for heat damage detection in composite materials. - Continued development of fiber-optic Bragg grating sensor and demodulation technology system for structural health monitoring of ships and submarines. - Continued development of new 3D mechanical characterization technique for polymer composites 			

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602236N: <i>Warfighter Sustainment Applied Res</i>	PROJECT 0000: <i>Warfighter Sustainment Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>based on dissipative energy density principles.</p> <ul style="list-style-type: none"> - Continued development of continuous based monitoring techniques of new synthetic fuels and lubricants based on electromagnetic signature analysis. - Continued development and application of distributed fiber optic Bragg gratings for structural health monitoring of ships and aircrafts. - Continued development of novel growth methods to specialized single crystal transducer materials tuned to requirements of specialized naval systems. - Continued assessment of the degree of sensitization potential of marine grade Al alloys. - Continued investigation of criteria for stable pitting of stainless steel. - Continued development of surface assessment technologies to measure surface profile and chlorine. - Continued evaluation of advanced material coating for erosion control on helicopter main rotor blade leading edges. - Completed ballistic test program to assess dependence of penetration velocity on coating thickness and substrate properties. - Completed modeling and process development of single-melt cold hearth casting of naval titanium alloys including Ti 5-1-1-1 for enhanced mechanical properties and formability. - Completed development of a revolutionary new thermal spray technology for repair and refurbishment of worn and/or corroded components on ships, aircraft and combat vehicles. - Initiated development of seamless joining technologies for large, complex shaped conventional ceramic windows from small, inexpensive components using electrophoretic deposition of ceramic nanoparticles. - Initiated development of intelligent corrosion sensor systems for intergranular corrosion cracking. - Initiated studies on fuel cell corrosion. - Initiated development of superhydrophobic surface modification technology. - Initiated studies on mitigation of pitting corrosion and stress corrosion cracking in marine aluminum alloys. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete development of new 3D mechanical characterization technique for polymer composites based on dissipative energy density principles. - Complete development of compositional tuning of single-crystal, high-strain transducer materials, for specialized naval system applications. 			
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiate development of quantitative coating quality assurance tools. - Initiate development of surface tolerant coating removal methods. - Initiate development of processing technologies to fabricate piezoelectric single crystals into complex transducer assemblies. - Initiate development of thermal management system(s) to arrest excessive heat fluxes and loads on amphibious ship by advanced Naval/USMC aircraft. - Initiate development of MEMS based sensor nodes, with energy harvesting and wireless communication capabilities, for system health management and prognosis. -Initiate development of high-strength, high-hardness tool materials for friction-stir welding applications. -Initiate development of the rational engineering design of Al-alloys for naval applications. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete friction stir welding development for control of residual stresses and elimination of distortion in naval steels. 				
<p>Title: BIOCENTRIC TECHNOLOGIES</p> <p>Description: Biocentric technologies provide novel solutions for naval needs based upon the applications of bio-inspired sensors, materials, processes and systems. Topic areas include, but are not limited to development of biologically-based signal processing for medical, surveillance and security applications; bioinspired robotics; synthetic biology to produce high-value naval materials or to develop sentinel organisms, and marine mammal diagnostics to support the Navy's Fleet Marine Mammal Systems.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of innovative naval biosensors, biomaterials, and bioprocess technology - Continued efforts on naval biosensor to detect brain structures and blood vessels through skull bones. - Continued engineering development and optimization of sea-floor sediment energy harvesting system for sustainable and autonomous powering of underwater sensor networks and AUV's - Continued marine mammal diagnostics efforts, including the characterization of the dolphin fore-stomach microbial community, identification of probiotic immunostimulating species and immunobioassays for stress and infection detection. - Continued efforts on advanced biomimetic sensing and neural control for human-robot interaction to enable effective collaboration of warfighters and autonomous systems. -Continued integration of biomimetic sonar with bioinspired autonomous undersea vehicles (with high-lift propulsors) to achieve closed loop control. 		5.011	5.800	5.298

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued efforts in bioinspired quiet, and maneuverable self-propelled line array using high-lift propulsors based on animal wing and fin biomechanics. - Continued effort to develop living fluidic networks. - Completed research on microbial synthesis of phloroglucinol, an energetic material precursor. - Completed effort to develop and demonstrate methods for determining multiple microbial genetic sequences which will have profound implications for detection of environmental pathogens and marine sensory systems using microorganisms. - Completed development of a microfabricated analytical system for trace detection of illicit materials including explosives, and other hazardous chemicals. - Initiated development of a second set of molecular diagnostic tests for recently discovered viral, bacterial, and fungal pathogens of marine mammals <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete research for detection or mitigation of microbes or compounds of naval relevance in various settings. - Initiate long duration, realistic field tests, and modeling studies of autonomous microbial fuel cell power systems for underwater sensor networks. - Initiate efforts for bio-inspired massively parallel vision systems. - Initiate effort to evaluate breath analysis for non-invasive diagnostics in marine mammal medicine. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Initiate animal studies of autonomous in vivo devices for detection of biomarkers and drug delivery - Initiate studies to evaluate candidate probiotics in Atlantic bottlenose dolphins. 				
Title: COST REDUCTION TECHNOLOGIES		8.186	11.620	14.054
<p>Description: Cost Reduction Technology efforts include: developing ultrareliable materials and sensors to reduce cost by enabling condition-based and zero maintenance capabilities; and airframe and ship corrosion efforts for advanced cost effective prevention and life cycle management technologies. This activity includes the Navy's share of the Versatile, Affordable, Advanced Turbine Engine (VAATE) program for materials. Investments under this activity were previously reported under Advanced Naval Materials and were broken out to provide improved clarification of the overall investment scope. FY 2010 to FY 2011 funding increase is to support FNC EPE-FY10-03. FY 2011 to FY 2012 funding increase is due the Corrosion Mitigation Technologies and Design Integration and Rotor - Hot Spot Sensors and Integration FNC new start efforts.</p>				

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued development of ceramic matrix composite turbine blades for gas turbine engines. - Continued development of cavitation resistant ship rudder coatings. - Continued development of durable alloys and materials for shipboard and aircraft gas turbine engines and spallation-resistant thermal barrier coatings for shipboard/aircraft marine gas turbine hot sections. - Continued development of advanced materials and processes for high temperature marine turbine disks and combustors. - Continued development of oxidation and vanadium/sulfate-resistant high temperature coatings for shipboard/aircraft gas turbine engines. - Continued development of calcium magnesium aluminum-silicate (CMAS)-resistant coatings for ceramic matrix composites. - Continued development of high temperature foil bearing coatings for aircraft engine weight reduction. - Continued development of high temperature organic matrix composites. - Continued development of low-platinum and platinum-free aluminide coatings that are phase compatible with turbine blade alloys and exhibit low oxidation rates. - Continued efforts to assess manufacturing issues and reliability of ceramic matrix composites for turbine engines. - Continued development of materials processing for future gas turbine molybdenum-based alloys. - Continued efforts to conduct warfighter sustainment applied research, including technology management of investments supporting the naval enterprise and naval capability pillars. - Continued efforts to perform technology analyses to support the development and validation of FNC technology performance metrics for enabling capabilities structured to close naval capability gaps. - Continued efforts to assess technology options for the development of applied FNC technologies packaged into deliverable science and technology products. - Continued applied research and development of improved coatings for (1) non-skid surfaces, (2) ship rudders, (3) high performance ship topsides, and (4) high performance airfield pavements. - Continued analytical model and reduced scale component development of shipboard compact power conversion technologies for multi-function motor drives, bi-directional power conversion modules, and power management controllers, focusing on closing technology gaps associated with Alternative Integrated Power System Architectures. - Continued applied research in determining lifting of hot section materials exposed to alternative synthetic fuels and petroleum-synthetic fuel blends. - Continued applied research development of Calcium Magnesium Aluminum-Silicate (CMAS)-resistant 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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coatings for molybdenum-base alloys.

- Continued life prediction research for modeling of hot section gas turbine materials, including blades, in mixed naval environments.
- Continued development of an Adaptive Expert System to automatically and rapidly analyze aircrew performance (1M+ flight hours annually) to detect human factors related mishap leading indicators using a new technique with anomaly detection and corroboration.
- Completed integrated development of durable thermal barrier coating system with various bond coats for naval aircraft gas turbine hot section.
- Initiated durable environmental barrier coatings for 2700F ceramic-matrix composites.
- Initiated research on Nb-Cr-Si alloys for improved corrosion resistance at high temperatures.
- Initiated, developed and applied emerging technologies that support delivery of Navy approved FNC enabling capabilities structured to close operational capability gaps in warfighter sustainment.
- Initiated package emerging warfighter sustainment technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period.
- Initiated and developed mature warfighter sustainment technologies that support naval requirements identified within the Naval Power 21 capability pillars.
- Initiated development of novel seawater pretreatment strategies to optimize performance of prefiltration membranes (microfiltration or ultrafiltration membranes or filters).
- Initiated further development of novel high flux and chlorine resistant reverse osmosis membranes.

FY 2011 Plans:

- Continue all efforts of FY 2010 less those noted as completed above.
- Complete development of high temperature foil bearing coatings for aircraft engine weight reduction.
- Complete integrated development of durable thermal barrier coating system with various bond coats for naval aircraft gas turbine hot section.
- Initiate research and development of ceramic matrix composite vanes for Naval aircraft.
- Initiate applied research on radiation barrier coatings.
- Initiate development of 1500F capable disk coatings.
- Initiate development of advanced ASGS (Active Shaft Grounding System) with integrated shaft current sensing and extremely low frequency electromagnetic (ELFE) control.
- Initiate development of novel ICCP (Impressed Current Cathodic Protection) anodes, reference cells and sensors with high Mean Time Between Failure(MTBF).

FY 2010	FY 2011	FY 2012

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiate development of dual-use ICCP and novel sensor technology for CBM and closed-loop deamping to extend hull/ballast coating longevity and reduce recalibration frequency. - Initiate applied research in modeling and simulation to identify key corrosion drivers and target problem areas for material modification and improved barrier dielectrics. - Intitiate development of spatial corrosion recognition and diagnostic models for hull, ballast tanks and propulsor condition. - Initiate/complete systems analysis efforts to identify and prioritize critical, relevant variable/adaptive cycle propulsion system technologies and development plans/approaches. The outcome of these analyses will provide essential information supporting initiation of the Variable Cycle Advanced Technology (VCAT) Program in FY 2012 (see PE 0602123N). -Initiate development of durable lift fan alloy. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Complete applied research development of Calcium Magnesium Aluminum-Silicate (CMAS)-resistant coatings for molybdenum-base alloys. - Complete research on Nb-Cr-Si alloys for improved corrosion resistance at high temperatures. - Complete applied research on radiation barrier coatings - Initiate applied research in wireless energy harvesting sensors, architecture, and diagnostics for rotorcraft structural health management. - Initiate development of sprayable acoustic damping systems for submarines to significantly reduce weight and costly maintenance procedures and increase operational readiness. - Initiate development of low temperature carbon supersaturation (LTCSS) technology to incorporate improved corrosion resistance and surface hardness to materials in erosion-corrosion environments. - Initiate development of algorithms to incorporate into design module for corrosion prevention to predict the occurrence of corrosion and provide alternative solutions for use in component and system design. 				
Title: ENVIRONMENTAL QUALITY		2.984	3.139	3.155
<p>Description: Environmental Quality technologies enable sustained world-wide Navy operations in compliance with all local, state, regional, national and international laws, regulations and agreements, and support the Navy Transformational Roadmap in the areas of Sea Basing, Sea Strike and Sea Warrior. Compliant operations enable training evolutions and exercises that are critical for maintaining readiness.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of advanced environmentally sound technologies for shipboard waste treatment and pollution abatement systems. 				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued development and modifications to shipboard oily waste treatment systems to accommodate processing of synthetic lubricants. - Continued field evaluation of prototype robotic Hull BUG to identify gaps needed to refine and advance the technology. - Continued development of new, advanced, environmentally benign AF/Anti-Corrosive (AC) coating systems for Navy platforms - Completed pilot scale system development of miniature gasification process for treatment of shipboard solid waste. - Completed far-term noise and air pollution emissions abatement technology for unrestricted operations. - Completed multiple aqueous metal ion sensor to incorporate copper sensor developed in the Strategic Environmental Research and Development Program (SERDP) program for planned combined transition to the Environmental Security Technology Certification Program (ESTCP). - Initiated efforts on ballast tank and system design optimization that minimize fuel discharges from compensated systems, minimize sedimentation in clean ballast and compensated ballast tanks, and maximize exchange of organisms during ballast tank exchanges. - Initiated efforts on solids separation/removal from shipboard liquid waste streams. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Continue development and modifications to shipboard oily waste treatment systems to accommodate processing of synthetic lubricants. - Complete field evaluation of prototype robotic Hull BUG and transition to FNC program. - Initiate efforts on improved handheld, waterborne, underwater hull cleaning technologies. - Initiate studies on oil emulsion issues and development of novel bilge water treatment systems on existing and new ships. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. 				
Title: HUMAN SYSTEMS DESIGN		1.993	3.197	4.021
Description: This activity supports the warfighter by designing affordable user-centered systems that are efficient, easy to use, and provide required mission capabilities at lowest lifecycle costs. Such systems will be optimally designed for the right number and types of personnel, requiring minimum training while providing high skills retention.				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Congressional, DoD, and Navy policies and instructions require the Navy and Marine Corps to have a comprehensive plan for Human Systems Design (HSD) in the acquisition process to optimize total system performance, minimize total ownership costs, and ensure the system is built to accommodate the characteristics of the user population that will operate, maintain, and support the systems.</p> <p>The increase in funding from FY 2011 to FY 2012 reflects the planned initiation of a new project and the planned funding profile of the other projects in this activity.</p> <p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued research into technologies and strategies for significantly improving on-board training and performance measurement for improving submarine command team decision making and overall submarine team performance and resilience. - Continued research into operational constructs, processes, methods, and software specifications to merge the full spectrum of Human Systems Engineering into the Navy's standards based, open-architecture, Integrated Product Data Environment. - Continued research to develop and demonstrate automation and human interface technologies to support collaborative decision-making in which multiple unmanned system operators manage groups of vehicles with optimal manning. - Completed HSI interface display research to improve ships personnel's ability to efficiently and effectively detect, recognize, and identify noisy targets in ambiguous and uncertain dynamic environments. - Initiated research into mission performance optimization encompassing task centered design and advanced human performance modeling for achieving the requisite manning, both in numbers and capabilities, for the complex ships and systems of the future fleet. - Initiated research into improving the capability to fuse imaging, electronic warfare, inorganic and acoustic sensor inputs into integrated, fused, and intuitive displays that enhance the presentation and command understanding of uncertain information. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Complete research into technologies and strategies for significantly improving on-board training and performance measurement for improving submarine command team decision making and overall submarine team performance and resilience. - Complete research to develop and demonstrate automation and human interface technologies to support collaborative decision-making in which multiple unmanned system operators manage groups of vehicles with optimal manning. - Initiate research into the impact of incorporating environmental stressors (fatigue, motion, vibration and extreme temperatures) into systems engineering tools for the development for complex Navy systems. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Complete research into operational constructs, processes, methods, and software specifications to merge the full spectrum of Human Systems Engineering into the Navy's standards based, open-architecture, Integrated Product Data Environment.</p> <p>- Complete research into mission performance optimization encompassing task centered design and advanced human performance modeling for achieving the requisite manning, both in numbers and capabilities, for the complex ships and systems of the future fleet.</p>				
<p>Title: LITTORAL COMBAT / POWER PROJECTION</p> <p>Description: This activity provides for technologies that enhance the ability of the Navy-Marine Corps team to assure access and sustained operations in the Littorals. The FNC Program considers all the critical functions of warfighting: command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); fires; strike; maneuver; sustainment; and fleet/force protection. This activity includes technical assessments and trade studies for FNC Enabling Capabilities that transition high priority technologies to the Navy and Marine Corps in support of the Sea Strike, Sea Shield, Sea Basing, and ForceNet Naval Power 21 pillars as well as Enterprise and Platform Enabling Science and Technology requirements.</p> <p>The decrease from FY2010 to FY 2011 is due to the realignment of FNC efforts to other PE's. The increase from FY2011 to FY2012 is due to increase in the Modular Photonics Mast Housing and Compact Low Light Level SWIR Video Camera FNC efforts.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued efforts to assess technology options for the development of applied FNC technologies packaged into deliverable S&T products. - Initiated development of technologies to reduce the load of warfighters by 1) reducing the weight of and improving the capability of the day/night weapon sight, 2) eliminating battery incompatibility, and 3) providing GUI-based software for tradeoff analyses based on Military Operational Posture. (Concurrent funding provided by PE 0603236N) - Initiated research to develop technology to reduce fabrication and life cycle costs of SSN/SSGN next generation photonics mast and to improve SSN surface situational awareness through faster image acquisition rates, improve range performance under adverse weather conditions and improve autonomous detection and classification. (Concurrent funding provided by PE 0603236N) <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. 		12.405	11.593	12.615

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Realign development of technologies to reduce the load of warfighters by 1) reducing the weight of and improving the capability of the day/night weapon sight, 2) eliminating battery incompatibility, and 3) providing GUI-based software for tradeoff analyses bases on Military Operational Posture to PEs 0602131M, 0603236N and 0603640M.</p> <p>- Continue efforts to assess technology options for the development of applied research for FNC technologies, to include preparation of detailed technology specifications and performance metrics, packaged into deliverable S&T products for enabling capabilities structured to close naval capability gaps.</p> <p>FY 2012 Plans:</p> <p>- Continue all efforts of FY 2011 less those noted as completed above.</p>				
<p>Title: MANPOWER/PERSONNEL</p> <p>Description: These technologies enhance the Navy's ability to select, assign, and manage its people by responding to a variety of requirements, including: managing the force efficiently and maintaining readiness with fewer people and smaller budgets; providing warfighting capabilities optimized for low-intensity conflict and littoral warfare; and operating and maintaining increasingly sophisticated weapons systems while managing individual workload and supporting optimal manning.</p> <p>This activity further supports the warfighter by providing enhanced capabilities by designing affordable user-centered systems that are efficient, easy to use, and provide required mission capabilities at lowest lifecycle costs. Such systems will be optimally designed for the right number and types of personnel, requiring minimum training while providing high skills retention.</p> <p>The reduction in funding from FY 2011 to FY 2012 reflects realignment of projects by the program sponsor; OPNAV N1.</p> <p>FY 2010 Accomplishments:</p> <p>- Continued research into decision support tools to better enable meeting the goals of the Navy's evolving strategies for personnel and manpower management and especially to evaluate manpower alternatives.</p> <p>- Continued research into intelligent agents to empower total force members to make training and assignment choices that enhance their careers and meet personal goals.</p> <p>- Continued research into agent-based simulations for enhancing the effectiveness of behaviorally-based predictive models.</p>		2.569	2.391	2.194

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiated research into supporting technologies for a prototype decision support system to enable community management program analysts to better forecast and assess the effects of active duty enlisted and officer behavior resulting from both proposed and current policy decisions.</p> <p>FY 2011 Plans: N/A</p> <p>FY 2012 Plans: N/A</p>				
<p>Title: MEDICAL TECHNOLOGIES</p> <p>Description: This program supports the development of field medical equipment, diagnostic capabilities and treatments; technologies to improve warfighter safety and to enhance personnel performance under adverse conditions; and systems to prevent occupational injury and disease in hazardous, deployment environments. Navy investment in these areas is essential because Navy/USMC mission needs are not adequately addressed by the civilian sector or other Federal agencies. For example, civilian emergency medicine does not address casualty stabilization during long transit times to definitive care. The National Institutes of Health (NIH) focuses on the basic science of disease processes and not applied research related to development. Programs are coordinated with other Services through the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee, and Joint Technical Coordinating Group (JTTCG) process, to prevent duplication of effort. This project funds the Force Health Protection FNC that will provide technology options for future Navy and Marine Corps capabilities and supports the "Sea Warrior" component of the Naval Transformation Roadmap, medical logistics aspects of "Sea Basing" and expeditionary force medical support associated with "Sea Strike".</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued program to develop enhanced First Responder capabilities. - Continued program to develop enhanced Forward Resuscitative Surgical capabilities. - Continued program to develop enhanced En Route Care capabilities. - Continued efforts to mitigate the effects of environmental and other threats to health. - Continued program, with Army, in regenerative medicine (Armed Forces Institute for Regenerative Medicine (AFIRM)). - Continued efforts to reduce operational injuries. - Continued efforts to reverse NIHL. 		17.259	18.092	19.483

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602236N: <i>Warfighter Sustainment Applied Res</i>	PROJECT 0000: <i>Warfighter Sustainment Applied Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued studies on decompression sickness (DCS) and arterial gas embolism (AGE), to include novel approaches to the prevention, detection and treatment of DCS/AGE, particularly by nonrecompressive methods. - Continued efforts to develop prophylactic agents preventing hyperbaric oxygen toxicity. Prolonged exposure to hyperbaric oxygen can be toxic to lungs, nervous system and eyes. - Continued efforts to assess the impact of thermal (i.e., heat and cold) stress on operational performance. Underwater thermal extremes can affect diver performance and alter risk of incurring decompression sickness. - Continued studies related to optimization of diver performance. Operational performance in the undersea environment can be hampered by a variety of environmental stressors. - Continued studies related to optimization of submariner health and performance. Submarine crewmembers are exposed to a variety of unique stressors including prolonged deployments, effects of altered diurnal rhythms, non-standard breathing gases, lack of sunlight, etc that can impact health and performance. - Continued studies related to biomedical effects of underwater sound. Military divers must operate safely and effectively in potentially complex underwater sound fields. - Continued efforts for "stress inoculation" to mitigate the impact of exposure to stressful combat environments prior to deployment - Continued efforts to develop advanced technologies to support Rapid Blood Treatment. (Previously identified as First Responder in FY09 in this activity) - Continued efforts to develop advanced technologies to support Warfighter Restoration. (previously identified as FRSS/ERSS in FY09 in this activity). - Continued efforts to develop advanced technologies to support Warfighter Restoration. (Previously identified as En Route Care in FY09 in this activity). - Continued efforts to model accelerated head and neck injuries; operational injuries. - Completed safety studies and analysis of compartmental shipboard heat exposure levels; environmental threats to health. - Initiated research to reduce noise at the source, i.e. jet engine quieting and flight deck noise reduction. - Initiated research to study the incidence and susceptibility of Noise Induced Hearing Loss (NIHL) and tinnitus, and to evaluate mitigation strategies. - Initiated research in medical prevention and treatment of NIHL and tinnitus (ringing in the ears). - Initiated research to improve personal protective equipment technology. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602236N: <i>Warfighter Sustainment Applied Res</i>	PROJECT 0000: <i>Warfighter Sustainment Applied Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiated research to develop a Human Injury and Treatment (HIT) model for predicting outcomes of personnel exposure to shipboard damage.</p> <p>- Initiated and develop mature force health protection technologies that support naval requirements identified within the Navy and Marine Corps.</p> <p>FY 2011 Plans:</p> <p>- Continue all efforts of FY 2010 less those noted as completed above.</p> <p>- Initiate development of multifunctional blood substitute program.</p> <p>- Initiate program in hypothermics.</p> <p>FY 2012 Plans:</p> <p>- Continue all efforts of FY 2011.</p> <p>- Initiate Jet Noise Reduction Project, Noise Induced Hearing Loss Program, to utilize analytical modeling and simulation tools anchored by experiment to develop and assess solutions enabling mitigation of jet induced noise from high performance tactical aircraft. (NIHL Transitions from PE 0603729N in FY 2012)</p> <p>- Initiate development of the Automated Critical Care System (ACCS).</p> <p>- Initiate program in hypothermics.</p>				
<p>Title: SEA BASING TECHNOLOGIES</p> <p>Description: This activity includes development and advancement of technologies to support Seabasing. Areas include: advanced hull forms, propulsion, and materials to support high speed, shallow draft, and beachable connectors; innovative connector interface and transfer technologies; advanced wave and position sensors and autonomous controls to support vessel to vessel interfaces; and autonomous conveyance systems to support automated and integrated warehousing.</p> <p>The decrease in funding from FY 2011 to FY 2012 is due to the completion of T-CRAFT scale technology demonstration articles.</p> <p>FY 2010 Accomplishments:</p> <p>- Continued Sense and Respond Logistics (S&RL) research in: battlefield fuel management; decision support systems for S&RL; emergent intelligence/intelligent agents for S&RL; and advanced sensors/processes for S&RL.</p> <p>- Continued efforts for the development of technologies supporting automated shipboard assembly of air-delivered weapons</p> <p>- Continued multiple INP contracts for preliminary designs in the area of a T-CRAFT and a Rapidly</p>		21.388	24.127	7.243

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602236N: <i>Warfighter Sustainment Applied Res</i>		PROJECT 0000: <i>Warfighter Sustainment Applied Res</i>
B. Accomplishments/Planned Programs (\$ in Millions)				
				FY 2010
				FY 2011
				FY 2012
<p>Deployable Seabasing Stable Transfer Platform.</p> <ul style="list-style-type: none"> - Continued the construction of a scaled model of a Rapidly Deployable Stable Transfer Platform demonstrator. - Continued a second evaluation of potential Seabasing INP efforts. - Initiated the down-selection of Sense and Respond Logistics Information Architecture prototype development. - Completed the down-selection of T-CRAFT designs for prototype and component development. - Completed T-CRAFT model testing and evaluation. - Initiated contract design and develop shipyard building plans for T-CRAFT prototype and component construction. - Initiated procurement of components and material to support T-CRAFT prototype construction. - Initiated development of agent based decision support and logistics planning algorithms. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete T-CRAFT scale technology demonstration articles. - Initiate development of a detailed technology demonstration plan. - Initiate T-CRAFT technology demonstration component construction. - Initiate the modeling and simulation of first article prototypes of Sense and Respond demonstration systems; Logistics Common Operating Picture, Decision Support Tools, Prognostics Embedded Health Management, Macro Fuel Quantity Management, Portable Fuel Quality Analysis. - Initiate development of the Connectors and the Sea Base Enabling Capability including Environmental Ship Motion Forecasting and Advanced Mooring System Technologies. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete testing and integration of Sense & Response Logistics Common Operating Picture. - Initiate model testing of Advanced Mooring System and planning of at-sea demonstration. 				
Title: TRAINING TECHNOLOGIES				11.698
Description: Training technologies enhance the Navy's ability to train effectively and affordably in classroom settings, in simulated environments, while deployed, and to operate effectively in the complex, highstress, information-rich and ambiguous environments of modern warfare such as asymmetric warfare. Technology development responds to a variety of requirements, including providing more affordable				9.889
				8.951

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602236N: <i>Warfighter Sustainment Applied Res</i>	PROJECT 0000: <i>Warfighter Sustainment Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>approaches to training and skill maintenance. Improved training efficiency and cost-effectiveness is achieved by applying operations research, modeling and simulation, and instructional, cognitive, and computer sciences to the development, delivery, evaluation, and execution of training.</p> <p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued development of optimized strategies for performance aiding and training - Continued development of virtual technologies for warfare training application. - Continued research and assessment of advanced gaming technology for enhanced training. - Continued research into game based training to more effectively enable better warfighter understanding of languages and cultures to enhance their regional expertise. - Continued creation and conduct of experiments to validate automated performance assessment and after action reviews. - Continued a systematic program of applied research addressing unanswered questions regarding effective instructional strategies in artificially intelligent tutoring. - Continued research on software tools to facilitate building natural language tutorial dialogs for artificially intelligent tutoring. - Continued task to develop multi-agent based architectures for modeling human behavior, improve techniques for human cognitive and behavioral modeling, and create highly realistic simulated teammates. - Continued field studies and user tests evaluating new features and job aiding tools. - Initiated research to create computational models of human behavior in selected non-Western environments that reflect the dominant cultural, social, ethnic, and economic determinants of behaviors, attitudes, and beliefs of individuals, groups, and organizations operating in these environments, and exploit these models to forecast responses to our actions and those of others attempting to exert influence in these environments. - Initiated research into computational neuron-models in the design of training systems - Initiated the integration of cognitive and neuron-computational models of human learning. - Initiated research into intelligent tutoring systems for adaptive competency in submarine bridge team and surface ship combat information center trainers. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 except those noted as complete above. - Complete development of optimized strategies for performance aiding and training - Complete development of virtual technologies for warfare training application. - Complete research and assessment of advanced gaming technology for enhanced training. - Complete creation and conduct of experiments to validate automated performance assessment and after action reviews. 			
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602236N: <i>Warfighter Sustainment Applied Res</i>	PROJECT 0000: <i>Warfighter Sustainment Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>- Initiate research to identify the perceptual cues in the urban and dense infrastructure and environment that may improve warfighter performance.</p> <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 except those noted as complete above. - Complete research into game based training to more effectively enable better warfighter understanding of languages and cultures to enhance their regional expertise. - Initiate development of simulation technologies to deliver safe, effective, and balanced live-virtual-constructive training to achieve meaningful training and readiness levels without the costs involved with only using live assets. - Initiate research to determine the improvement in recruit classification provided by the addition of measures of fluid intelligence and working memory - Initiate research to understand the structural relations among the latent variables of short-term memory, working memory, executive attentional control, and fluid intelligence - Initiate research on techniques to improve warfighter adaptability and resilience. 			
Accomplishments/Planned Programs Subtotals	99.740	113.724	101.205

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0603236N: <i>WARFIGHTER SUSTAINMENT ADVANCED TECHNOLOGY</i>	38.414	50.625	56.311	0.000	56.311	63.410	43.106	35.585	17.278	0.000	304.729
• 0603729N: <i>WARFIGHTER PROTECTION ADVANCED TECHNOLOGY</i>	8.603	12.463	12.471	0.000	12.471	13.580	12.359	5.083	2.493	0.000	67.052

D. Acquisition Strategy
Not applicable.

E. Performance Metrics
As discussed in Section A, there are a significant number of varied efforts within this PE. For the most part these efforts support the FNC program. As such, each is monitored at two levels. At the lowest level each is measured against both technical and financial milestones on a monthly basis. Annually each FNC and its projects are reviewed in depth for technical and transition performance by the Chief of Naval Research against goals which have been approved by the Navy.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE	PROJECT
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	PE 0602236N: <i>Warfighter Sustainment Applied Res</i>	0000: <i>Warfighter Sustainment Applied Res</i>

The FNC managers conduct routine site visits to performing organizations to assess programmatic and technical progress and most projects conduct an annual or biannual review by an independent board of visitors who assess the level and quality of the Science and Technology (S&T) basis for the project.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE					PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>			PE 0602236N: <i>Warfighter Sustainment Applied Res</i>					4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	5.591	-	-	-	-	-	-	-	-	0.000	5.591

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	5.591	-	-
Accomplishments/Planned Programs Subtotals	5.591	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602236N: <i>Warfighter Sustainment Applied Res</i>				9999: <i>Congressional Adds</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	16.257	-	-	-	-	-	-	-	-	0.000	16.257

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
<p>Congressional Add: Advanced Composite Maritime Manufacturing</p> <p>FY 2010 Accomplishments: This effort addressed characterization and modeling, process innovation and tooling, design and testing of advance composites integrated into a virtual simulation environment with a focus on Prepreg Tape Placement process and Autoclave Prepreg processing.</p>	1.593	-
<p>Congressional Add: Assistive Technologies for Injured Service Members</p> <p>FY 2010 Accomplishments: This effort advanced noninvasive technologies to compensate for sensory (vision, balance) and mobility deficits.</p>	0.797	-
<p>Congressional Add: Biosensors for Defense Applications</p> <p>FY 2010 Accomplishments: This effort investigated emerging environmental factors in inflammatory and cellular stress responses. The objective of this effort was to measure and characterize the inflammatory and cell stress response of relevant cell systems to key emergent environmental chemical conditions with the goal of defining relevant mechanisms.</p>	0.797	-
<p>Congressional Add: Composite Materials Enhancements through Polymer Science R&D</p> <p>FY 2010 Accomplishments: This effort investigated composite matrix technology for lighter weight, stronger, stiffer, higher toughness materials providing for more accurate property predictions, and accurate service life prediction.</p>	5.099	-
<p>Congressional Add: Managing and Extending DoD Asset Lifecycles</p> <p>FY 2010 Accomplishments: This effort developed technologies to; extend the useful life of facilities and equipment, yield a reduction in maintenance manpower, and contribute to DoD's knowledge base to improve mission capability rates while decreasing life cycle costs by providing an examination and evaluation of corrosion-resistant hybrid coatings for facilities and aircraft as well as investigation and development of concepts for decentralized netcentric decision support tools.</p>	1.593	-
<p>Congressional Add: Nanotechnology for Anti-Reverse Engineering</p>	2.390	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602236N: <i>Warfighter Sustainment Applied Res</i>	PROJECT 9999: <i>Congressional Adds</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011
<i>FY 2010 Accomplishments:</i> This effort provided cost effective active and passive Inner Volume protections linked to firmware and software Anti-Tamper (AT). The AT tools and techniques at each layer provide innovative features and characteristics that will add value to the DoD's AT toolbox of techniques .		
<i>Congressional Add:</i> Productization of Anti-fouling and Fouling Release Coating Systems	2.788	-
<i>FY 2010 Accomplishments:</i> This effort provided for development of a new class of environmentally friendly antifouling coatings for use on U. S. Navy vessels, which may result in reduced maintenance and achieving 12 years between dry-docking of vessels.		
<i>Congressional Add:</i> ENV SAFE DECON AGENTS	1.200	-
<i>FY 2010 Accomplishments:</i> This effort support the development and test environmentally safe decontaminating agents for bio-defense, biomedical, and environmental use.		
Congressional Adds Subtotals	16.257	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602271N: <i>Electromagnetic Systems Applied Research</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	72.192	83.902	108.329	-	108.329	104.339	102.059	106.575	109.454	Continuing	Continuing
0000: <i>Electromagnetic Systems Applied Research</i>	66.012	83.902	108.329	-	108.329	104.339	102.059	106.575	109.454	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	1.400	-	-	-	-	-	-	-	-	0.000	1.400
9999: <i>Congressional Adds</i>	4.780	-	-	-	-	-	-	-	-	0.000	4.780

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

The Electromagnetic Systems Applied Research Program addresses technology needs associated with Naval platforms for new capabilities in EO/IR Sensors, Surveillance, Electronic Warfare, Navigation, Solid State Electronics, Vacuum Electronics Power Amplifiers, and Nanoelectronics. The program supports development of technologies to enable capabilities in Missile Defense, Directed Energy, Platform Protection, Time Critical Strike, and Information Distribution. This program directly supports the Department of Defense Joint Warfighter Plan and the Defense Technology Area Plans. Activities and efforts within this Program have attributes that focus on enhancing the affordability of warfighting systems. The program also provides for technology efforts to maintain proactive connectivity and collaboration between Department of the Navy (DON) Science and Technology (S&T) and Joint, Navy, and Marine Corps commands worldwide.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602271N: <i>Electromagnetic Systems Applied Research</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	69.327	83.902	80.672	-	80.672
Current President's Budget	72.192	83.902	108.329	-	108.329
Total Adjustments	2.865	-	27.657	-	27.657
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	3.636	-			
• SBIR/STTR Transfer	-1.700	-			
• Program Adjustments	-	-	27.618	-	27.618
• Section 219 Reprogramming	0.930	-	-	-	-
• Rate/Misc Adjustments	-	-	0.039	-	0.039
• Congressional General Reductions Adjustments	-0.001	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

Congressional Add: *Gallium Nitride (GaN) Power Technology*

Congressional Add: *National Initiatives for Applications of Multifunctional Materials*

Congressional Add: *SiC Wafer Production*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.593	-
	1.992	-
	1.195	-
Congressional Add Subtotals for Project: 9999	4.780	-
Congressional Add Totals for all Projects	4.780	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602271N: <i>Electromagnetic Systems Applied Research</i>				0000: <i>Electromagnetic Systems Applied Research</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>Electromagnetic Systems Applied Research</i>	66.012	83.902	108.329	-	108.329	104.339	102.059	106.575	109.454	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project addresses technology opportunities associated with Naval platforms for new capabilities in EO/IR Sensors, Surveillance, Electronic Warfare, Navigation, Solid State Electronics, Vacuum Electronics Power Amplifiers, and Nanoelectronics. The project supports development of technologies to enable capabilities in Missile Defense, Directed Energy, Platform Protection, Time Critical Strike, and Information Distribution. This project directly supports the Department of Defense Joint Warfighter Plan and the Defense Technology Area Plans. Activities and efforts within this program have attributes that focus on enhancing the affordability of warfighting systems. The program also provides for technology efforts to maintain proactive connectivity and collaboration between Department of the Navy (DON) Science and Technology (S&T) and Joint, Navy, and Marine Corps commands worldwide.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: ELECTRONIC AND ELECTROMAGNETIC SYSTEMS</p> <p>Description: This R2 activity is devoted to mid-term technology development in close concert with programs of record. The products of these efforts are expected to transition at the end of their schedule into the associated program of record. These Future Naval Capability (FNC) Enabling Capabilities (EC's) span across the Electronics, EW, Radar, Communications, and other technology areas supporting Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR). This R2 activity also appears in PE 0603271N. For Enabling Capabilities (EC) receiving funding from both PE's the PE 0602271N portion is generally focused on component design and development while the funding from PE 0603271N is focused on integration and demonstration. The specific objectives of the current EC's are:</p> <p>a) Next Generation Airborne Electronic Attack: Develop and demonstrate advanced capability Airborne Electronic Attack (AEA) sub-systems (e.g., broadband exciters, power amplifiers, and transmit arrays) that provide Suppression of Enemy Air Defenses (SEAD), deliver Non-Kinetic Fires, counter Integrated Air Defense Systems (IADS), and provide suppression of Command, Control & Communications (C3) links and data networks.</p> <p>b) Countermeasures Technologies for Anti-Ship Cruise Missiles (ASCM) and Anti-Ship Ballistic Missiles (ASBM) Defense: Improve ship survivability by disrupting the terminal engagement phase of hostile anti-ship cruise and ballistic missiles, including improvements to both onboard (Enhanced Surface Electronic Warfare Improvement Program,(SEWIP)) and offboard (Nulka) radio frequency (RF) Electronic Attack systems.</p>	20.957	30.700	36.652

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602271N: <i>Electromagnetic Systems Applied Research</i>	PROJECT 0000: <i>Electromagnetic Systems Applied Research</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>c) Next Generation Countermeasure Technologies for Ship Missile Defense: Develop and demonstrate the fundamental technologies required to conduct next generation, persistent Electronic Warfare (EW) in support of ship, sea base, and littoral force missile defense operations in a distributed, coordinated manner across the entire battlespace.</p> <p>d) Long Range Detection and Tracking: Develop capability for simultaneous full volume radar coverage of contacts at long ranges and in a dense contact environment.</p> <p>e) Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms: Develop and demonstrate electronics components technologies using wide bandgap semiconductors, mixed signal analog and digital, RF, microwave, millimeter wave and associated passive components thus enabling high efficiency transmitter element chains for arrays.</p> <p>f) Affordable Common Radar Architecture: Develop a common affordable, scalable, open radar architecture that provides affordable capability improvements and addresses total ownership cost challenges for 5 different radars.</p> <p>g) Low Cost over the Horizon Communications, Satellite Communications (SATCOM) and Line of Sight (LOS) Apertures: Develop technologies that provide the tools to implement a wideband tactical communications infrastructure. Developments will include techniques for LOS relay and routing using airborne platforms, as well as a SATCOM on-the-move capability for United States Marine Corps (USMC) tactical ground vehicles. Also included are technologies for pointing and tracking of airborne platforms, open architecture radio technologies, communications security (COMSEC), networking, and airborne apertures necessary for airborne relay and routing. Further developments include techniques for integrating multiple shipboard apertures in a limited space, cosite mitigation and the investigation of digital radio technologies that permit digitization at the aperture itself.</p> <p>h) SATCOM Vulnerability Mitigation: Develop technologies for mitigating SATCOM vulnerabilities using a wideband airborne and air-to-surface infrastructure. Technologies include approaches for development of ultra-low cost phased arrays and techniques for mitigating multi-path and scintillation on communications links. Architecture and application development will include surface-to-air communications in the 14-17 gigahertz (GHz) band, and air-to-air communications in the millimeter wave bands. Additionally, advanced techniques for the use of the ultra high frequency (UHF) spectrum will be developed which include beam forming techniques and alternative waveform designs that are used to support high bandwidth infrastructure establishment and control.</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602271N: <i>Electromagnetic Systems Applied Research</i>	PROJECT 0000: <i>Electromagnetic Systems Applied Research</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>i) Radar Electronic Attack Protection (REAP): Develop single platform precision passive electronic support measure (ESM) and electronic protection (EP) techniques and technology to counter hostile use of modern electronic attack (EA) self protection jammers.</p> <p>j) Data Exfiltration Nanosatellite Innovative Space Enabler (DENISE)(formerly known as Global Applications for Data Exfiltration(GLADDEX)): Develop a nano-sat satellite bus with all its requisite structural, power, thermal, control, and separation subsystems and a nano-satellite compatible payload and ground terminal for monitoring and relay of unattended sensor data for global situational awareness.</p> <p>k) Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) 3.3: Develop integrated RF communications and RF jammer capability that addresses the electromagnetic interference (EMI) issue to enable interoperability.</p> <p>l) Wide Area Surgical and Persistent Surveillance (WASPS) Capabilities For Tier 2/3 UAVs: Develop and integrate enhanced capability interactive autonomous, small, lightweight EO/IR SAR, SIGINT sensors and integrate into an upgraded smaller lightweight, stabilized gimbal designed for 24/7 persistent surveillance applications.</p> <p>m) Submarine Survivability-Electronic Warfare: Develop and demonstrate technologies that will provide submarines an EA capability against surveillance radar systems through EW payloads integrated with submarine masts, as well as networked offboard platforms. These capabilities will improve the submarine's survivability in a hostile RF environment by providing a non-kinetic strike capability against enemy Intelligence, Surveillance and Reconnaissance (ISR) sensors</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p>The increase from FY 2010 to FY 2011 is associated with the following:</p> <ul style="list-style-type: none"> - Initiation of the two new Enabling Capabilities: the Radar Electronic Attack Protection (REAP) and the Data Exfiltration Nanosatellite Innovative Space Enabler (DENISE). - Additional emphasis in two ongoing Enabling Capabilities: Countermeasures Technologies (Surface Electronic Warfare Improvement Program (SEWIP)) and the SATCOM Vulnerability Mitigation. - JCREW 3.3 research effort. <p>The increase from FY 2011 to FY 2012 is due to initiating EC programs include "Submarine Survivability - Electronic Warfare" and "Wide Area Surgical and Persistent Surveillance (WASPS) Capabilities For Tier 2/3 UAVs" and increased investment in JCREW.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p><i>FY 2010 Accomplishments:</i></p> <p>Next Generation Airborne Electronic Attack:</p> <ul style="list-style-type: none"> - Continued the development of RF technologies that support advances in receiver architecture, antenna performance, subsystem miniaturization, decoys and advanced signal processing. - Continued the Next Generation Airborne Electronic Attack (NGAEA) effort by conducting a requirements validation and technology assessment review. <p>Countermeasures Technologies for Anti-Ship Cruise Missiles (ASCM) and Anti-Ship Ballistic Missile (ASBM) Defense:</p> <ul style="list-style-type: none"> - Continued establishment of an industrial standard appropriate for the demonstration of greater than 106(>1E6) hour lifetime for RF life testing of Gallium Nitride (GaN) based Monolithic Microwave Integrated Circuits (MMICs) and devices, and began to apply this standard to state-of-the-art (SOA) MMICs and devices. - Continued the Enhanced Nulka Payload FNC effort by conducting a Transmitter and Receiver Technology Trade Space study. - Continued the Enhanced Surface Electronic Warfare Improvement Program (SEWIP) Transmitter FNC effort by conducting a Transmitter and Cooling Technology Trade Space study. <p>Next Generation Countermeasure Technologies for Ship Missile Defense:</p> <ul style="list-style-type: none"> - Initiated the Next Generation Countermeasures Technologies for Ship Missile Defense effort by development of techniques and technology for coordination of offboard surface/air EW payloads to achieve wide area protection for defense against anti-ship missiles. <p>Long Range Detection and Tracking:</p> <ul style="list-style-type: none"> - Continued demonstration of packaging techniques to provide cost reduction and affordability for modules, including component architecture, packaging, and scale of integration optimization. - Continued design and development of a X-Band Digital Array Radar (DAR). - Continued development of Maritime Classification and Identification modes for APY-6. - Continued development of full volume surveillance capability of the DAR advanced development model prototype. <p>Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms:</p> <ul style="list-style-type: none"> - Continued effort on Affordable Electronically Scanned Array Technology to include electronics component technologies supporting S-band radar, X-band radar and electronic attack. <p>Affordable Common Radar Architecture (ACRA):</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Initiated development of an Affordable Common Radar Architecture to improve supportability and performance of multiple legacy radars.</p> <p>Low Cost over the Horizon Communication, SATCOM and LOS Apertures:</p> <ul style="list-style-type: none"> - Continued development of technology to provide a set of apertures (LOS, Satellite Communications) and link electronics that are suitable for broad Naval applications. - Continued development of technology to provide open, programmable core terminal components applicable to multiple platforms to include airborne applications and Marine vehicles. - Continued development of low cost satellite, airborne and shipboard apertures; demonstrate components in laboratory and realistic field environments. <p>SATCOM Vulnerability Mitigation:</p> <ul style="list-style-type: none"> - Initiated wideband infrastructure architecture design and development, development of alternative waveforms and development of advanced techniques for use of the spectrum. - Initiated development of technology components (e.g., phased arrays/apertures, cosite and fade mitigation techniques, advanced high band (14-17 GHz) signal processing radios) needed to support a wideband airborne infrastructure. <p>FY 2011 Plans:</p> <p>Next Generation Airborne Electronic Attack:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>Countermeasures Technologies for Anti-Ship Cruise Missiles (ASCM) and Anti-Ship Ballistic Missile (ASBM) Defense:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate redesign and fabrication of a new cooling method due to an increase in the junction temperature from DARPA's Government Furnished Equipment (GFE) amplifier. - Initiate redesign and fabrication of a new amplifier mounting design which is required to accommodate the reduction of amplifier temperatures. <p>Next Generation Countermeasure Technologies for Ship Missile Defense:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>Long Range Detection and Tracking:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms: - Continue all efforts of FY 2010.</p> <p>Affordable Common Radar Architecture (ACRA): - Continue all efforts of FY 2010.</p> <p>Low Cost over the Horizon Communication, SATCOM and LOS Apertures: - Complete all efforts of FY 2010.</p> <p>SATCOM Vulnerability Mitigation: - Continue ramp up of all architecture development efforts, and multi-year development efforts for waveforms and technology components cited above which were initiated in FY 2010.</p> <p>Radar Electronic Attack Protection (REAP): - Initiate a Network "Sentric" Electronic Protection (EP) capability by developing hardware, software and algorithms to achieve a multi-platform networked EP. - Initiate the Identification and Defeat of Electronic Attack Systems (IDEAS) FNC effort by developing single platform precision passive electronic support measure (ESM) and EP techniques and technology to counter hostile use of modern electronic attack self protection jammers.</p> <p>Data Exfiltration Nanosatellite Innovative Space Enabler (DENISE): - Initiate the development of a spacecraft bus structure, thermal, power, control, and command/telemetry systems for 3-axis, maneuverable, 30cm cube, 10kg, 10watt orbital average nano-satellite. - Initiate the development of launch dispensing separation mechanisms. - Initiate the development of a multi-function Data-Ex payload and ground terminal for reception of low rate (<9600 bits/sec) VHF - UHF transmissions.</p> <p>Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) 3.3: - Initiate JCREW 3.3 architecture analysis and design. - Initiate JCREW 3.3 component development.</p> <p><i>FY 2012 Plans:</i></p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>Next Generation Airborne Electronic Attack: - Complete all efforts of FY 2011.</p> <p>Countermeasures Technologies for Anti-Ship Cruise Missiles (ASCM) and Anti-Ship Ballistic Missile (ASBM) Defense: - Continue all efforts of FY 2011. - Complete the Enhanced Nulka Payload FNC effort.</p> <p>Next Generation Countermeasure Technologies for Ship Missile Defense: - Continue all efforts of FY 2011.</p> <p>Long Range Detection and Tracking: - Complete demonstration of full volume surveillance capability of the DAR advanced development model prototype</p> <p>Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms: - Continue all efforts of FY 2011.</p> <p>Affordable Common Radar Architecture (ACRA): - Continue all efforts of FY 2011 less those noted as completed above.</p> <p>SATCOM Vulnerability Mitigation: - Continue all efforts of FY 2011.</p> <p>Radar Electronic Attack Protection (REAP): - Continue all efforts of FY 2011.</p> <p>Data Exfiltration Nanosatellite Innovative Space Enabler (DENISE): - Continue all efforts of FY 2011.</p> <p>Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) 3.3: - Complete JCREW 3.3 architecture analysis and design and component development. - Initiate the Distributed Counter-RCIED FNC effort through algorithm development and assessment. - Initiate the Integrated Counter-RCIED EW (ICEW) FNC effort by starting component design and integration plans.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>Wide Area Surgical and Persistent Surveillance (WASPS) Capabilities For Tier 2/3 UAVs: - Initiate the development and integration of enhanced capability interactive autonomous, small, lightweight EO/IR SAR, SIGINT sensors and integrate into an upgraded smaller lightweight, stabilized gimbal designed for 24/7 persistent surveillance applications.</p> <p>Submarine Survivability-Electronic Warfare: - Initiate the Coherent Electronic Attack for Submarines (CEAS) FNC effort by commencing development of the compact EA payload and techniques for the multi-mission mast (MMM). - Initiate the Distributed Coherent Electronic Attack for Submarines (D-CEAS) FNC effort by commencing an assessment of current capabilities.</p>				
<p>Title: ELECTRONIC WARFARE TECHNOLOGY</p> <p>Description: The overarching objective of this activity is to develop technologies that enable the development of affordable, effective and robust Electronic Warfare (EW) systems across the entire electromagnetic spectrum that will increase the operational effectiveness and survivability of U.S. Naval units. Emphasis is placed on passive sensors and active and passive countermeasure (CM) systems that exploit and counter a broad range of electromagnetic threats. The focus is on maintaining near perfect real-time knowledge of the enemy; countering the threat of missiles against deployed Naval forces; precision identification and location of threat emitters; and development of technologies that have broad application across multiple disciplines within the EW mission area. This activity also includes developments to protect these technologies from external interference and modeling and simulation required to support the development of these technologies. Also included is technology development in support of the Integrated Distributed Electronic Warfare System (IDEWS) concept. The current specific objectives are:</p> <p>a) Sensors for the Purpose of Detection, Localization, and Identification of Hostile Signals of Interest: Develop sensors for the purpose of detection, localization, and identification of hostile signals of interest anywhere in the electromagnetic spectrum to provide autonomous and persistent Intelligence, Surveillance, and Reconnaissance (ISR) to forward deployed forces and detecting/identifying terrorists/hostiles and their communications networks.</p> <p>b) Components and Advanced Architectures/Signal Processing Designs: Develop components and advanced architectures/signal processing designs to ensure effective and reliable threat detection of hostile emissions in dense environments.</p> <p>c) Countermeasures and Techniques to Defeat Advanced Radio Frequency (RF) Guided Threats:</p>		17.048	23.311	37.212

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Develop countermeasures and techniques to defeat advanced RF guided threats to protect high value assets from advanced weapon attack, develop forward deployed jamming systems to negate advanced RF surveillance systems, and deny enemy usage of Global Positioning System (GPS) navigation.</p> <p>d) Countermeasures and Techniques to Defeat Advanced Electro-Optic/Infrared (EO/IR) Guided Threats: Develop countermeasures and techniques to defeat advanced EO/IR guided threats to protect high value assets from advanced weapon attack, disrupt and attack EO/IR ISR assets, and provide false/misleading information to hostile EO/IR targeting and tracking systems.</p> <p>e) Modeling and Simulation: Use modeling and simulation to assess the effectiveness of Electronic Attack (EA) engagements to develop an understanding of adversary threat characteristics to support countermeasures technique requirements/development and assess/predict engagement effectiveness to optimize combat system engagement resources.</p> <p>f) Electronic Protection from Electromagnetic Interference (EMI) and EA: Develop Electronic Protection (EP)/Electronic Counter-Countermeasures (ECCM) to prevent the disruption and denial of U.S. Naval RF and EO/IR sensors and systems from both unintentional EMI and intentional EA and permit unimpeded usage of the electromagnetic spectrum by U.S. and allied forces.</p> <p>g) Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW): Develop and demonstrate technologies to improve virtually all aspects of performance related to next generation JCREW equipment.</p> <p>h) Offboard/Unmanned Platforms - Electronic Warfare: Develop and demonstrate technologies that support the increased effectiveness of EW unmanned platforms.</p> <p>i) Integrated Distributed Electronic Warfare System (IDEWS) concept: Develop and demonstrate technologies that will enable the control of the electromagnetic (EM) spectrum over wide geographical areas, optimally utilizing all available off-board and on-board EW assets to provide synchronized and networked EW sensing and attack.</p> <p>j) Electronic Warfare (EW) Roadmap: Develop classified advanced electronic warfare technology in support of current and predicted capability requirements.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.

The increase from FY 2010 to FY 2011 is due to initiation of research to develop Countermeasures and Techniques to Defeat Advanced EO/IR Guided Threats.

The increase from FY 2011 to FY 2012 is due to increased emphasis and priority in research supporting the Sensors for the Purpose of Detection, Localization, and Identification of Hostile Signals of Interest, and Components and Advanced Architectures/Signal Processing Designs research objectives.

FY 2010 Accomplishments:

Sensors for the Purpose of Detection, Localization, and Identification of Hostile Signals of Interest:

- Continued technology development in the areas of Tactical Aircraft, Surface Ships, Submarines, Unmanned Aerial Vehicles (UAVs), and EW Enabling Technology.
- Continued the development of techniques to identify and exploit the processing vulnerability of passive location systems.
- Continued the development of techniques to identify and exploit the processing vulnerability of passive location systems.

Transferred from PE 0602271N Supporting Technologies.

- Continued the Digital Directional Correlator (DDC) effort by building and refining a more complete simulation of the correlator and determining via simulation and analysis the primary characteristics required for the system.
- Completed the DDC effort capable of detecting, identifying, and measuring the directional azimuth and elevation of all RF emitters (including frequency hoppers) within a 360 degree field of view in a single circular sweep.

Components and Advanced Architectures/Signal Processing Designs:

- Continued development of RF technologies that support advances in receiver architecture, antenna performance, subsystem miniaturization, decoys and advanced signal processing.
- Continued development of a novel approach to near real time active digital augmentation to improve the isolation of shipboard EW systems.
- Continued the Exploiting Non-Traditional Signals Using a Photonics Based Signal Processor effort by performing proof-of-concept demonstrations for the three main modes of operation for the spatial spectral optical materials when used for Electronics Support Measures (ESM) applications.
- Completed the Miniature 2-70 GHz Integrated Optical Channelizer (IOC) effort by fabricating and demonstrating the second generation IOC.

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Completed the Exploiting Non-Traditional Signals Using a Photonics Based Signal Processor effort that will rapidly and accurately detect and identify non-traditional RF signals including spread spectrum, frequency hopping, noise-like waveforms, and unintentional RF emissions.</p> <p>- Completed the Cueing Receiver for Faster EA Response Management effort by integrating the receiver into the Naval Post Graduate School's photonic, single-bit 1st order sigma-delta digital antenna to test and evaluate the new architecture's ability to digitize wideband signals directly at the antenna.</p> <p>- Completed the Antennas from VHF to THz effort by testing the final combo antenna from 0.03-110 GHz.</p> <p>- Initiated the Direction Finding of Low Probability of Intercept (LPI) Emitters effort by commencing digital algorithm development.</p> <p>Countermeasures and Techniques to Defeat Advanced RF Guided Threats:</p> <p>- Continued the investigation of Millimeter Wave (MMW) technologies to support the development of off board and onboard countermeasures.</p> <p>- Completed the development to assess the electronic protection capability of modern missiles using advanced processing and investigate the improvements needed to restore countermeasures effectiveness. Transferred from PE 0602271N Supporting Technologies.</p> <p>- Initiated the Concurrent Multi-Spectral RF Carrier Generator effort to develop a single-chip, low power multi-spectral RF jamming sub-system that has programmable and automatic random mode switching and nanosecond frequency hopping over 1-18 GHz.</p> <p>Countermeasures and Techniques to Defeat Advanced EO/IR Guided Threats:</p> <p>- Initiated efforts to Detect and Deny EO/IR ISR Systems by developing passive and active detection systems using advanced Focal Plane Array (FPA)-based sensors and multi-spectral laser transmitters.</p> <p>- Initiated efforts to Detect and Defeat Imaging IR sensors by developing laser-based countermeasures and advanced IR expendable decoys.</p> <p>Modeling and Simulation:</p> <p>- Completed the EW Tactical Decision Algorithms (TDA) for Satellite Communications effort by evaluating two atmospheric propagation models to assist in visualizing the impact of satellite communications on future planning and tactics.</p> <p>- Initiated the Real-Time EA Effectiveness Monitoring effort to assess the effectiveness in real-time of jamming an RF guided missile by exploiting the missile's RF transmission characteristics.</p> <p>- Initiated the Integrated Onboard/Offboard EA Effectiveness effort by starting investigation with offboard decoy waveforms and structured ship targets.</p> <p>Electronic Protection from EMI and EA:</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiated efforts for Electronic Protection of RF Sensors by developing passive and active techniques to adaptively process RF signals in EA denied and RF saturation environments.</p> <p>- Initiated efforts for Electronic Protection of EO/IR Sensors by developing passive and active techniques to adaptively filter EO/IR radiation in EA denied and EO/IR saturation environments.</p> <p>FY 2011 Plans: Sensors for the Purpose of Detection, Localization, and Identification of Hostile Signals of Interest: - Continue all efforts of FY 2010 less those noted as completed above.</p> <p>Components and Advanced Architectures/Signal Processing Designs: - Continue all efforts of FY 2010 less those noted as completed above. - Complete the Direction Finding of LPI Emitters effort by conducting field testing</p> <p>Countermeasures and Techniques to Defeat Advanced RF Guided Threats: - Continue all efforts of FY 2010 less those noted as completed above. - Complete the Concurrent Multi-Spectral RF Carrier Generator effort by fabricating and testing an RF carrier generator with the capability of generating up to 5 simultaneous asynchronous frequencies and controlled chaotic waveforms within 1-18GHz.</p> <p>Countermeasures and Techniques to Defeat Advanced EO/IR Guided Threats: - Continue all efforts of FY 2010. - Initiate the Multi-Wavelength Laser with Broad Spectrum Coverage effort by commencing quantum cascade (QC) and interband cascade (IC) chip design and fabrication in Band 4a. - Initiate the High Power Long Wave Infrared (LWIR) QC Lasers for Shipboard Infrared Countermeasures (IRCM) effort with device design and thermal modeling tasks. - Initiate the Layered Multi-band Obscurant effort by commencing numerical analysis to optimize the predicted performance of potential materials for macroparticle design and fabrication. - Initiate the Directed Energy Defeat of Multi-Mode Threats effort by measuring missile seeker interference effects.</p> <p>Modeling and Simulation: - Complete all efforts of FY 2010.</p> <p>Electronic Protection from EMI and EA:</p>				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Continue all efforts of FY 2010.</p> <p>FY 2012 Plans: Sensors for the Purpose of Detection, Localization, and Identification of Hostile Signals of Interest:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Initiate technology development in the area of network enabled coherent Electronic Warfare Support (ES). - Initiate technology development to detect and defeat passive sensing systems. - Initiate technology development in the area of coordinated coherent EA waveforms. - Initiate development in cross-platform EA techniques. - Initiate technology development in the area of wideband cueing receivers. <p>Components and Advanced Architectures/Signal Processing Designs:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Initiate technology development in components and architectures for ES payloads. - Initiate technology development in ES adaptive signal processing. - Initiate development in compact high power RF emulators. - Initiate technology development in the area of wideband distributed decoys and control. - Initiate technology development in the area of transmitters and EA techniques. - Initiate technology development in the areas of wideband critical receiver components and wideband adaptive RF signal processing. <p>Countermeasures and Techniques to Defeat Advanced RF Guided Threats:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Initiate technology development in the areas of wideband high power critical EA components, wideband EA techniques and technique generators, and millimeter wave high power transmitters. <p>Countermeasures and techniques to Defeat Advanced EO/IR Guided Threats:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 <p>Modeling and Simulation:</p> <ul style="list-style-type: none"> - Initiate technology development in the area of advanced architectures for modeling and simulation of networked EW assets. <p>Electronic Protection from EMI and EA:</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Continue all efforts of FY 2011.</p> <p>- Initiate technology development in the area of advanced architectures for modeling and simulation of networked EW assets.</p> <p>Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW):</p> <p>- Initiate development of technologies to improve capabilities and effectiveness of JCREW equipment.</p> <p>Offboard/Unmanned Platforms - Electronic Warfare:</p> <p>- Initiate technology development in the area of autonomous control, high efficiency engines and EW payloads suitable for use in offboard and unmanned platforms.</p> <p>Integrated Distributed Electronic Warfare System (IDEWS) concept:</p> <p>- Initiate technology development in the area of networked-enabled coordinated and spatially distributed EW.</p> <p>Electronic Warfare (EW) Roadmap:</p> <p>- Initiate development of classified advanced electronic warfare technology in support of current and predicted capability requirements.</p>				
<p>Title: EO/IR SENSOR TECHNOLOGIES</p> <p>Description: The overarching objective of this thrust is to develop technologies that enable the development of affordable, wide area, persistent surveillance optical architectures, day/night/adverse weather, adaptable, multi-mission sensor technology comprised of optical sources, detectors, and signal processing components for search, detect, track, classify, identify (ID), intent determination, and targeting applications and includes developments to protect these technologies from external interference. Also included are modeling and simulation required to support the development of these technologies. Efforts will also include the development of optical RF components, infrared technologies including lasers and focal plane arrays using narrow bandgap semiconductors. The current specific objectives are:</p> <p>a) Optically Based Terahertz (THz) and Millimeter Wave Distributed Aperture Systems: Develop optically based terahertz (THz) and millimeter wave distributed aperture systems for imaging through clouds, fog, haze and dust on air platforms.</p> <p>b) Wide Area Optical Architectures: Develop wide area optical architectures for persistent surveillance for severely size constrained airborne applications.</p>		7.053	7.324	5.888

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>c) High Power Laser Sources: Develop high power laser sources for countermeasure and active imaging applications.</p> <p>d) Dynamic, Adaptable Wide Field-of-View (WFOV)/Narrow Field-of-View (NFOV) Surveillance and Sensor Technology: Develop dynamic, adaptable WFOV/NFOV surveillance and sensor technology for airborne surveillance, identification, and targeting applications.</p> <p>e) Non-cryogenically Cooled Infrared Photon Detectors: Develop non-cryogenically cooled infrared photon detectors for compact sensors on severely power constrained platforms.</p> <p>f) UAV Deployable Infrared (IR) Sensor Payloads: Develop UAV deployable EO/IR sensor payloads for persistent surveillance missions.</p> <p>g) Hyperspectral sensors and processing: Develop visible, shortwave IR, mid-wave IR, and long-wave IR hyperspectral sensors, along with processing algorithms to detect anomalies and targets.</p> <p>h) Coherent Laser Radar (LADAR): Develop and improve components for LADAR applications including fiber lasers, coherent focal planes, and advanced processing.</p> <p>i) Autonomous and Networked sensing: Develop algorithms and processing that supports autonomous sensing for UAV platforms and that supports networked sensing over multiple sensors and/or sensor platforms.</p> <p>The decrease from FY 2011 to FY 2012 is associated with reduced efforts in EO/IR Sensor Technologies.</p> <p>In FY 2010, research formerly funded and justified in the Navigation, EO/IR and Sensor Technologies Activity in PE 0602114N is being consolidated into this PE. Funding levels associated with the consolidated efforts are consistent with prior year totals.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p>FY 2010 Accomplishments: Optically Based Terahertz (THz) and Millimeter Wave Distributed Aperture Systems:</p>				

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued to perform field demonstration and testing of 94 gigahertz (GHz) passive millimeter wave (MMW) imager. Transferred from PE 0602114N. - Continued the development of techniques to combine current EO/IR technology and recent findings on the characteristics of the eye to classify and identify optical devices and individuals in real time at militarily significant ranges. Transferred from PE 0602114N. - Continued the development of a process to detect hostile camouflaged or hidden targets in shadows and diverse backgrounds of militarily challenging environments. Transferred from PE 0602114N. - Completed the development of signal processing techniques to improve situational awareness and autonomous detection of hostile fire events in a dynamic urban clutter environment. Transferred from PE 0602114N. - Completed the development of an active optics system that can survey a wide area and instantly, nonmechanically zoom-in on an area of interest for target tracking/identification. Transferred from PE 0602114N. - Initiated miniaturization and modularization of MMW imaging system components for small platform systems. <p>Wide Area Optical Architectures:</p> <ul style="list-style-type: none"> - Continued development of ultra-high-sensitivity detectors suitable for use in focal plane arrays (FPAs) for the Shortwave Infrared (SWIR) spectral band. Transferred from PE 0602114N. - Continued development of mid and long wave IR focal plane arrays using graded-bandgap Wtype-II superlattices with much higher detectivity than state-of-the-art Mercury Cadmium Telluride (HgCdTe,MCT) FPAs. Transferred from PE 0602114N. - Completed field and flight testing of foveated zoom imager. Transferred from PE 0602114N - Completed system integration and test of optically agile zoom imager. Transferred from PE 0602114N. - Initiated design of read-out integrated circuits for temporally adaptive focal plane arrays. - Initiated development of spectrally agile visible, near-infrared, short-wave infrared and midwave infrared imaging technology. - Initiated integration of optically and temporally adaptable imaging technologies into sensor for networked persistent surveillance system. <p>High Power Laser Sources:</p> <ul style="list-style-type: none"> - Completed development of high power fiber lasers in MWIR (2-5 1/4m) based upon highly nonlinear IR transmitting chalcogenide photonic crystal fibers. Transferred from PE 0602114N. <p>FY 2011 Plans: Optically Based Terahertz (THz) and Millimeter Wave Distributed Aperture Systems: - Continue all efforts of FY 2010 less those noted as completed above.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<ul style="list-style-type: none"> - Complete demonstration and testing of 94 GHz passive MMW imaging system. - Complete the development of techniques to combine current EO/IR technology and recent findings on the characteristics of the eye to classify and identify optical devices and individuals in real time at militarily significant ranges. - Complete the development of a process to detect hostile camouflaged or hidden targets in shadows and diverse backgrounds of militarily challenging environments. - Initiate integration of spectrally agile multi-band sensors into integrated system for use in persistent and time critical surveillance. - Initiate processing architecture for data analysis and fusion of multi-spectral images. <p>Wide Area Optical Architectures:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Complete effort to develop ultra-high-sensitivity detectors suitable for use in focal plane arrays (FPAs) for the short-wave infrared (SWIR) spectral band. Transferred from PE 0602114N. - Complete integration of optically and temporally adaptable imaging technologies into sensor for networked persistent surveillance system. <p>FY 2012 Plans:</p> <p>Optically Based Terahertz (THz) and Millimeter Wave Distributed Aperture Systems:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Complete field demonstration and testing of 77 gigahertz (GHz) passive millimeter wave (MMW) imager. The 77 GHz band will be used in place of 94 GHz for decreased cost and risk. <p>Wide Area Optical Architectures:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Initiate the development of super-resolution techniques in WFOV MWIR sensors. <p>Hyperspectral sensors and processing:</p> <ul style="list-style-type: none"> - Initiate integration of hyperspectral instruments onto test platforms. - Initiate the processing of hyperspectral data from a maritime environment. <p>Coherent Laser Radar (LADAR):</p> <ul style="list-style-type: none"> - Initiate the development of fiber lasers and coherent focal plane arrays suitable for LADAR applications. 			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
Autonomous and Networked sensing: - Initiate the development of algorithms and processing that supports autonomous sensing for UAV platforms - Initiate the development of algorithms and processing that supports networked sensing over multiple sensors and/or sensor platforms.			
Title: NAVIGATION TECHNOLOGY Description: The overarching objective of this activity is to develop technologies that enable the development of affordable, effective and robust Position, Navigation and Timing (PNT) capabilities using the GPS, non-GPS navigation devices, and atomic clocks. This project will increase the operational effectiveness of U.S. Naval units. Emphasis is placed on GPS Anti-Jam (AJ) Technology; Precision Time and Time Transfer Technology; and Non-GPS Navigation Technology (Inertial aviation system, bathymetry, gravity and magnetic navigation). The focus is on the mitigation of GPS electronic threats, the development of atomic clocks that possess unique long-term stability and precision, and the development of compact, low-cost Inertial Navigation Systems (INS). The current specific objectives are: a) GPS AJ Antennas and Receivers: Develop anti-jam and anti-spoofers antennas and antenna electronics for Navy platforms for the purpose of providing precision navigation capabilities in the presence of emerging electronic threats. b) Precision Time and Time Transfer Technology: Develop tactical grade atomic clocks that possess unique long-term stability and precision for the purpose of providing GPS-independent precision time, and the capability of transferring precision time via radio frequency links precision time. c) Non-GPS Navigation Technology: Develop inertial/bathymetric/gravity navigation system for the purpose of providing an alternative means of providing precision navigation for those Naval platforms which may not have GPS navigation capabilities and/or loss of GPS signals. The following are non-inclusive examples of accomplishments and plans for projects funded in this activity. FY 2010 Accomplishments: GPS Anti-Jam Antennas and Receivers: - Continued the development of GPS AJ Antenna Electronics (AE) with low-cost analog processor		3.617	2.835
		2.889	

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>technique for Direction of Arrival (DOA) estimation and nulling (up to 60dB nulling capability).</p> <ul style="list-style-type: none"> - Continued the development of Space-Frequency Adaptive Processing (SFAP) for GPS Anti-Spoofers using the existing Code Gated Maximum Likelihood (CGML) receiver. - Continued the GPS Dual Receiver Hot Start Acquisition (DRHSA) project. - Continued the GPS Threat Assessment project. - Continued the Multi-Frequency Continuously Operating GPS Anomalous Event Monitor (GAEM) project. - Continued the Precise at-Sea Ship System for Indoor Outdoor Navigation (PASSION) project. <p>Precision Time and Time Transfer Technology:</p> <ul style="list-style-type: none"> - Continued the Self-Locked Intra-Cavity Alkali Vapor Laser (ICAL) Opto-Atomic Clock project. - Continued the Evolved Global Navigation Satellite System (GNSS) Signal Monitoring Receiver Element project. <p>Non-GPS Navigation Technology:</p> <ul style="list-style-type: none"> - Continued the Deeply Integrated Navigation Grade GPS Inertial System project. - Continued the Micro Fiber Optical Gyro (MFOG) project. - Continued the Ship's Passive Inertial Navigation System (SPINS) project. - Continued the Sonar Aided Inertial Navigation Technology (SAINT) project. - continued the Optically Transduced Inertial Navigation System (INS) Sensor Suite (OPTIMUSS) project. - Initiated development of the Three-Axis Resonant Fiber Optic-based Inertial Navigation System with the accuracy of 10 milli(m)-degrees per hour and the angle random walk (ARW) of 10 milli (m)-degrees per root hour. - Initiated development of the SAINT system for littoral application; the SAINT will be applied to the existing Precision Underwater Mapping (PUMA) device. <p>FY 2011 Plans:</p> <p>GPS Anti-Jam Antennas and Receivers:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete GPS AJ Antenna Electronics effort. - Complete the SFAP for GPS Anti-Spoofers using the CGML receiver effort. - Complete the DRHSA project. - Initiate Time-transfer via IEEE 1588 effort. - Initiate Military User Equipment Integrated Fault Analysis effort. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>Precision Time and Time Transfer Technology:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete the ICAL Opto-Atomic Clock project. - Initiate Advanced-Development of a Miniature Atomic Clock. <p>Non-GPS Navigation Technology:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete Deeply-Integrated GPS-INS project. - Complete MFOG project. - Complete SPINS project. - Complete SAINT project. - Complete SAINT-PUMA application. - Initiate Micro-Electro-Mechanical System (MEMS) Gyro effort. <p>FY 2012 Plans:</p> <p>GPS Anti-Jam Antennas and Receivers:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Complete Time-transfer via IEEE 1588 effort. - Initiate MUE Integrated Fault Analysis Technology. - Initiate Anti-tamper Investigation Support. - Initiate System for enhanced electronic protection, electronic support and precision navigation. <p>Precision Time and Time Transfer Technology:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Initiate Effects of Code Distortion in Modernized GPS Signals on GPS Timing Receiver. - Initiate Compact and versatile passively CEP (carrier envelope phase)-stabilized optical clock system. - Initiate Micro cold atom atomic frequency standard (CAAFS). <p>Non-GPS Navigation Technology:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Complete Micro-Electro-Mechanical System (MEMS) Gyro effort. - Initiate Portable Precision Celestial Navigation System. 				
Title: SOLID STATE ELECTRONICS		7.125	8.149	9.128

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>Description: The overarching objective of this activity is to develop higher performance components and subsystems for all classes of military RF systems that are based on solid state physics phenomena and are enabled by improved understanding of these phenomena, new circuit design concepts and devices, and improvements in the properties of electronic materials. An important subclass are the very high frequency (VHF), ultra-high frequency (UHF), microwave (MW), and millimeter wave (MMW) power amplifiers for Navy all-weather radar, surveillance, reconnaissance, electronic attack, communications, and smart weapons systems. Another subclass are the analog and high speed, mixed signal components that connect the electromagnetic signal environment into and out of digitally realized, specific function systems. These improved components are based on both silicon (Si) and compound semiconductors (especially the wide bandgap materials and narrow bandgap materials), low and high temperature superconductors, novel nanometer scale structures and materials. Components addressed by this activity emphasize the MMW and submillimeter wave (SMMW) regions with an increasing emphasis on devices capable of operating in the range from 50 gigahertz (GHz) to 10 sdterahertz (THz). The functionality of the technology developed cannot be obtained through Commercial-Off-the-Shelf (COTS) as a result of the simultaneous requirements placed on power, frequency, linearity, operational and instantaneous bandwidth, weight, and size. Effort will involve understanding the properties of engineered semiconductors as they apply to quantum information science and technology. The current specific objectives are:</p> <p>a) Solid State Transistors and Devices: Develop solid state transistors and devices for high frequency analog and digital operation.</p> <p>b) High Efficiency, Highly Linear Amplifiers: Develop high efficiency, highly linear amplifiers for microwave, millimeter-wave, low-noise, and power applications.</p> <p>c) Superconducting Electronics: Develop components for RF systems utilizing superconducting and other technologies which are designed to deliver software defined, wide band, many simultaneous signal functionality over a wide range of frequencies, in increasingly field-ready packaging and demonstrate the ability of these components to be combined into chains to deliver superior functionality in conventional system contexts, including, but not limited to, SATCOM, Electronic Warfare (EW), signal intelligence (SIGINT), and communications.</p> <p>d) Control, Reception, and Processing of Signals: Develop electronics technology that provides for the control, reception, and processing of signals.</p>			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>e) Novel Nanometer Scale Logic/Memory Devices and Related Circuits and Architectures: Develop novel nanometer scale (feature size at or below 10nm) logic/memory devices and related circuits and architectures to deliver ultra-low power, light weight and high performance computational capability for autonomous vehicles and individual warfighters.</p> <p>The increase from FY 2011 to FY 2012 is due to emphasis in Solid State Electronics research in response to naval need.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p>In FY 2010, efforts from Supporting Technologies and Solid State Power Amplifiers are being consolidated into this new activity to provide improved fidelity of efforts.</p> <p><i>FY 2010 Accomplishments:</i> Solid State Transistors and Devices: - Continued development of Antimony (Sb)-based diodes and multipliers for the exploitation of the frequency spectrum from 94-1000 GHz. - Continued development of an integrated tunable frequency selective and low noise integrated module. - Continued effort to develop W-band high-power Gallium Nitride (GaN) Metal Insulator Semiconductor (MIS) transistors. - Continued MMW field plate GaN High Electron Mobility Transistor (HEMT) development.</p> High Efficiency, Highly Linear Amplifiers: - Continued development of MMW AlGaIn/GaN wide bandgap HEMT. - Continued development of AlGaIn HEMT broadband amplifiers for electronic warfare decoys with increased power and efficiency than achieved with conventional solid state amplifiers. - Continued high-efficiency microwave GaN HEMT amplifier development. - Continued work on GaN MMW components at >44 GHz to allow for EHF SATCOM insertion and other MMW applications spanning to 95GHz. - Continued the expansion of scope of the GaN MMW device program. - Continued component development in support of multifunctional electronic warfare. - Continued transition of GaN high-efficiency microwave HEMT amplifiers to radar and communications applications. - Continued development of MMW high efficiency amplifiers for satellite communications and compact high efficiency MMW sources for active denial systems. - Continued development of high-efficiency broadband GaN HEMT amplifiers for electronic warfare applications. - Continued Sub-MMW GaN Device technology for communications, target identification and high speed data processing.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Completed high efficiency S-Band GaN HEMT amplifier development.</p> <p>Superconducting Electronics:</p> <ul style="list-style-type: none"> - Continued development of a second generation superconducting digital channelizer which includes a 1xk multiplier. - Continued demonstration of an improved signal processing technique that can be applied to state-ofthe-art L, S, X, and Ka-band superconducting bandpass ADCs to realize an improvement in dynamic range of greater than 6dB. - Completed proof of concept demonstration of a wideband, high dynamic range combined LNA and antenna, based on arrays of superconducting quantum interference devices (SQUIDS) on a 1 centimeter squared (cm²) chip for frequencies below 200 megahertz (MHz). <p>Control, Reception, and Processing of Signals:</p> <ul style="list-style-type: none"> - Continued development of an integrated tunable frequency selective and low noise integrated module. - Continued development of Gallium Nitride-based low-noise components for Interference Immune Navy Satcom receivers. <p>Novel Nanometer Scale Logic/Memory Devices and Related Circuits and Architectures:</p> <ul style="list-style-type: none"> - Completed development of Cellular Nonlinear Network (CNN) processing techniques for unmanned air vehicle (UAV)landing applications. - Continued effort to develop a highly linear, low-noise RF amplifier using aligned arrays of single-walled carbon nanotubes. - Continued development of three dimensional (3D)-integrated CNN image sensing processing architecture research. <p>FY 2011 Plans:</p> <p>Solid State Transistors and Devices:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate mixed-signal GaN Monolithic Microwave Integrated Circuit (MMIC) technology development. <p>High Efficiency, Highly Linear Amplifiers:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Initiate development of GaN Monolithic Microwave Integrated Circuit (MMIC) Amplifier Technology for operation greater than (>)100 GHz. - Initiate development of high efficiency GaN amplifier MMICs for 50-100 GHz operation. <p>Superconducting Electronics:</p> <ul style="list-style-type: none"> - Complete development of a second generation superconducting digital channelizer which includes a 1xk multiplier. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Complete demonstration of an improved signal processing technique that can be applied to state-of-the-art L, S, X, and Ka-band superconducting bandpass ADCs to realize an improvement in dynamic range of greater than 6dB.</p> <p>- Initiate development of first packaged prototype of 1 cm squared HF-UHF antenna for space limited platforms such as UAVs.</p> <p>- Initiate effort to improve superconducting analog to digital converter performance by more than 2 bits as well as 2x in sample rate..</p> <p>Control, Reception, and Processing of Signals: - Continue all efforts of FY 2010.</p> <p>Novel Nanometer Scale Logic/Memory Devices and Related Circuits and Architectures: - Continue all efforts of FY 2010 less those noted as completed above. - Complete development of three dimensional (3D)-integrated CNN image sensing processing architecture research. - Initiate new research in graphene synthesis and device concepts.</p> <p>FY 2012 Plans: Solid State Transistors and Devices: - Continue all efforts of FY 2011 less those noted as completed above. - Initiate investigations into ultra-low noise Group III-Nitride transistor structures for RF and mm-wave receivers and transmitters. - Initiate group III-Nitride transistor development for 1 THz circuits</p> <p>High Efficiency, Highly Linear Amplifiers: - Continue all efforts of FY 2011. - Initiate low-noise, high dynamic range Group-III Nitride amplifier development for W-band receivers</p> <p>Superconducting Electronics: - Continue all efforts of FY 2011 less those noted as completed above. - Initiate development of mixed superconducting/semiconducting output circuits that allow energy efficient data transfer to room temperature at >10 Gbps per line and precision amplification of signals returned to the superconducting domain. These technologies are critical to the delivery of maximum system functionality from superconducting electronics and enable transmitter interference mitigation in wideband receivers.</p> <p>Control, Reception, and Processing of Signals: - Continue all efforts of FY 2011.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiate investigations into low-noise, high dynamic range group-III Nitride receiver components for W-band and higher signal detection</p> <p>Novel Nanometer Scale Logic/Memory Devices and Related Circuits and Architectures:</p> <p>- Continue all efforts of FY 2011 less those noted as completed above.</p> <p>- Initiate work on graphene based devices and circuits for low power flexible electronics.</p> <p>- Initiate research on graphene-organic hybrid materials interfaces and device structures.</p>				
<p>Title: SPECTRUM SHARING</p> <p>Description: Research in this activity addresses the need to develop innovate new and improved methods and technologies for management of the RF Spectrum to compensate for decreased RF Spectrum frequencies reserved for military use and increasing demand from Navy sensor and communications systems. Navy platforms rely on the RF Spectrum for both sensing and communication capabilities. Efficient sharing of the RF Spectrum requires the development of new concepts and technologies to manage spectrum demands. Spectrum Sharing will develop concepts and technologies that will optimize spectrum management and sharing across within individual systems, platforms, and across the battlespace.</p> <p>FY 2012 Plans: Initiate research for RF Spectrum Management for Navy communications and sensor systems and platforms. This effort is classified.</p>		-	-	3.300
<p>Title: SURVEILLANCE TECHNOLOGY</p> <p>Description: The overarching objective of this activity is to develop advanced sensor and sensor processing systems for continuous high volume theater-wide air and surface surveillance, battle group surveillance, real time reconnaissance and ship defense. Major technology goals include long-range target detection and discrimination, target identification (ID) and fire control quality target tracking in adverse weather, background clutter and electronic countermeasure environments and includes modeling and simulation required to support the development of these technologies. The current specific objectives are:</p> <p>a) Radar Architectures, Sensors, and Software which Address Ballistic Missile and Littoral Requirement Shortfalls: Develop radar architectures, sensors, and software which address Ballistic Missile and Littoral requirement shortfalls including: sensitivity; clutter rejection; and flexible energy management.</p> <p>b) Algorithms, Sensor Hardware, and Signal Processing Techniques for Automated Radar Based Contact Mensuration and Feature Extraction: Develop algorithms, sensor hardware, and signal processing techniques for automated radar based contact</p>		6.980	8.170	9.434

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>mensuration and feature extraction in support of asymmetric threat classification and persistent surveillance and to address naval radar performance shortfalls caused by: man-made jamming and Electronic Counter Measures (ECM), unfavorable maritime conditions, and atmospheric and ionosphere propagation effects.</p> <p>c) Software and Hardware for a Multi-Platform, Multi-Sensor Surveillance System: Develop software, and hardware for a multi-platform, multi-sensor surveillance system for extended situational awareness of the battlespace.</p> <p>d) Small UAV Collision Avoidance/Autonomy Technology: Develop small UAV collision avoidance/autonomy technology.</p> <p>e) Long Range Radio Frequency (RF) Identification (ID): Develop, hardware, software, algorithms, and RF techniques to extend identification capabilities in support of Intelligence Surveillance and Reconnaissance (ISR).</p> <p>Increase from FY 2011 to FY 2012 is due to emphasis in Surveillance Technology research in response to naval need.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p><i>FY 2010 Accomplishments:</i> Radar Architectures, Sensors, and Software which Address Ballistic Missile and Littoral Requirement Shortfalls:</p> <ul style="list-style-type: none"> - Continued the Horizon Extension Sensor System (HESS) project with form factored integration of High Power Amplifier (HPA) and development of a Silicon Germanium (SiGe) downconverter in support of HESS and Digital Array Radar (DAR) efforts. - Continued an element level DAR effort on down conversion and digital beam formers. - Continued the requirements analysis and trade studies of an Advanced Common Radar Architecture. - Initiated development of a millimeter wave active/passive identification sensor. <p>Algorithms, Sensor Hardware, and Signal Processing Techniques for Automated Radar Based Contact Mensuration And Feature Extraction:</p> <ul style="list-style-type: none"> - Continued development efforts to demonstrate signal processing, waveform generation and one dimensional active phased array apertures for harbor surveillance and situational awareness. - Continued demonstrations of advanced Non-Cooperative Target Recognition (NCTR) algorithms in congested harbor environments. - Continued the assessment of vulnerabilities of modern side lobe canceling (SLC) algorithms to adversary jamming and develop mitigating SLC design improvements. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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- Continued the development of a process to detect hostile camouflaged or hidden targets in shadows and diverse backgrounds of militarily challenged environments.
- Continued investigation of means of optimally combining mensuration, classification, and noncooperative target recognition of surface craft.
- Completed the assessment of vulnerabilities of modern side lobe canceling (SLC) algorithms to adversary jamming and develop mitigating SLC design improvements.
- Initiated development of a technology architecture for the Persistent Autonomous Surveillance System.
- Initiated development of automated controls for an airborne persistent multi-node sensor network.

Software and Hardware for a Multi-Platform, Multi-Sensor Surveillance System:

- Continued the development of signal processing techniques to improve situational awareness and autonomous detection of hostile fire events in a dynamic urban clutter environment.

Small UAV Collision Avoidance/Autonomy Technology:

- Continued development of research technologies and analytical algorithms for an effective and highly reliable collision avoidance system.

FY 2011 Plans:
Radar Architectures, Sensors, and Software which Address Ballistic Missile and Littoral Requirement Shortfalls:

- Continue all efforts of FY 2010.

Algorithms, Sensor Hardware, and Signal Processing Techniques For Automated Radar Based Contact Mensuration And Feature Extraction:

- Continue all efforts of FY 2010 less those noted as completed above.
- Initiate development of algorithms and signal processing for Electronic Protection in airborne radars.
- Initiate development of software and algorithms for multi-platform radar controls.

Software and Hardware for a Multi-Platform, Multi-Sensor Surveillance System:

- Continue all efforts of FY 2010.

Small UAV Collision Avoidance/Autonomy Technology:

FY 2010	FY 2011	FY 2012

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602271N: <i>Electromagnetic Systems Applied Research</i>	PROJECT 0000: <i>Electromagnetic Systems Applied Research</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Continue all efforts of FY 2010.</p> <p>FY 2012 Plans: Radar Architectures, Sensors, and Software which Address Ballistic Missile and Littoral Requirement Shortfalls:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete the Horizon Extension Sensor System (HESS) project with form factored integration of High Power Amplifier (HPA) and development of a Silicon Germanium (SiGe) downconverter in support of HESS and Digital Array Radar (DAR) efforts. - Complete an element level DAR effort on down conversion and digital beam formers. - Complete the requirements analysis and trade studies of an Advanced Common Radar Architecture. - Initiate Advanced Common Radar Architecture, and mode development. <p>Algorithms, Sensor Hardware, and Signal Processing Techniques for Automated Radar Based Contact Mensuration And Feature Extraction:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete development efforts to demonstrate signal processing, waveform generation and one dimensional active phased array apertures for harbor surveillance and situational awareness. <p>Software and Hardware for a Multi-Platform, Multi-Sensor Surveillance System:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Small UAV Collision Avoidance/Autonomy Technology:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Long Range Radio Frequency (RF) Identification (ID):</p> <ul style="list-style-type: none"> - Initiate studies for Long Range RFID techniques and initial hardware designs. 				
<p>Title: VACUUM ELECTRONICS POWER AMPLIFIERS</p> <p>Description: The overarching objective of this activity is to develop millimeter wave (MMW) and sub-MMW power amplifiers for use in Naval all-weather radar, surveillance, reconnaissance, electronic attack, and communications systems. The technology developed cannot, for the most part, be obtained through commercial off the shelf (COTS) as a result of the simultaneous requirements placed on power, frequency, bandwidth, weight, and size. Responding to strong interests from the various user communities, efforts are focused on the development of technologies for high-data-rate communications, electronic warfare</p>		3.232	3.413	3.826

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>and high-power radar applications at MMW and upper-MMW regime. The emphasis is placed on achieving high power at high frequency in a compact form factor. Technologies include utilization of spatially distributed electron beams in amplifiers, such as sheet electron beams and multiple-beams, and creation of simulation based design methodologies based on physics-based and geometry driven design codes.</p> <p>The current specific objectives are:</p> <p>a) High Power Millimeter and Upper Millimeter Wave Amplifiers: Develop science and technology for high power millimeter and upper millimeter wave amplifiers including high current density diamond cathodes, sheet and multiple electron beam formation and mode suppression techniques in overmoded structures.</p> <p>b) Lithographic Fabrication Techniques: Develop lithographic fabrication techniques for upper-millimeter wave amplifiers.</p> <p>c) Accurate and Computationally Effective Device-Specific Multi-Dimensional Models for Electron Beams: Develop accurate and computationally effective device-specific multi-dimensional models for electron beam generation, large-signal and stability analysis to simulate device performance and improve the device characteristics.</p> <p>The increase from FY 2011 to FY 2012 is due to expanded effort in Vacuum Electronics Power Amplifiers research.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p><i>FY 2010 Accomplishments:</i> High Power Millimeter and Upper Millimeter Wave Amplifiers: - Continued the development of high-current-density cathodes based on diamond current amplifier. - Continued effort to produce a compact, high-power, W-band amplifier by developing an extended interaction klystron circuit that will be mated to a novel sheet-beam gun, permanent magnet & collector. - Continued the development of new spatially-distributed electron beam traveling-wave amplifier structures incorporating novel mode suppression techniques.</p> <p>Lithographic Fabrication Techniques: - Continued effort to develop 220 GHz millimeter-wave amplifiers employing electromagnetic structures that are microfabricated using lithographic techniques.</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602271N: <i>Electromagnetic Systems Applied Research</i>	PROJECT 0000: <i>Electromagnetic Systems Applied Research</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Accurate and Computationally Effective Device-Specific Multi-Dimensional Models for Electron Beams:</p> <ul style="list-style-type: none"> - Continued effort on the gun/collector code MICHELLE with improved interface with the large signal codes CHRISTINE and Telegrapher's Equation Solution for Linear Amplifiers (TESLA). - Continued the effort on developing algorithms and models in large signal code TESLA for multiple beam klystrons. - Continued the effort on the development and implementation of models and algorithms in a large signal klystron code to model sheet electron beam - wave interaction. - Continued the effort on developing models and algorithms based on generalized model expansion (GENOME) techniques for large signal modeling of extended interaction klystrons (EIK). - Continued the effort on the development and implementation of models and algorithms in a large signal TWT code to model sheet electron beam - wave interaction. - Completed nonlinear stability analysis for the broadband coupled cavity - traveling wave tube (CC-TWT). - Completed an end-to-end analysis of a Helix traveling wave tube (TWT). using the large signal CHRISTINE 3D code. - Initiated development of coupled-cavity 2D algorithms in TESLA for the CC-TWT. <p>FY 2011 Plans:</p> <p>High Power Millimeter and Upper Millimeter Wave Amplifiers:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>Lithographic Fabrication Techniques:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>Accurate and Computationally Effective Device-Specific Multi-Dimensional Models for Electron Beams:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Complete effort on the gun/collector code MICHELLE with improved interface with the large signal codes CHRISTINE for helix TWT's and TESLA for klystrons. - Initiate development of parallel version of MICHELLE for gun/collector code to reduce computational time by factor of 10 for realistic 3D electron beams. - Initiate effort in the development of stability analysis for broadband extended interaction klystrons. <p>FY 2012 Plans:</p> <p>High Power Millimeter and Upper Millimeter Wave Amplifiers:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 . 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
Lithographic Fabrication Techniques: - Continue all efforts of FY 2011.			
Accurate and Computationally Effective Device-Specific Multi-Dimensional Models for Electron Beams: - Continue all efforts of FY 2011 less those noted as complete above.			
Accomplishments/Planned Programs Subtotals	66.012	83.902	108.329

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0603271N: <i>ELECTROMAGNETIC SYSTEMS ADVANCED TECHNOLOGY</i>	19.594	24.586	31.782	0.000	31.782	39.723	29.845	24.876	6.109	0.000	176.515

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

This PE supports the development of technologies that addresses technology needs associated with Naval platforms for new capabilities in EO/IR Sensors, Surveillance, Electronic Warfare, Navigation, Solid State Electronics, Vacuum Electronics Power Amplifiers, and Nanoelectronics. The program supports development of technologies to enable capabilities in Missile Defense, Directed Energy, Platform Protection, Time Critical Strike, and Information Distribution. Each PE Activity has unique goals and metrics, some of which include classified quantitative measurements. Overall metric goals are focused on achieving sufficient improvement in component or system capability such that the 6.2 applied research projects meet the need of or produce a demand for inclusion in advanced technology that may lead to incorporation into acquisition programs or industry products available to acquisition programs.

Specific examples of metrics under this PE include:

- Provide a secure, over the horizon, on-the- move capability to communicate with higher headquarters at a data rate of 256-512 Kbps at a cost of \$75,000.
- Provide an array configuration suitable for installation on aircraft that will support TCDL data rates of 10.7 and 45 Mbps at greater than 150 nautical mile range.
- Develop prototype Ku band phased array apertures in a form factor suitable for installation on the CVN-78.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>			PE 0602271N: <i>Electromagnetic Systems Applied Research</i>				4027: <i>Naval Innovative Science and Engineering</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	1.400	-	-	-	-	-	-	-	-	0.000	1.400

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act. Such efforts are geared to supporting defense Labs in three broad areas.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Innovative basic and applied research that is conducted at defense labs and supports military missions. - Developmental programs that support the transition of technologies developed by defense labs into operational use. - Workforce development activities that improve the capacity for defense labs to recruit and retain personnel with needed scientific and engineering expertise. 	1.400	-	-
Accomplishments/Planned Programs Subtotals	1.400	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602271N: <i>Electromagnetic Systems Applied Research</i>	PROJECT 9999: <i>Congressional Adds</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	4.780	-	-	-	-	-	-	-	-	0.000	4.780

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
<i>Congressional Add:</i> Gallium Nitride (GaN) Power Technology <i>FY 2010 Accomplishments:</i> This effort supported gallium nitride power technology research.	1.593	-
<i>Congressional Add:</i> National Initiatives for Applications of Multifunctional Materials <i>FY 2010 Accomplishments:</i> This effort studied fundamental properties with the potential to impact widely tunable devices such as filters or phase shifters which are applicable to Navy electronic needs.	1.992	-
<i>Congressional Add:</i> SiC Wafer Production <i>FY 2010 Accomplishments:</i> This effort supported development of a low-defect silicon carbide (SiC) wafer production process for DoD applications to improve efficiency and tactical abilities of directed energy systems and all-electric vehicle platforms.	1.195	-
Congressional Adds Subtotals	4.780	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Add.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	52.363	49.491	50.076	-	50.076	50.553	51.559	53.475	54.536	Continuing	Continuing
0000: <i>Ocean Wrfghtg Env Applied Res</i>	46.954	49.491	50.076	-	50.076	50.553	51.559	53.475	54.536	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	0.230	-	-	-	-	-	-	-	-	0.000	.230
9999: <i>Congressional Adds</i>	5.179	-	-	-	-	-	-	-	-	0.000	5.179

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE provides the unique, fundamental programmatic instrument by which basic research on the natural environment is transformed into technological developments that provide new or enhanced warfare capabilities for the Battlespace Environment (BSE). The objectives of this program are met through measuring, analyzing, modeling and simulating, and applying environmental factors affecting naval material and operations in the BSE. This program provides for BSE technological developments that contribute to meeting top joint warfare capabilities established by the Joint Chiefs of Staff, with primary emphasis on Joint Littoral Warfare and Joint Strike Warfare.

This PE fully supports the Director of Defense Research and Engineering's Science and Technology Strategy and is coordinated with other DoD Components through the Defense Science and Technology Reliance process. Work in this program is related to and fully coordinated with efforts in accordance with the on-going Reliance joint planning process. There is close coordination with the US Air Force and US Army under the Reliance program in the BSE categories of Lower Atmosphere, Ocean Environments, Space & Upper Atmosphere, and Terrestrial Environments. Within the Naval Transformation Roadmap, the investment will contribute toward achieving each of the "key transformational capabilities" required by Sea Strike, Sea Shield, and Sea Basing. Moreover, environmental information, environmental models, and environmental tactical decision aids that emerge from this investment will form one of the essential components of FORCEnet (which is the architecture for a highly adaptive, human-centric, comprehensive maritime system that operates from seabed to space). The Navy program includes efforts that focus on, or have attributes that enhance, the affordability of warfighting systems.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
1319: <i>Research, Development, Test & Evaluation, Navy</i>	PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>
BA 2: <i>Applied Research</i>	

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	53.727	49.491	51.279	-	51.279
Current President's Budget	52.363	49.491	50.076	-	50.076
Total Adjustments	-1.364	-	-1.203	-	-1.203
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.145	-			
• SBIR/STTR Transfer	-0.759	-			
• Program Adjustments	-	-	-1.288	-	-1.288
• Section 219 Reprogramming	-0.458	-	-	-	-
• Rate/Misc Adjustments	-	-	0.085	-	0.085
• Congressional General Reductions Adjustments	-0.002	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *Autonomous Marine Sensors and Networks*
- Congressional Add: *Underwater Imaging and Communications Using Lasers*
- Congressional Add: *Unmanned Undersea Vehicle Submerged Long Range Positioning*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	2.390	-
	1.992	-
	0.797	-
Congressional Add Subtotals for Project: 9999	5.179	-
Congressional Add Totals for all Projects	5.179	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>Ocean Wrfghtg Env Applied Res</i>	46.954	49.491	50.076	-	50.076	50.553	51.559	53.475	54.536	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project provides technologies that form the natural environment technical base on which all systems development and advanced technology depend. Furthermore, this technical base provides developments that may be utilized in the Future Naval Capabilities programs: Organic Mine Countermeasures (MCM) and Autonomous Operations. This project contains the National Oceanographic Partnership Program (NOPP) (Title II, subtitle E, of Public Law 104-201) and efforts aimed at understanding and predicting the impacts of underwater sound on marine mammals.

Major efforts of this project are devoted to: gaining real-time knowledge of the BSE, determining the natural environment needs of regional warfare, providing the on-scene commander with the capability to exploit the environment to tactical advantage and, developing atmospheric research related to detection of sea-skimming missiles and strike warfare. This project provides natural environment applied research for all fleet operations and for current or emerging systems. Major developments are routinely transitioned to the Fleet Numerical Meteorology and Oceanography Center and to the Naval Oceanographic Office where they are used to provide timely information about the natural environment for all fleet operations.

Joint Littoral Warfare efforts address issues in undersea, surface, and air battlespace. Efforts include ocean and atmospheric analysis and prediction for real-time description of the operational environment, shallow water acoustics, multiple-influence sensors for undersea surveillance and weapon systems, and influences of the natural environment on MCM and Anti-Submarine Warfare (ASW) systems. Joint Strike Warfare efforts address issues in air battlespace dominance. Efforts include influences of the natural environment on air operations, electromagnetic (EM)/electro-optic (EO) systems used in intelligence, surveillance, reconnaissance, targeting, bomb damage assessment, and detection of missile weapon systems. They also include improvements in tactical information management about the BSE.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: Coastal Geosciences/Optics	7.049	6.653	7.788
Description: The goal of this activity is to determine the sources, distribution, and natural variability (concentration and properties) of optically important matters in the coastal ocean in support of Naval Mine, Undersea, and Special Warfare. Research investments in this activity support the development and testing of expendable and autonomous bioluminescence sensors, the continued development of extended range underwater imaging technologies, and algorithm development and testing for application to ocean color remote sensing from aircraft and space in order to characterize key features of the coastal battle space such as bathymetry, shallow-water bottom types, and the distribution of ocean water optical properties.			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>FY 2011 to FY 2012 funding increase is due to additional efforts associated with ASW Surveillance, and Littoral Geosciences/Optics.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued to refine algorithms that fuse sediment information extracted from operational sonar with historical sediment databases. - Continued development of a Benthic Unattended Generator to power an autonomous ocean environmental profiler and provided demonstration. - Continued experiments (and data collection) to test user performance as a function of display clutter. - Continued effort to understand and predict how power harvesting from the seabed is controlled by sediment geochemistry, microbiology, physical properties, and energetics. - Continued effort to develop and evaluate an integrated multi-sensor suite, including a small microflow cytometer, to characterize optical and biological properties of subsurface particle layers in coastal waters using unmanned underwater glider technology. - Continued effort to develop an intelligent decluttering algorithm (or system of algorithms) that accounts for both global and local clutter metrics in complex, multivariate displays. - Continued effort to develop a next generation atmospheric correction algorithm which will greatly enhance ocean passive retrievals including ocean color and visibility, bathymetry and sea surface temperature. - Completed effort to develop visible/near infrared hyperspectral imagery algorithms for autonomous, near real time, retrieval of environmental products, such as diver visibility, bottom type and reflectivity, and bathymetry. - Completed effort to develop automatic coordination and utilization of distributed web services. - Completed bioluminescence sensor effort with emphasis on needs of the Special Warfare (SPECWAR) forces and Naval Oceanographic Office survey capabilities, and use of the bioluminescence sensors in joint field measurements with ocean sensors to determine persistence of the bioluminescence signal and the ocean factors controlling the persistence. - Initiated development of riverine expert system for environmental characterization. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. 				
Title: Marine Mammals and Biology		4.577	4.998	5.090

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Description: This activity consolidates and expands research conducted in previous years in Coastal Geosciences/Optics and the Physical Oceanography Activities and expands these efforts. The sensitivity of Marine Mammals to sound produced by Naval operations and training will continue. This program is to assure that Navy decisions can be based on scientifically defensible positions. The goal of this activity is to support: (1) marine mammal research related to understanding impacts of sound (especially sonar) on marine mammal behavior, hearing, physiology, distributions and ecology; (2) development and testing of new technologies for the detection of marine mammals at sea; (3) research on the bio-acoustic properties, use of sound for detection of, and effects of sound on fish and lesser marine organisms; and (4) research on optically important biota in the coastal ocean in support of Naval Mine, Undersea, and Special Warfare (including oceanic bioluminescence and the development and testing of bioluminescence sensors). The marine mammals research conducted in this PE represents part of a total effort executed in coordination with complementary research performed in PE 0602747N.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued at-sea demonstration of radar and acoustics systems to monitor marine mammals in fleet activities. - Continued multi-investigator, coordinated field research to test responses of marine mammals (especially beaked whales) to controlled sound exposures. - Continued development of new technologies for detection and localization of marine mammals, including (but not restricted to) gliders equipped with passive acoustic sensors, radar and thermal imagery. - Continued research examining hearing sensitivity of marine mammals (including temporary and permanent threshold shifts). - Continued research efforts examining distributions and abundances of marine mammals relative to prey fields and basic oceanographic parameters. - Continued development of and evaluate models that predict time- and space-dependent sound fields produced by anthropogenic noise sources and mammal responses to the noise. - Continued development and testing of multi-frequency acoustic technologies for detection, identification and enumeration of fish. - Continued research to examine sensitivity of fish to anthropogenic sound. - Continued research leading to better predictability of bioluminescent and pigment-bearing planktonic organisms. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Initiate research on the physiology and stress of marine mammals in the wild.</p> <p>FY 2012 Plans:</p> <p>- Continue all efforts of FY 2011.</p>			
<p>Title: Marine Meteorology</p> <p>Description: The marine atmosphere affects most aspects of naval operations. This activity develops observing technologies, models, Numerical Weather Prediction (NWP) systems and Tactical Decision Aids (TDA) that describe the atmospheric environment and its impacts on naval sensors and operations. This activity focuses on uniquely marine aspects of atmospheric science such as air-sea interaction, coupled ocean-atmosphere modeling, EM and EO propagation, coastal meteorology, Tropical Cyclone (TC) prediction, and the use of remote sensing to obtain quantitative observations of atmospheric properties. Aspects of the atmospheric environment of particular interest include near-surface phenomena that affect refractivity, marine boundary layer dynamics that affect clouds, rain, visibility and fog, and processes that control TC structure, track, and intensity. Objectives of this activity are improved NWP systems and TDAs that provide NOWCAST and forecast skill at global, regional, and tactical scales for operational support, sensor and system development, and performance prediction.</p> <p>FY 2011 to FY 2012 funding decrease is due to a reduced level of effort in atmospheric science applications.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued developments in atmospheric effects on EMs and EOs because of the central importance of EM and EO propagation to many modern warfare systems. - Continued development of an EO propagation model that accounts for the atmospheric effects of near-surface refraction, scintillation, aerosol extinction, illumination and target, background and sensor characteristics for incorporation into EO tactical decision aids and for supporting warfare systems development. - Continued application of predictability concepts to optimize use of new-generation satellite data to target observation selection for maximum forecast impact in military areas of interest. - Continued exploitation of optimal methods for capturing uncertainty of environmental predictions on regional and local scales for reliability estimates of tactical parameters. - Continued program to develop the ability to assimilate data from the next generation of operational weather satellites to benefit real-time analysis of the battlespace environment as well as improving the global forecasting skill. 		9.531	10.312
		9.349	

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>	PROJECT 0000: <i>Ocean Wrfghtg Env Applied Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued development and validation of the Advanced Propagation Model to account for atmospheric effects on EM radiation, in particular, by the addition of the capability to describe high frequency radio frequencies. - Continued the development of global and mesoscale aerosol/radiation models that account for the major sources (desert dust, sea spray, biomass burning, industrial pollution) of visibility degradation in the atmosphere and integrate with numerical weather prediction systems for an aerosol predictive capability that can support militarily relevant time and space scales. - Continued development of methods to retrieve and assimilate remotely-sensed aerosol data into aerosol prediction models. - Completed development of new methods, which account for a wider range of atmospheric conditions, for determination of refractivity from clutter as an inverse method of obtaining the critical refractivity properties of the atmosphere that affect EM propagation. - Completed effort to optimize rapid environmental assessment using coupled air-sea systems to support multiple warfare and mission areas pertaining to Special Warfare. - Completed the development of a real-time meteorological and oceanographic battlespace characterization capability (NOWCAST) that collects, processes and exploits on-scene environmental data for rapid environmental assessment. The system will combine high-resolution atmospheric forecast information with 4-D data assimilation of on-scene observations (radar, satellite, conventional observations, etc) for customized display at time and space scales relevant for tactical operation support. - Completed effort to exploit probabilistic parameter ensembles for model improvement and construct a basis for observation-informed stochastic model integration. - Completed effort to improve understanding of atmospheric physical processes in the Arctic. - Completed tracking analysis of small satellite calibration targets to determine atmospheric drag due to neutral density via LIDAR remote sensing. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Continue effort to optimize rapid environmental assessment using coupled air-sea systems to support multiple warfare and mission areas. - Complete development of new methods, that account for a wider range of atmospheric conditions, for determination of refractivity from clutter as an inverse method of obtaining the critical refractivity properties of the atmosphere that affect EM propagation. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>	PROJECT 0000: <i>Ocean Wrfghtg Env Applied Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Complete development of an EO propagation model that accounts for the atmospheric effects of near-surface refraction, scintillation, aerosol extinction, illumination and target, background and sensor characteristics for incorporation into EO tactical decision aids and for supporting warfare systems development.</p> <p>- Initiate development of a next-generation coupled mesoscale model that can analyze and predict ocean-atmosphere processes at resolutions suitable for simulating coastal ocean circulations, waves, and detailed marine atmospheric boundary layer structure to extend existing modeling capabilities to tactically useful resolutions (<1 km).</p> <p>-Initiate development of a next generation mesoscale model that includes coupling of the physics between the ocean-land-atmosphere-ice and two-way interaction with larger scales for higher resolution local atmospheric prediction, optimal forcing of coastal ocean prediction systems, and improved representation of mesoscale effects on global predictions.</p> <p>-Initiate development of a next-generation, higher resolution, higher altitude, coupled global numerical weather prediction model to include advanced physics, advanced numerical methods and advanced data assimilation methods, and conduct testing and validation to investigate its suitability for replacement of current prediction systems.</p> <p>-Develop, test and validate a next-generation TC prediction system that can analyze, initialize, and predict TC track, structure and intensity, using a high-resolution mesoscale model coupled to the ocean waves and currents. The development will include advanced data assimilation and modeling techniques as well as new methods of retrieving observations from remote sensing.</p> <p><i>FY 2012 Plans:</i></p> <p>-Continue all efforts of FY 2011 less those noted as completed above.</p> <p>-Initiate development of a coupled atmosphere-ocean-cryosphere-wave prediction system capable of forecasts from the submesoscale to decadal.</p> <p>-Initiate development of a high resolution Arctic ice/ocean/weather/wave prediction system that can assimilate synthetic aperture radar data.</p>			
Title: National Oceanographic Partnership Program (NOPP)		8.322	9.085
Description: This activity focuses on US Navy investments in the NOPP. NOPP, established by the US Congress (Public Law 104-201) in Fiscal Year 1997, is a unique collaboration among 15 federal agencies involved in conducting, funding, or utilizing results of ocean research. NOPP's value to the Navy derives from the capacity of the partnership to enable and ensure multi-agency efforts where such collaboration			9.299

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>	PROJECT 0000: <i>Ocean Wrfghtg Env Applied Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>enhances efficiency or effectiveness, and/or reduces costs. Major areas of investment by NOPP include: development of an integrated coastal ocean observation system and development of sensors, communications and data acquisition, storage and processing tools required to affect it, modernization of ocean research and observation infrastructure, and marine mammal-related research.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued marine mammal program on noise mitigation. - Continued development of sensors for sustained, autonomous measurement of chemical or biological parameters in the ocean. - Continued marine mammal program on methods for detection and tracking of marine mammals and mapping their habitat. - Continued and completed wireless communications for the coastal ocean. - Continued real-time forecasting system of winds, waves and surge in TCs. - Completed The Partnership for Advancing Interdisciplinary Global Modeling. - Completed Global Ocean Data Assimilation Experiment (GODAE) including assessment of GODAE boundary conditions for use in coastal ocean predictions. - Completed new methods for detection of fish, fish populations and mapping of fish habitat. - Initiated effort to develop global ocean models with sufficient resolution to accurately simulate tides and internal waves to improve the fidelity of ocean prediction systems. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Complete marine mammal program on noise mitigation. - Initiate development of improving wind-wave predictions: global to regional scales. 				
<p>Title: Ocean Acoustics</p> <p>Description: This activity is dedicated to the determination of the impact of the natural ocean environment on acoustic wave phenomena in support of naval undersea warfare and underwater force protection operations. This activity studies underwater acoustic propagation, scattering from ocean boundaries, and ambient noise issues that impact the development and employment of acoustic systems. The Littoral Zone (LZ) has been the ocean environment of greatest interest. Aspects of this environment, that greatly impact underwater acoustic systems, are the shallow water included in the Littoral Zone, the consequent</p>		6.838	7.025	6.676

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>	PROJECT 0000: <i>Ocean Wrfghtg Env Applied Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>closeness and physical significance of the ocean bottom, and the complexities inherent to rapid changes of the ocean structure. The objectives of this program are met through measuring, analyzing, modeling and simulating, and exploiting ocean acoustic factors to gain advantage over potential adversaries using undersea acoustic systems. Results of this activity support acoustic sensor and system development, performance prediction, and tactical decision aids.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of an integrated hydrodynamic/acoustic propagation modeling capability for littoral regions to predict acoustic ASW system performance in dynamic environments. - Continued development of a TDA that can predict the dynamic oceanographic characteristics of shallow-water internal waves and their effects on underwater acoustic signals. - Continued development of a validated, physics-based processing algorithm that diagnoses acoustic performance directly from oceanographic data. - Continued development of a set of physics-based environmental acoustic metrics to evaluate the predictions of TDAs that are used in planning asset allocation and placement of distributed Autonomous Undersea Vehicles (AUVs) in a time evolving scenario. - Continued development of improved performance predictions for sonar surveillance systems that utilize horizontal line arrays operating in shelf-break environments and relate horizontal-array signal gain and coherence length to the statistics and scale lengths of transverse environmental inhomogeneities. - Continued development of an ocean magnetic prediction system for magnetic fields generated by high amplitude internal waves, internal bores, and internal solitary waves. - Completed development of glider ocean sampling strategies to minimize acoustic detection range uncertainty for anti-submarine warfare predictions. - Completed development of a broadband, bistatic reverberation time-series simulator for range dependent underwater environments. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less noted as completed above. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less noted as completed above. <p>Title: Physical Oceanography</p>				
		10.637	11.418	11.874

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>	PROJECT 0000: <i>Ocean Wrfghtg Env Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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Description: The goal of this activity is to develop naval tactical uses of knowledge of the physics of the ocean within the BSE. This is achieved through the development of predictive models of the water mass structure, waves, currents, and air-sea interactions and developing measurement/observation technology. Other applications utilize knowledge of the interaction of the water column hydrodynamics and the acoustics to predict the undersea transmission characteristics and sources of uncertainty in these statistics. Utilizing knowledge of the ocean surface physics, the physical oceanography program seeks to exploit the combination of remotely sensed data, in-situ data, and adaptively sampled data to optimize predictions of ocean currents and water column structure. These predictions, custom databases, adaptive sampling schemes and data programs serve ASW, Naval Special Warfare (NSW), Sea-Basing, and mine warfare needs.

FY 2010 to FY 2011 funding increase is due to ramping up emerging physical oceanography technologies programs.

- FY 2010 Accomplishments:**
- Continued to employ ocean models to complete 3-D acoustic simulations of space-time coherence of the acoustic field, which is a primary characteristic related to detection performance of acoustic systems.
 - Continued development of mass conserving baroclinic finite element models using discontinuous Galerkin methods.
 - Continued to extend current theory dealing with tidal variations in sound-speed to sound-speed events with strong range-dependence.
 - Continued the development of a data assimilative nearshore modeling capability using measurements to guide hydrodynamic forecasts including data sampling strategies and model sensitivity to data.
 - Continued new ocean mixed-layer algorithms for generation of synthetic profiles which has led to the operational implementation of a new Navy Ocean Sound Speed Prediction (NOSSP) system at the Naval Oceanographic Office.
 - Continued the integration of hyperspectral imagery into underwater autonomous vehicles and derive river environmental properties through a combination of models and observations.
 - Continued the development and implementation of new techniques for parameterizing fluxes of mass and energy across the air-sea interface in coupled ocean-atmosphere models, to improve operational predictions of the BSE.
 - Continued development and testing of acoustic communications, disposable environmental instruments, and Unmanned Undersea Vehicles (UUV) and gliders for NSW mission support.
 - Continued developing Delft3-D-Coupled Ocean Atmosphere Mesoscale Prediction System

FY 2010	FY 2011	FY 2012

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>	PROJECT 0000: <i>Ocean Wrfghtg Env Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>(COAMPS) to include new options for riverine input and transport and behavior of contaminants in support of NSW mission planning.</p> <ul style="list-style-type: none"> - Continued development of the knowledge layer of the internal wave tactical decision aid. - Continued development and testing of optimizing remote environmental monitoring units and other autonomous devices for NSW-Meteorological and Oceanographic Command (METOC) uses in assessing METOC conditions and providing data for assimilation. - Continued the development of synthetic aperture radar (SAR) and hyperspectral imagery exploitation for NSW and Marine Expeditionary Forces as well as the support of new riverine units. - Continued studies of the monitoring and evaluation of ocean currents and water mass properties near topographic control points in marginal seas. - Continued to develop improved ocean wave prediction, especially shoaling waves, based on the extensive basic research measurement programs in this area over the past decade. - Continued developments in atmospheric and ocean model NOWCAST/forecast systems at a variety of scales (global, regional, semi-enclosed seas, local) including relocateable and nested models dependent on other priorities in this area. - Continued development of predictive capability of internal wave affects on the battlespace, including affects on acoustic transmission. - Continued the development of the coupled Delft3-D-COAMPS model within the larger naval forecast system for use in NSW mission planning. - Continued the development of adaptive sampling algorithms for minimizing acoustic uncertainty using persistent, reconfigurable sampling by UUVs. - Continued on-board processing of METOC data on gliders/UUV for exfiltration consistent with operational concept of operations. - Continued the custom installation of adaptive sampling algorithms for minimizing acoustic uncertainty using persistent, reconfigurable sampling by UUVs using Naval Oceanographic (NAVO) modeling systems. - Completed effort to develop a coupled, high-resolution, comprehensive ocean prediction system for the study of complex air-sea process. - Completed development and testing of glider uses in ASW METOC, adaptive sampling, and NSW support. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. 			
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>	PROJECT 0000: <i>Ocean Wrfghtg Env Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Complete effort to obtain tidal constituents in estuaries combining sequential remote sensing imagery, tide gauge data and numerical model simulations. - Complete effort to develop and put in place the algorithms, data processing systems, product validation, mission planning and post-processing resources to exploit the science data stream from the Hyperspectral Imager for the Coastal Ocean (HICO) spaceborne hyperspectral imager. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Complete development of the knowledge layer of the internal wave tactical decision aid. - Complete development and testing of optimizing remote environmental monitoring units and other autonomous devices for NSW-METOC uses in assessing METOC conditions and providing data for assimilation. - Complete developments in atmospheric and ocean model NOWCAST/forecast systems at a variety of scales (global, regional, semi-enclosed seas, local) including relocateable and nested models dependent on other priorities in this area. - Initiate multi-scalable visualization tools using GPU's, tablets and remote sensing data. - Initiate testing of Air-Deployed Ocean Profiler in research and fleet test. - Initiate development of a coupled atmosphere-ocean-cryosphere-wave prediction system capable of forecasts from the submesoscale to decadal. - Initiate development of a high resolution Arctic ice/ocean/weather/wave prediction system that can assimilate SAR data. 			
Accomplishments/Planned Programs Subtotals	46.954	49.491	50.076

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

All Science and Technology model improvements undergo a rigorous validation verification and evaluation against quantifiable metrics before being accepted for transition into operations. In Marine Meteorology, for example, typical improvements over the past decade have amounted to a gain in skill of one forecast-day (i.e., the 4-day forecast is now as skillful as the 3-day forecast of a decade ago), and tropical cyclone forecast track error has been reduced by 50%. It is expected that future increases in skill will continue at or above this pace.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE					PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>			PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>					4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	0.230	-	-	-	-	-	-	-	-	0.000	.230

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	0.230	-	-
Accomplishments/Planned Programs Subtotals	0.230	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602435N: <i>Ocean Wrfghtg Env Applied Res</i>				PROJECT 9999: <i>Congressional Adds</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	5.179	-	-	-	-	-	-	-	-	0.000	5.179

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: Autonomous Marine Sensors and Networks <i>FY 2010 Accomplishments:</i> This effort developed platform functionality enhancements to the Bottom Stationed Ocean Profiler through investigating the use of acoustic modems on the BSOP and on glider platforms; integrated optical sensors and passive acoustic sensors into the BSOP and gliders; developed an integration plan for the SEAS instrument; and performed off shore deployments in the Eastern Gulf of Mexico.	2.390	-
Congressional Add: Underwater Imaging and Communications Using Lasers <i>FY 2010 Accomplishments:</i> This effort investigated issues pertaining to using lasers for imaging objects in turbid underwater environments, such as bottom-mounted mines, at greater ranges than currently possible using optical transmitters and receivers and to investigate environmental constraints on the limits of underwater optical communications as applied to underwater networks of unmanned platforms.	1.992	-
Congressional Add: Unmanned Undersea Vehicle Submerged Long Range Positioning <i>FY 2010 Accomplishments:</i> This effort addressed positioning accuracy of Unmanned Undersea Vehicles (UUVs) during submerged long endurance missions.	0.797	-
Congressional Adds Subtotals	5.179	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602651M: <i>JT Non-Lethal Wpns Applied Res</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	5.836	6.002	5.937	-	5.937	5.918	6.056	6.187	6.294	Continuing	Continuing
0000: <i>JT Non-Lethal Wpns Applied Res</i>	5.836	6.002	5.937	-	5.937	5.918	6.056	6.187	6.294	Continuing	Continuing

A. Mission Description and Budget Item Justification

The DOD's Joint Non-Lethal Weapons Program (JNLWP) was established by the Secretary of Defense, who assigned centralized responsibility for DoD joint research and development of non-lethal technology to the Commandant of the Marine Corps as the Executive Agent. The Under Secretary of Defense for Acquisition, Technology and Logistics provides direct oversight of the JNLWP.

The efforts described in this Program Element (PE) reflect science and technology (S&T) investment decisions provided by the Joint Non-Lethal Weapons (NLW) Integrated Product Team, a multi-service flag level corporate board that executes the JNLWP for the Commandant of the Marine Corps. This direction is based on the needs and capabilities of the Services, the Special Operations Command, and the Coast Guard, as identified in the DoD's Non-Lethal Weapons Joint Capabilities Based Assessment Document. This coordinated joint S&T development approach addresses mutual capability gaps and assures the best non-lethal technologies and equipment are provided to the operating forces while eliminating duplicative service S&T investment.

This program funds the applied research, study, assessment, and demonstration of technologies that could provide a non-lethal capability or target effect. Investment areas include applied research related to: non-lethal directed energy weapons (lasers, millimeter wave and high power microwave) for counter-personnel and counter-material missions; non-lethal acoustic and optical technologies; advanced non-lethal materials (including materials for vehicle/vessel stopping and counter-facility applications); associated human effects and effectiveness for new non-lethal stimuli; injury potential and effectiveness of directed energy, electric stun, ocular, and acoustic based non-lethal technologies; and developing models of crowd behavior and dynamics. This program transitioned from PE 0602114N, Power Projection Applied Research by order of the Under Secretary of Defense for Acquisition, Technology, and Logistics, USD(AT&L), to a separate PE for Joint Non-Lethal Weapons Applied Research and established the Marine Corps as the executive agent for DoD Joint Non-Lethal Weapons RDT&E.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	PE 0602651M: <i>JT Non-Lethal Wpns Applied Res</i>

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	5.983	6.002	5.948	-	5.948
Current President's Budget	5.836	6.002	5.937	-	5.937
Total Adjustments	-0.147	-	-0.011	-	-0.011
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.147	-			
• Rate/Misc Adjustments	-	-	-0.011	-	-0.011

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602651M: <i>JT Non-Lethal Wpns Applied Res</i>				PROJECT 0000: <i>JT Non-Lethal Wpns Applied Res</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>JT Non-Lethal Wpns Applied Res</i>	5.836	6.002	5.937	-	5.937	5.918	6.056	6.187	6.294	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds the applied research, study, assessment, and demonstration of technologies that could provide a non-lethal capability or target effect. Investment areas include applied research related to: non-lethal directed energy weapons (lasers, millimeter wave and high power microwave) for counter-personnel and counter-material missions; non-lethal acoustic and optical technologies; advanced non-lethal materials (including materials for vehicle/vessel stopping and counter-facility applications); associated human effects and effectiveness for new non-lethal stimuli; injury potential and effectiveness of directed energy, electric stun, ocular, and acoustic based non-lethal technologies; and developing models of crowd behavior and dynamics.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: (U) JOINT NON -LETHAL WEAPONS	5.836	6.002	5.937
FY 2010 Accomplishments:			
<ul style="list-style-type: none"> - Continued investigation of the characteristics, optimization, and control of Laser Induced Plasma (LIP) phenomena for its non-lethal applications to both counter-personnel and counter-materiel missions. Completed the Counter-vehicle mission applicability determination portion of this effort. LIP is a phenomenon of high energy, short pulse lasers that have several potential applications to produce or transmit non-lethal stimuli - Continued refinement of directed energy weapon models through research into non-lethal phenomena and assessment of human effects and weapon effectiveness - Continued applied research in the development of counter-personnel and counter-materiel directed energy non-lethal weapons, including counter-vehicle and advanced active denial activities - Continued academic research into technology areas with relevance to non-lethal weapon capabilities - Continued investigations of alternative technologies with potential to address emerging capability gaps - Continued characterization efforts of alternative directed energy technologies by building upon the Advanced Total Body Model (ATBM) as part of the Human Effects Modeling Analysis Program (HEMAP) to incorporate suitable sensors capable of measuring directed energy effects (millimeter - wave, high powered microwave, etc) - Continued investigation of candidate technologies applicable to delivering laser induced plasma effects - Completed examination of target effects/characterization and assessed the resulting crowd behavior and effectiveness of non-lethal acoustic and optical (light stun/distract) technologies - Completed investigation of several advanced non-lethal material technologies with non-lethal weapons applications, including engine suffocates, morphing materials for new non-lethal rounds or flight bodies, and new non-lethal nano-materials - Initiated human effects investigation of alternative physical phenomena to non-lethally suppress 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602651M: <i>JT Non-Lethal Wpns Applied Res</i>	PROJECT 0000: <i>JT Non-Lethal Wpns Applied Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>humans beyond small arms range</p> <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2010, less those noted as complete above - Initiate target effects characterization and assessment of resulting crowd behavior and effectiveness associated with promising alternative physical phenomena identified during FY 2010 investigations - Initiate investigations of advanced materials and emergent technologies suitable for extended range non-lethal weapon payload applications - Initiate transition of foundational effects associated with advanced electro-muscular disruption technologies to higher levels of technology development and demonstration <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2011, less those noted as complete in FY10 - Complete applied research in the development of counter-personnel and counter-materiel directed energy non-lethal weapons, including counter-vehicle and advanced active denial activities - Complete investigation of candidate technologies applicable to delivering laser induced plasma effects - Initiate applied research for potential emergent technologies with applicability to the clear-a-space counter-personnel mission - Initiate transition of foundational effects associated with underwater acoustics bioeffects applied research to higher levels of technology development 				
Accomplishments/Planned Programs Subtotals		5.836	6.002	5.937
C. Other Program Funding Summary (\$ in Millions)				
N/A				
D. Acquisition Strategy				
Not applicable.				
E. Performance Metrics				
<p>The primary objective of this Program Element is the development of technologies that lead to the next-generation of Non-Lethal Weapons. The program consists of a collection of projects that range from studies and analyses to the development and evaluation of feasibility demonstration models. Individual project metrics reflect the technical goals of each specific project. Typical metrics include both the effectiveness of the technology, human effects and effectiveness, and potential for compliance with policy and legislation. Overarching considerations include the advancement of related Technology Readiness Levels and Human Effects Readiness Levels, the degree to which project investments are leveraged with other performers, reduction in life cycle cost upon application of the technology, and the identification of opportunities to transition technology to higher categories of development.</p>				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602747N: <i>Undersea Warfare Applied Res</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	64.000	69.186	108.666	-	108.666	113.155	115.662	122.343	125.097	Continuing	Continuing
0000: <i>Undersea Warfare Applied Res</i>	53.465	69.186	108.666	-	108.666	113.155	115.662	122.343	125.097	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	0.975	-	-	-	-	-	-	-	-	0.000	.975
9999: <i>Congressional Adds</i>	9.560	-	-	-	-	-	-	-	-	0.000	9.560

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE funds applied research efforts in undersea target detection, classification, localization, tracking, and neutralization. Technologies being developed within this PE are aimed at enabling Sea Shield, one of the core operational concepts detailed in the Naval Transformational Roadmap. Associated efforts focus on new Anti-Submarine Warfare (ASW) operational concepts that promise to improve wide-area surveillance, detection, localization, tracking, and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. Related efforts are aimed at leveraging technologies that will protect the country's current capital investment in surveillance, submarine, surface ship, and air ASW assets. Research focused on understanding the impacts on marine mammals of manmade underwater sound is also conducted in the Program Element.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	65.003	69.186	89.728	-	89.728
Current President's Budget	64.000	69.186	108.666	-	108.666
Total Adjustments	-1.003	-	18.938	-	18.938
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.301	-			
• SBIR/STTR Transfer	-1.178	-			
• Program Adjustments	-	-	19.385	-	19.385
• Section 219 Reprogramming	0.485	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.447	-	-0.447
• Congressional General Reductions Adjustments	-0.009	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

Congressional Add: *Advanced High Energy Density Surveillance Power Module*

Congressional Add: *Autonomous UUV Delivery and Communication System Integration*

Congressional Add: *Galfenol Energy Harvesting*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	3.187	-
	3.585	-
	2.788	-
Congressional Add Subtotals for Project: 9999	9.560	-
Congressional Add Totals for all Projects	9.560	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>				PROJECT 0000: <i>Undersea Warfare Applied Res</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>Undersea Warfare Applied Res</i>	53.465	69.186	108.666	-	108.666	113.155	115.662	122.343	125.097	Continuing	Continuing

A. Mission Description and Budget Item Justification

This PE funds applied research efforts in undersea target detection, classification, localization, tracking, and neutralization. Technologies being developed within this project are aimed at enabling Sea Shield which is one of the core operational concepts detailed in the Naval Transformational Roadmap. Associated efforts focus on new ASW operational concepts that promise to improve wide-area surveillance, detection, localization, tracking, and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. Related efforts are aimed at leveraging technologies that will protect the country's current capital investment in surveillance, submarine, surface ship, and air ASW assets.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: ANTI-SUBMARINE WARFARE (ASW) DISTRIBUTED SEARCH</p> <p>Description: ASW Distributed Search focuses on the development of technologies for the non-covert tactical search for undersea targets ranging from hours to weeks using automated sensor systems deployed around operating areas including along key transit routes to protect naval/maritime forces, around temporarily fixed sea base regions and naval force operating areas, or around fixed defensive regions and areas of interest such as key US/Allied ports. "Non-covert" implies availability of airborne assets for sensor deployment (although other means may also be used), and the ability to employ active sonar along with passive and non-acoustic methods. "Search" is conducted in concentrated areas, typically exploiting cues received from surveillance systems. The submarine target must be detected beyond its weapons release range. The objective is to develop rapidly deployable systems employing automated detection and classification capabilities for use in both shallow and deep water operating environments. Distributed Search supports the ASW protected passage Maritime Shield operational constructs. Related efforts include the development of distributed systems employing optimization as well as active acoustic sensing and processing techniques, navy-unique transduction and underwater networking technology. Efforts also include the development of Unmanned Undersea Vehicle-based and affordable off-board deployable sensing systems employing persistent detection concepts and components. These efforts provide an extended reach of organic platform-based systems through the use of new sensor concepts, improved materials for advanced sensors, optimized deployment, employment, and automated operation of distributed sensor fields. The cornerstone of Distributed Search is the development of rapidly deployable, long-endurance active sensors with automated processing suitable for use in a wide variety of operational environments.</p> <p>Increase from FY 2010 to FY 2011 is due to the new EC SHD-FY10-02 High Fidelity Active Sonar Training (HIFAST).</p> <p>FY 2010 Accomplishments: Wide Area ASW Surveillance activity:</p>	11.776	14.592	16.571

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>	PROJECT 0000: <i>Undersea Warfare Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued development of signal processing algorithms aimed at reducing clutter-generated false alerts. - Continued development/improvement of multi-static signal processing techniques for systems employing coherent sound sources. - Continued development of "intelligent" algorithms aimed at optimizing distributed multistatic sources/receivers. - Continued a collaborative follow-on Joint Research Project for Next Generation Autonomous Sensing (NGAS). - Initiated research and development of feature-based tracking techniques to improve multi-sensor tracking of quiet submarines in littoral and deep-ocean environments. - Initiated research into the characterization and classification of deep-ocean clutter sources to improve active sonar system performance in Convergence Zone (CZ) and other deep-ocean propagation conditions. - Initiated development of Non-Traditional Transduction Methods (NTTM) which fundamentally departs from conventional ASW transduction techniques. - Initiated development of Non-Acoustic Fiber Optic Sensors (NA-FOS) for ASW applications. - Initiated research aimed at adaptive design and synthesis of networked distributed sensors. - Initiated effort to demonstrate the effectiveness of structural acoustic-based classifier techniques to detect, localize and identify. - Completed research effort to accomplish array shape estimation using fiber-optic interferometric methods. <p>The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> - Continued an applied research effort to improve distributed system processing techniques and capabilities. - Initiated development of high fidelity computer-based simulation training with linked architecture that supports ASW training from the operator-level to the ASW Commander-level applicable to both surface and air platforms. <ul style="list-style-type: none"> - Continued development of signal processing improvements for coherent tactical active sonar systems aimed at improving Detection, Classification, and Localization of small, slow moving submarines in shallow water. - Continued development of improved techniques to distinguish submarine echoes from those produced by ocean bottom features. - Continued design and development of underwater projectors using structural magnetostrictive materials. - Continued dipole projector array design and development. - Continued compact low frequency projector developments. - Continued single crystal and hybrid projector design and development. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>	PROJECT 0000: <i>Undersea Warfare Applied Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Complete dipole projector array design and development.</p> <p>The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete an applied research effort to improve distributed system processing techniques and capabilities. Technologies will transition to Air ASW Systems, NAVAIR PMA. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. 			
<p>Title: ANTI-SUBMARINE WARFARE (ASW) PERFORMANCE ASSESSMENT</p> <p>Description: The goal of this work is to integrate ocean and atmospheric environmental characteristics with sensor performance predictions in order to develop algorithms and Tactical Decision Aids (TDAs) that will accurately predict overall sensor performance in a given environment in near real-time for both present and future situations. The results of these research efforts in conjunction with embedded state-of-the-art command and operator-level training will facilitate the optimum employment of ASW sensor systems, thus increasing their effectiveness and potentially decreasing the number of sensors used to provide coverage in a given area. This work will provide operational commanders with sensor performance predictions which allow them to accurately judge the performance of those sensors, as well as information with which to deploy them for the greatest operational effect. It will also provide information as to how the performance evolves over time due to effects such as the deformation of sensor locations by currents, sound velocity profile changes, geologic magnetic interference changes, or changes to the optical properties of the water, etc. The effort includes performance predictions for fields of sensors as well as individual sensors themselves and applies to both acoustic and nonacoustic sensors.</p> <p>Work includes development of ASW sensor and system performance models, and realistic simulations and measures of effectiveness that incorporate and exploit critical environmental knowledge. It includes efforts to couple ocean dynamics and acoustics, characterize ambient noise in the littorals, measure and model acoustic and optical propagation and scattering in complex environments, develop algorithms to extract environmental information from through-the-sensor measurements and quantification and prediction of uncertainty. This information is combined with the operating characteristics of particular sensors (or groups of sensors) to provide predictions of sensor performance in the environment at that particular time and in the future. The predictions will also include assessments of the prediction uncertainty due to environmental measurement and sensor performance uncertainties.</p>		4.047	3.052
		2.258	

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>	PROJECT 0000: <i>Undersea Warfare Applied Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>This work aligns principally with the Assure Access and Hold at Risk S&T Focus Area in the Naval S&T Strategic Plan and contributes measurably to the Operational Environments S&T Focus Area strategic objectives.</p> <p>Decrease in funding for fiscal years 2010, 2011 and 2012 is due to phasing down funding for FNC SHD-FY09-01 (Operation of ASW Active Distributed Systems).</p> <p>FY 2010 Accomplishments: Wide Area ASW Surveillance activity: - Naval Research Laboratory effort in Wide Area-Performance Assessment (NRL/WA-PA): Completed development of models that accurately characterize short and long range forward scattering from the ocean boundaries for surveillance through tactical sonar frequencies.</p> <p>The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area: - Continued an applied research effort to improve distributed system processing techniques and capabilities. - Continued research effort aimed at the ideal placement of acoustic sources and drifting sensor systems using in-situ environmental information and models. - Continued research effort focusing on distributed system in-situational environmental characterization and system monitoring. - Continued research effort aimed at the ideal placement and control of acoustic sources and drifting sensors systems. - Continued research effort to determine the placement of and follow-on control and pattern keeping of mobile sources and distributed sensor systems. - Initiated development of algorithms to extract environmental information from through-the-sensor measurements.</p> <p>FY 2011 Plans: The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area: - Continue all efforts of FY 2010.</p> <p>FY 2012 Plans: - Continue all efforts of FY 2011.</p>				
Title: ANTI-SUBMARINE WARFARE (ASW) PRECISION LOCALIZATION		3.381	3.694	3.710
Description: Precision Localization focuses on the development and demonstration of technologies which use information from surveillance or search systems to determine an area of uncertainty (AOU) relative to target range, bearing, and depth adequate				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>	PROJECT 0000: <i>Undersea Warfare Applied Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>to handoff to an attack system. Precision Localization employs non-acoustic techniques such as magnetic and optical sensing to highly localize submerged threats. The objective is to increase magnetic sensor range and robustness, enable deployment on Unmanned Air Vehicles (UAVs), and increase optical sensing search rates. Efforts include the development of non-traditional tracking and advanced magnetic and electric field sensors and processing. These technologies will provide a decreased AOU size thus enabling the effective use of smaller, more versatile torpedoes as well as increased performance gain in detection, targeting, tracking/trailing, and homing via target acquisition and covert prosecution.</p> <p>FY 2010 Accomplishments: Wide Area ASW Surveillance activity:</p> <ul style="list-style-type: none"> - Continued development of a non-traditional tracking system for deployment on undersea vehicles. - Continued testing of a non-traditional tracking system. - Continued development of alternative active optical sources and sensor devices for Non-Acoustic ASW systems. - Continued an effort to extend the technology base for blue laser sources for Undersea Warfare applications including underwater communications. - Continued an effort to extend the technology base for high performance electro-optic detectors suitable for Undersea Warfare applications including underwater communications. - Continued an effort to extend the technology base for high performance electro-optic filters suitable for Undersea Warfare applications including underwater communications. - Continued an effort to develop consistent and comprehensive modeling and simulation tools for photonic Undersea Warfare and underwater communications components and systems. - Continued an effort to develop optical signal processing and hybrid computing technology appropriate for Undersea Warfare and underwater communications systems. - Completed development of spin-dependent tunneling and coupled magnetostrictive/piezoelectric passive magnetometer device technologies. - Completed development of models that accurately characterize short and long range forward scattering from the ocean boundaries for surveillance through tactical sonar frequencies. - Initiated development of ASW sensor technologies capable of being deployed by a gun or missile launcher. <p>FY 2011 Plans: - Continue all efforts of FY 2010, less those noted as completed above.</p> <p>FY 2012 Plans: - Continue all efforts of FY 2011.</p>				
Title: ANTI-SUBMARINE WARFARE (ASW) SURVEILLANCE		15.841	26.232	63.985

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>	PROJECT 0000: <i>Undersea Warfare Applied Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Description: ASW Surveillance focuses on dramatically improving detection, classification, and localization capabilities in large ocean areas relative to the capabilities of legacy ASW surveillance systems. The related technologies support the conduct of covert wide-area surveillance ranging from one day to six months. The objectives are to develop and demonstrate technologies that provide clandestine indications and warnings in far forward and contested operating areas and in complex operational environments against all submarine threats including new threats with unknown target signatures and tactics. Covertiness implies use of non-observable platforms and/or deployed automated sensors employing passive sonar or other non-detectable methods. The surveillance process includes initial detection and classification. Efforts include the development of Unmanned Undersea Vehicle-based and affordable off-board deployable sensing systems employing a wide variety of surveillance concepts and components. These efforts focus on alternative detection phenomena, vector/tensor sensors, automated acoustic processing, more compact and longer lasting power sources, and high bandwidth acoustic communications links.</p> <p>FY 2010 to FY 2011 funding increase is due to new FNC (SHD-FY10-05 Affordable Vector Sensor Towed Array and Signal Processing) starting in FY 2011. FY 2012 funding increase is due to the initiation of a new INP for Large Displacement Unmanned Undersea Vehicles (LD-UUV).</p> <p>FY 2010 Accomplishments: Wide Area ASW Surveillance activity: - Naval Research Laboratory effort in Wide Area-Surveillance (NRL/WA-SV): Continued development of new acoustic and magnetic sensors for autonomous, networked underwater threat monitoring over large spatial scales. - Completed design of a "Sea Star" undersea local area network to link peripheral sensors to a centralized node through high-bandwidth, short-haul acoustic communications. - NRL/WA-SV: Completed fiber optic technology development to support the next generation of submarine hull arrays including new transducers, optical multiplexing, and optical components. - Initiated development of Non-Acoustic Underwater Communications. - Initiated development of Advanced Imaging Methods (AIM) to provide expanded spatial, temporal and spectral imaging options. - Initiated an effort to research improved seawater electrodes for Underwater Electric Potential (UEP) sensing in ASW applications. - Initiated research the goal of which is to form underwater magnetic sensors into a virtual gradiometric array via non-cabled communications.</p> <p>The following Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area: - Continued development of technologies to provide rapid localization of threat submarines for On-Demand Detection, Classification and Localization (On-Demand DCL).</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>	PROJECT 0000: <i>Undersea Warfare Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>- Initiated development of a vector sensor towed array and associated signal processing with performance nominally equivalent to a "thin-line" (TB-29) twin-line towed array to be compatible with the existing TB-29 array handling system.</p> <p>Battlegroup ASW Defense activity:</p> <ul style="list-style-type: none"> - Continued development of an acoustic/magnetic hybrid sensor. - Continued development of low cost, compact, combined acoustic sensor. - Continued electroactive polymer smart sensor development. - Continued research to improve detection of quiet diesel-electric submarines using passive sonar arrays in deep ocean environments. - Completed development of target classification algorithms that adapt to local shipping noise conditions, thereby reducing false alarm probability. - Completed development of environmentally adaptive target detection and classification algorithms for deep water operating environments. - Initiated research to predict performance of automated passive sonar detection and classification algorithms in shallow and deep ocean environments. - Initiated biomimetic and nano sensor development. - Initiated 'hockey puck' transducer/amplifier module development. - Initiated broadband, directional, high power array development. - Continue development of new acoustic and magnetic sensors for autonomous, networked underwater threat monitoring over large spatial scales. - Complete fiber optic technology development to support the next generation of submarine hull arrays including new transducers, optical multiplexing, and optical components. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - NRL/WA-SV: Complete development of new acoustic and magnetic sensors for autonomous, networked underwater threat monitoring over large spatial scales. <p>The following efforts contribute to the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete development of new acoustic and magnetic sensors for autonomous, networked underwater threat monitoring 			
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>	PROJECT 0000: <i>Undersea Warfare Applied Res</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>over large spatial scales.</p> <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of 2011, less those noted as completed above. - Initiate development of a long endurance air independent energy source for Large UUVs. - Initiate development of Autonomy for operation of UUV in the littorals. - Initiate development of core UUV technologies to extend the reliability and endurance of UUV operating in the littorals. - Initiate at sea testing of prototype LD-UUV technologies. - Initiate Consortium for Robotics and Unmanned Systems Research (CRUSER) in support of the LD UUV program. 			
<p>Title: MARINE MAMMALS</p> <p>Description: The goal of this activity is to support: (1) marine mammal research related to understanding impacts of underwater sound (especially sonar) on marine mammal behavior, hearing, physiology, distributions and ecology; (2) development and testing of new technologies for the detection of marine mammals at sea; (3) research on the bio-acoustic properties, use of sound for detection of, and effects of sound on fish and lesser marine organisms; and (4) research on optically important biota in the coastal ocean in support of Naval Mine, Undersea, and Special Warfare (including oceanic bioluminescence and the development and testing of bioluminescence sensors).</p> <p>The marine mammals research conducted in this Program Element (P.E.) represents part of a total effort executed in coordination with complementary research performed in PE 0602435N.</p> <p>This Activity has been created specifically to address the work associated with determining and mitigating the effects on the behavior of marine mammals of manmade sound transmitted underwater.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued multi-investigator, coordinated field research to test responses of marine mammals (especially beaked whales) to controlled sound exposures. - Continued development of new technologies for detection and localization of marine mammals, including (but not restricted to) gliders equipped with passive acoustic sensors, radar and thermal imagery. - Continued research examining hearing sensitivity of marine mammals (including temporary and permanent threshold shifts). - Continued research efforts examining distributions and abundances of marine mammals relative to prey fields and basic oceanographic parameters. - Continued development of and evaluate models that predict time- and space-dependent sound fields produced by anthropogenic noise sources and mammal responses to the noise. 		4.790	5.205
		5.236	

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued development and testing of multi-frequency acoustic technologies for detection, identification and enumeration of fish. - Continued research to examine sensitivity of fish to anthropogenic sound. - Continued research leading to better predictability of bioluminescent and pigment-bearing planktonic organisms. - Initiated research on effects of chronic physiological stress related to acoustic exposure of marine mammals in the wild. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all FY 2010 efforts. - Initiate research on the population level consequences of acoustic disturbance to marine mammals. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 				
<p>Title: UNDERSEA WEAPONRY</p> <p>Description: Undersea Weaponry focuses on the development of enabling technologies to counter threat submarines and surface vessels by increasing Probability of Kill and platform survivability. Weapon technology focus areas include: Explosives and Warheads, Guidance and Control (G&C), Multidisciplinary Systems Design & Optimization (MSDO) (comprising Simulation Based Design, Silencing, and Propulsion), Power Sources, Supercavitation, and Counter Weapons/Counter Measures.</p> <p>The ultimate goal of this activity is to provide revolutionary capabilities needed to fill Sea Shield and Sea Strike Warfighter Capability Gaps, to accommodate unique payload limitations through the development of modular and reduced sized undersea weapons based on common technology enablers (where possible), and to provide improved platform pre-engagement positioning and fire-control solutions for effective weapon-to-target engagement, and provide countermeasures and counterweapons against current and next-generation undersea weapons.</p> <p>FY 2010 to FY 2011 funding increase is due to new FNC (SHD-FY11-01 Torpedo Common Hybrid Fuzing System) starting in FY 2011. FY 2011 to FY 2012 funding increase is due to increased funding to support stealth technologies in accordance with Ohio Replacement mission.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Completed evaluation of alternative undersea warhead fuzing concept developed under the advanced undersea warhead fuzing initiative. - Completed weaponization study for unmanned surface vehicle. - Completed assessment of the kinetic energy warhead concept potential to provide enhanced undersea warhead performance. - Completed transition of the Torpedo Intelligent Controller to NAVSEA/PMS 404. 		13.630	16.411	16.906

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602747N: <i>Undersea Warfare Applied Res</i>	PROJECT 0000: <i>Undersea Warfare Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>The following efforts support the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> - Continued development of a reduced size/weight Compact Rapid Attack Weapon (CRAW) for air deployment. This effort will include sensor, guidance and control, warhead, propulsion, and air frame integration tasks. - Continued the development of algorithms for CRAW to search, home and terminally home in deep and shallow water against targets both without and with countermeasures. - Continued the development of a CRAW warhead that will achieve required performance against submarine targets, and demonstrate feasibility of achieving final goal. - Completed development of enhanced performance concept for torpedo warheads using focused energy technologies for Light Weight Torpedo (LWT) Improvement and CRAW applications. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Complete assessment of the kinetic energy warhead concept potential to provide enhanced undersea warhead performance. - Complete a proof-of-concept demonstration of optical fuzing components developed under the advanced undersea warhead fuzing initiative. - Complete development of the supercavitating 6.75-inch vehicle with vehicle control devices. - Complete assessment of the long pulse concept potential to provide enhanced undersea warhead performance with smaller volumetric requirements. - Initiate design of advance undersea weapon testbed vehicles. - Initiate CONOPs and tactical-level analysis and employment for advanced undersea weapons. <p>The following efforts support the Sea Shield FNC in the Littoral Anti-Submarine Warfare Mission Area:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY2011, less those noted as completed. - Complete design of advance undersea weapon testbed vehicles. - Initiate design/formulation of advanced warheads. - Initiate design/formulation and early-stage testing of propulsion system components for advanced undersea platforms. - Initiate construction of advance undersea weapon testbed vehicles. - Initiate efforts to provide relevant stealth technologies in accordance with Ohio Replacement mission and threat analysis. - Initiate efforts to provide technologies for the next generation Ohio Class submarine. 			
Accomplishments/Planned Programs Subtotals	53.465	69.186	108.666

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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• 0603747N: <i>UNDERSEA WARFARE ADVANCED TECHNOLOGY</i>	20.065	22.995	22.609	0.000	22.609	17.051	21.949	21.113	10.501	0.000	136.283

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of applied research in undersea warfare are to develop technologies aimed at improving target detection, classification, localization, tracking, increasing attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments, countering enemy torpedoes, providing the ability to conduct long-range engagements, increasing weapons load-out, providing multi-platform connectivity, increasing endurance/survivability, and reducing size and power requirements.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>				PE 0602747N: <i>Undersea Warfare Applied Res</i>				4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	0.975	-	-	-	-	-	-	-	-	0.000	.975

A. Mission Description and Budget Item Justification
Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	0.975	-	-
Accomplishments/Planned Programs Subtotals	0.975	-	-

C. Other Program Funding Summary (\$ in Millions)
N/A

D. Acquisition Strategy
Not applicable.

E. Performance Metrics
Overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	9.560	-	-	-	-	-	-	-	-	0.000	9.560

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: Advanced High Energy Density Surveillance Power Module <i>FY 2010 Accomplishments:</i> This effort developed battery packs based on high quality lithium carbon monofluoride D-diameter cells.	3.187	-
Congressional Add: Autonomous UUV Delivery and Communication System Integration <i>FY 2010 Accomplishments:</i> This effort provided for technical expertise in developing and designing technology for autonomous docking of Unmanned Undersea Vehicles (UUV) in support of the autonomous UUV delivery and communications demonstration effort.	3.585	-
Congressional Add: Galfenol Energy Harvesting <i>FY 2010 Accomplishments:</i> This effort advanced the Galfenol force-based energy harvester technology from a proof-of-principle to a prototype device targeted toward a real-world Naval application. A prototype energy harvesting system, hardware and power conditioning electronics were designed, built, and tested.	2.788	-
Congressional Adds Subtotals	9.560	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602782N: <i>Mine & Exp Warfare Applied Res</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	42.756	36.833	37.583	-	37.583	42.368	47.686	56.426	62.224	Continuing	Continuing
0000: <i>Mine & Exp Warfare Applied Res</i>	39.569	36.833	37.583	-	37.583	42.368	47.686	56.426	62.224	Continuing	Continuing
9999: <i>Congressional Adds</i>	3.187	-	-	-	-	-	-	-	-	0.000	3.187

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE provides technologies for Naval Mine Countermeasures (MCM), Expeditionary Warfare, U.S. Naval sea mining, Naval Special Warfare (NSW), and Joint Tri-Service Explosive Ordnance Disposal (EOD). This program is strongly aligned with the Joint Chiefs of Staff Joint Warfighting Capability Objectives through the development of technologies to achieve military objectives with minimal casualties and collateral damage. Within the Naval Transformation Roadmap, this investment will achieve one of three "key transformational capabilities" required by "Sea Shield" as well as technically enable the Ship to Objective Maneuver (STOM) key transformational capability within "Sea Strike" by focusing on technologies that will provide the Naval Force with the capability to dominate the battlespace, project power from the sea, and support forces ashore with particular emphasis on rapid MCM operations. These efforts concentrate on the development and transition of technologies for the MCM-related and Urban Asymmetric/Expeditionary Warfare Operations (UAEO)-related Future Naval Capabilities (FNC) Enabling Capabilities (ECs). The Mine and Obstacle Detection/Neutralization efforts include technologies for clandestine and overt minefield reconnaissance, organic ship self-protection, organic minehunting and neutralization/breaching. The Urban Asymmetric Operation effort includes critical warfighting functions such as Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), fires, maneuver, sustainment, etc. The Naval Special Warfare and Explosive Ordnance Disposal technology efforts concentrate on the development of technologies for safe near-shore mine detection, diver mobility and survivability, and ordnance disposal operations.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	43.897	36.833	37.836	-	37.836
Current President's Budget	42.756	36.833	37.583	-	37.583
Total Adjustments	-1.141	-	-0.253	-	-0.253
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.082	-			
• SBIR/STTR Transfer	-0.675	-			
• Program Adjustments	-	-	0.133	-	0.133
• Section 219 Reprogramming	-0.383	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.386	-	-0.386
• Congressional General Reductions Adjustments	-0.001	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

Congressional Add: *Electromagnetic Signatures Assessment System*

Congressional Add: *Virtual Onboard Analyst for Multi-Sensor Mine Detection*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.992	-
	1.195	-
Congressional Add Subtotals for Project: 9999	3.187	-
Congressional Add Totals for all Projects	3.187	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>			R-1 ITEM NOMENCLATURE PE 0602782N: <i>Mine & Exp Warfare Applied Res</i>				PROJECT 0000: <i>Mine & Exp Warfare Applied Res</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
0000: <i>Mine & Exp Warfare Applied Res</i>	39.569	36.833	37.583	-	37.583	42.368	47.686	56.426	62.224	Continuing	Continuing

Note

Special Warfare/EOD R2 Activity includes the funding increase for the Joint Service Explosive Ordnance Disposal (JSEOD) effort.

A. Mission Description and Budget Item Justification

This project focuses on reducing the time involved in conducting MCM operations and increasing safe standoff from minefields. It develops and transitions technologies for MCM-related and UAEO-related FNC ECs. The MCM effort includes technologies for clandestine and overt minefield reconnaissance, organic ship self-protection, organic minehunting, neutralization/breaching and clearance. The Littoral Warfare effort includes critical warfighting functions such as C4ISR, fires, maneuver, sustainment, etc. The sea mining effort emphasizes technologies for future sea mines. The Naval Special Warfare and Explosive Ordnance technology efforts concentrate on the development of technologies to enhance diver capabilities including: safe near-shore mine sensing, mobility and survivability, and ordnance disposal operations.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: MINE TECHNOLOGY</p> <p>Description: This activity assesses advanced sea mine technologies to maintain expertise in this Naval Warfare area. An acoustic sensing capability for the naval mine Target Detection Device (TDD) is being addressed. Future mine and minefield concepts are being addressed.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued assessment of sea mine technologies in order to maintain a level of expertise in naval mines. - Continued evaluation of an acoustic sensing capability for the naval mine Target Detection Device (TDD). - Initiated development of concepts for semi-autonomous and remote controlled mines and minefields. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete evaluation of an acoustic sensing capability for the naval mine Target Detection Device (TDD). - Initiate development of target discrimination technology for Target Detection Device (TDD). <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. 	0.275	0.330	0.474
<p>Title: MINE/OBSTACLE DETECTION</p>	28.018	25.684	23.598

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B. Accomplishments/Planned Programs (\$ in Millions)				FY 2010		
<p>Description: This activity focuses on applied research to enable longer detection ranges and precise mine location with fewer false alarms in a variety of challenging environments. It supports Discovery and Invention (D&I) and MCM-related FNC ECs. Efforts in Synthetic Aperture Sonar (SAS) technologies for longer range detection and classification of mine-like targets and magnetic gradiometer sensing and electro-optic (EO) technology for buried mine identification, and sensor integration onto Autonomous Underwater Vehicles (AUVs) are being addressed. EO sensor research develops algorithms to enable image processing for rapid overt reconnaissance from an Unmanned Aerial Vehicle (UAV). Other processing, classification and data fusion techniques to reduce operator workload, and a mine burial prediction "expert system" are also being developed. Efforts also support development of MCM Mission Modules for Littoral Combat Ships (LCS).</p> <p>FY 2010 to FY 2011 funding decrease is due to the completion and transition of major Future Naval Capability (FNC) - MCM Data Fusion Techniques Using Multiple Unmanned Sensors and Systems; MCM Systems for Littoral Combat Ship, Advanced Flight, Mission Modules; Undersea Cooperative Cueing and Intervention for MCM operations and D&I programs.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued at-sea testing of prototype Low Frequency Broadband (LFBB) acoustic scattering sonar focusing on multi-aspect mine classification/identification and characterization of clutter in various environments. - Continued development of automatic mine detection and classification algorithms for integrated forward-looking iPUMA sonar and side-looking sonars. - Continued development of multi-platform fusion of data from high-resolution mine hunting systems (e.g. AN/AQS-20) and submarine-launched Mine Warfare (MIW) Unmanned Underwater Vehicles (UUVs) via registration with those from the Mine Warfare Environmental Data Library (MEDAL) for improved mine detection and avoidance. - Continued development of UUV-based extended range electro-optic identification sensors and supporting meteorology and oceanography and planning systems. - Continued large area search and survey based upon multiple, cooperating UUVs. - Continued demonstration of flapping fin propulsion on an inexpensive, stealthy undersea vehicle to enable new mine warfare mission capabilities. - Continued development of an ultrafast silicon carbide (SiC) avalanche transistor and a SiC drift step recovery diode. - Continued development of Multiple Input Multiple Output (MIMO) UUV communications by determining channel capacity and extending use to moving platforms. - Continued integration of iPUMA and SAS systems in a single vehicle to obtain 100% area coverage. - Continued to investigate and develop signal processing algorithms in areas of research such as 						

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>environmentally adaptive channel estimation/equalization, multi-carrier modulation techniques, and spatial diversity exploitation to enable reliable, high-rate communication between fixed and/or mobile nodes in an ad hoc underwater acoustic communication network.</p> <ul style="list-style-type: none"> - Continued development of a Mine/Obstacle Detection and Avoidance capability for Autonomous Underwater Vehicles (AUVs) equipped with the iPUMA sonar system. - Continued development of a small ultrasound acoustic underwater camera for UUV-based classification and identification of underwater mines. - Continued development of drifting mine detection concepts. - Continued development of heat engine for unmanned underwater vehicles powered by thermal gradients in the water column. - Continued modeling of data fusion and mine contact handling. - Continued research to demonstrate new structural-acoustic-based mine identification algorithms that do not require extensive training data to work in new underwater environments. - Continued research to extend electro-optical imaging resolution in underwater environments by using short exposure techniques. - Completed technology development for a Tactical UAV (TUAV) buried minefield detection sensor. - Completed development of advanced 3-D Light Detection and Ranging (LIDAR) mine detection algorithms to support post mission analysis. - Completed development of the Performance Analysis and Training Tool (PATT) to assess the performance characteristics of high frequency imaging sonars and the associated sonar processing concepts. - Completed investigation of Finite Element Modeling (FEM) for estimating the performance of the Low Frequency Broadband (LFBB) Buried Mine Identification System over a wide range of tactically important environments. - Completed technology development for MCM Mission Module systems for Advanced Flight LCS. - Initiated development of iPUMA/Synthetic Aperture Sonar system to provide the first non marine mammal based mine detection and classification capability for confined or highly obstructed areas. - Initiated development of Small Acoustic Color/Imaging Sonar system to provide the first non marine mammal detection, classification and identification capability for very shallow water (VSW) and reduce the false-alarm rate by x20 for all VSW mine threats. - Initiated development of Long Range Low Frequency Broadband (LRLFBB) Sonar to significantly increase the minehunting area coverage rate. - Initiated development of a high source level, single crystal based projector that can extend the maximum detection range of the Low Frequency Broadband (LFBB) Mine Identification System. - Initiated Phase 2 of Advanced Mission Module Technology Development. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiated performance evaluation of physical layer signal processing algorithms and signaling schemes developed for underwater acoustic communication networks. - Initiated implementation of candidate physical layer algorithms and signaling schemes into acoustic modems targeted for UUV platforms. - Initiated investigation into cross-layer and/or network layer design strategies for ad hoc underwater acoustic communication networks comprised of fixed and/or mobile nodes. - Initiated development of technologies for detection of mines and obstacles in riverine environments. - Initiated development of mine burial prediction models which include migrating sandwaves. - Initiated development of prediction models for surf zone optical properties. - Initiated effort to quantify and validate improvements in probability of detection and the reduction of false alarms that can be achieved through multi-static acoustic sensing and processing for cooperating, unmanned vehicles. - Initiated development of new waveforms and algorithms for improved automatic discrimination of mines from non-traditional clutter. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Continue development of automatic mine detection and classification algorithms for integrated forward-looking iPUMA sonar and side-looking sonars. - Continue research to extend electro-optical imaging resolution in underwater environments by using short exposure techniques. - Complete large area search and survey based upon multiple, cooperating UUVs and USVs. - Complete Phase 2 of Advanced Mission Module Technology Development with a final demonstration. - Complete development of multi-platform fusion of data from high-resolution mine hunting systems (e.g. AN/AQS-20) and submarine-launched Mine Warfare (MIW) UUVs via registration with those from the Mine Warfare Environmental Data Library (MEDAL) for improved mine detection and avoidance. - Complete performance evaluation of physical layer signal processing algorithms and signaling schemes developed for underwater acoustic communication networks. - Complete development of Multiple Input Multiple Output (MIMO) UUV communications by determining channel capacity and extending use to moving platforms. - Complete demonstration of flapping fin propulsion on an inexpensive, stealthy undersea vehicle to enable new mine warfare mission capabilities. - Complete development of an ultrafast silicon carbide (SiC) avalanche transistor and a SiC drift step recovery diode. - Complete at sea prototype Low Frequency Broadband (LFBB) acoustic scattering sonar focusing on multi-aspect mine classification/identification and characterization of clutter in various environments. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiate development of system concepts for wide area detection of surface and submerged drifting mines. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete implementation of candidate physical layer algorithms and signaling schemes into acoustic modems targeted for UUV platforms. - Complete investigation into cross-layer and/or network layer design strategies for ad hoc underwater acoustic communication networks comprised of fixed and/or mobile nodes. - Initiate development of advanced overhead tactical sensing concepts. - Initiate applied research in MCM-specific autonomous behaviors, distributed autonomy, modernization of MCM search theory, autonomy/warfighter interface, and enablers of scalable autonomy. - Initiate development of the compact Modular Sensor Suite for real time detection and classification of surface and near surface moored and drifting mines. - Initiate development of Mine Drift Prediction Tactical Decision Aid. 				
<p>Title: MINE/OBSTACLE NEUTRALIZATION</p> <p>Description: Activity includes applied research to support selected MCM related FNC ECs for rapid mine and obstacle neutralization and sea mine jamming techniques to increase surface ship safe standoff from threat mines. It includes various lethality, vulnerability and dispensing computational tools, models and assessments to support the various far-term Surf Zone (SZ) and Beach Zone (BZ) mine and obstacle breaching concepts.</p> <p>The FY 2010 to FY 2011 funding decrease is due to the completion of Future Naval Capability (FNC) - AUV Technology for Neutralization of Littoral Mines.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of AUV technologies for neutralization of littoral sea mines. - Completed acoustic organic mine jamming investigations as a follow-on to FNC work in electromagnetic organic mine jamming. - Completed development of precision navigation capability for targeting, safe navigation through assault lanes including lane marking. - Completed development of prototype mission planner for Joint Direct Attack Munition (JDAM) Assault Breaching System (JABS) in the VSW. - Completed review of data collected during Amphibious Assault Vehicle (AAV) testing with augmented reality. - Completed review of GPS augmentation data collected during end-to-end tests with AAV and airborne platform with mine detection sensor. 		1.200	0.801	0.853

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602782N: <i>Mine & Exp Warfare Applied Res</i>	PROJECT 0000: <i>Mine & Exp Warfare Applied Res</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Completed technology development for autonomous neutralization of sea mines in VSW areas. - Initiated development of concepts for sweeping and/or jamming of advanced mine threats. - Initiated a project to study feasibility of mine jamming from autonomous undersea vehicles. - Initiated development of autonomous behaviors to improve neutralization efficiency of littoral sea mines. - Initiated development of system concepts for autonomous neutralization of surface and submerged drifting mines. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete development of AUV technologies for neutralization of littoral sea mines. - Complete development of autonomous behaviors to improve neutralization efficiency of littoral sea mines. - Initiate demonstration of autonomous neutralization of littoral sea mines. - Initiate a project to study system concepts for autonomous neutralization of surface and submerged drifting mines. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete demonstration of autonomous neutralization of littoral sea mines. - Complete a project to develop mine jamming capability as a spiral capability addition to a LCS mine warfare mission package. - Complete a project to study feasibility of jamming threat mines that were deferred/ not studied in previous D&I efforts. - Complete a project to study feasibility of mine jamming from autonomous undersea vehicles. - Initiate concept development for neutralization of war surface drifting mines. 				
<p>Title: SPECIAL WARFARE/EOD</p> <p>Description: The goal of this effort is to develop technologies to extend stand-off of special operations and EOD forces in clandestine hydrography, mine clearance and port security missions while increasing the range and effectiveness of divers. Advanced technologies are needed to gain access to areas contaminated by area-denial sensors and/or booby traps. Developed technologies will transition to the Joint Service EOD Program, the Naval EOD Program, or the DOD Technical Response Group. This activity includes applied research in sensor technology for NSW and EOD autonomous and handheld sonar systems to increase detection range and accuracy in harsh environments. Other efforts include mission support technology improvements for AUVs and human divers - such as communications, navigation and life support.</p> <p>The FY 2011 to FY 2012 funding increase is due to the Joint Service Explosive Ordnance Disposal (JSEOD) effort.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of AUV technologies for autonomous inspection of ship hulls. 		10.076	10.018	12.658

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602782N: <i>Mine & Exp Warfare Applied Res</i>	PROJECT 0000: <i>Mine & Exp Warfare Applied Res</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued development of low collateral damage neutralization device. - Continued development of technologies for the detection and disruption of passive and active Infra-red (IR) sensors. - Completed design of an underwater riverine autonomous surveillance system that uses multiple small sensor nodes to provide persistent surveillance. - Completed development of low probability of intercept/low probability of detection (LPI/LPD) underwater communications. - Completed development of metal-hydride based thermal control technology for combat divers. - Completed development of tactile-feedback robotic manipulators. - Completed development of technologies for portable hand-held detection of concealed Improvised Explosive Devices (IEDs). - Completed development of technology to detect, monitor, and disrupt operation of Explosive Safe and Arming (ESA) devices. - Initiated development of maritime Tagging, Tracking, and Locating (TTL) technologies. - Initiated development of technologies for contaminated water diving. - Initiated development of technologies for enhanced navigation and Intelligence, Surveillance and Reconnaissance (ISR) in riverine environments. - Initiated development of technologies to detect and locate IEDs. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete development of low collateral damage neutralization device. - Complete development of technologies for the detection and disruption of passive and active IR sensors. - Initiate development of technologies to access IEDs. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Initiate development of technologies to diagnose and identify underwater munitions. - Initiate development of technologies to identify and diagnose components and characteristics of Improvised Explosive Devices. - Initiate development of technologies to detect and locate buried munitions. - Initiate effort to support Joint Service Explosive Ordnance Disposal (JSEOD) applied research. 			
Accomplishments/Planned Programs Subtotals	39.569	36.833	37.583

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602782N: <i>Mine & Exp Warfare Applied Res</i>	PROJECT 0000: <i>Mine & Exp Warfare Applied Res</i>

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• 0603782N: <i>MINE AND EXPEDITIONARY WARFARE ADVANCED TECHNOLOGY</i>	34.315	21.591	21.941	0.000	21.941	4.373	4.483	2.810	0.000	0.000	89.513

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of this applied research program are the development of technologies which focus on the Expeditionary Warfare challenge of speeding the tactical timeline and increasing safe standoff from minefields. Individual project metrics include the transition of 6.2 technology solutions into 6.3 advanced technology programs.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 2: <i>Applied Research</i>			PE 0602782N: <i>Mine & Exp Warfare Applied Res</i>				9999: <i>Congressional Adds</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	3.187	-	-	-	-	-	-	-	-	0.000	3.187

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
<i>Congressional Add:</i> Electromagnetic Signatures Assessment System	1.992	-
<i>FY 2010 Accomplishments:</i> This effort supported phase III applied research for creation of an electromagnetic signatures assessment system using multiple autonomous undersea vehicles.		
<i>Congressional Add:</i> Virtual Onboard Analyst for Multi-Sensor Mine Detection	1.195	-
<i>FY 2010 Accomplishments:</i> This effort conducted laboratory and field testing of a multi-sensor mine detection system and analyzed the data collected.		
Congressional Adds Subtotals	3.187	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	114.524	117.908	114.270	-	114.270	56.247	61.449	61.102	56.596	Continuing	Continuing
2911: <i>Power Proj Adv Tech</i>	94.468	117.908	114.270	-	114.270	56.247	61.449	61.102	56.596	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	1.414	-	-	-	-	-	-	-	-	0.000	1.414
9999: <i>Congressional Adds</i>	18.642	-	-	-	-	-	-	-	-	0.000	18.642

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This program develops and demonstrates advanced technologies, including Em Rail Gun for naval weapon systems. This Program Element (PE) includes elements of the following Future Naval Capabilities (FNCs); Time Critical Strike, and ForceNet. Within the Naval Transformation Roadmap, this investment will achieve one of four key transformational capabilities required by Sea Strike as well as technically enable elements of both Sea Shield and Force Net.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	116.191	117.908	91.301	-	91.301
Current President's Budget	114.524	117.908	114.270	-	114.270
Total Adjustments	-1.667	-	22.969	-	22.969
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.800	-			
• Program Adjustments	-	-	23.238	-	23.238
• Section 219 Reprogramming	1.141	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.269	-	-0.269
• Congressional General Reductions Adjustments	-0.008	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *AARGM Counter Air Defense Future Capabilities*
- Congressional Add: *Flow Path Analysis Tool*
- Congressional Add: *Moving Target Indicator Scout Radar*
- Congressional Add: *X-49A Envelope Expansion Modifications*
- Congressional Add: *High Speed Anti-Raditation Demonstration (HSAD)*
- Congressional Add: *Information Sharing For ISR Targeting & Engagement*
- Congressional Add: *Smart Instrument Development For The Magdalena Rid*
- Congressional Add: *Countermine LIDAR UAV-based System*
- Congressional Add: *Quiet Drive Advanced Rotary Actuator*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.992	-
	1.593	-
	0.797	-
	3.585	-
	1.514	-
	1.992	-
	3.983	-
	1.593	-
	1.593	-
Congressional Add Subtotals for Project: 9999	18.642	-
Congressional Add Totals for all Projects	18.642	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy

DATE: February 2011

APPROPRIATION/BUDGET ACTIVITY

1319: *Research, Development, Test & Evaluation, Navy*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE

PE 0603114N: *Power Projection Advanced Technology*

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603114N: <i>Power Projection Advanced Technology</i>				2911: <i>Power Proj Adv Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2911: <i>Power Proj Adv Tech</i>	94.468	117.908	114.270	-	114.270	56.247	61.449	61.102	56.596	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project supports the Time Critical Strike (TCS) and ForceNet FNC components which address technological issues associated with the development of strike weapons to significantly decrease the launch to engagement timeline; provide the Navy of the future the ability to quickly locate, target, and strike critical targets; and enhance mission capabilities and operational utility of Naval forces by dramatically increasing the autonomy, performance, and affordability of Naval organic Unmanned Vehicle systems.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: STRIKE AND LITTORAL COMBAT TECHNOLOGIES</p> <p>Description: The focus of this activity is on those technologies that will support the Naval Precision Strike Operations and provide the Navy of the future the ability to quickly locate, target, and strike critical targets. This activity includes support to the following FNC Enabling Capabilities (ECs): Advanced Naval Fires Technology, Hostile Fire Detection and Response, Dynamic Target Engagement & Enhanced Sensor Capabilities, and Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets.</p> <p>FY10 is a combination of funding additional FNC projects while other FNC projects are completing. This Activity reflects the alignment of investments for the following ECs: Dynamic Target Engagement & Enhanced Sensor Capabilities, Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets and Enhanced Weapons Technologies. Increased Capability Against Moving and Stationary Targets, Counter Air Mid-Range Air-to-Air Missile (AMRAAM) Defense/High Speed Improvements, Multi-Target Laser Designator and Selectable Output Components and High Energy Fiber Laser System.</p> <p>FY11 to FY12 funding increase is due to the initiation of High Energy Fiber Laser System and due to increases in multiple FNC Demonstration Program investments.</p> <p>FY 2010 Accomplishments: Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets: - Continued Weapon Data Link project by demonstrating the performance capability of the system and the architecture developed under the project.</p> <p>Increased Capability Against Moving and Stationary Targets: - Continued the Direct Attack Seeker Head (DASH) project to drive down seeker cost during the procurement and test of the infrared imaging seeker components.</p>	16.311	17.405	20.640

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>	PROJECT 2911: <i>Power Proj Adv Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>- Continued Multi-Mode Sensor/Seeker (MMSS) project to conduct a Critical Design Review (CDR) and initiate the build of a common aperture Laser Radar (LADAR) and infrared sensor system.</p> <p>Enhanced Weapon Technologies:</p> <ul style="list-style-type: none"> - Continued three new products to address short-falls in current Counter Air (CA) and Counter Air Defense (CAD) capabilities by providing improved range and end-game maneuverability while decreasing Time-of-Flight. - Continued definition and documentation of system level requirements for airframe, thrust level, insensitive-munitions and safety/reliability for CA Advanced Mid-Range Air-to-Air Missile (AMRAAM) Improvements. - Continued definition and documentation of system level requirements for CAD. - Continued definition and documentation of system level requirements for High Speed Components. - Completed Ultra Endurance UAV efforts. <p>FY 2011 Plans:</p> <p>Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets:</p> <ul style="list-style-type: none"> - Complete Weapon Data Link project by demonstrating the performance capability of the system and the architecture develop under the project. <p>Increased Capability Against Moving and Stationary Targets:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate research for advanced optical techniques to enable multiple simultaneous target designation in order to defeat multiple simultaneous targets or SWARM attacks. - Initiate Strike Accelerator program. This effort will provide an advanced airborne capability to accurately identify targets using Advanced Target Recognition (ATR). These capabilities utilizing the F/A-18 E/F, AESA (Active Electronically Scanned Array) Radar and ATFLIR (Advanced Targeting Forward Looking Infrared) sensors will enable Strike Aircraft to quickly ID and Target maritime threats. <p>Selectable Output Weapon:</p> <ul style="list-style-type: none"> - Initiate Selectable Output Weapon Sea Strike Project. This project will develop and integrate new technologies to enable real-time selection of a munitions energetic output. <p>Enhanced Weapon Technologies:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate development of advanced technologies that support delivery of Navy approved FNC enabling 			
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>	PROJECT 2911: <i>Power Proj Adv Tech</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>capabilities structured to close operational capability gaps in power projection.</p> <ul style="list-style-type: none"> - Initiate package advanced power projection technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period. - Initiate mature power projection technologies that support naval requirements identified within the Sea Strike and FORCEnet naval capability pillars. <p>FY 2012 Plans:</p> <p>Increased Capability Against Moving and Stationary Targets:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Enhanced Weapon Technologies:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Selectable Output Weapon:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Strike Accelerator:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Multi-Target Laser Designator:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>High Energy Fiber Laser System:</p> <ul style="list-style-type: none"> - Initiate development of an advanced laser weapon subsystem for demonstration on an air-borne platform. This system will provide the detection and defeat of current and future threats. - Initiate development of advanced technologies that support delivery of Navy approved FNC enabling capabilities structured to close operational capability gaps in power projection. 			
Title: PRECISION STRIKE TECHNOLOGY		78.157	100.503
Description: This activity focuses on the development of high speed (Mach 3 to Mach 4+) strike technologies which significantly decrease the engagement timeline from multiple sea surface and air launched platforms.			57.130

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>	PROJECT 2911: <i>Power Proj Adv Tech</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>FY 2010 to FY 2011 increase is due to the significant increase in the 6.3 demonstration portion of the Electromagnetic (EM) Railgun Program and cooperative Navy/DARPA Program for the Long Range Anti-Ship Missile (LRASM) Program.</p> <p>FY2011 to FY2012 reduction is due to the completion of LRASM detailed hardware design, test component and subsystem functionality and fit</p> <p><i>FY 2010 Accomplishments:</i> EM Gun: <ul style="list-style-type: none"> - Continued development and testing of barrel life components with EM lab launcher expanding to 32 MJ of muzzle energy. - Continued development of industry advanced launcher prototypes, completing detail design activities and initiating detail design fabrication. - Continued development and testing of projectile component concepts, completing the dispense lethality demo and initiating 32 MJ muzzle energy tests. - Continued ship integration study efforts. - Initiated planning for FY 2011 final INP Phase I assessment. - Initiated next generation pulsed power concept design. </p> <p>LRASM:- New Start: DARPA initiated effort for development of missile preliminary designs and perform analysis demonstrating designs compliant with program requirements and that subsystem technologies development plans have acceptable risk, schedule and cost. <ul style="list-style-type: none"> - Initiated detailed hardware design. </p> <p><i>FY 2011 Plans:</i> EM Gun: <ul style="list-style-type: none"> - Continue ship integration study efforts. - Continue next generation pulsed power concept design. - Continue development and testing of single shot barrel life components with EM lab launcher at 32 MJ of muzzle energy including a 100 shot demo. - Continue development of industry advanced launcher prototypes including delivery and installation at Electromagnetic Launch Facility (EMLF) for government test and evaluation with 100 shot demo and 3 shot burst assessment. - Continue development and testing of projectile component at 32 MJ muzzle energy. - Complete final INP Phase I assessment. </p> <p>LRASM:</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>	PROJECT 2911: <i>Power Proj Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Complete detailed hardware design. - Initiate/Complete and test component and subsystem functionality and fit. - Initiate flight hardware fabrication. <p>Weapons System Improvement:</p> <ul style="list-style-type: none"> - Initiate kill-chain studies to identify and recommend engineering trades to enable weapon system interoperability and data fusion alternatives. These studies will assess engineering feasibility of various kill-chain options and assess the capability provided. <p>FY 2012 Plans:</p> <p>EM Gun:</p> <ul style="list-style-type: none"> - Continue ship integration study efforts. - Continue development and testing of single shot barrel life components with EM lab launcher at 32 MJ of muzzle energy including a 100 shot demo. - Complete next generation single shot pulsed power concept design. - Complete development of industry advanced launcher prototypes including delivery and installation at EMLF facility for government test and evaluation with 100 shot demo. - Complete final INP Phase I assessment of industry advanced launcher prototypes assessments. - Initiate next generation rep rate launcher development and test planning. - Initiate next generation rep rate pulsed power fabrication in support of future rep rate launcher testing. <p>LRASM:</p> <ul style="list-style-type: none"> - Complete fabrication of flight hardware. - Complete launch canister expulsion tests. - Complete booster separation flight tests. - Complete integrated flight tests. <p>Weapons System Improvement:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 				
<p>Title: DATA DECISION TOOLS</p> <p>Description: This is a new effort for FY12.</p> <p>The Navy is furthering Decision Making Tools in the following areas:</p>		-	-	17.000

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>		PROJECT 2911: <i>Power Proj Adv Tech</i>
B. Accomplishments/Planned Programs (\$ in Millions)				
				FY 2010
				FY 2011
				FY 2012
<p>1) Data to Decision: The Navy is performing a series of limited technology experiments (LTE) identifying issues to enable the integration of combat systems and C2 systems to enable rapid, accurate decision making. These experiments are integrating S&T capabilities directly into current combat systems and SOA C2 systems. This is a joint series of experiments with the AF and Army including Navy PEO IWS and PEO C4I which will lead to transition directly into the Advanced Capability Builds 12 - 16 for the IWS POR and into CANES for PEO C4I POR. In FY2012, Navy will continue work associated with the LTEs and perform integrated prototype testing in a more operational environment.</p> <p>2) Autonomy and Data to Decision: This Navy effort involves integrated reverie and land scenarios. The objective is to develop autonomous networked sensor systems (disparate platforms and sensors) that significantly reduce (objective eliminate) human system management and analysis to enable small forces such as Navy reverie expeditionary teams to focus on the execution of missions with significant sensor support. Currently mission execution is limited by the number of people that have to be engaged in sensor management and analysis. Autonomous Data to Decision capability is also adaptable to autonomous sensor networks in support of FOB protection. More funds in the first year would enable a much richer diversity of sensors, platforms, and automated analysis techniques.</p> <p>FY 2012 Plans: -Initiate and complete an integrated prototype testing in a operational environment for the integration of combat systems and C2 systems to enable rapid, accurate decision making. -Initiate and complete futhering diversity of sensors, platforms and automated analysis techniques.</p>				
<p>Title: CYBER SECURITY ARCHITECTURE</p> <p>Description: This is a new effort for FY12.</p> <p>The Cyber Security Architecture effort will establish a prototype environment that be used to integrate the results of numerous ongoing S&T efforts to build a cyber security architecture of ever increasing capability There are a number of strategies that have been taken to help mitigate cyber attacks. This effort is aimed at developing an integrated approach that draws on these different strategies and enables new concepts to be brought into the integrated approach. The key is developing a highly flexible architecture. The overarching approach is to providing integrated and modularized cyber defense platform with built-in multiple levels of intelligence for controlling and acting against known and new cyber attacks. The platform encompasses all levels of hierarchy and abstraction of cyber infrastructure, and allows for all cyber defense techniques to efficiently and synergistically co-exist, providing maximum collective coverage against cyber attacks and enhancing mission assurance.</p>				6.000

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>	PROJECT 2911: <i>Power Proj Adv Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
FY 2012 Plans: -Initiate and complete a Cyber Security Architecture prototype environment			
Title: EW/EP MODELING Description: This is a new effort for FY 2012. Electronic Warfare/Electronic Protection (EW/EP) Technology Development, Modeling and Implementation: Research in this activity addresses EW battle space management. Project goal is to develop technology that will utilize EW for platform / task force protection through the integration of EW into a networked coherent structure to provide better fleet defense, and develop techniques to deny the enemy the effective use of their sensors to do battle space awareness and targeting by creating a distorted battle space picture. This effort also continues EP modeling and implementation improvements by funding upgrades to hardware and software required for the characterization of platforms, contribute to modeling and simulation of implementable solutions, and technology validation through flight demonstrations of those solutions. EP upgrades scheduled for transition to the platform program offices in FY 2013 and FY 2014. FY 2012 Plans: -Initiate integration of EW into a networked coherent structure to provide better fleet defense -Initiate development of EP techniques to deny enemy battlespace awareness -Initiate upgrades for improved EP modeling and simulation and for EP technology validation and transition	-	-	13.500
Accomplishments/Planned Programs Subtotals	94.468	117.908	114.270

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• 0602114N: <i>POWER PROJECTION APPLIED RESEARCH</i>	7.923	6.765	10.651	0.000	10.651	14.433	10.088	5.248	1.458	0.000	56.566

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>	PROJECT 2911: <i>Power Proj Adv Tech</i>

E. Performance Metrics

The metrics used are programmatic milestones and technical milestones such as flight test and testing of projectile concepts for technical demonstration programs; Technology Transition Agreements (TTAs) which are agreements between the Office of Naval Research and an acquisition program office to transition FNC 6.3 technologies into an acquisition program.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603114N: <i>Power Projection Advanced Technology</i>				4027: <i>Naval Innovative Science and Engineering</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	1.414	-	-	-	-	-	-	-	-	0.000	1.414

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	1.414	-	-
Accomplishments/Planned Programs Subtotals	1.414	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603114N: <i>Power Projection Advanced Technology</i>				9999: <i>Congressional Adds</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	18.642	-	-	-	-	-	-	-	-	0.000	18.642

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: AARGM Counter Air Defense Future Capabilities FY 2010 Accomplishments: This effort advanced the technology necessary to demonstrate propulsion system improvements and associated system changes (i.e., improved flight profiles, guidance and control system modifications) needed to field the longer range Advanced Anti-Radiation Guided Missile (AARGM) capability. This effort enabled system range and time of flight improvements and eventual fielding of a critical standoff capability to the warfighter.	1.992	-
Congressional Add: Flow Path Analysis Tool FY 2010 Accomplishments: This effort analyzed and predicted performance characteristics of future weapon systems that use ramjet / scramjet hypersonic engine technology (e.g. operate at Mach 4 through Mach 8) by integrating state-of-the art computational fluid dynamics technology into a unified analysis tool to predict flow behavior and performance in propulsion system components, and verified the results by comparison to actual data and evaluated new technologies to improve the efficiency and accuracy of the analysis.	1.593	-
Congressional Add: Moving Target Indicator Scout Radar FY 2010 Accomplishments: This effort developed, integrated and tested a "Move Stop Move" mode software to an existing unmanned air vehicle mounted active electronically scanned array radar.	0.797	-
Congressional Add: X-49A Envelope Expansion Modifications FY 2010 Accomplishments: This effort provided for modification of the X-49A vectored thrust ducted propeller compound helicopter technology demonstrator to integrate the adaptive digital automated pilot technology, and supplementary power unit systems to enable flight validation of the technology's potential to significantly increase speed, range, hover payload, ceiling, maneuverability, and survivability beyond that of conventional helicopters.	3.585	-
Congressional Add: High Speed Anti-Raditation Demonstration (HSAD)	1.514	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>	PROJECT 9999: <i>Congressional Adds</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011
<i>FY 2010 Accomplishments:</i> This effort supported transition of HSAD designs into a tactical configuration allowing progression of demonstration work on advanced rocket propulsion systems that can provide either twice the distance or half the time to target over solid propellant rocket motors.		
<i>Congressional Add:</i> Information Sharing For ISR Targeting & Engagement	1.992	-
<i>FY 2010 Accomplishments:</i> This effort supported development of components to support multiple, simultaneous detections, tracking, identification and targeting of asymmetric and mobile threats in ISRTE operations.		
<i>Congressional Add:</i> Smart Instrument Development For The Magdalena Rid	3.983	-
<i>FY 2010 Accomplishments:</i> This effort supported smart instrument development for the Magdalena Ridge Observatory Interferometer concentrating on testing the first 1.4 meter unit telescope for the array. Testing included the verification of performances both at the factory and in situ.		
<i>Congressional Add:</i> Countermine LIDAR UAV-based System	1.593	-
<i>FY 2010 Accomplishments:</i> This effort developed a unique software program that combines multi-sensor airborne data to produce seafloor images and 3D models of the littorals, beach exit zone, and riverine environments. CLUBS employs novel data fusion algorithms to produce seafloor classification images for use in anti-mine warfare applications and contributes contributes to 4 focus areas of the Office of Naval Research's Science and Technology Strategic Plan: Operational Environments; Maritime Domain Awareness; Asymmetric and Irregular Warfare; and Assure Access and Hold at Risk.		
<i>Congressional Add:</i> Quiet Drive Advanced Rotary Actuator	1.593	-
<i>FY 2010 Accomplishments:</i> This effort supported quiet drive advanced rotary actuator research.		
Congressional Adds Subtotals	18.642	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603114N: <i>Power Projection Advanced Technology</i>	PROJECT 9999: <i>Congressional Adds</i>

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603123N: <i>Force Protection Advanced Technology</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	94.569	61.877	64.057	-	64.057	71.574	77.254	61.939	69.146	Continuing	Continuing
2912: <i>Force Protection Advanced Technology</i>	59.700	59.405	42.730	-	42.730	49.879	55.182	59.271	66.429	Continuing	Continuing
3049: <i>Force Protection</i>	3.266	2.472	2.504	-	2.504	2.552	2.612	2.668	2.717	Continuing	Continuing
3315: <i>Medium Range Unmanned Aerial System</i>	-	-	18.823	-	18.823	19.143	19.460	-	-	0.000	57.426
4027: <i>Naval Innovative Science and Engineering</i>	4.397	-	-	-	-	-	-	-	-	0.000	4.397
9999: <i>Congressional Adds</i>	27.206	-	-	-	-	-	-	-	-	0.000	27.206

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This program supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial and air) and the protection of those platforms. This PE supports the Future Naval Capabilities (FNC) in the areas of Sea Shield and Cross Pillar Enablers, and Enterprise and Platform Enablers (EPE). The goal of this program is to provide the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage while preserving operational capability. Surface Ship & Submarine, Hull, Mechanical & Electrical (HM&E), Missile Defense, Fleet Force Protection and Defense against Undersea Threats, and Emerging Threats activities all support FNC efforts.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	92.962	61.877	54.554	-	54.554
Current President's Budget	94.569	61.877	64.057	-	64.057
Total Adjustments	1.607	-	9.503	-	9.503
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.509	-			
• SBIR/STTR Transfer	-2.060	-			
• Program Adjustments	-	-	9.747	-	9.747
• Section 219 Reprogramming	4.179	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.244	-	-0.244
• Congressional General Reductions Adjustments	-0.003	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *Captive Air Amphibious Transporter (CAAT)*
- Congressional Add: *HBCU Applied Research Incubator*
- Congressional Add: *High-Temperature Radar Dome Materials*
- Congressional Add: *Multi-Element Structured Filter Arrays for Naval Platforms*
- Congressional Add: *NAVAIR Project for Land/Sea-Based Air Systems Maintenance and Air Worthiness*
- Congressional Add: *Pure Hydrogen Supply from Logistic Fuels*
- Congressional Add: *Agile Port And High Speed Ship Technology*
- Congressional Add: *Single Generator Operations Lithium Ion Battery*
- Congressional Add: *High Power Density Motor Drive*
- Congressional Add: *Wide Area Sensor For Force Protection Targeting*
- Congressional Add: *Accelerated Fuel Cells Manufacturability and Their*
- Congressional Add: *Advanced Logistics Fuel Reformer For Fuel Cells*

	FY 2010	FY 2011
	2.191	-
	0.797	-
	1.593	-
	3.426	-
	1.992	-
	2.390	-
	1.593	-
	3.983	-
	2.868	-
	1.593	-
	1.593	-
	2.390	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *High Temperature Superconductor Trap Field Magnet*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

FY 2010	FY 2011
0.797	-
27.206	-
27.206	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603123N: <i>Force Protection Advanced Technology</i>				2912: <i>Force Protection Advanced Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2912: <i>Force Protection Advanced Technology</i>	59.700	59.405	42.730	-	42.730	49.879	55.182	59.271	66.429	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This project supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. It supports the Sea Shield and Cross Pillar Enablers, and Enterprise and Platform Enablers (EPE) -- Future Naval Capabilities (FNCs). The goals of this project are to provide the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage while preserving operational capability.

This Project reflects the alignment of investments for the following ECs: Anti-Ship Missile Defense Technologies; Defense of Harbor and Near-Shore Naval Infrastructure Against Asymmetric Threats; Sea Based Missile Defense of Ships & Littoral Installations; Four-Torpedo Salvo Defense; Shipboard Force Protection in Port and Restricted Waters - Detection and Classification; Compact Power Conversion Technologies; Affordable Submarine Propulsion and Control Actuation and Underwater Total Ship Survivability.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: FLEET FORCE PROTECTION AND DEFENSE AGAINST UNDERSEA THREATS	20.571	17.441	11.490
Description: Fleet Force Protection and Defense against Undersea Threats addresses efforts that include applied research for complementary sensor and processing technologies for platform protection and shipboard technologies to increase the survivability of surface ship and submarine platforms against torpedo threats.			
The first major goal of this activity is to develop complementary sensor and processing technologies for 21st century warfighting success and platform protection. Current small platforms (both surface and airborne) have little or no situational awareness (SA) or self-protection against air, surface, and asymmetric threats. This activity will provide tactical aircraft (TACAIR) and other platforms with effective threat warning and self-protection. The technology areas specific to platform protection will develop individual or multi-spectral [Electro-Optic (EO), IR, radio frequency (RF), EM, visual, and acoustic] sensors and associated processing. To defend platforms from current and advanced threats in at-sea littoral environments and in port, these technologies must improve multi-spectral detection and distribution of specific threat information.			
The Fleet Force Protection portion of this activity includes support to the FNC Enabling Capabilities for: Aircraft Integrated Self-protection Suites; Intent Determination - EO/IR Enhancements; Proof-of-Concept for Non-lethal Approach; Advanced Electronic Sensor Systems for Missile Defense; Hostile Fire Detection and Response Spirals 1 and 2; Defense of Harbor and Near-Shore			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 2912: <i>Force Protection Advanced Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>Naval Infrastructure Against Asymmetric Threats; Four-Torpedo Salvo Defense; and Shipboard Force Protection in Port and Restricted Waters - Detection and Classification.</p> <p>The second major goal of this activity is to develop enabling technologies that will increase the survivability of surface ship and submarine platforms against torpedo threats. Proposed technologies focus on defeating high priority threats including torpedoes (i.e. straight running, wake homing, acoustic homing, air dropped torpedoes, and salvoes of torpedoes). Technologies developed will minimize shipboard impact and require no shipboard organizational maintenance. The Anti-Torpedo Torpedo (ATT) provides technologies that enable an ATT to engage threat torpedoes detected by a surface ship towed sensor system. The ultimate goal is to develop technologies to enable a torpedo defense capability, including ship self-defense against salvo torpedo attacks, to fill the FNC Sea Shield Warfighting Capability Gap/Enabling Capability: Platform Defense against Undersea Threats. Ultimately the goal is to deliver an anti-torpedo-torpedo for use in defeating a four-torpedo salvo attack against a surface platform. This activity supports the development of technologies that aid the helicopter pilot when operating in degraded visual cue environments (brown-out).</p> <p>The decrease in funding from FY 2011 to FY 2012 is due to several FNCs that are nearing completion.</p> <p><i>FY 2010 Accomplishments:</i> Sensors & Associated Processing - - Continued new FNC Enabling Capability (EC) Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. This project will develop mission specific electro-optic/infrared sensors to detect, classify, and determine the intent of potential terrorist and special operations force threats to ships and craft in port and transiting restricted waters. - Continued the Countermeasures for Advanced Imaging Infrared (IIR) Guided Missiles FNC effort by commencing IIR threat surrogate hardware development. - Continued the Countermeasures for Millimeter Wave Guided Missiles FNC effort by initiating wide band gap monolithic microwave integrated circuit (MMIC) Ka-band development. - Continued the Multifunction Capabilities for Missile Warning Sensors FNC effort by commencing signal processor development. - Continued the Helicopter Laser-Based Landing Aids FNC effort by commencing laser technologies development.</p> <p>Underwater Platform Self-Defense -</p>				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 2912: <i>Force Protection Advanced Technology</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Continued the development of low-cost, light-weight swimmer detection and localization technologies.</p> <p>- Continued expanded development of autonomous, underway refueling for Unmanned Sea Surface Vehicle Technologies.</p> <p>- Continued advanced development of software encoded algorithms for the Anti-Torpedo Torpedo (ATT) sensor and controller that will enable ATT's to successfully engage torpedo salvos of up to four attacking units.</p> <p>- Completed development and demonstration of low-cost, light-weight swimmer detection and localization technologies.</p> <p>FY 2011 Plans: Sensors & Associated Processing - - Continue all efforts of FY 2010. - Continue the Helicopter Laser-Based Landing Aids FNC effort by development of a ladar capable of sensing through brown-out and providing a display format that is usable to the pilot. - Complete FNC EC Shipboard Force Protection in Port and Restricted Waters - Detection and Classification. This effort develops mission specific electro-optic/infrared sensors to detect, classify, and determine the intent of potential terrorist and special operations force threats to ships and craft in port and transiting restricted waters. Sensor projects included in this FNC EC include Distributed Millimeter Wave (DmmW) Sensor, Active/Passive Dual Imaging IR (MW/SW) Sensor, and Situational Panoramic Infrared (SPIR) Sensor.</p> <p>Underwater Platform Self-Defense - - Continue all efforts of FY 2010, less those noted as completed above.</p> <p>In support of FNC (Force Projection Advanced Technology), perform the following efforts - - Initiate the development of advanced technologies that support delivery of Navy approved FNC enabling capabilities structured to close operational capability gaps in force projection. - Initiate the packaging of advanced force projection technologies into deliverable FNC products and ECs that can be integrated into acquisition programs within a five year period. - Initiate the development of force projection technologies that support naval requirements identified within the Sea Shield and Sea Strike naval capability pillars as well as those applicable to specific naval platforms and those that apply across the naval enterprise.</p> <p>FY 2012 Plans: Sensors & Associated Processing</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 2912: <i>Force Protection Advanced Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete the Multifunction Capabilities for Missile Warning Sensors FNC effort. - Complete the Helicopter Laser-Based Landing Aids FNC effort by development of a ladar capable of sensing through brown-out and providing a display format that is usable to the pilot. <p>Underwater Platform Self-Defense</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 				
<p>Title: MISSILE DEFENSE (MD)</p> <p>Description: This activity describes Missile Defense Science and Technology (S&T) projects of the Sea Shield Future Naval Capability (FNC) program.</p> <ul style="list-style-type: none"> - Naval Interceptor Improvements (NII) technology upgrades for STANDARD Missile (SM) future missile. Metrics are to achieve SM performance requirements in specified tactical rain environments and all specified electronic countermeasures environments, while meeting the planned transition date. - Extended Distributed Weapons Coordination (EDWC) algorithms for an Automated Battle Management Aid (ABMA) that recommends hard kill weapons, soft kill countermeasures, and emission control measures to reduce the probability of being hit or to optimally engage threats with self-defense weapons. Metric is improved probability of negation (Pneg) against advanced ballistic & cruise missile anti-ship threats that may be susceptible to decoys & jamming, while meeting the planned transition date. - Positive Control of Naval Weapons (PCNW) - additional technology upgrades for SM to enable forward relay, remote launch and potentially forward pass engagements. Metrics are classified. - Midcourse and Terminal Algorithms (MTA) for prototype state-of-the art weapon system algorithms for STANDARD Missile (SM) engagements vs modern anti-ship missile threats. Specific metrics are classified. - Enhanced Lethality Guidance Algorithms (ELGA) to increase Navy shipboard missile probability of kill versus an expanded threat set including ASBMs and advanced ASCMs. Metrics for this project are classified. - Enhanced Maneuverability Missile Airframe (EMMA) technology for Navy shipboard missile systems to intercept highly agile maneuvering ASCMs and ASBMs. Metrics for this project are classified. - Integrated Active & Electronic Defense (IAED) technology basis for response combinations of active and electronic weapons & systems to optimize Pneg against ASBMs and ASCMs, including potential interactions. Metrics are classified. <p>- Radar Resource Manager (RRM) algorithms and software for weapon control system capability to provide dynamic platform and force-level radar management and coordination of radar resources for integrated air and missile defense (IAMD). Metrics will be classified.</p>		20.342	24.184	13.385

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 2912: <i>Force Protection Advanced Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>Funding increases from FY 2010 to FY 2011 as a result from EDWC, NII and PCNW project funding migrating from Applied Research (6.2) to Advanced Research (6.3) in their last year of effort before transition to acquisition. The MTA project ramps up in FY 2010 while the ELGA and EMMA projects start in FY 2010, also accounting for part of this increase. The FY 2011 to FY 2012 decrease represents completion of EDWC, PCNW, and NII projects in FY 2011 and is not offset by initiation of the RRM project in FY 2012.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued EDWC, NII and PCNW project efforts. - Continued MTA project efforts. - Initiated ELGA and EMMA project efforts. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Complete EDWC, NII and PCNW efforts. - Continue MTA and ramp up of the ELGA and EMMA projects. - Initiate IAED project effort. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Initiate RRM project effort. 				
<p>Title: SURFACE SHIP & SUBMARINE HULL MECHANICAL & ELECTRICAL (HM&E)</p> <p>Description: Activity includes: Signature Reduction, Hull Life Assurance, and Advanced Capability Electric Systems. Signature Reduction addresses electromagnetic (EM), infrared (IR), and acoustic signature tailoring, both topside and underwater. Hull Life Assurance addresses development of new structural system approaches for surface ships and submarines, including the management of weapon effects to control structural damage and the improvement of structural materials. Advanced Capability Electric Systems area addresses electrical and auxiliary systems and component technology to provide improvements in system energy and power density, system operating efficiency, and recoverability from casualties. Advanced Damage Control Countermeasures addresses fire, smoke, and flooding detection using a volume sensor and the use of a hybrid water-mist for electronic space protection. This activity includes support to the Sea Strike, Cross Pillar Enablers, and Enterprise and Platform Enablers (EPE) FNC programs.</p> <p>The decrease in funding from FY 2010 to FY 2011 is for the Advanced Naval Power Next Generation Systems (NGIPS) development, a separate effort from the ongoing Compact Power Conversion FNC. The NGIPS effort is ramping down; the FNC efforts will be entering Phase III in FY 2011.</p>		18.787	17.780	17.855

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 2912: <i>Force Protection Advanced Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued development of diesel fuel reforming technology for molten carbonate and proton exchange membrane fuel cells. - Continued risk reduction activities of advanced superconducting homopolar main propulsion motor with General Atomics. - Continued development of autonomous recovery system for Unmanned Sea Surface Vehicles from a host ship. - Continued development of thermal management technology for shipboard power distribution. - Continued development of Integrated Damage Control Systems which includes Integrated Damage Control Communications and Advanced Magazine Protection System. - Continued compact power conversion technologies FNC transitioned from PE 0603236N/Turbine Engine Technology. - Continued Total Ship Survivability Damage Tolerance and Recoverability efforts which include integrated damage control situation awareness technologies. - Continued expansion of the Next Generation Integrated Power Systems (NGIPS) technology development, to de-risk and demonstrate applicable Medium Voltage Direct Current (MVDC) power dense, efficient, and fault tolerant technologies needed for future surface, and subsurface platforms. - Continued Affordable Submarine Propulsion and Control Surface Actuator technologies focused on the development and demonstration of affordable advanced material propellers and torque dense and quiet actuation of submarine control surface efforts. - Continued Underwater Total Ship Survivability/Payload Implosion and Platform Damage Avoidance efforts. - Completed preliminary designs of control surface actuator systems. - Completed expanded demonstration of superconductive degaussing coil in a relevant environment. - Initiated detailed design and breadboard demonstration of control surface actuator systems. - Initiated scaled testing and large scale analysis for ship protection systems. - Initiated Compact Power Conversion Technology Phase 2 Critical Component Development. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete detailed design and breadboard demonstration of control surface actuator systems. - Complete Compact Power Conversion Technology Phase 2 Critical Component Development. - Initiate fabrication of scaled control surface actuator systems. 			
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 2912: <i>Force Protection Advanced Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
- Initiate Compact Power Conversion Technology Phase 3 large Scale Component Development and testing.			
<i>FY 2012 Plans:</i>			
- Continue all efforts of FY 2011, less those noted as completed above.			
- Complete Compact Power Conversion Technology Phase 3 large Scale Component Development and testing.			
- Initiate efforts in support of Renewable-Sustainable Expeditionary Power FNC.			
- Initiate efforts in support of Long Endurance Undersea Vehicle Propulsion FNC.			
Accomplishments/Planned Programs Subtotals	59.700	59.405	42.730

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0602123N: <i>FORCE PROTECTION APPLIED RESEARCH</i>	26.579	21.747	20.769	0.000	20.769	17.226	9.152	1.238	0.000	0.000	96.711

D. Acquisition Strategy
Not applicable.

E. Performance Metrics

The overall goals of this advanced technology program are the development of technologies which focus on the warfighter and providing the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage while preserving operational capability. Overall metric goals are to transition the advanced technology projects into acquisition programs. Each Activity within this PE has unique goals and metrics, some of which include classified quantitative measurements.

Specific examples of metrics under this PE include:

- Demonstrate improved performance of main propulsion electric motors and controllers (50% reduced weight and volume) by FY 2011.
- Demonstration of a Medium Voltage Direct Current (MVDC) architecture containing Commercial Off the Shelf (COTS) components to assess the viability of MVDC distribution for CG (X) cruiser by the end of FY 2011.
- Items included within the Missile Defense Activity description.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603123N: <i>Force Protection Advanced Technology</i>				3049: <i>Force Protection</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
3049: <i>Force Protection</i>	3.266	2.472	2.504	-	2.504	2.552	2.612	2.668	2.717	Continuing	Continuing

A. Mission Description and Budget Item Justification

Advanced technologies developed, critical to protecting naval installations, will provide seamless full spectrum protection against asymmetric terrorist attack by improving the ability to: sense developing and immediate threats; shape our responses through improved situational awareness and decision making; shield personnel, mission critical facilities, infrastructure, and operating fleet assets; maintain essential functions; and sustain and restore critical services in the aftermath of an incident. Technologies developed will also seek to reduce the required manpower and skill levels devoted to the force protection mission.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: EMERGING THREATS	3.266	2.472	2.504
<p>Description: This activity includes: Advanced technologies developed, critical to protecting naval installations, will provide seamless full spectrum protection against asymmetric terrorist attack by improving the ability to: sense developing and immediate threats; shape our responses through improved situational awareness and decision making; shield personnel, mission critical facilities, infrastructure, and operating fleet assets; maintain essential functions; and sustain and restore critical services in the aftermath of an incident. Technologies developed will also seek to reduce the required manpower and skill levels devoted to the force protection mission.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of lower cost/higher performance Force Protection sensors and automated detection algorithms, and decision support tools. - Continued interim demonstration of prototype Force Protection sensors. - Continued development of intrusion/incident response countermeasures for Force Protection. - Continued research to reduce force protection manpower and equipment costs through automation and predictive learning algorithms. - Continued threat characterization research and perception experiments for sensor performance optimization and model development and validation. - Completed full scale demo of swimmer defense system including sensors and response countermeasures. - Completed interim demonstration of force protection detection and response system with automated detection and self learning algorithms. - Initiated development of all weather sensors optimized for installation of force protection. - Initiated research to advance sensor fusion capabilities in high density networks with diverse sensor grids. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 3049: <i>Force Protection</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiated research into sensors for use in counter-surveillance around protected facilities. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete interim demonstration of prototype Force Protection sensors. - Complete development of intrusion/incident response countermeasures for Force Protection. - Initiate development of assessment algorithms and information analysis technologies to augment skills or replace persons in operations centers. - Initiate research into sensors and countermeasures for use against unmanned underwater vehicles. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete threat characterization research and perception experiments for sensor performance optimization and model development and validation. - Complete research to advance sensor fusion capabilities in high density networks with diverse sensor grids. 				
Accomplishments/Planned Programs Subtotals		3.266	2.472	2.504
C. Other Program Funding Summary (\$ in Millions)				
N/A				
D. Acquisition Strategy				
Not applicable.				
E. Performance Metrics				
<p>The overall goals of this advanced technology program are the development of technologies which will provide seamless full spectrum protection against asymmetric terrorist attack by improving the ability to protect naval installations. Overall metric goals are to reduce the required manpower and skill levels devoted to the force protection mission. Specific metric under the Project includes: In-water successful demonstration of warhead lethality against specified threat at required Closest Point of Approach (CPA).</p>				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 3315: <i>Medium Range Unmanned Aerial System</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
3315: <i>Medium Range Unmanned Aerial System</i>	-	-	18.823	-	18.823	19.143	19.460	-	-	0.000	57.426

A. Mission Description and Budget Item Justification

This program is a FY12 New Start. This is a future sea and land based Vertical Take-off and Landing (VTOL) Unmanned Aerial System (UAS) with at least a 300 mile radius and 9 hours endurance. Primary mission is Intelligence, Surveillance and Reconnaissance. The system will be fully autonomous and have provisions for future weapons system integration. This will be a technology development effort consisting of initial trade studies to identify enabling technologies and technology gaps and identify potential candidate systems suitable for technology insertion. Technology thrust areas will include air-vehicle performance, shipboard launch and recovery, autonomous operations and sensors technologies.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: Medium Range Unmanned Aerial System	-	-	18.823
FY 2012 Plans: - Initiate design, development and demonstration of technologies for advanced autonomous capabilities to enable highly capable sea based unmanned or optionally manned air vehicles. - Initiate design, development and demonstration of air vehicle technologies to enable sea based unmanned or optionally manned platforms.			
Accomplishments/Planned Programs Subtotals	-	-	18.823

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall goal of this advanced technology program is the development of technologies which focus on Intelligence, Surveillance and Reconnaissance. The desired IOC is 2018/2019.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603123N: <i>Force Protection Advanced Technology</i>				4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	4.397	-	-	-	-	-	-	-	-	0.000	4.397

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed un Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed un Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	4.397	-	-
Accomplishments/Planned Programs Subtotals	4.397	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603123N: <i>Force Protection Advanced Technology</i>				9999: <i>Congressional Adds</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	27.206	-	-	-	-	-	-	-	-	0.000	27.206

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: Captive Air Amphibious Transporter (CAAT) <i>FY 2010 Accomplishments:</i> This effort developed a 1/2 scale technology demonstrator of an amphibious, logistic craft for the Marine Corps to transport supplies and equipment from ship to challenging landing locations.	2.191	-
Congressional Add: HBCU Applied Research Incubator <i>FY 2010 Accomplishments:</i> This effort demonstrated a realistic three-dimensional flat display surface multi-touch technology for the effective control of submarine perspective displays replacing the current two dimension "plan-view" displays.	0.797	-
Congressional Add: High-Temperature Radar Dome Materials <i>FY 2010 Accomplishments:</i> This effort supported high-temperature radar dome materials research.	1.593	-
Congressional Add: Multi-Element Structured Filter Arrays for Naval Platforms <i>FY 2010 Accomplishments:</i> This effort provided research to reduce weight, volume and parasitic energy consumption of air filtration and distribution systems used for next generation shipboard fuel cell auxiliary power units, which will significantly increase the effectiveness of current and future Naval platforms by enhancing key war fighting capabilities such as speed, range and fuel efficiency.	3.426	-
Congressional Add: NAVAIR Project for Land/Sea-Based Air Systems Maintenance and Air Worthiness <i>FY 2010 Accomplishments:</i> This effort developed thermal barrier coating systems for the Naval Air Systems Command (NAVAIR) in collaboration with Focus: HOPE.	1.992	-
Congressional Add: Pure Hydrogen Supply from Logistic Fuels <i>FY 2010 Accomplishments:</i> This effort investigated a means of extracting pure hydrogen from standard logistic fuels to be used by all applications of fuel cells.	2.390	-
Congressional Add: Agile Port And High Speed Ship Technology	1.593	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 9999: <i>Congressional Adds</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011
<i>FY 2010 Accomplishments:</i> This effort supported agile port and high speed ship technology research.		
<i>Congressional Add:</i> Single Generator Operations Lithium Ion Battery	3.983	-
<i>FY 2010 Accomplishments:</i> This effort supported single generator operations lithium ion battery research.		
<i>Congressional Add:</i> High Power Density Motor Drive	2.868	-
<i>FY 2010 Accomplishments:</i> This effort identified optimal trade-offs between various component and subsystem ratings, sizes, weights that will lead to a fully realizable demonstration of an advanced high power density motor drive at a modest power rating.		
<i>Congressional Add:</i> Wide Area Sensor For Force Protection Targeting	1.593	-
<i>FY 2010 Accomplishments:</i> This effort developed a design for a podlet structure attached to the ball-gimbal sensor suitable for carriage on a tactical Unmanned Air System (UAS), such as the MQ-1C Extended Range Multi-Purpose (ERMP) /Warrior. The structure design, mounting, packaging and interconnection of the system components in the podlet were developed.		
<i>Congressional Add:</i> Accelerated Fuel Cells Manufacturability and Their	1.593	-
<i>FY 2010 Accomplishments:</i> This effort provided for the demonstration of a high-volume assembly and remanufacturing processes associated with the life-cycle of solid oxide fuel cells.		
<i>Congressional Add:</i> Advanced Logistics Fuel Reformer For Fuel Cells	2.390	-
<i>FY 2010 Accomplishments:</i> This effort conducted advanced technology development targeted towards demonstration of a fuel processor system and development of a diesel engine performance improvement system for shipboard applications to improve the reliability and efficiency of shipboard engines, improve service life and reduce operating costs.		
<i>Congressional Add:</i> High Temperature Superconductor Trap Field Magnet	0.797	-
<i>FY 2010 Accomplishments:</i> This effort supported high-temperature superconductor trap field magnet motor research.		
Congressional Adds Subtotals	27.206	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603123N: <i>Force Protection Advanced Technology</i>	PROJECT 9999: <i>Congressional Adds</i>

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Congressional Add.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603235N: <i>Common Picture Advanced Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	105.124	96.720	49.068	-	49.068	47.752	52.066	46.345	40.341	Continuing	Continuing
2919: <i>Communications Security</i>	102.608	96.720	49.068	-	49.068	47.752	52.066	46.345	40.341	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	0.923	-	-	-	-	-	-	-	-	0.000	.923
9999: <i>Congressional Adds</i>	1.593	-	-	-	-	-	-	-	-	0.000	1.593

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

Activities and efforts in this program address the advanced technology development, test, and evaluation of a dynamic distributed common picture based on emergent technologies that will improve situational awareness across command echelons. The promise of net-centricity and potential for persistent and pervasive sensing creates greater demand for automated fusion of large volumes of multi-sensor data, techniques to coordinate deployment of multiple diverse sensors, and tailored dissemination of information to support network centric operations. The focus of this program is to refine technologies that exploit information and networking technology to ensure mission success in unpredictable warfighting environments. These missions include the Overseas Contingency Operations (OCO), urban operations, and asymmetric warfare. To ensure Maritime Domain Awareness, the Navy must be able to collect, fuse, and disseminate enormous quantities of data drawn from US joint forces and government agencies, international coalition partners and forces, and commercial entities. To further network centric capabilities, this project demonstrates technologies that support seamless information services afloat and ashore; collaborative decision-making among geographically dispersed warfighters; a common, consistent view of the battlespace geared to user requirements; system interoperability with coalition forces; real-time information access with quality of service guarantees; and information assurance. Technologies of interest provide access to, and automated processing of, information necessary to make decisions that lead to rapid, accurate decision-making and result in decisive, precise, and desired engagement outcomes. The payoff is access to tailored information in near real time with corresponding increases in speed of command, improved decision-making, and reduction in manpower.

The Common Picture Program supports FORCEnet, Sea Shield and Sea Strike pillars and contains investments in the following Enabling Capabilities (ECs): Combatant Commanders (COCOM) to Marine Combat ID; Combat ID Information Management of Coordinated Electronic Surveillance; Combat ID in the Maritime Domain to Reveal Contact Intent; Automated Control of Large Sensor Networks; Dynamic Command and Control (C2) for Tactical Forces and Maritime Operations Center (MOC); Dynamic Tactical Communications Networks; Globally Netted Joint/Coalition Force Maritime Component Commander; OCO Focused Tactical Persistent

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603235N: <i>Common Picture Advanced Technology</i>
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Surveillance; Actionable Intelligence Enabled by Persistent Surveillance; High Band Width Free-Space Laser Communications; Pro-Active Computer Network Defense and Information Assurance; Fast Magic; Naval Research Laboratory (NRL) Space; Advanced Tactical Data Link; and Autonomous Tactical Persistent Surveillance.

In the context of the Naval Transformation Roadmap construct, this investment will achieve capabilities required by FORCEnet (Persistent Intelligence, Surveillance, and Reconnaissance; Time Sensitive Strike; and Sea Based Information Operations), Sea Strike (Ship-to-Objective Maneuver), and Sea Shield (Theater Air and Missile Defense).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	104.531	96.720	55.951	-	55.951
Current President's Budget	105.124	96.720	49.068	-	49.068
Total Adjustments	0.593	-	-6.883	-	-6.883
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-1.689	-			
• SBIR/STTR Transfer	-3.275	-			
• Program Adjustments	4.900	-	-6.904	-	-6.904
• Section 219 Reprogramming	0.700	-	-	-	-
• Rate/Misc Adjustments	-	-	0.021	-	0.021
• Congressional General Reductions Adjustments	-0.043	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: *Congressional Adds*

Congressional Add: *4D Data Fusion Visualization*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.593	-
	1.593	-
	1.593	-

Change Summary Explanation

Technical: Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy

DATE: February 2011

APPROPRIATION/BUDGET ACTIVITY

1319: *Research, Development, Test & Evaluation, Navy*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE

PE 0603235N: *Common Picture Advanced Technology*

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603235N: <i>Common Picture Advanced Technology</i>				PROJECT 2919: <i>Communications Security</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2919: <i>Communications Security</i>	102.608	96.720	49.068	-	49.068	47.752	52.066	46.345	40.341	Continuing	Continuing

A. Mission Description and Budget Item Justification

Activities and efforts in this project address the advanced technology development, test, and evaluation of a dynamic distributed common picture based on emergent technologies that will improve situational awareness across command echelons. The promise of net-centricity and potential for persistent and pervasive sensing creates greater demand for automated fusion of large volumes of multi-sensor data, techniques to coordinate deployment of multiple diverse sensors, and tailored dissemination of information to support network centric operations. The focus of this program is to refine technologies that exploit information and networking technology to ensure mission success in unpredictable warfighting environments. These missions include the OCO, urban operations, and asymmetric warfare. To ensure Maritime Domain Awareness, the Navy must be able to collect, fuse, and disseminate enormous quantities of data drawn from US joint forces and government agencies, international coalition partners and forces, and commercial entities. To further network centric capabilities, this project demonstrates technologies that support seamless information services afloat and ashore; collaborative decision-making among geographically dispersed warfighters; a common, consistent view of the battlespace geared to user requirements; system interoperability with coalition forces; real-time information access with quality of service guarantees; and information assurance. Technologies of interest provide access to, and automated processing of, information necessary to make decisions that lead to rapid, accurate decision-making and result in decisive, precise, and desired engagement outcomes. The payoff is access to tailored information in near real time with corresponding increases in speed of command, improved decision-making, and reduction in manpower.

The Communications Security project supports FORCEnet, Sea Shield and Sea Strike pillars and contains investments in the following Enabling Capabilities (ECs): COCOM to Marine Combat ID; Combat ID Information Management of Coordinated Electronic Surveillance; Combat ID in the Maritime Domain to Reveal Contact Intent; Automated Control of Large Sensor Networks; Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC); Dynamic Tactical Communications Networks; Globally Netted Joint/Coalition Force Maritime Component Commander; OCO Focused Tactical Persistent Surveillance; Actionable Intelligence Enabled by Persistent Surveillance; High Band Width Free-Space Laser Communications; Pro-Active Computer Network Defense and Information Assurance; Fast Magic; Naval Research Laboratory (NRL) Space; Advanced Tactical Data Link; and Autonomous Tactical Persistent Surveillance.

In the context of the Naval Transformation Roadmap construct, this investment will achieve capabilities required by FORCEnet (Persistent Intelligence, Surveillance, and Reconnaissance (ISR); Time Sensitive Strike; and Sea Based Information Operations), Sea Strike (Ship-to-Objective Maneuver), and Sea Shield (Theater Air and Missile Defense).

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: HIGH-INTEGRITY GLOBAL POSITIONING SYSTEM (HIGPS)	56.106	40.911	-
Description: The High-Integrity Global Positioning System (HIGPS) activity is focused on developing the technology required to demonstrate the capability of using the existing Iridium satellite constellation to enhance current GPS navigation and timing			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603235N: <i>Common Picture Advanced Technology</i>	PROJECT 2919: <i>Communications Security</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>capabilities. Enhancements include improved anti-jam performance, improved accuracy of navigation and positioning, increased availability of satellite navigation signals, improved accuracy in time stability transfer, and faster acquisition times.</p> <p>This activity focuses on integrating a HIGPS Enabling Technology Development (ETD) prototype. This effort is planned to transition to a HIGPS Technology Concept Demonstration (TCD) program under Navy program management at Office of Naval Research.</p> <p>The decrease from FY 2010 to 2011 is due to the completion of research and demonstration activities for the HIGPS TCD project.</p> <p>FY 2010 Accomplishments: - Continued the HIGPS TCD project. The HIGPS project continued using the HIGPS ETD as a foundation to assemble a system that will demonstrate the GPS augmentation concept.</p> <p>FY 2011 Plans: - Complete the HIGPS TCD project.</p>				
<p>Title: INFORMATION SECURITY RESEARCH</p> <p>Description: The overarching objective of this activity is to protect the Navy and the Joint information infrastructure from hostile exploitation and attack. The current specific objectives are:</p> <p>a) Network Situation Awareness & Security: Develop tools, techniques and methodologies to improve network resistance to denial of service attacks and improve indications and warnings of suspect activities.</p> <p>b) Network Traffic Analysis and Assessment: Develop methods for conducting network traffic analysis; monitoring and assessing network status and health; identifying new capabilities to analyze network vulnerabilities and attacks; and providing situational awareness of network assets and operations.</p> <p>c) Information Assurance: Develop and measure the effectiveness of Information Assurance (IA) protective solutions and improve the quality and level of certification of information assurance software.</p> <p>The following accomplishments and plans are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p>FY 2010 Accomplishments:</p>		1.701	1.840	1.876

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Network Situation Awareness & Security:</p> <ul style="list-style-type: none"> - Continued development of a tool for the development of agents that integrates UML and that provides a verifiable agent programming language, an inter-agent communication protocol, security agents for enforcing run-time properties, and property checkers. - Completed a tool for the development of agents that integrates unified modeling language (UML) and that provides a verifiable agent programming language, an inter-agent communication protocol, security agents for enforcing run-time properties, and property checkers. - Initiated new high assurance security protocols for networks and communications infrastructure with particular emphasis on attack resistance and security management. <p>Network Traffic Analysis and Assessment:</p> <ul style="list-style-type: none"> - Continued development of the security management tool that provides a common picture of the networked environment with respect to IA and security, with emphasis on visualization capabilities to support active computer network defense. - Continued the development of capabilities and an infrastructure that will support the management of high assurance devices/ components used within Navy networks. Ensured the approach was supported by the Navy's network centric architecture. <p>Information Assurance:</p> <ul style="list-style-type: none"> - Completed a tool suite that will provide evidence of assurance for security products based on the foundations of formal methods that will provide the automated analysis of the implementation based on the security policy. <p>FY 2011 Plans:</p> <p>Network Situation Awareness & Security:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. <p>Network Traffic Analysis and Assessment:</p> <ul style="list-style-type: none"> - Complete development of the security management tool that provides a common picture of the networked environment with respect to IA and security, with emphasis on visualization capabilities to support active computer network defense. - Complete the development of capabilities and an infrastructure that will support the management of high assurance devices/ components used within Navy networks. Ensure the approach is supported by the Navy's network centric architecture. <p>Information Assurance:</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiate enclave boundary security controller to protect Navy networks from attack and exploitation with emphasis on addressing malware, detection, data exfiltration, general attack detection, network reconstitution, exploitable cross-infrastructure dependencies.</p> <p>FY 2012 Plans: Network Situation Awareness & Security: - Continue all efforts of FY 2011. - Initiate development of algorithms/methods for providing attribution of threat-agents through the network/infrastructure. Emphasis will be placed on addressing translational boundaries, cross-domains, and obfuscation techniques to avoid detection and tagging. - Initiate the development of new algorithms to link/mine disparate system/network activities in order to identify malicious/threat agent actions against infrastructure components/systems.</p> <p>Network Traffic Analysis and Assessment: - Initiate the development of new algorithms focused on detection of nation state sponsored activities through the network infrastructure. Develop algorithms to address sophisticated malicious code techniques that exploit network traffic/data that is fragmented, encrypted, and/or obfuscated using polymorphic techniques.</p> <p>Information Assurance: - Continue all efforts of FY 2011. - Initiate the development of new domain data sharing algorithms/technology to address disparate classification levels, identification and authentication, inference techniques, and policy enforcement. Ensure algorithms/technology scale to support representative networks and provide the necessary protections against exploitation techniques such as data exfiltration.</p>				
<p>Title: KNOWLEDGE SUPERIORITY AND ASSURANCE (KSA)</p> <p>Description: A portion of this activity is devoted to mid-term technology development in close concert with programs of record. The products of these efforts are expected to transition at the end of their schedule into the associated acquisition programs of record. This activity area also appears in PE 0602235N. The aspects of a given EC in PE 0602235N focus on component technology, while this PE focuses on the integration of the components and on demonstrations. Warfighter Capability Gaps are being addressed by EC's. Each EC delivers capability-level products to acquisition in a three to five-year effort, and allocates a sufficient investment to ensure a capability is provided.</p>		44.801	53.969	47.192

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>The Future Naval Enabling Capabilities in this activity span across the Information Infrastructure, Applications/Tools/Decision Aids, Command and Control, Apertures and Radios, and Tactical Networks and Network Control/Management, and Computer Network Defense and Information Assurance technology areas. Technologies being developed will integrate sensors, networks, decision aids, weapons and supporting systems into a highly adaptive, human-centric, comprehensive maritime system. This system will operate from the sea bed to space in a Service Oriented Architecture (SOA) that can be used in a Joint Environment. To accomplish this information integration, efforts are underway to develop rapid, accurate decision making and dynamic, efficient, mission-responsive communications and networks. Objectives of the current ECs are:</p> <p>a) Combat ID Information Management of Coordinated Electronic Surveillance: Develop capability to dynamically re-task organic sensors in conjunction with fused intelligence products to support Command Control and Combat Systems. Efforts will include capability for automated integration of multi-intelligence surveillance & reconnaissance of red, white, and blue force locations for Combat Identification by providing software integrated into Navy and Marine Corps Command Control and Combat Systems. Demonstrations will be conducted in an operational Sea Trial environment. The benefits to the war-fighter include: More effective use of tactical sensors to maintain track and identify consistent with Commander's priorities; tactical sensor resources allocated effectively to complement Intelligence coverage; reduction in exposure of friendly forces to hostile action; order of magnitude reduction to false recognition and improper identification of significant military entities consistent with sensor capabilities; SOA enabled applications and infrastructure.</p> <p>b) Combat ID in the Maritime Domain to Reveal Contact Intent: Develop an automated capability to understand and interpret relationships among objects in the context of the maritime environment to include threat prediction and intent as well as event outcome assessment. Benefits to the Naval decision-maker include: automated interpretation of asset relationships and threat/impact assessment; automated processing over wide disparate datasets; recognition of anomalies, and proactive means to confirm or discount suspicious activity; framework extension of fusion to a real-time SOA enterprise environment.</p> <p>c) Automated Control of Large Sensor Networks: Develop a capability for automated and mission specific tactical sensor fields capable of fulfilling specific mission objectives with smart sensors that are capable of forwarding knowledge vice raw data. Technical development efforts also include a fusion engine capable of translating tactical sensor data into appropriate situational awareness for battalion level forces and below. Integration of the tactical sensor network with Distributed Common Ground System (DCGS) will assure that fusion, visualization, resource management and information dissemination engines run seamlessly from the individual Marine to the Commander, Joint Task Force (CJTF).</p>			
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>d) OCO Focused Tactical Persistent Surveillance: Develop a netted, organically controlled, adaptive sensor field that is capable of detecting and classifying features relevant to OCO. This includes organic sensors for small tactical expeditionary units, capable of supporting the dynamic character of modern operations from the highly mobile to the long-term. Also, Tracking, Tagging and Locating (TTL) technical development of Quantum dot, Electro-Optic (EO) phase shifted and optical tags for use against vehicles and high priority entities. Finally the effort includes technical development to enhance tactical sensor communications for a two-way high data rate radio. Technology allows for automatic adaptation of waveforms for increased network capacity.</p> <p>e) Globally Netted Joint/Coalition Force Maritime Component Commander: Develop 'globally- networked, theater-focused' maritime capabilities to enhance Joint Task Force (JTF) and COCOMs' ability to execute their intentions. The efforts will support multiple users and multiple roles to access data at any command echelon; provide consistent, qualified, and traceable operational & tactical maritime information across theaters; provide pedigree to provide a clear representation of complex situation and threat elements; supports user interaction across the SOA environment. The benefits to Naval forces include: exploitation of navy presence FORWARD to monitor vessels, people, cargo and designated missions, areas of interest within the global maritime environment; access to all relevant databases; and collection, analysis, and dissemination of relevant information.</p> <p>f) Dynamic Tactical Communications Networks: Develop, integrate and demonstrate dynamically adaptive automated software algorithms, protocols, and network management techniques that provide a rapidly auto-configuring and self-organizing networking capability. This capability will adapt to available links of opportunity at lower echelons and assure priority movement of critical data intra-network and through reachback gateway networks that interface with the Global Information Grid (GIG) across multiple security/routing domains. Benefits of this effort to the war-fighter include: timely exchange of situational awareness and C2 information for the Naval Expeditionary Combatant forces; high throughput tactical network access/delivery, SOA and coalition interoperability through a reliable communications grid; ad-hoc re-tasking and targeting of warriors, weapons and sensors with minimum human intervention; shortened kill chain for tactical engagement missions.</p> <p>g) Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC): Develop a capability that will provide the maritime commander with agile and responsive control and management of tactical Anti-Submarine Warfare (ASW) interactions in a net-centric enterprise environment. Focus will address classified ASW requirements for command and control at the tactical level. Benefits to Naval forces include flexible command and control among tactical units with severely degraded communications with the Maritime Operations Center.</p> <p>h) High-bandwidth Free-space Laser Communication (Lasercomm): Develop an affordable, reliable and high-bandwidth Free-Space Lasercomm capability which is adaptive and agile in mitigating a wide range of atmospheric and sea surface/state</p>			
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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turbulence, precipitation and obscuration conditions. Benefits include real-time high-bandwidth direct ship-ship, ship-air and ship-shore links in RF denied environments; enhanced reachback for Forward Operating Bases (FOB) to Marine expeditionary Command Operation Centers (COC) with limited SATCOM access; and biometrics information sharing between Marine Interdiction Operation (MIO) parties.

i) Actionable Intelligence Enabled by Persistent Surveillance: Develop a capability to provide accurate threat detection by exposing the enemy's vulnerabilities, unmasking their latent networks, discovering their tactics, techniques, procedures and exploiting in new ways the vast amount of sensor data available today against an irregular threat. Also being developed: an electro-optical, infrared and laser Intelligence, Surveillance, and Reconnaissance Targeting (ISRT) optics technology, capable of wide Field of View/Field of Range (FOV/FOR) at variable resolution & pointing direction, for installation in mobile platforms without gimbals; a light weight, low cost sensor suite and autonomy algorithms to enable detection and avoidance of all classes of aircraft or Unmanned Aerial Vehicles (UAV).

j) Pro-Active Computer Network Defense and Information Assurance: Develop a capability to 1) identify and counter real-time threats to the network during mission execution; 2) provide dynamic security management and component management of network-based assets to support mission execution; and 3) ensure mission essential capabilities and data exist despite malicious cyber actions. Specific efforts include: 1) Next Generation Sensors and Gateways to provide security and control mechanisms to protect networks, data and systems from attacks (e.g., malicious code, data exfiltration); 2) Next Generation Security Protocols and Security Management Protocols to provide hardened, highly survivable, stealthy, reconfigurable overlay of protocols onto networks to ensure network-base configuration and control of security components essential to mission operations, as well as provide data provenance to support dynamic resource management and decision support; and 3) Common Operational Security Decision System to aggregate, correlate, fuse and visualize network security posture information to support integrated warfighting decisions.

k) Fast Magic: Develop a capability for enabling Information Operations from tactical platforms in a net-centric environment. Details are classified.

l) NRL Space: Develop a capability to integrate multiple sensor information from multiple net-centered data stores in a service oriented architecture environment for persistent vessel tracking situational awareness. Details are classified.

m) Advanced Tactical Data Link - Develop a capability to support Advanced Tactical Data Link operations in permissive, contested, and anti-access environments as well as the real-time network operations capabilities needed to dynamically add/

FY 2010	FY 2011	FY 2012

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<p>remove participants, allocate Advanced Tactical Data Link resources to each participant, and add/remove network partitions in support of dynamic mission execution.</p> <p>n) Autonomous Tactical Persistent Surveillance - Develop a capability to allow autonomous control of persistent, tactical networks of sensors; enable ISR assets to provide an "Information Bubble" to the mobile user; provide revolutionary sensor and data support to agile tactical missions by anticipating information needs; and provide sensor planning and management relevant to a higher order knowledge model. This will provide the capability to autonomously maintain persistent surveillance of activities and entities over a region of interest, 24/7, while providing underlying context for real time adaptive surveillance in support of tactical mission objectives.</p> <p>The following accomplishments and plans are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p>The increase from FY 2010 to FY 2011 is associated with the following:</p> <ul style="list-style-type: none"> - Initiate three new FNC Enabling Capabilities (ECs): Pro-Active Computer Network Defense and Information Assurance, Fast Magic, and NRL Space. - Continue ramp up of ongoing EC efforts: High-bandwidth Free-space Lasercomm, GWOT Focused Tactical Persistent Surveillance, Globally Netted Joint/Coalition Force Maritime Component Commander, Dynamic C2 for Tactical Forces and Maritime Operations Center (MOC), Actionable Intelligence Enabled by Persistent Surveillance, and FNC Common Picture Technology. <p>The decrease from FY 2011 to FY 2012 represents the completion of multiple products in FY 2011 in the "Combat ID in the Maritime Domain to Reveal Contact Intent" and "Automated Control of Large Sensor Networks" ECs. The funding variation with this activity reflects the summation of the changing funding requirements between multiple FNC, EC programs and associated products. Each EC and its products represent multi-year development efforts with changing funding requirements across each products approved baseline.</p> <p>FY 2010 Accomplishments: Combat ID Information Management of Coordinated Electronic Surveillance: - Completed the development of software that will provide the capability to dynamically re-task organic sensors in conjunction with fused intelligence products to support Command Control and Combat Systems. Efforts will include capability for automated integration of multi-intelligence surveillance & reconnaissance of red, white, and blue force locations for Combat Identification by providing software integrated into Navy and Marine Corps Command Control and Combat Systems.</p>				

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>- Completed the development and demonstration of the service oriented network-centric architecture for adapting multi-sensor fusion and adaptive resource management across a network of intelligence sensors in an operational (Sea Trial) environment.</p> <p>Combat ID in the Maritime Domain to Reveal Contact Intent:</p> <ul style="list-style-type: none"> - Continued the development of algorithms and software that will provide an automated capability to understand and interpret relationships among objects in the context of the maritime environment to include threat prediction and intent as well as event outcome assessment. - Continued the development and demonstration of software that provides the capability to extract anomalies and provide basic reasoning techniques to separate false alarms from true anomalies. Tests will be conducted in both Limited Technology Experiments and Sea Trials. - Continued the development and demonstration of smart algorithms for each sensor type that enables the translation of signals to information at the node; tactical multi-INT fusion algorithms; enhancements allowing for the fusion of tactical and higher sourced data and for the combined translation of information to actionable intelligence; and a tactical service oriented architecture. <p>Automated Control of Large Sensor Networks:</p> <ul style="list-style-type: none"> - Continued the development, integration and demonstration of high information tactical agile sensors, including a tactical wide area surveillance UAV payload, tactical RF sensors, sensors to sense the state of a person and smart tactical imagers and acoustic sensors; of novel high bandwidth communications links for tactical UAVs and battery powered high information content tactical sensors; and airborne readers of optical tags. - Continued the development and demonstration of smart algorithms for tactical sensors that can process data at the node in a battery efficient manner; an ability to generate behavioral indications and warnings based on detected alerts across disparate data sources; and functional extensions of a service oriented environment down to the most tactical node. Tests were conducted in an Advanced Warfighting Experiment during FY 2010. <p>OCO Focused Tactical Persistent Surveillance:</p> <ul style="list-style-type: none"> - Continued the development of a netted, organically controlled, adaptive sensor field that is capable of detecting and classifying features relevant to overseas contingency operations. This includes organic sensors for small tactical expeditionary units, technical development of Quantum dot, Electro-Optic (EO) phase shifted and optical tags for use against vehicles and high priority entities, and technical development to enhance tactical sensor communications for a two-way high data rate radio. - Initiated development, integration, and demonstration of high information tactical agile sensors, including a tactical wide area surveillance UAV payload and an RF payload for a tier-2 UAV. - Initiated development, integration, and demonstration of a distributed architecture of smart metadata and analysis tools. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<p>Globally Netted Joint/Coalition Force Maritime Component Commander:</p> <ul style="list-style-type: none"> - Continued development of technology to enable the coordinated Global Joint and Coalition Force Maritime Component Commander (J/CFMCC) capture and share information from sources and processes; with the intended result of managing at least 10,000 tracks per day in a consistent manner to support user awareness and control (current capability is approximately 200 tracks per day globally). - Continued the development, integration, and demonstration in Sea Trials the near real time ability to access all relevant databases and collect, analyze and disseminate relevant information to Maritime Component Commanders. <p>Dynamic Tactical Communications Networks:</p> <ul style="list-style-type: none"> - Continued effort to develop and apply emerging technologies that support self-organizing networking and assured communications exchange in tactical communications networks. - Continued development, integration and demonstration of wireless network auto-configuration and self-organization (including dynamic partitions and merge) algorithms and protocols; distributed and dynamic policy based network management and secure mobility management solutions; network service discovery mechanisms and network-aware middleware-enabled applications; inter-domain (security and routing) protocols for fully-connected domains; and robust and bandwidth efficient group communication protocols for the tactical environment, including disruption tolerance. <p>Dynamic C2 for Tactical Forces and MOC:</p> <ul style="list-style-type: none"> - Continued effort to mature, demonstrate and apply emerging technologies that support dynamic and response management and control of net-centric enterprise theater and tactical ASW operations. This includes automation support for synchronized planning of resources and multi-mission execution, and access and shared awareness of data, activities and status among Maritime Operation Centers and tactical forces in a tactical netted SOA environment. - Continued the development, integration and demonstration of SOA tactical services that support C2 by providing decision-quality information to the commander much more rapidly than in the past, and in response to unanticipated changes in operational requirements using data management with disconnected, intermittent, or limited communications paths; shared awareness of track data; adaptation to network conditions; and automated and real-time composition of existing tactical enterprise services to accomplish a new C2 function. - Continued the development and demonstration of automated techniques for force planning and allocation of resources based on information as it is passed from the Operational Level MOC to the local-tactical level and from local-tactical centers to adjacent local-tactical centers. <p>High-bandwidth Free-Space Lasercomm:</p>			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiated the development of software/hardware for mitigation techniques for laser beam propagation through atmospheric turbulence and aerosol obscuration; fast acquisition and fine beam steering/tracking algorithms; characterization of performance/affordability of mechanical steering to not-so-mature electronic steering approaches under the Adaptive Photonic Phase-Locked Elements (APPLE) program.</p> <p>- Initiated the development of wide-area avalanche photo-diode receive array techniques; high bandwidth wide field-of-view retro-reflector optics; and adaptive bit rate and transmit power control.</p> <p>- Initiated the development and integration of turbulence mitigation techniques to dual-mode free-space optical terminal electronics/optics.</p> <p>- Initiated the development and demonstration of adaptive bit rate (10 Mbps-1 Gbps) and transmit power control; wide-area avalanche photo-diode receive array technique; high bandwidth wide field-of-view retro-reflector optics.</p> <p>- Initiated the development of platform specific (e.g., P3/E2-C or ship or sub periscope mount) terminal configuration and 'disadvantaged platform' specific retro-reflector configuration.</p> <p>Actionable Intelligence Enabled by Persistent Surveillance:</p> <p>- Initiated development, integration and demonstration of an active liquid crystal lens for a very high resolution focal plane array, a distributed architecture of smart meta data and analysis tools, and control laws that allow a tier-2 UAV to satisfy flight safety standards required in manned airspace.</p> <p>FY 2011 Plans:</p> <p>Combat ID in the Maritime Domain to Reveal Contact Intent:</p> <p>- Complete the development of algorithms and software that will provide an automated capability to understand and interpret relationships among objects in the context of the maritime environment to include threat prediction and intent as well as event outcome assessment.</p> <p>- Complete the development and demonstration of software that provides the capability to extract anomalies and provide basic reasoning techniques to separate false alarms from true anomalies. Tests will be conducted in both Limited Technology Experiments and Sea Trials.</p> <p>- Complete the development and demonstration of smart algorithms for each sensor type that enables the translation of signals to information at the node; tactical multi-INT fusion algorithms; enhancements allowing for the fusion of tactical and higher sourced data and for the combined translation of information to actionable intelligence; and a tactical service oriented architecture.</p> <p>Automated Control of Large Sensor Networks:</p>				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Complete the development and demonstration of smart algorithms for tactical sensors that can process data at the node in a battery efficient manner; an ability to generate behavioral indications and warnings based on detected alerts across disparate data sources; and functional extensions of a service oriented environment down to the most tactical node.</p> <p>- Complete the development, integration and demonstration of high information tactical agile sensors, including a tactical wide area surveillance UAV payload, tactical RF sensors, sensors to sense the state of a person and smart tactical imagers and acoustic sensors; of novel high bandwidth communications links for tactical UAVs and battery powered high information content tactical sensors; and airborne readers of optical tags. Tests will be conducted in an Advanced Warfighting Experiment.</p> <p>OCO Focused Tactical Persistent Surveillance: - Continue all efforts of FY 2010.</p> <p>Globally Netted Joint/Coalition Force Maritime Component Commander: - Continue all efforts of FY 2010.</p> <p>Dynamic Tactical Communications Networks: - Continue all efforts of FY 2010.</p> <p>Dynamic C2 for Tactical Forces and MOC: - Continue all efforts of FY 2010.</p> <p>High-bandwidth Free-space Lasercomm: - Continue all efforts of FY 2010.</p> <p>Actionable Intelligence Enabled by Persistent Surveillance: - Continue all efforts of FY 2010.</p> <p>Pro-Active Computer Network Defense and Information Assurance: - Initiate the development, integration and demonstration of Next Generation Sensors and Gateways to provide security and control mechanisms to protect networks, data and systems from attacks (e.g., malicious code, data exfiltration.) - Initiate the development, integration and demonstration of Next Generation Security Protocols and Security Management Protocols to provide hardened, highly survivable, stealthy, reconfigurable overlay of protocols onto networks to ensure network-base configuration and control of security components essential to mission operations, as well as provide data provenance to support dynamic resource management and decision support.</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Initiate the development, integration and demonstration of Common Operational Security Decision System to aggregate, correlate, fuse and visualize network security posture information to support integrated warfighting decisions.</p> <p>Fast Magic: - Initiate the development of algorithms and demonstration of technologies and software for enabling Information Operations from tactical platforms in a net-centric environment. Details are classified.</p> <p>NRL Space: - Initiate the development of multiple intelligence fusion algorithms and software for dynamic distributed computing environments. Demonstrate the capability to integrate multiple sensor information from multiple net-centered data stores in a service oriented architecture environment for persistent vessel tracking situational awareness.</p> <p>FY 2012 Plans: OCO Focused Tactical Persistent Surveillance: - Continue all efforts of FY 2011.</p> <p>Globally Netted Joint/Coalition Force Maritime Component Commander: - Continue all efforts of FY 2011.</p> <p>Dynamic Tactical Communications Networks: - Continue all efforts of FY 2011.</p> <p>Dynamic C2 for Tactical Forces and MOC: - Continue all efforts of FY 2011.</p> <p>High-bandwidth Free-space Lasercomm: - Continue all efforts of FY 2011.</p> <p>Actionable Intelligence Enabled by Persistent Surveillance: - Continue all efforts of FY 2011.</p> <p>Pro-Active Computer Network Defense and Information Assurance: - Continue all efforts of FY 2011</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>Fast Magic: - Continue all efforts of FY 2011. Details are classified.</p> <p>NRL Space: - Continue all efforts of FY 2011. Details are classified.</p> <p>Advanced Tactical Data Link - Initiate the development, integration and demonstration of technologies to support Advanced Tactical Data Link operations in permissive, contested, and anti-access environments as well as the real-time network operations capabilities needed to dynamically add/remove participants, allocate Advanced Tactical Data Link resources to each participant, and add/remove network partitions in support of dynamic mission execution.</p> <p>Autonomous Tactical Persistent Surveillance - Initiate the development, integration and demonstration of technologies to allow autonomous control of persistent, tactical networks of sensors; enable ISR assets to provide an "Information Bubble" to the mobile user; provide revolutionary sensor and data support to agile tactical missions by anticipating information needs; and provide sensor planning and management relevant to a higher order knowledge model.</p>			
Accomplishments/Planned Programs Subtotals	102.608	96.720	49.068

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0602235N: <i>COMMON PICTURE APPLIED RESEARCH</i>	27.585	26.752	34.334	0.000	34.334	27.318	15.424	7.179	2.185	0.000	140.777

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

This PE supports the development of technologies that address the advanced technology development, test, and evaluation of a dynamic distributed common picture based on emergent technologies that will improve situational awareness across command echelons. Each PE Activity has unique goals and metrics, some of which include classified quantitative measurements. Overall metric goals are focused on achieving sufficient improvement in component or system capability such that the

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603235N: <i>Common Picture Advanced Technology</i>	PROJECT 2919: <i>Communications Security</i>
<p>6.2 applied research projects meet the need of or produce a demand for inclusion in advanced technology that may lead to incorporation into acquisition programs or industry products available to acquisition programs.</p> <p>Specific examples of metrics under this PE include:</p> <ul style="list-style-type: none">- Enable the coordinated Global Joint and Coalition Force Maritime Component Commander to capture and share information from sources and processes with the intended result of managing at least 10,000 tracks per day in a consistent manner to support user awareness and control (current capability is approximately 200 tracks per day globally).- Enable faster planning of assets allocated to fill ISR coverage gaps by 100 times; 100 percent more coverage or 50 percent reduction in sensor asset usage to enable more effective allocation of assets to eliminate redundant ISR coverage; 95 percent of all significant military objects correctly located, tracked and identified.- Enable self-organizing tactical communication networks by increasing multimember network size from 20 nodes to 200 nodes; decreasing time for networks auto-configuration from hours to five minutes for 200 nodes; and decreasing time for individual entities to join or leave a network from minutes (often hours) to 10 seconds.		

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603235N: <i>Common Picture Advanced Technology</i>				4027: <i>Naval Innovative Science and Engineering</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	0.923	-	-	-	-	-	-	-	-	0.000	.923

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	0.923	-	-
Accomplishments/Planned Programs Subtotals	0.923	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603235N: <i>Common Picture Advanced Technology</i>				9999: <i>Congressional Adds</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	1.593	-	-	-	-	-	-	-	-	0.000	1.593

A. Mission Description and Budget Item Justification

Congressional add.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: 4D Data Fusion Visualization	1.593	-
FY 2010 Accomplishments: This effort improved and enhanced the interfaces to the 4D Data Fusion Visualization software, which improved the capability to process, fuse and rapidly visualize very large amounts of spatial and temporal data in an immersive environment to facilitate situational awareness and understanding of the battlespace.		
Congressional Adds Subtotals	1.593	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Congressional add.

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	92.138	98.261	71.232	-	71.232	69.823	67.014	62.062	52.035	Continuing	Continuing
2915: <i>Warfighter Sustainment Adv Tech</i>	83.094	98.261	71.232	-	71.232	69.823	67.014	62.062	52.035	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	2.670	-	-	-	-	-	-	-	-	0.000	2.670
9999: <i>Congressional Adds</i>	6.374	-	-	-	-	-	-	-	-	0.000	6.374

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval Science and Technology (S&T) Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential S&T efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

Warfighter Sustainment Advanced Technology supports: Manpower and Personnel, Training, and Readiness; and the Future Joint Warfighting Capabilities identified by the Joint Chiefs of Staff. It supports Future Naval Capabilities (FNC) Programs in Airframe/Ship Corrosion; Turbine Engine Technologies; Littoral Combat; Sea Base Planning, Operations and Logistics; and Sea Base Mobility and Interfaces. It develops technologies that enable the Navy to better recruit, select, classify, assign, and manage its people; to train effectively and affordably in classroom settings, in simulated and actual environments, and while deployed; and to effect human systems design into weapon systems. Other technologies enable reduced operating costs through life-extension of legacy systems and increased efficiency of future propulsion systems and improved diagnostic tools.

Within the Naval Transformation Roadmap, this investment supports the achievement of all the transformational capabilities of Sea Warrior and the transformational capabilities of: Ship to Objective Maneuver and Time Sensitive Strike required by Sea Strike; Littoral Sea Control and Anti-Sub Warfare required by Sea Shield; Compressed Deployment and Employment Times and Enhanced Sea-Borne Positioning of Assets required by Sea Basing; and Battlespace Integration required by FORCEnet.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	92.864	98.261	92.820	-	92.820
Current President's Budget	92.138	98.261	71.232	-	71.232
Total Adjustments	-0.726	-	-21.588	-	-21.588
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.747	-			
• SBIR/STTR Transfer	-2.255	-			
• Program Adjustments	-	-	-21.196	-	-21.196
• Section 219 Reprogramming	2.290	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.392	-	-0.392
• Congressional General Reductions Adjustments	-0.014	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

Congressional Add: *Intelligent Retrieval of Imagery*

Congressional Add: *Nanofluidic Lubricants for Increased Fuel Efficiency in Heavy Duty Vehicles*

Congressional Add: *Environmentally-Sealed, Ruggedized Avionics Displ*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.992	-
	1.195	-
	3.187	-
Congressional Add Subtotals for Project: 9999	6.374	-
Congressional Add Totals for all Projects	6.374	-

Change Summary Explanation

Technical: Reflects a correction to the Seabasing INP funding profile to be consistent with the changes in complexity and cost associated with going from preliminary design and model development through prototype fabrication.

Schedule: N/A

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APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>				2915: <i>Warfighter Sustainment Adv Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2915: <i>Warfighter Sustainment Adv Tech</i>	83.094	98.261	71.232	-	71.232	69.823	67.014	62.062	52.035	Continuing	Continuing

A. Mission Description and Budget Item Justification

Warfighter Sustainment Advanced Technology supports Manpower and Personnel, Training, and Readiness; and the Future Joint Warfighting Capabilities identified by the Joint Chiefs of Staff. This project supports FNC Programs in Airframe/Ship Corrosion; Turbine Engine Technologies; Littoral Combat; Sea Base Planning, Operations and Logistics; and Sea Base Mobility and Interfaces. This project develops technologies that enable the Navy to better recruit, select, classify, assign, and manage its people; to train effectively and affordably in classroom settings, in simulated and actual environments, and while deployed; and to effect human systems integration into weapon systems. Other technologies enable reduced operating costs through life-extension of legacy systems, increased efficiency of future propulsion systems and improved diagnostic tools. Within the Naval Transformation Roadmap, this investment supports the achievement of all the transformational capabilities of Sea Warrior and the transformational capabilities of Ship to Objective Maneuver and Time Sensitive Strike required by Sea Strike; Littoral Sea Control and Anti-Submarine Warfare (ASW) required by Sea Shield; Compressed Deployment and Employment Times and Enhanced Sea-Borne Positioning of Assets required by Sea Basing; and Battlespace Integration required by FORCEnet.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: AIRFRAME/SHIP CORROSION/COST REDUCTION TECHNOLOGIES	4.674	9.662	15.255
<p>Description: This activity includes an integrated approach for the control of the effects of external and internal corrosion in Naval weapon systems as well as cost reduction technology efforts. The work develops advanced, cost effective prevention and lifecycle management technologies. This is particularly significant to life extension for the aging fleet.</p> <p>FY 2010 to FY 2012 funding increase is due to the initiation and ramp-up of several new EC's including corrosion related signature technologies and advanced shipboard water desalination and corrosion.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development on improved non-skid coatings. - Continued development on improved ship rudder coatings. - Continued development on high performance topside coatings - Continued development on high performance airfield pavements. - Completed evaluation of advanced materials for erosion control on helicopter main rotor blade leading edges. - Initiated down select of materials for erosion control of helicopter main rotor blade leading edges for subsystem evaluation of performance. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiated evaluation and correlation of materials repair technologies related to sub-system materials for erosion control on helicopter main rotor blade leading edges.</p> <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all effort of FY 2010, less those noted as completed above. - Initiate systems testing of materials systems for erosion control on helicopter main rotor blade leading edges. - Initiate evaluation, design and demonstration of advanced ASGS (Active Shaft Grounding System) with Condition Based Maintenance (CBM) and signature control. - Initiate evaluation, design, large scale testing and demonstration of Impressed Current Cathodic Protection (ICCP) components. - Initiate evaluation, design and demonstration of dual-use ICCP and novel sensor technology for CBM and closed-loop deamping. - Initiate testing and evaluation of diagnostic models and demonstration of materials with improved barrier dielectrics. - Initiate evaluation, testing and demonstration of CBM underwater hull analysis model integrated with closed loop deamping model. - Initiate development of thermal management system(s) to arrest excessive heat fluxes and loads on amphibious ship by advanced Naval/USMC aircraft. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Initiate evaluation and design of rotorcraft structural health management sensors, architecture and diagnostics - Initiate development of sprayable acoustic damping systems for submarines to significantly reduce weight and costly maintenance procedures and increase operational readiness. - Initiate development of low temperature carbon supersaturation (LTCSS) technology to incorporate improved corrosion resistance and surface hardness to materials in erosion-corrosion environments. - Initiate development of algorithms to incorporate into design module for corrosion prevention to predict the occurrence of corrosion and provide alternative solutions for use in component and system design. 				
<p>Title: HUMAN SYSTEMS DESIGN (FORMALLY INTEGRATION)</p> <p>Description: This effort supports the warfighter by providing enhanced capabilities by designing affordable user-centered systems that are efficient, easy to use, and provide required mission capabilities at lowest lifecycle costs. Such systems will be optimally designed for the right number and types of personnel, requiring minimum training while providing high skills retention.</p> <p>This field of research is paramount to the reduction in complex naval systems design, acquisition, operation, and maintenance costs and improvements in the effectiveness of operations. Congressional, DoD, and Navy policies and instructions require Navy and Marine Corps Program Managers to have a comprehensive plan for Human Systems Design in the acquisition process</p>		5.804	6.521	6.815

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B. Accomplishments/Planned Programs (\$ in Millions)			FY 2010	FY 2011	FY 2012
<p>to optimize total system performance, minimize total ownership costs, and ensure the system is built to accommodate the characteristics of the user population that will operate, maintain, and support the systems. A strong Human Systems Design effort is required to meet these goals.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued developing and demonstrating automation and human interface technologies to support collaborative decision-making in which multiple unmanned system operators manage groups of vehicles with optimal manning. - Continued developing innovative strategies for significantly improving on-board training and performance measurement for improving submarine command team decision making and overall submarine team performance and resilience. - Continued developing a prototype and operational construct, processes, methods and software specifications to merge the full spectrum of Human Systems Engineering into the Navy's standards based, open-architecture, Integrated Product Data Environment. - Completed HSI interface display research to improve ships personnel's ability to efficiently and effectively detect, recognize, and identify noisy targets in ambiguous and uncertain dynamic environments. - Initiated development of mission performance optimizations encompassing task centered design and advanced human performance modeling for achieving the requisite manning, both in numbers and capabilities, for the complex ships and systems of the future fleet. - Initiated improving the capability to fuse imaging, electronic warfare, inorganic and acoustic sensor inputs into integrated, fused, and intuitive displays that enhance the presentation and command understanding of uncertain information. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Complete developing and demonstrating automation and human interface technologies to support collaborative decision-making in which multiple unmanned system operators manage groups of vehicles with optimal manning. - Complete developing innovative strategies for significantly improving on-board training and performance measurement for improving submarine command team decision making and overall submarine team performance and resilience. - Initiate developments to incorporate environmental stressors impact(fatigue, motion, vibration and extreme temperatures) into systems engineering tools for the development for complex Navy systems. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Complete developing a prototype and operational construct, processes, methods and software specifications to merge the full spectrum of Human Systems Engineering into the Navy's standards based, open-architecture, Integrated Product Data Environment. 					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011				
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B. Accomplishments/Planned Programs (\$ in Millions)						
				FY 2010		
				FY 2011		
				FY 2012		
<p>- Complete development of mission performance optimization encompassing task centered design and advanced human performance modeling for achieving the requisite manning, both in numbers and capabilities, for the complex ships and systems of the future fleet.</p> <p>Title: LITTORAL COMBAT</p> <p>Description: The goal of Littoral Combat is the application of technologies to enhance the ability of the Navy/Marine Corps team to execute the Naval portion of a joint campaign in the littorals. This activity considers all the critical functions of warfighting: command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR), fires, maneuver, sustainment, force protection, and training. The activity includes support to the following FNC ECs; Battlefield Power, Reduced Support Costs 1, Advanced Naval Fires Technology Spiral 1, Combatant Commander (COCOM) to Marine Combat Identification (ID), Global Information Grid (GIG)-Compliant Networking, Hostile Fire Detection and Response Spiral 2, Position-Location-Information, Reduced Cost of Operations 1, Sea Base Collaborative Command and Control, Sea Base Mobility and Interfaces, and Sea Base Integrated Operations.</p> <p>FY 2010 to FY 2012 funding decrease is due to completion of project Advance Power generation Technology and realignment of funding to PE 060213M and 0603640M.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of advanced lighter weight modular individual protective system that will provide increased flexibility and protection for the warfighter. (Concurrent effort funded by PE 0602131M and PE 0603640M). - Continued development and transition advanced power generation technologies that enable reduction of the logistical burden on small tactical units. - Initiated development of advanced armor technologies for improved survivability and advanced suspension technologies for improved cross country mobility of Marine Corps tactical and combat vehicles.(Previous FY 2009 funding by PE 0602131M and 0603640M; concurrent funding by PE 0602131M and PE 0603640M- funding by these PEs completes development and transition). - Initiated development of technologies that will lighten the load of individual warfighters by reducing weight, improving survivability and increasing the mobility of the warfighter.(Concurrent funding provided by PE 0602236N) - Initiated research to develop technology to reduce fabrication and life cycle costs of SSN/SSGN next generation photonics mast and to improve SSN surface situational awareness through faster image acquisition rates, improve range performance under adverse weather conditions and improve autonomous detection and classification.(Concurrent funding provided by PE 0602236N). <p>FY 2011 Plans:</p>				9.607	7.664	5.974

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Continue development of individual warfighter lightweight protective system technologies that will reduce body armor weight, improve survivability and increase the mobility of the warfighter (lighten the load). - Continue development of technologies that will lighten the load of individual warfighters by reducing weight, improving survivability and increasing the mobility of the warfighter. (Concurrent funding provided by PE 0602131M and PE 0603640M - funding by these PE's completes development and transition). - Continue research to develop technology to reduce fabrication and life cycle costs of SSN/SSGN next generation photonics mast and to improve SSN surface situational awareness through faster image acquisition rates, improve range performance under adverse weather conditions and improve autonomous detection and classification. (Concurrent funding provided by PE 0602236N), - Complete development and transition advanced power generation technologies that enable reduction of the logistical burden on small tactical units. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Continue and realign development and transition of technologies to reduce the load of warfighters by 1) reducing the weight of and improving the capability of the day/night weapon sight, 2) eliminating battery incompatibility, and 3) providing GUI-based software for tradeoff analyses bases on Military Operational Posture to PEs 0602131M, and 0603640M. - Continue research to develop technology to reduce fabrication and life cycle costs of SSN/SSGN next generation photonics mast and to improve SSN surface situational awareness through faster image acquisition rates, improve range performance under adverse weather conditions and improve autonomous detection and classification.(Concurrent funding provided by PE 0602236N). -Complete transition of advanced power generation technologies that enable reduction of the logistical burden on small tactical units to PM-Expeditionary Power Systems, Marine Corps Systems Command. 				
Title: MANPOWER AND PERSONNEL DEVELOPMENT		5.210	4.966	4.513
Description: This activity provides Navy personnel system managers with the ability to attract and retain the right people and to place them in jobs that best use their skills, training, and experience. The application of modeling and simulation, mathematical optimization, advanced testing, information visualization, and human performance measurement technologies will enhance Fleet readiness and reduces personnel costs. These technologies enhance the Navy's ability to manage the force efficiently and maintain readiness with fewer people and smaller budgets; provide warfighting capabilities optimized for low-intensity conflict and littoral warfare; and operating and maintaining increasingly sophisticated weapons systems while managing individual workload and supporting optimal manning.				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>FY 2011 to FY 2012 funding reduction reflects realignment of projects by the program sponsor; OPNAV N1.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development and demonstration of decision support tools to better enable meeting the goals of the Navy's evolving strategies for personnel and manpower management. - Continued integration of multi-faceted decision support tools to evaluate manpower alternatives. - Continued development and demonstration of an agent-based simulation to enhance the effectiveness of behaviorally-based predictive models. - Furthered development of a prototype decision support system to enable community management program analysts to better forecast and assess the effects of active duty enlisted and officer behavior resulting from both proposed and current policy decisions. - Furthered investigation into relationship of delivery methods of Navy schools training and the differences in training and job performance outcomes and on how these are related to differences in individual's non-cognitive characteristics. - Furthered investigation of methods for composing minimally sized crews to facilitate the development of teamwork intensive proficiencies at an accelerated pace. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete investigation into relationship of delivery methods of Navy schools training and the differences in training and job performance outcomes and on how these are related to differences in individual's non-cognitive characteristics. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Complete investigation of methods for composing minimally sized crews to facilitate the development of teamwork intensive proficiencies at an accelerated pace. 				
<p>Title: SEA BASE MOBILITY AND INTERFACES</p> <p>Description: This activity includes support for Sea Base Mobility and Interfaces and Force Closure. This activity improves the capability for transfer of cargo between Sea Base/Logistics vessels and employment of combat ready forces over unimproved beaches during high sea states. Capabilities being developed include propulsion technologies, maneuvering technologies, and advanced hull systems technologies needed for sustained operations at high speed in high sea states. This activity further supports the Seabasing mission of transporting troops, equipment, and materials from the seabase to shore, and providing support to seaborne forces via surface distribution interfaces.</p>		6.598	0.698	0.090

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>	PROJECT 2915: <i>Warfighter Sustainment Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>FY 2010 and FY 2011 funding reduction is due to the completion of FNC BAS-FY06-01, Sea Base Mobility and Interfaces - Specific products are High Rate Vertical/Horizontal Material Movement and Small to Large Vessel At-Sea Transfer Sea Base Connector. FNC EPE-FY07-02, MPF (F) Force, Closure is nearing completion - Specific product is 38 MW Axial-Flow Waterjet. The reduction between FY 2011 and FY 2012 is due to FNC EPE-FY07-02, MPF (F) Force, Closure nearing completion and final testing for the 38 MW Axial-Flow Waterjet.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued efforts to develop a large scale Axial Flow Waterjet technology with the new transition target to Littoral Combat Ship (LCS). - Completed work for a beachable high speed craft as a Sea Base mobility interface. - Completed technology exploration in hydrodynamic impacts and design space trade studies. - Completed efforts to develop blade control technology for the heavy lift vertical air replacement platform - Completed efforts for Small-to-Large Vessel At-Sea Transfer development via an at-sea demonstration of the technology. - Completed efforts for High Rate Vertical / Horizontal Material Mover development via a large-scale demonstration of the technology. - Completed efforts to develop large ship fuel savings technologies for high speed materiel transport ships and follow on efforts initiated under Friction Drag Reduction refocused to other FNC efforts. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Initiate deliver full scale waterjet to LCS shipbuilder. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Complete FNC EPE-FY07-02, MPF (F) Force final testing for the 38 MW Axial-Flow Waterjet. 				
Title: SEA BASE PLANNING, OPERATIONS AND LOGISTICS		18.945	20.063	16.357
Description: This activity includes support for Sea Base Integrated Operations; Surface Connector Vehicle Transfer; Automated Weapons Assembly; and Sense and Respond Logistics. Sea Basing will require more robust afloat command and control for sustainment activities. Logistics must integrate with the joint task force common operating picture, and provide awareness of mission supportability and readiness at an operational and tactical level. This activity will produce techniques and systems to support automated transfer of cargo from shipboard unload/onload point to stowage spaces. This activity further supports				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>	PROJECT 2915: <i>Warfighter Sustainment Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>the Seabasing mission of marshalling troops, equipment, and materials. It will improve current replenishment capabilities for transfer of cargo between Sea Base/Logistics vessels (large ship-to-ship) during high sea states, while maintaining safety of operations. Technologies include optical recognition, advanced robotics for weapons assembly, integrated data architectures, high-strength composites, wear-resistant coatings, environmental sensing, ship-motion compensation for force control-based systems, intelligent systems, and robotics.</p> <p>FY 2010 to FY 2012 funding increase is due to support the initiation and ramp up of FNC BAS-FY11-01 for Connectors and the Seabase. FY11 to FY12 funding decrease is due to the re-alignment of funds for higher priority requirements.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued efforts in the development of Interface Ramp Technologies for seabasing. - Continued efforts for the development of technologies supporting automated shipboard assembly of air-delivered weapons. - Continued efforts to develop Sense and Respond Logistics Information Architecture prototype - Completed efforts for Intra-Connector Material Handling cargo securing technology development via an at-sea demonstration and transition to NAVSEA PMS 377. - Completed efforts on the Large to Large Vessel Interface Lift on/Lift off capability with post-test analyses and transition to NAVSEA PMS385. - Completed the down selection of the Sense and Respond Logistics Information Architecture. - Initiated efforts to demonstrate sensor based Sense and Respond Logistics advanced technologies. - Initiated procurement and testing of available microfiltration (MF), and ultrafiltration (UF), systems suitable for shipboard use. - Initiated investigation of seawater treatment strategies to optimize performance of MF/UF pretreatment approaches. - Initiated procurement and testing of approaches to recover energy from pressurized reverse osmosis waste brine. - Initiated efforts to select optimal reverse osmosis membranes. - Initiated development of agent based decision support and logistics planning tools. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete procurement and testing of available MF, and UF, systems suitable for shipboard use. - Complete investigation of seawater treatment strategies to optimize performance of MF/UF pretreatment approaches. - Complete procurement and testing of approaches to recover energy from reverse osmosis waste brine. - Complete efforts to select optimal reverse osmosis membranes. 				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>	PROJECT 2915: <i>Warfighter Sustainment Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Complete and test first article prototypes of Sense and Respond demonstration systems; Logistics Common Operating Picture, Decision Support Tool, Prognostics Embedded Health Management, Maco Fuel Quantity Management, Portable Fuel Quantity, Portable Fuel Quality Analysis. - Initiate down selection of desired components and begin design of pretreatment system. - Initiate down selection of desired energy recovery strategies and reverse osmosis membranes and begin design of reverse osmosis systems. - Initiate development of the Connectors and the Sea Base Enabling Capability including Environmental Ship Motion Forecasting and Advanced Mooring System Technologies. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete testing and integration of Sense & Response Logistics Common Operating Picture. - Complete efforts on Interface Ramp Technologies development with demonstrations in relevant environments and transition to NAVSEA PMS385. - Initiate model testing of Advanced Mooring System and planning of at-sea demonstration. 				
<p>Title: SEA BASING</p> <p>Description: This activity includes advancement of technologies to support the design and development of Sea Base Enabler Innovative Naval Prototypes (INP's). Areas include design and development of various Sea Basing prototypes in the areas of high speed, shallow draft and beachable connectors; and vessel to vessel interfaces.</p> <p>The Sea Base Enabler INP effort was initiated in FY 2006. The INP program spans from conceptual design through prototype fabrication and testing. This INP plan includes the completion of the development and at-sea testing of the Rapid Deployable Seabasing Stable Transfer Platform demonstrator; the continuation of several land based and tow-tank based model construction and testing for the Sea Base to "Over-the-Shore" Connector Transformational Craft (T-CRAFT) Prototype; and the full scale component-level development, evaluation, and testing of critical T-CRAFT technologies.</p> <p>FY 2010 to FY2011 funding increase is due to contract design and intitation of procurement of components to support T-CRAFT Construction.</p> <p>FY 2011 to FY 2012 funding decrease is due to the completion of contract design and shipyard building plans for T-CRAFT prototype and component construction.</p> <p>FY 2010 Accomplishments:</p>		13.626	29.502	6.951

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>	PROJECT 2915: <i>Warfighter Sustainment Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued multiple INP contracts for preliminary designs in the area of a T-CRAFT and a Rapidly Deployable Seabasing Stable Transfer Platform. - Continued the down-selection of T-CRAFT designs for further development and model construction and testing. - Continued T-CRAFT model construction and testing. - Continued a second evaluation of potential new Seabasing INP efforts. - Continued planning of T-CRAFT prototype and component development.- Completed T-CRAFT model testing and evaluation. - Completed the down-selection of T-CRAFT designs for prototype and component development. - Completed testing and evaluation of E-CRAFT demonstrator hydrodynamic and structural characteristics. - Initiated contract design and develop shipyard building plans for T-CRAFT prototype and component construction. - Initiated procurement of components and material to support T-CRAFT prototype construction. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete contract design and develop shipyard building plans for T-CRAFT prototype and component construction. - Initiate development of a detailed technology demonstration plan. - Initiate T-CRAFT technology demonstration component construction. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. 				
Title: TRAINING SYSTEMS		8.328	8.453	7.791
<p>Description: This activity improves mission effectiveness and safety by applying both simulation and instructional technology to the design of affordable education and training methods and systems. Improved training efficiency and cost-effectiveness is achieved by applying operations research, modeling and simulation, and instructional, cognitive, and computer sciences to the logistics, development, delivery, evaluation, and execution of training.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued research and assessment of advanced gaming technology for enhanced training. - Continued advanced technology development demonstrations of game based training for better warfighter understanding of languages and cultures to enhance their regional expertise. - Continued development and experiments to validate automated performance assessment and after action reviews. 				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>	PROJECT 2915: <i>Warfighter Sustainment Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continue development of tools (behavioral assessment, individual and team trend analysis, and instructor support) to support enhanced live, virtual, and constructive training for land forces in expeditionary warfare. - Continued development of an Adaptive Expert System to automatically and rapidly analyze aircrew performance (1M+ flight hours annually) to detect human factors related mishap leading indicators using a new technique with anomaly and corroboration. - Initiated development of validated, effective, adaptive training system components to enhance individual and team training for submarine navigation and piloting skills and for surface ship Combat Information Center training. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete research and assessment of advanced gaming technology for enhanced training. - Complete development and experiments to validate automated performance assessment and after action reviews. - Initiate the designing, building, demonstration, and evaluation of the efficacy of the technology components/system to deliver combat/tactical profiling relevant perceptual training. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Complete development of game based training to more effectively enable better warfighter understanding of languages and cultures to enhance their regional expertise. - Initiate development of simulation technologies to deliver safe, effective, and balanced live-virtual-constructive aviation training to achieve meaningful training and readiness levels without the costs involved with only using live assets. 				
Title: TURBINE ENGINE TECHNOLOGY		10.302	10.732	7.486
<p>Description: This activity provides integration and experimental engine testing of advanced gas turbine engine technologies to reduce their technical risk and demonstrate their readiness for transition. These technologies will enable advanced capabilities for Navy weapon systems at reduced total ownership costs. Versatile Affordable Advanced Turbine Engines (VAATE) is a DoD/DOE/NASA/Industry program to develop and demonstrate versatile, affordable, advanced engine technologies enabling for increased systems capabilities and reduced total ownership costs. The VAATE goal is 10X improvement in propulsion system affordability (capability/cost) by 2017, with interim goals of 4X by 2009 and 6X by 2013. The elements of the capability-to-cost index are increased thrust to weight; decreased specific fuel consumption; and reduced development, production, and maintenance costs for the entire integrated propulsion system. To achieve these goals, VAATE is organized into multiple product areas. Specifically for the Navy, the focus, as part of the Enterprise and Platform Enablers FNC, is on turbine engine capability enhancements for future and emerging systems. Technologies critical to Navy fighter jets are being worked, including low pressure turbine technologies for short takeoff and landing; high pressure turbine technologies for higher temperature, longer life; fan and</p>				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>	PROJECT 2915: <i>Warfighter Sustainment Adv Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>compressor technologies for greater engine robustness and durability, and instrumentation and control technologies for greater engine state awareness and less unscheduled maintenance. Technologies being demonstrated include advanced aerodynamic, material, and structural concepts and emerging active control, prognostic health management, thermal management, aircraft subsystem integration, and information technologies.</p> <p>FY 2011 to FY 2012 funding reduction is due to a VAATE Phase II demonstrator engine effort with P&W being delayed to beyond FY 2012 and aligning funding to accommodate the delay.</p> <p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continue the VAATE Phase I demonstrator engine test with Pratt &Whitney (P&W), now to include Short Take-Off Vertical Landing (STOVL) clearance testing for turbine components. - Complete a VAATE Phase II durability demonstrator engine in a STOVL configuration with P&W in late CY 2014. - Completed testing of VAATE Phase I demonstrator engine with General Electric /Liberty Works (GE/LW) <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Complete the Delta Critical Design Review for the VAATE Phase I demonstrator engine test with P&W, now required due to inclusion of STOVL clearance testing for turbine components. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. - Complete the VAATE Phase I demonstrator engine test with P&W that includes STOVL clearance testing for turbine components. 			
Accomplishments/Planned Programs Subtotals	83.094	98.261	71.232

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• 0603640M: <i>USMC</i>	0.000	0.809	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.809
<i>ADVANCED TECHNOLOGY</i>											
<i>DEMONSTRATION (ATD)</i>											
• 0602236N: <i>WARFIGHTER</i>	27.828	27.809	37.238	0.000	37.238	35.065	19.967	11.237	3.732	0.000	162.876
<i>SUSTAINMENT APPLIED</i>											
<i>RESEARCH</i>											

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>	PROJECT 2915: <i>Warfighter Sustainment Adv Tech</i>
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C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0602131M: <i>MARINE CORPS LANDING FORCE TECHNOLOGY</i>	0.000	2.353	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.353

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Efforts within this PE support the FNC program and are monitored at two levels. At the lowest level, each is measured against technical and financial milestones on a monthly basis. Annually, each FNC project is reviewed in depth for technical and transition performance by The Chief of Naval Research. Routine site visits to performing organizations are conducted to assess programmatic and technical progress. Most are reviewed annually or bi-annually by an independent board of visitors who assess the level and quality of the Science and Technology basis for the project.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE					PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>					4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	2.670	-	-	-	-	-	-	-	-	0.000	2.670

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	2.670	-	-
Accomplishments/Planned Programs Subtotals	2.670	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy									DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603236N: <i>Warfighter Sustainment Advd Tech</i>				PROJECT 9999: <i>Congressional Adds</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	6.374	-	-	-	-	-	-	-	-	0.000	6.374

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: Intelligent Retrieval of Imagery <i>FY 2010 Accomplishments:</i> This effort developed technology for intelligent retrieval of video imagery from surveillance imagery based on automated or interactive queries to advance the state of the art of automated video analytics and intelligent retrieval of imagery conditioned on target type and event.	1.992	-
Congressional Add: Nanofluidic Lubricants for Increased Fuel Efficiency in Heavy Duty Vehicles <i>FY 2010 Accomplishments:</i> This effort provided research to improve vehicle lifecycle costs through the development of nanofluids that provide cost savings in terms of improved fuel efficiency, increased performance, lower maintenance, and extended vehicle lifetime. Nanofluids developed in this program include engine oil, transmission fluid, fuel, and coolant containing a small concentration of nanoparticles.	1.195	-
Congressional Add: Environmentally-Sealed, Ruggedized Avionics Displ <i>FY 2010 Accomplishments:</i> This effort conducted a study on productionization of an environmentally sealed, ruggedized airborne display for vertical lift systems to include engineering, modeling and analysis of the projection display technology and a solid state light engine modulator technology.	3.187	-
Congressional Adds Subtotals	6.374	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603271N: <i>Electromagnetic Systems Advanced Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	77.612	96.243	102.535	-	102.535	102.498	109.998	102.384	103.854	Continuing	Continuing
2913: <i>Electromagnetic Systems Advanced Technology</i>	60.493	82.143	102.535	-	102.535	102.498	109.998	102.384	103.854	Continuing	Continuing
2933: <i>Wide Focal Planar Array Camera S&T</i>	-	14.100	-	-	-	-	-	-	-	0.000	14.100
4027: <i>Naval Innovative Science and Engineering</i>	0.190	-	-	-	-	-	-	-	-	0.000	.190
9999: <i>Congressional Adds</i>	16.929	-	-	-	-	-	-	-	-	0.000	16.929

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

Activities and efforts in this Program Element (PE) address technologies critical to enabling the transformation of discrete functions to network centric warfare capabilities which simultaneously perform Radar, Electronic Warfare (EW), and Communications and Network functions across platforms through multiple, simultaneous and continuous communications/data links. The Electromagnetic Systems Advanced Technology program addresses Radio Frequency (RF) technology for Surface and Aerospace Surveillance sensors and systems, EW sensors and systems, RF Communication Systems, Multi-Function sensor systems, and Position, Navigation and Timing (PNT) capabilities. Within the Naval Transformational Roadmap, this investment offers affordable options for the transformational capabilities required by the Sea Shield (Theater Air and Missile Defense), Sea Strike (Persistent Intelligence, Surveillance, and Reconnaissance), and ForceNet (Communications and Networking) SeaPower 21 Naval Warfighting Pillars.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603271N: <i>Electromagnetic Systems Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	75.506	82.143	101.071	-	101.071
Current President's Budget	77.612	96.243	102.535	-	102.535
Total Adjustments	2.106	14.100	1.464	-	1.464
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	4.128	-			
• SBIR/STTR Transfer	-2.006	-			
• Program Adjustments	-	14.100	1.482	-	1.482
• Section 219 Reprogramming	-0.013	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.018	-	-0.018
• Congressional General Reductions Adjustments	-0.003	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

Congressional Add: *Pacific Airborne Surveillance & Testing*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	16.929	-
	16.929	-
	16.929	-

Change Summary Explanation

Technical: FY 2010 reflects the realignment of the Global Positioning System (GPS) & Navigation Technology Activity from PE 0603235N because the technology development efforts are directly related to the current mission of this Program Element.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603271N: <i>Electromagnetic Systems Advanced Technology</i>	PROJECT 2913: <i>Electromagnetic Systems Advanced Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2913: <i>Electromagnetic Systems Advanced Technology</i>	60.493	82.143	102.535	-	102.535	102.498	109.998	102.384	103.854	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project emphasizes near to mid-term transition opportunities by developing and demonstrating technologies which enable affordable options for transformational capabilities required by the Sea Shield, Sea Strike, and ForceNet pillars. Work in this project addresses cost-effective RF technology for Surface and Aerospace Surveillance sensors and systems, EW sensors and systems, RF Communication Systems, Multi-Function sensor systems, and Position, Navigation and Timing (PNT) capabilities.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: ELECTRONIC AND ELECTROMAGNETIC SYSTEMS	36.334	39.124	41.413
<p>Description: The overarching objective of this activity is to develop, test, and demonstrate communications, electronic attack (EA), electronic surveillance (ES), electronic warfare (EW), and radar functions. This activity also includes development of affordable wideband, high performance Advanced Multifunction Radio Frequency (AMRF) apertures. A portion of this PE is devoted to mid-term technology development in close concert with acquisition programs of record. The products of these efforts are expected to transition at the end of their schedule into the associated acquisition program of record. In this PE, these Future Naval Capability (FNC) Enabling Capabilities (ECs) span across Electronics, EW, Radar, and Communications technology areas. This activity also appears in PE 0602271N. For ECs receiving funding from both PEs, the PE 0602271N portion is generally focused on component design and development while the funding from this PE is focused on integration and demonstration.</p> <p>Effective FY 2010, resources and budget justification associated with the FNC ECs, formerly identified with the ADVANCED MULTI-FUNCTION RF TECHNOLOGY activity, are realigned into this activity. This realignment serves to better describe the full electromagnetic spectrum nature of the research initiatives and improve the tracking and justification of FNC initiatives within the budget submission.</p> <p>The Navy assumed responsibility for Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) 3.3 S&T by Congressional Mandate. In FY 2012, JCREW EC program will support JCREW 3.3 Acquisition Program Increment 2 Blocks 1 and 2 and will develop an advanced multi-function communications and EW architecture with supporting component technologies to support prototype development.</p> <p>The major objectives of this activity are:</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>a) Affordable Common Radar Architecture (ACRA) - Develop a scalable, open radar architecture that addresses affordability challenges for 5 different radars.</p> <p>b) Low Cost Over The Horizon (OTH) Communication, SATCOM and Line Of Sight (LOS) Apertures - Provide apertures, link electronics and programmable terminal components that are suitable for multiple platforms.</p> <p>c) SATCOM Vulnerability Mitigation - Develop a diverse, multi-tier communications networking capability for Naval strike forces.</p> <p>d) Long Range Detection and Tracking - Ability to detect, track and identify (ID) future anti-ship ballistic missiles, advanced cruise missiles, aircraft and Unmanned Air Vehicles (UAVs).</p> <p>e) Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms - Develop and demonstrate affordable components in beamforming element chains for efficient S- and X-Band radar, and EA using highly efficient digital solid state electronics components covering the RF and microwave frequencies.</p> <p>f) Countermeasure Technologies for Anti-Ship Missile Defense (ASMD) - Improve ship survivability by disrupting the terminal engagement phase of hostile Anti-Ship Cruise Missiles/ Anti-Ship Ballistic Missiles (ASCM/ASBM), including improvements to both onboard Surface Electronic Warfare Improvement Program (SEWIP) and offboard Nulka RF EA systems.</p> <p>g) Next Generation Countermeasure Technologies for Ship Missile Defense - Develop and demonstrate the fundamental technologies required to conduct next generation, persistent EW in support of ship, sea base, and littoral force missile defense operations in a distributed, coordinated manner across the entire battlespace.</p> <p>h) Next Generation Airborne Electronic Attack - Develop and demonstrate advanced capability Airborne Electronic Attack (AEA) sub-systems (e.g., broadband exciters, power amplifiers, and transmit arrays) that provide Suppression of Enemy Air Defenses (SEAD), deliver Non-Kinetic Fires, counter Integrated Air Defense Systems (IADS), and provide suppression of Command, Control & Communications (C3) links and data networks.</p> <p>i) Data Exfiltration Nanosatellite Innovative Space Enabler (DENISE)(formerly known as Global Applications for Data Exfiltration(GLADEX)) - Develop a capability for monitoring and relay of unattended sensor data for global situational awareness. Benefits include security through encryption, reduced dependence on commercial systems, and reduced collection needs by</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>manned and unmanned in-area assets. It addresses a shortfall to monitor shipping in territorial waters and the open ocean to combat terrorism, and, enforce criminal law.</p> <p>j) Radar Electronic Attack Protection (REAP) - Develop single platform precision passive Electronic Support Measure (ESM) and Electronic Protection (EP) techniques and technology to counter hostile use of modern Electronic Attack (EA) self protection jammers.</p> <p>k) Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) 3.3 - Develop integrated RF communications and RF jammer capability that addresses the electromagnetic interference (EMI) issue to enable interoperability.</p> <p>l) Submarine Survivability- Electronic Warfare - Develop and demonstrate technologies that will provide submarines an EA capability against surveillance radar systems through EW payloads integrated with submarine masts, as well as networked offboard platforms. These capabilities will improve the submarine's survivability in a hostile RF environment by providing a non-kinetic strike capability against enemy Intelligence, Surveillance and Reconnaissance (ISR) sensors.</p> <p>m) Electronic Warfare (EW) Roadmap - Develop classified advanced electronic warfare technology in support of current and predicted capability requirements.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p><i>FY 2010 Accomplishments:</i> Affordable Common Radar Architecture (ACRA): - Continued the ACRA effort by defining interface specifications. This effort is developing a radar architecture which moves the digital conversions as close to the antenna as possible for substantial performance and supportability improvements.</p> <p>Low Cost Over The Horizon (OTH) Communication, Satellite Communication (SATCOM) and Line Of Sight (LOS) Apertures: - Continued H-60 Tactical Common Data Link (TCDL) project. This effort develops a scalable, low cost, light weight, low drag multichannel Jam Resistant (JR) Tactical Common Data Link (TCDL) relay and networking terminal. - Continued Low cost SATCOM-on-the-Move array for Marine Corps. This effort develops a low cost, scalable SATCOM on-the-move communication system for both High Data Rate (HDR) and Low Data Rate (LDR) Marine Corps vehicular communications. - Continued nested, coplanar array/Modular Integrated Link Electronics System (MILES) design and integration. This effort develops a communications array which will provide Ultra High Frequency (UHF) LOS functionality and Ku-Band communications for Naval Tactical Networking (NTN).</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>SATCOM Vulnerability Mitigation:</p> <ul style="list-style-type: none"> - Initiated development of hardware and software appliques that implement waveforms, protocols, and techniques to significantly increase the data throughput on High Frequency (HF) communications channels. - Initiated development of multi-link, UHF, millimeter wave, air-to-air, air to ground and SATCOM terminals for networking airborne platforms with other airborne assets. <p>Long Range Detection and Tracking:</p> <ul style="list-style-type: none"> - Continued FNC EC Long Range Detection and Tracking. Capture and extend the prototype development that occurred under Advanced Electronic Sensor Systems for Missile Defense, this project delivers an affordable, open-architecture Digital Array Radar (DAR) single face Advanced Development Model (ADM). This effort demonstrates the ability to perform simultaneous full volume radar coverage of contacts at long ranges and in dense contact environments. <p>Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms:</p> <ul style="list-style-type: none"> - Continued to develop and demonstrate affordable components in beamforming element chains for efficient S- and X-Band radar, and EA using highly efficient digital solid state electronics components covering the RF and microwave frequencies. <p>Countermeasure Technologies for Anti-Ship Missile Defense (ASMD):</p> <ul style="list-style-type: none"> - Continued the Enhanced Nulka Payload FNC effort by starting system architecture design. This effort develops an affordable and extremely compact RF payload for the Nulka offboard decoy with an Electronically Scanned Array (ESA) transmitter, compact receiver chain, and advanced isolation materials. - Continued the Enhanced Surface Electronic Warfare Improvement Program (SEWIP) Transmitter FNC effort by starting system architecture design and Low Voltage Gallium Arsenide (GaAs) High Power Amplifier (HPA) Monolithic Microwave Integrated Circuit (MMIC) purchases. This effort develops affordable and reliable solid state transmitter technologies to engage anti-ship cruise and ballistic missile RF seekers. <p>Next Generation Countermeasure Technologies for Ship Missile Defense:</p> <ul style="list-style-type: none"> - Continued the development of technologies to demonstrate effective EW countermeasures for ship missile defense operations in a distributed coordinated manner across the entire battlespace. <p>Next Generation Airborne Electronic Attack:</p> <ul style="list-style-type: none"> - Continued the Next Generation Airborne Electronic Attack FNC effort by demonstrating critical subsystems operating in the RF low- and mid-bands. This effort develops and demonstrates advanced capability Airborne Electronic Attack (AEA) sub-systems 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>(e.g., broadband exciters, power amplifiers, and transmit arrays) that provide suppression of enemy air defenses (SEAD), deliver non-kinetic fires, counter integrated air defense systems (IADS), and provide suppression of C3 links and data networks.</p> <p>FY 2011 Plans: Affordable Common Radar Architecture (ACRA): - Continue all efforts of FY 2010.</p> <p>Low Cost Over The Horizon (OTH) Communication, SATCOM and Line Of Sight (LOS) Apertures: - Complete all efforts of FY 2010.</p> <p>SATCOM Vulnerability Mitigation: - Continue all efforts of FY 2010.</p> <p>Long Range Detection and Tracking: - Continue all efforts of FY 2010.</p> <p>Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms: - Continue all efforts of FY 2010.</p> <p>Countermeasure Technologies for Anti-Ship Missile Defense (ASMD): - Continue all efforts of FY 2010.</p> <p>Next Generation Countermeasure Technologies for Ship Missile Defense: - Continue all efforts of FY 2010.</p> <p>Next Generation Airborne Electronic Attack: - Continue all efforts of FY 2010.</p> <p>Data Exfiltration Nanosatellite Innovative Space Enabler (DENISE): - Initiate the development of a nano-satellite bus. This effort provides for the development, integration, and demonstration of a nano-sat satellite bus with all its requisite structural, power, thermal, control, and separation subsystems.</p>				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>- Initiate the development of a nano-satellite compatible payload and transportable ground terminal. This effort will provide for development, integration, and demonstration of a nano-sat compatible payload and ground terminal for monitoring and relay of unattended sensor data for global situational awareness.</p> <p>Radar Electronic Attack Protection (REAP):</p> <p>- Initiate the Identification and Defeat of Electronic Attack Systems (IDEAS) FNC effort by developing single platform precision passive electronic support measure (ESM) and electronic protection (EP) techniques and technology to counter hostile use of modern EA self protection jammers.</p> <p>Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) 3.3:</p> <p>- Initiate JCREW 3.3 component development.</p> <p>FY 2012 Plans:</p> <p>Affordable Common Radar Architecture (ACRA):</p> <p>- Continue all efforts of FY 2011.</p> <p>SATCOM Vulnerability Mitigation:</p> <p>- Continue all efforts of FY 2011.</p> <p>Long Range Detection and Tracking:</p> <p>- Complete FNC EC Long Range Detection and Tracking. Capture and extend the prototype development that occurred under Advanced Electronic Sensor Systems for Missile Defense. This project delivers an affordable, open-architecture DAR single face ADM. This effort demonstrates the ability to perform simultaneous full volume radar coverage of contacts at long ranges and in dense contact environments.</p> <p>Affordable Electronically Scanned Array Technology for Next Generation Naval Platforms:</p> <p>- Complete development and demonstration of affordable components in beamforming element chains for efficient S-and X-Band radar, and EA using highly efficient digital solid state electronics components covering the RF and microwave frequencies.</p> <p>Countermeasure Technologies for Anti-Ship Missile Defense (ASMD):</p> <p>- Continue all efforts of FY 2011.</p> <p>- Complete the Enhanced Nulka Payload FNC effort.</p>				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>Next Generation Countermeasure Technologies for Ship Missile Defense: - Continue all efforts of FY 2011.</p> <p>Next Generation Airborne Electronic Attack: - Complete the Next Generation Airborne Electronic Attack FNC effort.</p> <p>Data Exfiltration Nanosatellite Innovative Space Enabler (DENISE): - Continue all efforts of FY 2011</p> <p>Radar Electronic Attack Protection (REAP): - Continue all efforts of FY 2011</p> <p>Joint Counter Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) 3.3: - Continue all efforts of FY 2011. - Initiate the Distributed Counter-RCIED FNC effort through algorithm development and assessment. - Initiate the Integrated Counter-RCIED EW (ICEW) FNC effort by starting component design and integration plans.</p> <p>Submarine Survivability - Electronic Warfare: - Initiate the Coherent Electronic Attack for Submarines (CEAS) FNC effort by commencing development of the compact EA payload and techniques for the multi-mission mast (MMM). - Initiate the Distributed Coherent Electronic Attack for Submarines (D-CEAS) FNC effort by commencing an assessment of current capabilities.</p> <p>Electronic Warfare (EW) Roadmap: - Initiate development of classified advanced electronic warfare technology in support of current and predicted capability requirements.</p>				
Title: GLOBAL POSITIONING SYSTEM (GPS) & NAVIGATION TECHNOLOGY		4.198	4.601	4.442
Description: The overarching objective of this activity is to develop technologies that enable the development of affordable, effective and robust Position, Navigation and Timing (PNT) capabilities using either GPS systems, non-GPS navigation devices, or atomic clocks. This activity will increase the operational effectiveness of U.S. Naval units. The focus is on the mitigation of GPS electronic threats, the development of atomic clocks that possess unique long-term stability and precision, and the development of compact, low-cost, Inertial Navigation Systems (INS).				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Efforts identified in this R2 activity transfer from PE 0603235N in FY 2010.</p> <p>The major objectives of this activity are:</p> <p>a) GPS Anti-Jam Antennas and Receivers - Integrate and demonstrate anti-jam antennas and antenna electronics for Navy platforms for the purpose of providing precision navigation capabilities in the presence of electronic threats; to integrate and demonstrate anti-spoofers/anti-jam processors for the purpose of providing precision navigation capabilities in the presence of emergent threats.</p> <p>b) Precision Time and Time Transfer - Integrate and demonstrate tactical grade atomic clocks that possess unique long-term stability and precision for the purpose of providing GPS-independent precision time; to integrate and demonstrate the capability of transferring GPS-derived time via radio frequency links for the purpose of providing GPS-independent precision time.</p> <p>c) Non-GPS Navigation Technology - To integrate and demonstrate inertial navigation systems for the purpose of providing an alternative means of providing precision navigation for those Naval platforms which may not have GPS navigation capabilities and/or loss of GPS signals; to integrate and demonstrate a correlation navigation technique using earth maps of high precision (including bathymetric, magnetic and gravimetric data) for navigation for those Naval platforms which may not have GPS navigation capabilities and/or loss of GPS signals.</p> <p>The following are non-inclusive examples for projects funded in this activity.</p> <p>FY 2010 Accomplishments: GPS Anti-Jam Antennas and Receivers: - Continued the Adaptive Temporal Suppression of GPS Structured Interference project. - Continued the GPS anti-spoofers antenna electronics effort using Electronic Support Measures (ESM) and tracking/location-based system.</p> <p>Precision Time and Time Transfer: - Continued the development of algorithms for distributed time scaling; developed architectures necessary to establish a Navy Global Coordinated Time Scale; tested the algorithms via both simulation and using actual clock data provided by the U.S. Naval Observatory (USNO).</p>			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>Non-GPS Navigation Technology:</p> <ul style="list-style-type: none"> - Continued the development of a small, lightweight Micro-Electro-Mechanical Systems (MEMS) Accelerometer for navigation systems; and fabricated an Electro-Optic Accelerometer. - Continued the 5-cc accelerometer with the Embedded GPS Inertial (EGI) System for aircraft avionics applications. - Continued the MEMS Gyro-cluster INS for Tactical Platforms project. - Continued the Precision Celestial Navigation System (PCNS) project. - Continued the Dead Reckoning Advanced Tight Coupling (DRATC) project. - Continued the navigation grade Inertial Navigation System (INS) using fiber optic/MEMS gyros and electro-optic accelerometers. - Continued the development of the Sonar Aided Bathymetric Navigation Technology. - Continued the Optically Transduced MEMS Inertial Navigation System project. - Continued the Sub-harmonic Lateral Mode MEMS Inertial Navigation System project. - Continued the Two-Axis Gyro-compass Fiber Optic Inertial Navigation System project. <p><i>FY 2011 Plans:</i></p> <p>GPS Anti-Jam Antennas and Receivers:</p> <ul style="list-style-type: none"> - Complete Adaptive Temporal Suppression of Structured Interference. - Complete Anti-spoof Antenna Electronics using ESM and tracking. - Initiate Small Antenna Based Anti-spoofing project. - Initiate Advanced Spoofer Tracking. - Initiate Next Generation Global Positioning Satellite System - Situational Awareness (XGPSS-SA) Challenged Environment. <p>Precision Time and Time Transfer:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate Distributed Time-frequency Device. - Initiate Tactical Grade Atomic Clock. <p>Non-GPS Navigation Technology:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete 5-cc Accelerometer with EGI System. - Complete MEMS Gyro-cluster. - Complete PCNS project. - Complete DRATC project. - Complete navigation grade INS using MEMS gyro project. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Complete Sonar Bathymetric Navigation. - Initiate Wavewinds project. - Initiate Small Unmanned Underwater Vehicle - Sonar Aided Inertial Navigation Technology (UUV-SAINT) project. - Initiate Portable PCNS project. <p>FY 2012 Plans:</p> <p>GPS Anti-Jam Antennas and Receivers:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as complete. - Initiate Modernized Receiver for RF Challenged Environments. - Initiate Simulation of GPS Signals in a Stressed Environment. - Initiate Accurate Cooperative Geolocation System. - Initiate Self Calibrating GPS AJ Antennas for Electronic Support. <p>Precision Time and Time Transfer:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. <p>Non-GPS Navigation Technology:</p> <ul style="list-style-type: none"> - Complete the development of a small, lightweight Micro-Electro-Mechanical Systems (MEMS) Accelerometer for navigation systems; and fabricated an Electro-Optic Accelerometer. - Complete the 5-cc accelerometer with the Embedded GPS Inertial (EGI) System for aircraft avionics applications. - Complete the Dead Reckoning Advanced Tight Coupling (DRATC) project. - Initiate Superconducting Magnetometer On-Board Navigation (SIMON) System. - Initiate Alternative Navigation Over Unstructured or Featureless Terrain. 				
Title: INTEGRATED TOPSIDE (INTOP) INNOVATIVE NAVAL PROTOTYPE (INP)		19.961	38.418	56.680
<p>Description: The overarching objective of the INTOP INP is to develop and demonstrate a prototype that integrates RF functions (EW, Radar, Communications, Navigation) into a common set of multi-function apertures through an architecture that is modular, scalable across all platforms, and open at the RF as well as computer and software level. The apertures are capable of providing multiple simultaneous, independent beams which can together perform any of the above functions.</p> <p>Effective FY 2010, resources and budget justification associated with Integrated Topside (INTOP) formerly referred to as Integrated Digital Apertures and Array Radar System (IDAARS) effort are realigned from the activity titled ADVANCED MULTI-</p>				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>FUNCTION RF TECHNOLOGY. This realignment allows for improved description of the critical and unique application of technology, program technical initiatives, and associated resources within the INP program. IDAARS commenced in FY 2009.</p> <p>The major objectives of this activity are:</p> <p>a) Submarine SATCOM Array - Develop wide-band SATCOM array capable of supporting EW for submarines.</p> <p>b) Electronic Attack (EA) for Surface Combatants - Develop wide-band transmit array to support EA capability and other functions, including but not limited to Information Operations (IO) and Line of Sight (LOS) Communications, for surface combatants with potential application to other platforms.</p> <p>c) Architecture, Standards and Devices - Develop architecture and standards for wide-band multi-beam, multi-band arrays and below deck systems and the technology and electronic devices needed to make integrated array systems affordable.</p> <p>d) Surface Combatant Communication Array - Develop wide-band surface combatant communication array capable of supporting other RF functions.</p> <p>e) Resource Allocation Manager - Develop enterprise common Resource Allocation Manager.</p> <p>The increase from FY 2010 to FY 2011 is due to increased investment required for the initiation of the development of prototype capability for EA for Surface Combatants.</p> <p>The increase from FY 2011 to FY 2012 is due to the majority of the Surface EW/IO/Communications System build will take place starting in FY 2012.</p> <p>The following are non-inclusive examples of accomplishments and plans for projects funded in this activity.</p> <p><i>FY 2010 Accomplishments:</i> Submarine SATCOM Array: - Continued SATCOM Array technical designs. - Completed technical studies of enabling radio frequency (RF) components for submarine SATCOM arrays. - Initiated prototype array development.</p>				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>Electronic Attack (EA) for Surface Combatants:</p> <ul style="list-style-type: none"> - Completed studies for EA design as follow-on to Multi-Function Electronic Warfare (MFEW) capability for forward-fit and back-fit. - Initiated design of EA capability. <p>Architecture, Standards and Devices:</p> <ul style="list-style-type: none"> - Continued IDAARS, a multi-function RF topside aperture prototype covering approximately 200MHz to 22 GHz and provide the appropriate control and synergy of the functionality such that the RF functions automatically support one another providing improved operational capability. Additionally, demonstrate reductions in size, weight, and power as well as cost (both acquisition and life cycle) by reducing the number of topside apertures needed for communication, electronic warfare, and some radar functions. A critical tenet of the prototype will be the demonstration of an open architecture so that not only can different companies supply the major components such as a given receive or transmit aperture, but even down to the subarray and lower component level throughout the life cycle to ensure continuing competition for maintenance and replacement parts. - Continued development of architecture and interfaces and their application to wide-band SATCOM arrays for submarines. - Initiated development of deckhouse and platform integration strategies and concepts. <p>Surface Combatants Communications Array:</p> <ul style="list-style-type: none"> - Initiated studies of array concepts. <p>Resource Allocation Manager:</p> <ul style="list-style-type: none"> - Continued development of functional queue management software. - Continued development of control interface software for the resource allocation manager. <p>FY 2011 Plans:</p> <p>Submarine SATCOM Array:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete SATCOM Array technical designs. <p>Electronic Attack for Surface Combatants:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Initiate development of prototype capability. <p>Architecture, Standards and Devices:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. 			

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>Surface Combatant Communication Array: - Complete studies of array concepts.</p> <p>Resource Allocation Manager: - Continue all efforts of FY 2010.</p> <p><i>FY 2012 Plans:</i> Submarine SATCOM Array: - Complete prototype array development. - Initiate integration and test program.</p> <p>Electronic Attack for Surface Combatants: - Continue all efforts of FY 2011, less those noted as completed above. - Initiate integration and test program.</p> <p>Architecture, Standards and Devices: - Continue all efforts of FY 2011.</p> <p>Surface Combatants Communications Array: - Initiate design effort.</p> <p>Resource Allocation Manager: - Continue all efforts of FY 2011.</p>			
Accomplishments/Planned Programs Subtotals	60.493	82.143	102.535

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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• 0602271N: <i>ELECTROMAGNETIC SYSTEMS</i> <i>APPLIED RESEARCH</i>	14.673	19.469	28.829	0.000	28.829	24.803	11.936	5.151	1.303	0.000	106.164

D. Acquisition Strategy

N/A

E. Performance Metrics

Advanced Electronic Sensor Systems for Missile Defense and Long Range Detection and Tracking ECs are aligned to the Navy's Advanced Cruiser (CG(X)) plans and closely coordinated with Naval Sea Systems Command Integrated Warfare Systems (PEO IWS 2.0). Other performance metrics are discussed within the R-2a.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603271N: <i>Electromagnetic Systems</i> <i>Advanced Technology</i>				2933: <i>Wide Focal Planar Array Camera S&T</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2933: <i>Wide Focal Planar Array Camera S&T</i>	-	14.100	-	-	-	-	-	-	-	0.000	14.100

Note

This is a new Overseas Contingency Operations (OCO) project.

A. Mission Description and Budget Item Justification

This effort develops technology to support the maturation and demonstration of sensing and analysis capabilities that can enhance wide area tactical situational awareness and generate actionable intelligence.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Wide Focal Planar Array Camera S&T</p> <p>Description: This effort develops technology to support the maturation and demonstration of sensing and analysis capabilities that can enhance wide area tactical situational awareness and generate actionable intelligence.</p> <p>The major objectives of this activity are:</p> <p>A) Wide Focal Plane Array Camera (WFPAC) sensor - Develop an airborne sensor payload for a Group two-third form factor and procurement of a limited quantity of payloads in support of Unmanned Aerial Vehicle (UAV) integration and field user evaluation. Effort will also develop an advanced Mid Wavelength Infrared (MWIR) focal plane array in order to enable a night Group two-third wide area airborne payload and support Navy UAV integration effort as required.</p> <p>FY 2011 Plans: N/A</p> <p>FY 2011 OCO Plans: - Initiate and Complete effort to complete development, testing, integration and initial procurement of a Wide Focal Plane Array Camera (WFPAC) sensor for the RQ-7 "Shadow" Unmanned Aerial System (UAS), also referred to as the Marine Corps Tactical Unmanned Aerial System (MCTUAS), in support of OEF-Afghanistan. - Initiate and Complete development of a 59 megapixel WAAS payload in a shadow form factor by maturing the data link, adding color and a dual field of view for the purposes of field user technology and CONOPs evaluation, fabricate a limited number of sensors (4).</p>	-	14.100	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603271N: <i>Electromagnetic Systems</i> <i>Advanced Technology</i>	PROJECT 2933: <i>Wide Focal Planar Array Camera S&T</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
- Initiate and Complete maturation for the design of a 64 megapixel mid range IR focal plan array.			
Accomplishments/Planned Programs Subtotals	-	14.100	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Successful development of a sensor to provide a 16 square kilometers persistent field of view with a .5m resolution at 10 frames per second (fps), which would allow real time for up to 10 local Common Data Link transceivers while also being stored for post-mission exploitation and forensics at two fps.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603271N: <i>Electromagnetic Systems Advanced Technology</i>				4027: <i>Naval Innovative Science and Engineering</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	0.190	-	-	-	-	-	-	-	-	0.000	.190

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	0.190	-	-
Accomplishments/Planned Programs Subtotals	0.190	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy									DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603271N: <i>Electromagnetic Systems</i> <i>Advanced Technology</i>				PROJECT 9999: <i>Congressional Adds</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	16.929	-	-	-	-	-	-	-	-	0.000	16.929

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: Pacific Airborne Surveillance & Testing	16.929	-
FY 2010 Accomplishments: This effort developed a state-of-the-art Omnidirectional Synthetic Aperture Radar (OSAR) and demonstrated advances made in the dark target identification application in support of Pacific airborne surveillance and testing research.		
Congressional Adds Subtotals	16.929	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	138.913	115.089	124.324	-	124.324	129.381	132.326	135.095	137.509	Continuing	Continuing
2223: <i>Marine Corps ATD</i>	80.157	78.087	83.932	-	83.932	86.326	88.286	90.133	91.744	Continuing	Continuing
2297: <i>Marine Corps Warfighting Lab - Core</i>	35.206	37.002	40.392	-	40.392	43.055	44.040	44.962	45.765	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	0.428	-	-	-	-	-	-	-	-	0.000	.428
9999: <i>Congressional Adds</i>	23.122	-	-	-	-	-	-	-	-	0.000	23.122

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval Science and Technology (S&T) Strategic Plan approved by the S&T Corporate Board (Mar 2010). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential S&T efforts that will enable the continued supremacy of United States Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

As a key component of naval expeditionary forces, the Marine Corps has unique and technologically stressing requirements because of its expeditionary mission and intensive operational tempo, Marine Air-Ground Task Force (MAGTF) structure, and conduct of maneuver warfare. Critical requirements in this PE are: Command, Control, Communications, Computers (C4); Intelligence, Surveillance, and Reconnaissance (ISR); maneuver techniques and means; force protection; logistic sustainment; human performance, training and education; and firepower. There are ongoing actions to develop and demonstrate advanced technologies and concepts in operational environments. Joint service efforts are aligned with Defense Technology Objectives and Joint Warfighting Capability Objectives. In addition, there is funding for experimentation in warfighting concepts as well as operational assessment of emerging technologies, to include technical support of operating forces to assess military utility of selected technologies. This PE specifically supports: continued development of enhanced warfighting capabilities through field experiments with Marine operating forces; rapid response to low-, mid-, and high-intensity conflicts in the Overseas Contingency Operation (OCO); methods for countering irregular threats; and expansion of seabasing and naval force packaging capabilities. The investment directly assists in fulfilling the forward presence requirements of Sea Shield and the transformational capabilities prescribed by Sea Strike. The Future Naval Capability (FNC) process is supported and funds are programmed accordingly. This PE is largely focused on demonstration of products and capabilities from the knowledge base and Discovery and Invention (D&I) phases of Naval S&T. As Naval partners, the Navy and Marine Corps S&T Team strive to transition technologies that will implement objectives outlined in the Naval Operations Concept. This PE also funds technical solutions designed to increase Naval force capability, such as the Naval Expeditionary Combat Command. Investments in S&T provide the opportunities for future capabilities and will prevent technological surprise. The PE as a whole will advance the amphibious and expeditionary capabilities for the Combatant Commanders helping to meet their emerging challenges by enhancing Naval S&T contributions to the long commitment to the OCO.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
1319: <i>Research, Development, Test & Evaluation, Navy</i>	PE 0603640M: <i>MC Advanced Technology Demo</i>
BA 3: <i>Advanced Technology Development (ATD)</i>	

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	120.482	115.089	125.126	-	125.126
Current President's Budget	138.913	115.089	124.324	-	124.324
Total Adjustments	18.431	-	-0.802	-	-0.802
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	11.480	-			
• SBIR/STTR Transfer	-2.925	-			
• Program Adjustments	9.480	-	-0.041	-	-0.041
• Section 219 Reprogramming	0.428	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.761	-	-0.761
• Congressional General Reductions Adjustments	-0.032	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

- Congressional Add: *California Central Coast Partnership Research*
- Congressional Add: *Enhanced Small Arms Protective Insert*
- Congressional Add: *Future Immersive Training*
- Congressional Add: *Marine Air-Ground Task Force Situational Awareness*
- Congressional Add: *Ground Warfare Acoustical Combat System of Netted*
- Congressional Add: *Near Infrared optical (NIRO) Augmentation System*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	2.788	-
	1.593	-
	9.480	-
	2.689	-
	4.979	-
	1.593	-
Congressional Add Subtotals for Project: 9999	23.122	-
Congressional Add Totals for all Projects	23.122	-

Change Summary Explanation

Technical: FY 2010 and out resources reflect funding for a DoD directed integrated capability demonstration supporting the Protection of Ground Forces and Systems. DoD directed this initiative in response to the determination that its S&T investment is likely too small to meet the imposing security threats

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy DATE: February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	PE 0603640M: <i>MC Advanced Technology Demo</i>

that challenge our Nation, and it may not be adequately postured to take advantage of key scientific and technological opportunities that offer breakthrough advantages to our warfighters. This broad, multi-year (through FY2013) initiative will expand existing technology integration and increase/spur the application of more fundamental technologies to force and platform protection. The goal is multiple broad phased force protection applications and technologies, with off-ramps for fielding successes; therefore, funding associated with this DoD initiative is reflected throughout the PE. In FY 2011 preparation efforts continue in areas of technology that are ready for major, integrated technology demonstration. All technical work is being coordinated throughout DoD on these demonstrations. In areas such as vehicle technology demonstrations, the goal is to deliver multiple classes of advanced technology ground vehicle demonstrations leading to new classes of protective, efficient, ground vehicles.

Schedule: Project 2297, Worldwide contingency and combat operations (e.g., Operation Enduring Freedom (OEF) and humanitarian efforts)) have increased the operations tempo of the operating forces to the extent that their support of, and participation in, the Marine Corps Warfighting Laboratory (MCWL) experimentation was/remains challenging to coordinate and often directly impacts planned projects. Additionally, rapid responses to emergent warfighter needs impacts planned projects. Thus, executing planned projects becomes "an art" in an effort to balance complicated and competing needs.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2223: <i>Marine Corps ATD</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2223: <i>Marine Corps ATD</i>	80.157	78.087	83.932	-	83.932	86.326	88.286	90.133	91.744	Continuing	Continuing

A. Mission Description and Budget Item Justification

Critical Marine Corps requirements/imperatives addressed in this Project are: Maneuver; Force Protection; Human Performance, Training and Education; Logistics; Command, Control, Communications and Computers (C4); Intelligence, Surveillance and Reconnaissance (ISR) and Firepower. These are ongoing efforts to develop and demonstrate advanced technologies and system concepts in an operational environment. Multiple transitions into the Sub-system/Component Advanced Development Phase are planned, as well as fieldable prototyped to reduce risk in System Concept Development and Demonstration. A tactically effective Mine Countermeasures (MCM) capability is vital to Force Protection and necessary if Maneuver on land is to become a functional component of Naval Expeditionary Maneuver Warfare. Maneuver, supported by MCM provides synchronization and speed of detection, breaching, clearance, proofing, and marking operations. This project supports: 1) engaging regional forces in decisive combat on a global basis; 2) responding to all other contingencies and missions in the full spectrum of combat operations (high, middle, and low intensity), in Military Operations in Urban Terrain (MOUT), and in Operations other than War (OOTW); and 3) warfighting experimentation. By providing the technologies to enable these capabilities, this project supports the goals and objectives of the Strike, Littoral Warfare and Surveillance Joint Mission Areas. These are ongoing efforts to develop and demonstrate advanced technologies and system concepts in an operational environment.

In addition, this project supports the goals and objectives of the Littoral Combat/Power Projection related Enabling Capability (EC) within the Future Naval Capabilities (FNC) portfolio. The focus of the EC within this PE is technology related to Urban, Asymmetric, and Expeditionary Operations (UAEO). The UAEO Capability Gap is a science and technology developmental area that is of the highest importance to Marine Corps operations in Iraq and Afghanistan and is one of the highest ranked Capability Gaps prioritized by the Chief of Naval Operations and the Marine Corps Combat Development Command (MCCDC). The UAEO technology gap is being pursued as part of an overall effort that addresses the Sea Strike Capability Gap.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS (C4)	5.795	5.432	5.781
Description: This activity integrates and demonstrates enhanced communications and situational awareness in warfighting environments and communication and situational awareness technologies for near term USMC operations. The focus is on development and leveraging advanced C4 technologies to enable enhanced Distributed Operations, Irregular Warfare, and Marine Corps Expeditionary Warfare. Specifically, the C4 Thrust intends to demonstrate markedly improved capabilities in over-the-horizon (OTH), beyond line-of-sight, and restricted environment communications; mobile networking; tactical decision making; tactical situational awareness; and small unit position location and navigation. Advanced technology resources will be applied to complement commercial, other service, and defense agency investments to produce a technology base to address identified Marine Corps technology gaps.			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2223: <i>Marine Corps ATD</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>The FY 2011 decrease in funding is due to completion of the Software Reprogrammable Payload and Satellite Communications On-The-Move Integration efforts in order to meet transition milestones. The FY 2010 resources complete the SRP program S&T and enables transition the capability to 6.4. SRP is a high priority Navy/MC Aviation program that will enable on-the-fly reconfigurable, multiple, simultaneous missions and applications in a single payload. Navy will deliver an integrated hardware prototype, software, firmware, and supporting documentation to the transition sponsor (Navy/MC Aviation).</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued urban navigation with limited Global Positioning System availability demonstrations. - Continued demonstrations of improved urban communications capabilities. - Continued creating a service oriented sensor network for expeditionary forces' current and future tactical sensors. - Continued developing tailored tactical Human to Machine Interfaces aligned to primary operational functions and non-intrusive within the battlespace. - Continued creating services for the tactical network that are fully operable with DCGS and the DCGS Integration Backbone. - Completed an Assured Connectivity effort to develop waveforms suited to maintaining low data rate links under extreme conditions. - Completed Common Operational Picture Fusion Tools efforts, Software Reprogrammable Payload, Satellite Communications On-The-Move integration and demonstration, and C3 for the Individual Marine Spiral One. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete Fires interoperability, Advanced HF Communications and Restricted Communications. - Initiate Application-Network Architectures, Conformal Antenna Integration and Demonstration Spiral 2 and C3 for the Individual Marine Spiral Two. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. Conformal Antenna Integration and Demonstration Spiral 2 and C3 for the Individual Marine Spiral Two have been combined into M2C3 Development. - Complete Tactical Information Services. - Initiate Application Network Architecture(reprioritized from FY11) and Automated Small Unit Decision tools. 				
Title: FIREPOWER		5.744	7.044	7.992
Description: This activity develops technology for application on current and future expeditionary weapons and elements of the kill chain. It includes, but is not limited to, the following technologies: fuze, fire control, launch/propulsion, lethality, and accuracy.				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2223: <i>Marine Corps ATD</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>The FY 2010 to FY 2011 funding increase is due to the acceleration of a Non-Magnetic Azimuth Sensing technology effort. This will allow early transition of warfighting capability to Marine Corps forces.</p> <p>The FY2011 to FY2012 funding increase is due to the initiation of the development of Miniature Urban Missile.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued scalable effects conventional warhead concept development. - Continued improved mortar munition integration and demonstrations. - Continued development of targeting and engagement technologies for distributed operations collaborative fires integration and demonstrations. - Continued design, development, prototyping and testing of lightweight technologies that provide individual Marines enhanced capabilities to detect and identify man-size targets out to at least the maximum effective range of their personal weapons during all conditions (daylight, limited visibility, & darkness) by integrating multiple capabilities into a single system. - Continued a Flight Control Kinematic Unit effort (effort renamed Flight Control Mortar). Design & develop technology that provides guidance, navigation, and controls (GNC) to 81mm mortar rounds to enable trajectory shaping in urban environment to precisely & accurately strike specific targets. - Completed a Wind Sensing Program to provide technology that senses wind velocity & direction at firing point to apogee and supporting algorithms to compensate the computed/predicted wind effects on the ballistic flight of the 81mm mortar round in order to enhance weapon accuracy. - Completed an effort in Ballistic Flight Compensation Aiming in support of Distributed Operations Precision Engagement. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Continued Non-Magnetic Azimuth Sensing (NMAS previously identified as completed in PB 2011). <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Complete development and testing of enhanced range mortar munitions. - Initiate development of Miniature Urban Missile, leveraging technology from MEMS, designation, guidance and control, and warhead design, to develop a shoulder launched missile capable of defeating a variety of targets. - Initiate development of precision 60mm mortar system, to demonstrate increased precision, range, and lethality in a light mortar, providing indirect fire support through projectile flight trajectory shaping. 				
Title: FORCE PROTECTION		18.300	8.215	9.092

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2223: <i>Marine Corps ATD</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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Description: This activity supports the Force Protection Thrust's Advanced Technology Demonstration efforts in the areas of individual Marine platforms, equipment and autonomous systems. This includes technologies to enable detection, neutralization, breaching, and clearing of mines, Improvised Explosive Devices (IEDs), and unexploded ordnance from the beach exit to inland objectives. Efforts supported under Force Protection also include the demonstration of technologies such as Counter Rocket, Artillery, and Mortar (CRAM) and Counter Sniper technologies in support of maneuver warfare, small unit distributed operations, and fixed installation protection and technologies for improved Personnel Protective Equipment for individual protection against blast, ballistic, and blunt impact threats as well as in a chemical, radiological, and biological environment. Physical Security technologies to support expeditionary maneuver warfare, pier/port and base infrastructure are also addressed under this thrust. Beginning in FY 2009, Mine Countermeasures (MCM) efforts were funded within the Force Protection activity. FY 2009 was the first reporting cycle where Force Protection Thrust efforts are separated from the Maneuver activity. Counter-IED and Counter-RPG Technologies remain high priority Marine Corps focal areas.

The FY 2010 to FY 2011 decrease in funding is the result of the Urgent Theater Warfighting Requirement for countering Improvised Explosive Devices (IED) and vehicle borne IED, which was initiated in FY 2010.

The FY 2011 to FY 2012 increase in funding is due to enhanced funding for Anti-Tank Guided Missile (ATGM) technologies.

- FY 2010 Accomplishments:**
- Continued development of technologies to defeat side/top attack and advanced fuze mines through signature reduction and advanced signature duplication.
 - Continued development of technologies to locate and defeat IEDs.
 - Continued development of technologies to defeat advanced mine fuzes (seismic, acoustic, and infrared).
 - Continued efforts to detect IEDs using radio frequency sources.
 - Continued technology development programs to address force protection capability gaps.
 - Continued new Explosives Hazard Defeat to address the Suicide-Bomber threat. This effort will combine multiple sensor modalities, analysis algorithms, and data fusion to demonstrate high Pd, low FAR detection of suicide bombers from standoff distances from multiple aspect angles.
 - Continued a new Anti-Tank Guided Missile (ATGM) effort to defeat ATGMs in complex urban environment.
 - Continued Warfighter modeling and simulation efforts for the Warfighter-as-a-System analysis approach and methodology combining survivability, mobility, and warfighter performance parameters.
 - Completed advanced countermeasures technology development against magnetic fuzed landmines.
 - Completed development of point detection of explosives associated with IEDs. (Relates to the FY 2009 plan to detect IEDs using radio frequency sources).

	FY 2010	FY 2011	FY 2012

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2223: <i>Marine Corps ATD</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiated the Urgent Theater Warfighting Requirement for countering Improvised Explosive Devices (IED) and vehicle borne IED. - Initiated high-power solid state source development for IED neutralization. - Initiated vulnerability assessment of threat targeting sensors to directed energy. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete modeling and simulation (M&S) efforts for the Warfighter-as-a-System analysis approach and methodology combining survivability, mobility, and warfighter performance parameters. - Complete countermeasures technology development against seismic fuzed landmines. - Complete development of stand-off detection of explosives utilizing Raman and Laser Induced Breakdown Spectroscopy sensor modalities. (Relates to FY 2009 initiation of new Explosives Hazard Defeat Plan). - Initiate efforts to neutralize incoming rocket, artillery, and mortar threats via non-kinetic means. - Initiate development and evaluation of landmine detection utilizing ground penetrating radar from an airborne platform. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Continue efforts to neutralize incoming rocket, artillery, and mortar threats via non-kinetic means. - Continue development and evaluation of landmine detection utilizing synthetic aperture radar from an airborne platform. 				
<p>Title: HUMAN PERFORMANCE, TRAINING & EDUCATION</p> <p>Description: This activity develops and demonstrates advanced training technology and technologies that enhance neural and cognitive aspects of human performance including tactical decision-making, modeling, simulation, range instrumentation, synthetic environment generation and training effectiveness evaluation.</p> <p>The FY 2010 to FY 2011 funding increase is due to planned initiation of efforts to apply learning theories for language and culture training and to initiation of related efforts in team immersive language and cultural learning in simulation environments.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of "Warfighter as a System" modeling tools. (Effort renamed to Enhancing warfighter psycho-physical performance). - Continued development of adaptive experiential learning tools for Distributed Operations Training. (Effort renamed to Real-time adaptive training environments). - Continued development of automated behavioral and neurophysiological performance measurement technologies for Distributed Operations Warfighter assessment, classification and assignment to training. (Predictive training transfer toolset). 		8.875	10.693	11.539

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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2223: <i>Marine Corps ATD</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<ul style="list-style-type: none"> - Completed the development of tools to capture metrics and lessons learned from a variety of simulation and training sources. - Completed Marine Advanced Combat Headborne Initiative (MACHSI): physical protection of the head, neck and face. (Transitioned from the Firepower activity). - Completed development of the Distributed Operations Training/Virtual Test Bed. - Completed research into environmental effects on cognitive and team performance. - Completed in-depth analysis, state-of-the-art report, and testing on all USMC physical training regimens, their effectiveness and their injury incidence rates. - Completed Human Performance and Training capabilities (Cognitive and physical enhancement, modeling and simulation, virtual reality squad level training) in support of Distributed Operations. - Completed demonstrations and field studies of mitigation/augmentation capabilities that enhance squad level communication in support of Distributed Operations. - Completed development of a Distributed Operations virtual reality simulation training system prototype that will be scalable across fire team, squad, and platoon. - Completed Lightening the Load efforts aimed at developing the software necessary to conduct trade off analysis on a physically and ergonomically accurate model of the United States Marine and its infantry equipment. - Completed new Experiential Learning Technologies to improve the Infantry Immersive Trainer to support the Squad Immersive Training Environment (SITE) Marine Corps Urgent Needs Statement. This includes developing tracking, Helmet Mounted Displays, and software technologies to enable Augmented Reality in unimproved locations. - Initiated evaluations and validations of applications geared towards peak neural and cognitive performance-in distributed operations. - Initiated Distributed Operations training system investigations into perceptual skills enhancement that lead to enhanced cognition and decision making. - Initiated development of early prototype systems for Human Performance and Training efforts (Cognitive and physical enhancement, modeling and simulation, and virtual reality and mixed reality squad level training in support of Distributed Operations). <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Continue development of adaptive experiential learning tools for Distributed Operations Training. (Effort renamed Real-time adaptive training environments). - Continue development of "Warfighter as a System" modeling tools. (Effort renamed Enhancing warfighter psycho-physical performance). 			
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2223: <i>Marine Corps ATD</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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<ul style="list-style-type: none"> - Complete development of automated behavioral and neurophysiological performance measurement technologies for Distributed Operations Warfighter assessment, classification and assignment to training. - Complete evaluations and validations of applications geared towards peak neural and cognitive performance-in distributed operations. (Technologies supporting peak cognitive performance). - Complete Distributed Operations training system investigations into perceptual skills enhancement that lead to enhanced cognition and decision making. - Complete development of early prototype systems for Human Performance and Training efforts (Cognitive and physical enhancement, modeling and simulation, and virtual reality and mixed reality squad level training in support of Distributed Operations). - Complete development of adaptive experiential learning tools for Distributed Operations Training. - Complete in-depth analysis, state-of-the-art report, and testing on all USMC physical training regimens, their effectiveness, and their injury incidence rates. - Initiate efforts to apply learning theories for language and culture training. - Initiate team immersive language and cultural learning in simulation environments. - Initiate classroom/field testing of learning theories extended to complex tasks for a range of expertise levels; training mitigation strategies triggered by neurophysiological markers of learning, cognition and expertise; and principles of expertise development on a continuum of novice to expert. (Rename effort Algorithms Physiologically-derived to Promote Learning Efficiency (APPLE)). - Initiate field evaluations of training mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition, and expertise. - Initiate effectiveness and validation studies of Advanced Mobile Field Assessment and Readiness Technologies to improve the capability to assess situational awareness in the field and predict physical performance by developing mobile and rugged tools, algorithms, and models. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. Due to operational urgency in FY 2011 initiated development of an autonomous robotic adversarial target system to extend simulation marksmanship training to live-fire ranges with the use of robotic targets (all-terrain, mobile, tactical, return fire) and integrate with simulation feedback and scoring for transition to Marine Corps Systems Command (PM-Training Systems). - Continue effectiveness and validation studies of Advanced Mobile Field Assessment and Readiness Technologies to improve the capability to assess situational awareness in the field and predict physical performance by developing mobile and rugged tools, algorithms, and models. - Complete development of adaptive experiential learning tools for Distributed Operations Training. (Effort renamed to Real-time Adaptive Training Environments). 			
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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Complete development of "Warfighter as a System" modeling tools. (Effort renamed to Enhancing warfighter psycho-physical performance). - Complete development of algorithms physiologically derived to promote learning efficiency (Relates to early prototype systems for Human Performance and Training efforts initiated in FY10). - Complete development of expressive interactions for desktop virtual environments (Relates to early prototype systems for Human Performance and Training efforts initiated in FY10). - Complete efforts to apply learning theories for language and culture training. - Complete team immersive language and cultural learning in simulation environments. - Complete classroom/field testing of learning theories extended to complex tasks for a range of expertise levels; training mitigation strategies triggered by neurophysiological markers of learning, cognition and expertise; and principles of expertise development on a continuum of novice to expert. (Rename effort Algorithms Physiologically derived to Promote Learning Efficiency (APPLE)). - Complete field evaluations of training mitigation strategies triggered by behavioral and neurophysiological markers of learning, cognition, and expertise. - Initiate development of sleep deprivation mitigations (phase II) to enhance warfighter performance during extended operations (initial phase completed in FY10). - Initiate development of technologies supporting peak cognitive performance of warfighters. - Initiate development of physical conditioning assessment and training optimization methods to improve warfighter performance (previous efforts related to physical conditioning impacts on combat readiness resourced by PE 0602131M). - Initiate development of applied training technologies for Squad Immersive Training Environments(SITE). - Initiate evaluation of neurological symptoms of performance at altitude to reduce the incidences of acute mountain sickness (AMS). - Initiate development and demonstrate immersive training communication analysis systems to support instructor assessment of infantry units. 				
Title: INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR)		3.020	3.644	3.897
Description: This activity supports the demonstration of technologies to enhance situational awareness and tactical decision making through automated analysis, fusion of data, rapid integration of information, and acquired knowledge resulting in actionable intelligence at the lower command levels. The activity includes the demonstration of ISR efforts involving enhanced reconnaissance and persistent surveillance, and sensors for unmanned ground and aerial vehicles. Advanced Technology demonstrations also include the collection of information [monitoring, sensing, and locating] in the 3D urban battlespace as well as exploiting information [identifying and classifying data] as part of the intelligence preparation of the battlespace in order to facilitate operational maneuver and distributed operations.				

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>The FY2010 to FY2011 funding increase is due to initiation of robust efforts to automatically fuse data across all identifiers (TTL, biometrics, symbols) based on similarity measures.</p> <p>The FY2011 to FY2012 funding increase is due to acceleration of efforts to develop agile tactical sensor nets to improve the availability, timeliness, and usefulness of battlespace intelligence.</p> <p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued development of advanced tactical sensor nets that localize mobile detection of threats in a complex environment. - Continued development and demonstration of measurement and signature intelligence data management and integration capability. - Continued integration and demonstration of naval tactical warfighting applications and network connectivity. - Continued tagging, tracking, and locating efforts to demonstrate the effectiveness of tactically relevant tag readers which support track classification algorithms. - Continued efforts to refine enemy course of action prediction software to adapt to stimuli. - Continued new Actionable Intelligence for Expeditionary and Irregular Warfare efforts which include Human Network Decision Modeling and the fusion across modeling approaches to increase prediction accuracy. - Continued development of tactical sensor nets with organic unattended multi-level security processing and information dissemination. - Continued new Relevant and Situational Information on Demand such as Identity Dominance Enabled by an Integrated Biometric/Tag Track and Locate (TTL) Capability, providing human tracking algorithms based on models of biometric (face, voice and soft) and TTL (optical taggant) capabilities and modeling a biometric/optical taggant system relevant to human tracking across an urban 5 km x 2 km area. - Continued new Sensor Fields efforts such as Nanotechnology Enabled Witness Fields, development of sensors that provide near real time decision support to distributed operations by detecting specific interactions, and nanotechnology efforts which offer the potential to revolutionize tactical sensors. To enable this capability, nanomaterials that change state in the presence of another nanomaterial will be developed. - Completed efforts to refine enemy course of action prediction software to adapt to stimuli. - Initiated tagging, tracking, and locating efforts to demonstrate a system that will automatically translate large amounts of wide area surveillance data into tracks, useful to expose entity to entity associations; build urban context, as well as detect events and anomalies; and associate objects, tasks, locations and events for creating actionable intelligence. - Initiated algorithm development for base classification on context, similarity to clutter, and nearness to suspicion. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>- Initiated efforts to analyze and expose enemy networks using close observations of entity to entity associations and social network analysis. This includes development of audio tools which enable automated understanding of analog and digital recordings, as well as text files.</p> <p>- Initiated efforts to develop methods and techniques for investigating open source information on the Internet to form a human terrain map indicating space and time features to aid network identification and prediction of enemy activity.</p> <p>- Initiated efforts to incorporate social models for human decision making with statistical models. This includes new Actionable Intelligence for Expeditionary and Irregular Warfare efforts which include Human Network Decision Modeling and the fusion across modeling approaches to increase prediction accuracy and also the development of an active dynamic resource manager to make collected data better available to decision makers.</p> <p>FY 2011 Plans:</p> <p>- Continue all efforts of FY 2010, less those noted as completed above.</p> <p>- Initiate new Operational Adaptation Enablers effort to provide one analysis framework for the incorporation of interdisciplinary techniques related to addressing contextual questions.</p> <p>- Initiate efforts to extend the utility of track classification algorithms to sparse data.</p> <p>- Initiate efforts to automatically fuse data across all identifiers (TTL, biometrics, symbols) based on similarity measures.</p> <p>- Initiate efforts to show entity tracking using disparate ground and air sensors and tools that automatically compute latent area atmospheric measures.</p> <p>FY 2012 Plans:</p> <p>- Continue all efforts of FY 2011, less those noted as completed above.</p> <p>- Complete efforts to use the warfighter as a supplementary sensor in the battlespace to improve ISR to C2 connectivity.</p> <p>- Complete efforts to develop agile tactical sensor nets to improve the availability, timeliness, and usefulness of battlespace intelligence.</p> <p>- Initiate development of model based own force decision tools based on adversarial decision making models.</p> <p>- Initiate development of an active layered sensing capability.</p>			
Title: LITTORAL COMBAT/POWER PROJECTION (LC/PP)		17.111	17.622
Description: This activity is aligned with the Sea Strike, Sea Shield, Sea Basing, FORCEnet and the Expeditionary Maneuver Warfare pillars as well as Force Health Protection and Platform Enablers. It provides the capability for the demonstration and transition of technologies developed through the related Marine Corps S&T programs directly to an acquisition program of record. Littoral Combat/Power Projection is the Enabling Capability (EC).		18.075	

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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The funding profile reflects the alignment of the FNC program investments into ECs. Funding for each EC is aligned to a 6.2 or 6.3 Budget Activity (BA) as appropriate. The focus of the ECs within this PE will be on technology related to Urban, Asymmetric, Littoral and Expeditionary Operations. The related science and technology development is of the highest importance to Marine Corps operations in Iraq, Afghanistan and the OCO. Understandably, these Warfighter Capability Gaps are among those highest ranked of the prioritized Capability Gaps (prioritized by the OPNAV and the MCCDC). The technologies associated with these gaps are being pursued as part of an overall effort that addresses Sea Strike, Sea Shield, Sea Basing and FORCENet Capability Gaps. Warfighter Capability Gaps are made up of ECs and supporting products. This activity includes support to the Urban, Asymmetric Operations-related to EC's for IED's, Modular Scalable Effects Weapons, Advanced Naval Fires Technology, Dynamic Target Engagement, Position Location Information, Transparent Urban Structures, Hostile Fire Detection and Response, Lightweight Protective Systems, and Lightening the Load of Dismounted Combatants.

- FY 2010 Accomplishments:**
- Continued development of improved lightweight computational fire control interface technology. (Concurrent funding from PE 0602131M, PE 0602236N, PE 0603236N and PE 0603782N)
 - Continued development of improved fire control systems technologies to Expeditionary Fire Support System artillery and mortar systems (concurrent funding from PE 0602131M and 0602114N. These PEs complete the effort in FY 2010).
 - Continued development of transparent urban structures technologies. (Concurrent funding from PE 0602131M)
 - Continued development of modular scalable effects prototype weapon. (Concurrent funding from PE 0602131M)
 - Continued development of tactical urban breaching technologies.
 - Continued development of counter improvised explosive devices technologies. (Concurrent funding from PE 0602131M)
 - Continued development of individual Warfighter protection technologies. (Concurrent funding in PE 0602131M; funding will also be provided by PE 0603236N in FY 2009).
 - Completed development and transition of improved fire control technologies based on small-scale hardened non-magnetic azimuth sensor to improve timeliness and accuracy of mortars/howitzers.
 - Initiated development of advanced survivability and mobility technologies for Marine Corps tactical and combat vehicles. (Concurrent funding in PE 0602131M; funding will also be provided by PE 0603236N in FY 2010).

- FY 2011 Plans:**
- Continue all efforts of FY 2010, less those noted as complete above.
 - Complete development and transition transparent urban structures technologies which will enable tactical units to detect, classify and discriminate between friendly and enemy personnel in urban structures, and to gather ground data to dynamically develop 3D models to map urban areas using a UAV (Unmanned Air Vehicle)/UGV (Unmanned Ground Vehicle)-based system. (Concurrent funding provided by PE 0602131M.)

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B. Accomplishments/Planned Programs (\$ in Millions)				
				FY 2010
				FY 2011
				FY 2012
<p>- Complete development of individual warfighter lightweight protective system technologies that will reduce body armor weight, improve survivability and increase the mobility of the warfighter.</p> <p>- Initiate development of technologies to lighten the load of warfighters by 1) reducing the weight of and improving the capability of the day/night weapon sight, 2) eliminating battery incompatibility, and 3) providing Graphical User Interface (GUI-based) software for tradeoff analyses based on Military Operational Posture. (Previous FY10 effort resourced by PE 0602236N and PE 0603236N. Concurrent FY11 funding provided by PE 0602131M and PE 0603236N.)</p> <p>FY 2012 Plans:</p> <p>- Continue all efforts of FY 2011, less those noted as complete above. Due to urgent operational needs the development of tactical urban breaching technologies will complete in FY2011 to transition to the Marine Corps System Command SMAW II Rocket Launcher program. Due to required program necessities resourcing for the development of Modular Scalable Effects Weapons (selectable output weapon) technologies has been realigned to PE 0602114N and 0603114N.</p> <p>- Complete development of counter Improvised Explosive Device (IED) technologies. (Concurrent funding in PE 0602131M.)</p> <p>- Complete development of advanced survivability and mobility technologies for Marine Corps tactical and combat vehicles. (Concurrent funding in PE 0602131M and 0603236N).</p> <p>- Initiate development of wide area surgical and persistent surveillance technologies. (Concurrent funding in PE 0602271N and PE 0602131M).</p>				
Title: LOGISTICS				11.084
<p>Description: This activity supports Marine Corps Expeditionary Logistics which is the practical discipline and real world application of the deployment, sustainment, reconstitution, and re-deployment of forces engaged in expeditionary operations. Expeditionary Logistics replaces mass with assured knowledge and speed, is equally capable ashore or afloat in austere environments, and is fully scalable to meet uncertain requirements. Expeditionary Logistics logically divides into five pillars: deployment support, force closure, sustainment, reconstitution/redeployment, and command and control. These pillars are thoroughly integrated and perpetually related in execution.</p> <p>The FY 2010 to FY 2011 funding increase results from enhanced emphasis on the development of advanced lightweight fuel to energy conversion concepts.</p> <p>The FY 2011 to FY2012 funding increase results from operational demands to complete development of Marine Corps backpacks designed to minimize injurious peak oscillatory skeletal loading and generate electric power while walking during combat missions.</p>				13.125
FY 2010 Accomplishments:				13.931

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Continued exploring the development of portable fuel cell technologies capable of providing Power in the 100 Watt to 500 Watt power range. - Continued efforts to develop a micro turbine generator capable of 100W average power. - Continued research into developing a replaceable electrode battery power source that consists of a metallic structure that is consumed during power generation and then easily replaced with a new metallic component that restores a full charge. (Realigned from PE 0602131M.) - Continued analysis of material alternatives for automated vehicle health monitoring and reporting. - Continued development of a backpack that prevents oscillatory and transient peak loading forces from causing skeletal injury while enhancing human mobility with heavy loads. - Completed development of a tracking capability for major classes of supplies, forces & equipment. - Completed technology demonstration for responsive precision aerial logistic transport from Seabase to Distributed Operations Squad or Platoon. - Completed technology demonstration of an innovative bridge structure constructed from highly versatile modular composite components, thus expanding site-specific assembly options while simplifying logistic transport. - Completed development of a man-portable capability to analyze captured fuel for adulterants and contaminants. - Completed development of a lightweight man-portable multi-fuel thermoelectric battery charger. - Completed development of portable fuel analyzer. - Completed development of lightweight thermoelectric generator. - Initiated the development and demonstration of advanced materials for corrosion prevention and wear reduction for USMC vehicles and equipment. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010, less those noted as completed above. - Complete development of a low-cost, autonomous autogyro aerial logistic delivery system for resupplying small dispersed combat units. This includes: development of a fluid particle separator for small scale water purification; development of load sharing and energy storage capability for enhancing the efficiency of military power generators; and development of a Modular Composite Bridging demonstration based on prior applied research success. - Complete technology demonstration of a full scale bridge constructed from lightweight versatile modular composite components. - Initiate development of advanced lightweight fuel to energy conversion concepts. This includes development of power management electronics for reducing power requirements for military radios. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as completed above. - Initiate demonstration of advanced concepts for mobile infrastructure. 			

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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
- Complete development of backpacks designed to minimize injurious peak oscillatory skeletal loading and generate electric power while walking. Narrative Clarification: This effort was planned for completion in FY 2011 but was delayed due to technical challenges.				
<p>Title: MANEUVER</p> <p>Description: The Maneuver Thrust Technology Area focuses on the development, demonstration, and transition of technologies that will increase the warfighting capabilities and effectiveness of current and future Marine Corps maneuver systems. This Thrust aims at capturing emerging and "leap ahead" technologies in the areas of mobility, materials, propulsion, survivability, durability, signature reduction, modularity, and unmanned systems. Beginning in FY 2009, Mine Countermeasures (MCM) efforts are funded under the Force Protection activity. Presently, MCM supports and enhances the maneuver and force protection Marine landing forces with the development of technologies to enable detection, neutralization, breaching, and clearing of mines, Improvised Explosive Devices (IEDs), and unexploded ordnance from the beach exit to inland objectives. MAGTF MCM is a functional component of Naval Expeditionary Maneuver Warfare and includes Ship to Objective Maneuver (STOM), Expeditionary Operations from a Sea Base, sustained Operations Ashore, Urban and Asymmetric Operations, and OOTW.</p> <p>The FY 2010 to FY 2011 increase in funding is to due to plans for a major demonstration of Integrated Armor Solutions that provide lighter weight armor materials with enhanced protection to vehicle occupants.</p> <p>The FY 2011 to FY 2012 increase in funding is to due to plans to initiate programs to address and enhance maneuver capability gaps in mobility aimed at the development of an autonomous vehicle capability that will provide mobility and logistics support to the dismounted Marine during Enhanced Company Operations (ECO).</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued Advanced Electromagnetic Armor technology development efforts. - Continued development of a test bed to demonstrate advanced survivability concepts. - Continued development of fuel efficiency and battlefield power systems for improved performance. - Continued development of a Combat S&T Vehicle demonstrator to enhance crew survivability and vehicle fuel efficiency. - Continued survivability improvements and technologies to mitigate acceleration and traumatic brain injuries to occupants to enhance tactical mobility and survivability. - Continued advanced suspension systems development with ride height adjustment, ride quality adjustment, rollover prevention, and load equalizing systems for USMC tactical wheeled platforms to enhance tactical mobility in support of Distributed Operations 		10.228	12.312	13.625

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued a Survivability/ Active Protection Systems Improvement effort to increase effectiveness of defeat (Pdefeat) of shoulder launched RPG type threats and ATGM threats on light platforms utilizing non-kinetic kill technologies. - Continued new mobility efforts for On-Board Vehicle Power to increase mobile exportable power for Diesel Electric Propulsion Concepts and a Fuels effort to investigate future fuel alternatives for internal combustion engines to include Fischer-Tropsch and coal gasification processes for use in military tactical wheeled vehicles. - Continued Maneuver Enabling Technologies such as Vehicle Stabilization to improve vehicle suspension and control technologies to stabilize the platforms themselves to improve ride quality, shoot on the move capability and human systems integration. - Continued studies to identify technology development plans to close identified force protection capability gaps. - Continued development of fuel efficiency and battlefield power systems for improved performance. - Continued a Vehicle Demonstrator program to design and fabricate an Integrated Power Demonstrator platform capable of producing the power needs for mobility and survivability concept demonstrations. - Initiated efforts to evaluate current ground fleet platforms for their mobility and control capabilities as they relate to potential inclusion of an autonomous vehicle capability that will provide mobility and logistics support to the dismounted Marine during Enhanced Company Operations (ECO) <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Initiate efforts to demonstrate Integrated Armor Solutions that provide lighter weight armor materials with enhanced protection to vehicle occupants thereby enhancing tactical Mobility and Survivability in support of Distributed Operations. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Initiate programs to address and enhance maneuver capability gaps in mobility such as efforts, transitioned from 6.2, aimed at the development of an autonomous vehicle capability that will provide mobility and logistics support to the dismounted Marine during Enhanced Company Operations (ECO). 			
Accomplishments/Planned Programs Subtotals	80.157	78.087	83.932

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• 0603236N: <i>WARFIGHTER SUSTAINMENT ADVANCED TECHNOLOGY</i>	0.000	0.000	2.141	0.000	2.141	0.000	0.000	0.000	0.000	0.000	2.141

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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• 0602131M: <i>MARINE CORPS LANDING FORCE TECHNOLOGY</i>	8.698	7.278	8.981	0.000	8.981	7.219	3.648	1.155	0.000	0.000	36.979

D. Acquisition Strategy

N/A

E. Performance Metrics

The primary objective of this PE is the development of technologies to meet unique Marine Corps needs in conducting Expeditionary Maneuver Warfare. The program consists of a collection of projects categorized by critical warfighting function. Individual project metrics reflect the technical goals of each specific project. Typical metrics include the advancement of related Technology Readiness Levels, the degree to which project investments are leveraged with other performers, reduction in life cycle cost upon application of the technology, and the identification of opportunities to transition technology to higher categories of development.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603640M: <i>MC Advanced Technology Demo</i>				2297: <i>Marine Corps Warfighting Lab - Core</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2297: <i>Marine Corps Warfighting Lab - Core</i>	35.206	37.002	40.392	-	40.392	43.055	44.040	44.962	45.765	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Marine Corps Warfighting Laboratory (MCWL) examines lessons learned from current operations, explores emerging threats and opportunities, and explores Joint and emerging service concepts through concept-based experimentation in order to enhance current and future warfighting capabilities. The use of modeling and simulation (M&S), both conducted within Service wargaming and virtual experiment venues (conducted in partnership with the Navy and Joint Forces Command (JFCOM)), will provide both a necessary Joint context for the Marine Corps Expeditionary Force Development System process as well as the opportunity to explore the implications of proposed future programs on seabased power projection capabilities.

"Live experimentation" permits exploration of prototype and surrogate technologies, as well as Tactics, Techniques, and Procedures (TTPs), in order to better refine equipment requirements and to identify Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) initiatives needed to produce future capabilities. Experimentation encompasses inquiries into multiple warfighting areas, including: Combat Service Support (CSS) and Force Protection; Command, Control, Communications, and Computers (C4); Intelligence, Surveillance, and Reconnaissance (ISR); Fires, Targeting, and Maneuver; and Warfighting Excellence.

Using operational forces, MCWL conducts Advanced Warfighting Experiments (AWEs) supported by Limited Objective Experiments (LOEs), Limited Technical Assessments (LTAs), Wargames, and Studies. AWEs, LOEs, and LTAs examine discrete variables in as much isolation as can be achieved. Technologies assessed in LTAs are incorporated in LOEs while LOEs are building blocks from which resulting AWE-level campaigns are constructed. These campaigns are executed under the guidance of the Commandant of the Marine Corps (CMC) and in support of the Marine Air-Ground Task Force (MAGTF) Requirements List (MRL). The following provides an overview of MCWL experimentation:

- The Enhanced Company Operations (ECO) experiment series represents a major evolution in Marine infantry company operations. In the extended battlespace encountered in current and future operations, companies are required to execute functions normally conducted at battalion level and higher. ECO seeks to investigate structure, TTPs, training and equipment that will enable companies to effectively conduct full spectrum combat operations across an extended battlespace. ECO also seeks to use computer based simulation systems to expand the training opportunities and mission rehearsal capabilities.
- In Fiscal Year (FY) 2010 and beyond the MCWL experimentation will continue to address the broad challenges of seabased expeditionary warfare focused on the tactical levels. Specific areas of interest are reflected in the projects listed below which deal with outcomes impacting today's Marine Corps, the next Marine Corps, and Marine Corps after next.
- In FY 2011, MCWL experimentation will initiate a five-year campaign to encompass an examination of Enhanced MAGTF Operations (EMO) that fully exploit capabilities achieved in ECO experimentation to the greater MAGTF beyond the infantry company focus of the past in the areas of CSS, C4, ISR, and Fires, Targeting,

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2297: <i>Marine Corps Warfighting Lab - Core</i>		
and Maneuver. Additionally, FY 2011 investments will continue to support the immediate needs of deployed forces and exploit opportunities presented by emerging technologies.				
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
Title: COMBAT SERVICE SUPPORT (CSS) AND FORCE PROTECTION		4.773	4.902	5.389
<p>Description: This activity includes MCWL CSS and force protection experimentation efforts including assessment of equipment, new TTPs, training programs, and proposed organizational changes associated with enhanced capabilities. Although this category covers several small (less than \$500K per FY) efforts being pursued by MCWL, most programs listed below are considered major (valued at \$500K or more) or have near real-time operational impact.</p> <p>FY 2012 and beyond funding for Defense Advanced Research Projects Agency (DARPA)-legged robot program was realigned from Warfighting Excellence to CSS and Force Protection.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued to develop and experiment with bio-science (medical) technologies. - Continued experimentation of simulation based training technologies to enhance small unit leader decision-making ability (transitioned to Warfighting Excellence activity in FY 2010). - Continued assessment of unmanned ground logistics delivery technologies that support infantry small unit operations. - Initiated assessment of technologies for sustainment of tactical level units from the sea-base. - Initiated new investigations into point-of-wound stabilization and emerging technologies that support casualty evacuation (CASEVAC)/casualty extractions using robots. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Complete assessment of unmanned ground logistics delivery technologies that support infantry small unit operations. - Complete investigations into point-of-wound stabilization and emerging technologies that support CASEVAC/casualty extractions using robots. - Initiate research and assessment of technologies that reduce the demand required to support the MAGTF. - Initiate development, and test unmanned versions of current cargo vehicles. 				
Title: COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS (C4)		9.155	9.785	11.900
<p>Description: This activity encompasses all MCWL C4 related experimentation efforts including assessment of equipment, new TTPs, training programs, and proposed organizational changes associated with enhanced C4 capabilities. Although this category</p>				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2297: <i>Marine Corps Warfighting Lab - Core</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>covers several small (less than \$500K per FY) efforts being pursued by MCWL, most programs listed below are considered major (valued at \$500K or more) or have near real-time operational impact.</p> <p>The increase in the MCWL C4 activity funding from FY 2011 to FY 2012 is due to the assessment of enhanced Marine Air-Ground Task Force (MAGTF) communications concept demonstrators and the initiation of the Internally Transportable Vehicle (ITV) based C4 concept demonstrator. The investigation and assessment of a MAGTF C2 architecture and an integrated C2 application in support of the Enhanced MAGTF Operations (EMO) concept also initiate in FY 2012.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued C4 extended user assessments of selected prototype technologies in support of forces engaged in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). - Continued experimentation of concept demonstrators to support company and below alternative Command and Control (C2) architectures. - Completed C4 related small unit enhancements against irregular forces, including urban terrain. - Initiated assessment of network management systems for Capability Set (CAPSET) V (all C2 below Battalion) networks. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Complete C4 extended user assessments of selected prototype technologies in support of forces engaged in OEF and OIF. - Complete experimentation of concept demonstrators to support company and below alternative C2 architectures. - Complete assessment of network management systems for CAPSET V (all C2 below Battalion) networks. - Initiate assessment of fuzzy logic (artificial intelligence based) network management systems. - Initiate assessment of non-Radio Frequency based communications systems. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as complete above. - Initiate assessment of enhanced MAGTF communications concept demonstrators. - Initiate development and assessment of Internally Transportable Vehicle (ITV) based C4 concept demonstrator. - Initiate investigation and assessment of a MAGTF C2 architecture and an integrated C2 application in support of the EMO concept. 				
Title: FIRES, TARGETING, AND MANEUVER		1.534	1.648	1.811
Description: This activity includes MCWL experimentation efforts in the areas of fires, targeting, and maneuver including assessment of equipment, new TTPs, training programs, and proposed organizational changes associated with enhanced				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2297: <i>Marine Corps Warfighting Lab - Core</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>capabilities. Although this category covers several small (less than \$500K per FY) efforts being pursued by MCWL, most programs listed below are considered major (valued at \$500K or more) or have near real-time operational impact.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued assessment of small unit precision munitions/loitering weapons/armed Unmanned Aerial System (UAS) concept demonstrators. - Completed evaluation of alternative counter shooter technologies. - Initiated assessment of concept demonstrator precision targeting device. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts in FY 2010, less those noted as completed above. - Complete assessment of small unit precision munitions/loitering weapons/armed UAS concept demonstrators. - Initiate assessment of non-Radio Frequency based communications systems. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from 2011, less those noted as complete above. - Complete assessment of concept demonstrator precision targeting device. - Initiate investigation, development, and testing of concept demonstrator technologies and TTPs for enhanced fire support and fire support coordination associated with the EMO concept. - Initiate investigation, testing, and evaluation of hybrid electric vehicles capable of providing mobility to ground combat forces. 				
<p>Title: INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR)</p> <p>Description: This activity includes MCWL ISR related experimentation efforts including assessment of equipment, new TTPs, training programs, and proposed organizational changes associated with enhanced ISR capabilities. Although this category covers several small (less than \$500K per FY) efforts being pursued by MCWL, most programs listed below are considered major (valued at \$500K or more) or have near real-time operational impact.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued additional Improvised Explosive Device (IED) investigations into promising detect and neutralize technologies. - Continued experimentation with TTPs and payloads for a Research Surrogate (formerly referred to as Tier II) UAS concept demonstrator to provide persistent ISR at regimental and battalion levels. - Continued efforts to develop the TTPs required for small infantry units to employ UGVs, UASs, and unattended ground sensors. - Continued assessment of an integrated company level C4 ISR network. - Completed development and experimentation with a system that integrated tactical human intelligence collection, fusion, and visualization tools. 		5.179	4.974	4.842

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2297: <i>Marine Corps Warfighting Lab - Core</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiated investigations into rotary wing/hovering tactical level UAS concept demonstrators. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete experimentation with TTPs and payloads for a Research Surrogate UAS concept demonstrator to provide persistent ISR at regimental and battalion levels. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011, less those noted as complete above. - Complete investigations into rotary wing/hovering tactical level UAS concept demonstrators. - Initiate and complete experimentation with sensors tailored to the requirements of a Combat Logistics Patrol - Initiate development and testing of a sensor kit for manned/unmanned UGVs. - Initiate assessment of Vertical Takeoff and Landing (VTOL) micro UAS with a perch-and-stare capability. 				
<p>Title: MARINE CORPS WARFIGHTING LABORATORY (MCWL) OPERATIONS (SUPPORT)</p> <p>Description: MCWL Operations (Support) efforts include overall MCWL experimentation doctrine, planning, analysis, data collection, as well as technology transition tracking efforts. Although this category covers several small (less than \$500K per FY) efforts being pursued by MCWL, most programs listed below are considered major (valued at \$500K or more) or have near real-time operational impact.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued to synthesize results and lessons learned into proposed DOTMLPF recommendations for the Marine Corps. - Continued to provide technical, strategic, and managerial support to Marine Corps experimentation. - Continued to provide overall analysis and reporting of experimentation efforts, analytical assistance during experiment design, and maintenance of an ad-hoc analysis capability. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 		8.147	8.851	9.513
<p>Title: WARFIGHTING EXCELLENCE</p> <p>Description: This activity includes MCWL efforts in the development and assessment of joint and service warfighting concepts, joint and service missions, analysis of emerging threats and opportunities, and joint capability experimentation. It also includes MCWL service experimentation in areas that impact multiple warfighting functions. Although this category covers several small</p>		6.418	6.842	6.937

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2297: <i>Marine Corps Warfighting Lab - Core</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p>(less than \$500K per FY) efforts being pursued by MCWL, most programs listed below are considered major (valued at \$500K or more) or have near-real-time operational impact.</p> <p>FY 2012 and beyond funding for DARPA-legged robot program was realigned from Warfighting Excellence to CSS and Force Protection.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued executive agent responsibilities for Joint Title X programs, such as Unified Quest, Unified Course, and Unified Engagement. Title X war games address future capabilities in the context of Title X readiness responsibilities. - Continued management and oversight of non-Title X Wargaming, including the highly visible Office of the Secretary of Defense Net Assessment Transformation War Game series and the Special Operations Command wargaming series. - Continued to support the Center for Emerging Threats and Opportunities (CETO) mission: 1) prevent operational and tactical surprises to senior Warfighting Commanders by assessing future security environments in light of emerging threats and potential conceptual and technological opportunities; 2) help focus science, technology, and experimental efforts by appraising promising concepts and technologies; 3) serve as a catalyst to stimulate thought and debate on issues of importance to the Marine Corps. - Continued funding contributions to Joint Concept Technology Demonstrations (JCTDs) and Advanced Concept Technology Demonstrations (ACTDs). Both JCTDs and ACTDs are intended to rapidly field needed capabilities by using emergent mature technologies matched with innovative operational concepts. - Continued experimentation of simulation based training technologies to enhance small unit leader decision-making ability. - Initiated a MCWL-DARPA partnership for the development and demonstration of a legged robot in an effort to "Lighten the Load" of individual Marines. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 				
Accomplishments/Planned Programs Subtotals		35.206	37.002	40.392
C. Other Program Funding Summary (\$ in Millions)				
N/A				
D. Acquisition Strategy				
N/A				

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 2297: <i>Marine Corps Warfighting Lab - Core</i>

E. Performance Metrics

The primary objective of this PE is the development of technologies to meet unique Marine Corps needs in conducting Expeditionary Maneuver Warfare. The program consists of a collection of projects categorized by critical warfighting function. Individual project metrics reflect the technical goals of each specific project. Typical metrics include the advancement of related Technology Readiness Levels, the degree to which project investments are leveraged with other performers, reduction in life cycle cost upon application of the technology, and the identification of opportunities to transition technology to higher categories of development.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603640M: <i>MC Advanced Technology Demo</i>				4027: <i>Naval Innovative Science and Engineering</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	0.428	-	-	-	-	-	-	-	-	0.000	.428

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	0.428	-	-
Accomplishments/Planned Programs Subtotals	0.428	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 9999: <i>Congressional Adds</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	23.122	-	-	-	-	-	-	-	-	0.000	23.122

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: California Central Coast Partnership Research FY 2010 Accomplishments: This effort provided for research into; power and energy, operational environments, maritime domain awareness, information analysis and communication, Naval warrior performance and protection, survivability and self defense, and platform mobility at the California Central Coast Research Partnership.	2.788	-
Congressional Add: Enhanced Small Arms Protective Insert FY 2010 Accomplishments: This effort provided for research to develop a new Enhanced Small Arms Protective Insert (E-SAPI) that will have the same performance as the current E-SAPI, but at a lower weight and with the same protection level to enhance the war-fighter's performance and effectiveness.	1.593	-
Congressional Add: Future Immersive Training FY 2010 Accomplishments: This effort provided research to improve the Future Immersive Training Environment Joint Concept Technology Demonstration, an interoperable & reconfigurable hardware and software integrated training capability that enables the warfighter to train to accomplish close combat tasks in a realistic, fully immersive training environment that creates and reinforces complex (tactical and human dimension) decision making skills.	9.480	-
Congressional Add: Marine Air-Ground Task Force Situational Awareness FY 2010 Accomplishments: This effort designed, developed, tested and demonstrated the Marine Air Ground Task Force (MAGTF) situational Awareness Prototype decision support system.	2.689	-
Congressional Add: Ground Warfare Acoustical Combat System of Netted FY 2010 Accomplishments: This effort investigated cost-effective, light weight, man-wearable shot/fire event detection systems that enable quick response to direct shots or indirect fire from snipers, front line combatants,	4.979	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603640M: <i>MC Advanced Technology Demo</i>	PROJECT 9999: <i>Congressional Adds</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011
or other field assets. Proof of concept experimentation with GWACS and/or other GWACS-type systems was conducted to determine the concept's utility within a Marine Corps rifle unit.		
Congressional Add: Near Infrared optical (NIRO) Augmentation System	1.593	-
FY 2010 Accomplishments: This effort developed and demonstrated technologies that supported development of counter sniper technologies in support of maneuver warfare, small unit distributed operations, and fixed installation protection.		
Congressional Adds Subtotals	23.122	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603651M: <i>JT Non-Lethal Wpns Tech Dev</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	10.688	11.131	11.286	-	11.286	11.597	11.848	12.095	12.314	Continuing	Continuing
3022: <i>Joint Non Lethal Weapons</i>	10.688	11.131	11.286	-	11.286	11.597	11.848	12.095	12.314	Continuing	Continuing

A. Mission Description and Budget Item Justification

The DOD's Joint Non-Lethal Weapons Program (JNLWP) was established by the Secretary of Defense, who assigned centralized responsibility for DOD joint research and development of non-lethal technology to the Commandant of the Marine Corps as the Executive Agent. The Under Secretary of Defense for Acquisition, Technology and Logistics provides direct oversight of the JNLWP.

The efforts described in this Program Element (PE) reflect science and technology (S&T) investment decisions provided by the Joint NLW Integrated Product Team, a multi-service flag level corporate board that executes the JNLWP for the Commandant of the Marine Corps. This direction is based on the needs and capabilities of the Services, the Special Operations Command, and the Coast Guard, as identified in the DoD's Non-Lethal Weapons Joint Capabilities Based Assessment Document. This coordinated joint S&T development approach addresses mutual capability gaps and assures the best non-lethal technologies and equipment are provided to the operating forces while eliminating duplicative service S&T investment.

This program funds Advanced Technology Development of next-generation Non-Lethal Weapons (NLWs) and includes performing analysis, technical development efforts, and modeling and simulation necessary to ensure optimum weaponization and use of these NLWs. Investment areas include research and development of next-generation NLWs such as: non-lethal directed energy weapons (lasers, millimeter wave and high power microwave) for counter-personnel and counter-material missions; non-lethal counter-personnel technologies (acoustic, optical, and human electro-muscular disruption technologies), and advanced non-lethal materials (including materials for vehicle/vessel stopping and counter-facility applications). Next-generation NLW systems focus on long-range localized Non-Lethal (NL) effects to identified threat individuals (or groups of individuals) and/or their threat weapons systems operating in complicated environments such as urban areas, crowds, buildings, vehicles, vessels, and also in close proximity to high-value civilian facilities. By order of the Under Secretary of Defense for Acquisition, Technology, and Logistics, the Marine Corps is established as the Executive Agent for DoD Joint Non-Lethal Weapons RDT&E.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603651M: <i>JT Non-Lethal Wpns Tech Dev</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	11.749	11.131	11.384	-	11.384
Current President's Budget	10.688	11.131	11.286	-	11.286
Total Adjustments	-1.061	-	-0.098	-	-0.098
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.264	-			
• Rate/Misc Adjustments	-	-	-0.098	-	-0.098
• Congressional General Reductions Adjustments	0.003	-	-	-	-
• Congressional Add Adjustments	-0.800	-	-	-	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603651M: <i>JT Non-Lethal Wpns Tech Dev</i>				PROJECT 3022: <i>Joint Non Lethal Weapons</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
3022: <i>Joint Non Lethal Weapons</i>	10.688	11.131	11.286	-	11.286	11.597	11.848	12.095	12.314	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project funds the research and development of next-generation NLWs and includes performing analysis, technical development efforts, and modeling and simulation necessary to ensure optimum weaponization and use of these NLWs. Investment areas include research and development of next-generation NLWs such as: non-lethal directed energy weapons (lasers, millimeter wave and high power microwave) for counter-personnel and counter-material missions; non-lethal counter-personnel technologies (acoustic, optical, and human electro-muscular disruption technologies), and advanced non-lethal materials (including materials for vehicle/vessel stopping and counter-facility applications). Next-generation NLW systems focus on long-range localized NL effects to identified threat individuals (or groups of individuals) and/or their threat weapons systems operating in complicated environments such as urban areas, crowds, buildings, vehicles, vessels, and also in close proximity to high-value civilian facilities.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: JOINT NON-LETHAL WEAPONS	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: <ul style="list-style-type: none"> - Continued effort to assess the general utility, effect, and effectiveness of technologies for incapacitating personnel, clearing facilities, stopping vehicles and vessels, and denying enemy access to protected areas - Continued design of a man-transportable laser weapons system that can be used for non-lethal counter-personnel or non-lethal counter-material applications through ultra-high precision engagement of selected targets with minimal collateral damage - Continued research to define the optimum approaches, technologies and tactics necessary to clear a facility/building with and without entry - Continued modeling/research to develop an understanding of the complex relationships between individual, group and crowd dynamics in order to predict the macro effects of NLWs. Specifically, investigate factors that cause crowds to move to violent behavior, and what non-lethal technologies will be effective in controlling or mitigating violent crowd behavior - Continued effort to examine and optimize non-lethal effects and effectiveness of various non-lethal stimuli, to include light, acoustics, electrical, high power laser, high power microwave and active denial technology. Research includes human effects analysis with respect to existing non-lethal stimuli and other emerging system stimuli to characterize behaviors and their operational relevance - Continued non-lethal effects characterization through modeling and effects testing using the Advanced Total Body Model - Continued prototype development and demonstration of the most promising candidate technologies employing multi-sensory stimuli - Continued investigations of technology advancements to miniaturize proven non-lethal weapon prototypes /demonstrators to enable their transition to tactically relevant, cost effective capabilities in the field 	10.688	11.131	11.286

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603651M: <i>JT Non-Lethal Wpns Tech Dev</i>	PROJECT 3022: <i>Joint Non Lethal Weapons</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued prototype development of advanced payloads for candidate technological capabilities with applications relevant to emerging capability gaps - Continued prototype development and demonstration of the most promising candidate technologies addressing the extended range/duration incapacitation capability gap - Completed characterization of bioeffects induced via acoustic non-lethal weapon concepts - Initiated transition to higher levels of development and demonstration for the most promising candidate technologies employing multi-sensory stimuli <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2010, less those noted as completed above - Continue to address non-lethal counter-personnel capability gaps with alternative directed energy technologies. - Complete design of a man-transportable laser weapons system that can be used for non-lethal counter-personnel or non-lethal counter-material applications through ultra-high precision engagement of selected targets with minimal collateral damage. This effort was discontinued during FY09 based on ineffective results demonstrated during counter-personnel laser in-field testing. The counter-material application no longer meets the NLW definition per the JROC-approved Non-Lethal Effects Joint Capabilities Document (JCD) - Complete investigations of technology advancements to miniaturize proven non-lethal weapon prototypes/ demonstrators to enable their transition to tactically relevant, cost effective capabilities in the field - Complete prototype development and demonstration of the most promising candidate technologies employing multi-sensory stimuli and transition best candidates to higher levels of technology development and demonstration - Initiate transition to higher levels of technology development and demonstrate the most promising directed energy technologies under consideration for counter-personnel and counter-material applications - Initiate technology development employing optimized electro-muscular disruption waveforms and mechanisms for an extended duration counter-personnel suppression capability <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY 2011, less those noted as completed above - Initiate transition to higher levels of technology development the optimum approaches and technologies necessary to clear a facility/building with and without entry - Initiate transition to higher levels of technology development the most promising candidate technologies addressing the extended range/duration incapacitation capability gap - Initiate transition to higher levels of technology development for advanced payloads with applications relevant to emerging capability gaps 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603651M: <i>JT Non-Lethal Wpns Tech Dev</i>	PROJECT 3022: <i>Joint Non Lethal Weapons</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
- Initiate advanced prototype development and demonstration of a smaller, lighter active denial technology demonstrator based on most promising and mature 95 GHZ source technology			
Accomplishments/Planned Programs Subtotals	10.688	11.131	11.286

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The primary objective of this Program Element is the development of technologies that lead to the next-generation of Non-Lethal Weapons which address identified and prioritized joint NLW capability gaps. The program consists of a collection of projects for the development and evaluation of feasibility demonstration models. Individual project metrics reflect the technical goals of each specific project. Typical metrics include both the effectiveness of the technology, human effects and effectiveness, mitigation of high priority joint NLW capability gaps, and potential for compliance with policy and legislation. Overarching considerations include the advancement of related Technology Readiness Levels and Human Effects Readiness Levels, the degree to which project investments are leveraged with other performers, reduction in life cycle cost upon application of the technology, and the identification of opportunities to transition technology to higher categories of development.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603729N: <i>Warfighter Protection Adv Tech</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	51.062	18.076	18.119	-	18.119	23.213	23.126	30.019	34.250	Continuing	Continuing
2914: <i>Warfighter Protection Adv Tech</i>	17.701	18.076	18.119	-	18.119	23.213	23.126	30.019	34.250	Continuing	Continuing
9999: <i>Congressional Adds</i>	33.361	-	-	-	-	-	-	-	-	0.000	33.361

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This program supports the development and demonstration of field medical equipment, diagnostic capabilities and treatments; technologies to improve warfighter safety and to enhance personnel performance under adverse conditions; and systems to prevent occupational injury and disease in hazardous, deployment environments. Navy investment in these areas is essential because Navy/USMC mission needs are not adequately addressed by the civilian sector or other Federal agencies. For example, civilian emergency medicine does not address casualty stabilization during long transit times to definitive care. The National Institutes of Health (NIH) focuses on the basic science of disease processes and not product development. Programs are coordinated with other Services through the Armed Services Biomedical Research Evaluation Management (ASBREM) Committee to prevent duplication of effort. This project funds the Force Health Protection program a Future Naval Capability (FNC) that will provide technology options for future Navy and Marine Corps capabilities and supports the "Sea Warrior" component of the Naval Transformation Roadmap, medical logistics aspects of "Sea Basing" and expeditionary force medical support associated with "Sea Strike".

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603729N: <i>Warfighter Protection Adv Tech</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	51.893	18.076	18.379	-	18.379
Current President's Budget	51.062	18.076	18.119	-	18.119
Total Adjustments	-0.831	-	-0.260	-	-0.260
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.284	-			
• SBIR/STTR Transfer	-0.513	-			
• Program Adjustments	-	-	-0.255	-	-0.255
• Section 219 Reprogramming	-0.033	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.005	-	-0.005
• Congressional General Reductions Adjustments	-0.001	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

Congressional Add: *Naval Special Warfare Performance and Injury Prevention Program*

Congressional Add: *CW Bill Young Marrow Donor Program*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.992	-
	31.369	-
	33.361	-
	33.361	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603729N: <i>Warfighter Protection Adv Tech</i>				2914: <i>Warfighter Protection Adv Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2914: <i>Warfighter Protection Adv Tech</i>	17.701	18.076	18.119	-	18.119	23.213	23.126	30.019	34.250	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program supports the development and demonstration of field medical equipment, diagnostic capabilities and treatments; technologies to improve warfighter safety and to enhance personnel performance under adverse conditions; and systems to prevent occupational injury and disease in hazardous, deployment environments. Navy investment in these areas is essential because Navy/USMC mission needs are not adequately addressed by the civilian sector or other Federal agencies. For example, civilian emergency medicine does not address casualty stabilization during long transit times to definitive care. The NIH focuses on the basic science of disease processes and not product development. Programs are coordinated with other Services through the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee to prevent duplication of effort. This project funds the Force Health Protection program a Future Naval Capability (FNC) that will provide technology options for future Navy and Marine Corps capabilities and supports the "Sea Warrior" component of the Naval Transformation Roadmap, medical logistics aspects of "Sea Basing" and expeditionary force medical support associated with "Sea Strike".

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: BONE MARROW RESEARCH</p> <p>Description: The goal of the Bone Marrow program is to test, develop and evaluate military contingency capabilities in order to improve care for casualties of marrow-toxic substances. This program will research efforts to refine and correctly identify matched marrow and matched platelets for casualties as well as military members with medical injuries including combat trauma.</p> <p>FY 2010 Accomplishments: - Initiated and completed the Bone Marrow Research.</p>	0.909	-	-
<p>Title: CASUALTY CARE AND MANAGEMENT</p> <p>Description: The goal of Casualty Care and Management is to maximize the continuum of care with lifesaving interventions as close to the battlespace as possible. This is in an increasingly lethal battlespace, with reduced infrastructure and logistics.</p> <p>FY 2011 to FY 2012 funding increase is due to the development of the Automated Critical Care System (ACCS), FNC efforts in the activity.</p> <p>FY 2010 Accomplishments: - Continued study to demonstrate selectivity/specificity of biomarkers for mild & moderate RNT in appropriate pre-clinical model. - Continued efforts to develop advanced technologies for First Responders.</p>	5.288	5.287	8.750

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603729N: <i>Warfighter Protection Adv Tech</i>	PROJECT 2914: <i>Warfighter Protection Adv Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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- Continued efforts to develop advanced technologies to support the Forward Resuscitative Surgical System/ Expeditionary Resuscitative Surgical Systems (FRSS/ERSS).
- Continued program to develop advanced technologies to support En Route Care of casualties.
- Continued preclinical study to evaluate use of vasopressin to manage traumatic brain injury (TBI).
- Continued efforts to develop prototype technology for closed-loop resuscitation for USMC En Route Care system.
- Continued program to examine comorbidity of traumatic brain injury. (Continuation of similar effort funded in Healthy and Fit Force Activity.)
- Continued pharmacologic research studies to support an FDA Investigational New Drug (IND) application.
- Continued efforts to develop advanced technologies to support Rapid Blood Treatment. (Previously identified as First Responder.)
- Continued efforts to develop advanced technologies to support Advanced Forward Care. (Previously identified as FRSS/ERSS.)
- Continued efforts to develop advanced technologies to support Warfighter Restoration. (Previously identified as En Route Care.)
- Completed clinical trial evaluating safety of vasopressin for treatment of trauma patients.
- Completed efforts to develop a novel fibrinogen-like bandage using nanotechnology for hemorrhage control (internal and external).

FY 2011 Plans:

- Continue all efforts of FY 2010 less those noted as completed above.
- Initiate development of multifunctional blood substitute program.

FY 2012 Plans:

- Continue all efforts of FY 2011.
- Initiate development of the Automated Critical Care System (ACCS)

Title: CASUALTY PREVENTION	5.730	7.186	6.374
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Description: Casualty Prevention includes protecting the warfighter from environmental, occupational and battlefield threats.

FY 2010 to FY 2011 funding increase is due to the initiation of emerging technologies that support delivery of approved FNC enabling capabilities and to increased investments for the Human Injury and Treatment (HIT) model and Warfighter Restoration FNC efforts in this activity.

FY 2011 to FY 2012 funding decrease is due to the realignment of funding to support the development of the Automated Critical Care System FNC enabling capabilities effort.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603729N: <i>Warfighter Protection Adv Tech</i>	PROJECT 2914: <i>Warfighter Protection Adv Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued efforts to mitigate the effects of environmental and other threats to health. - Continued efforts to reduce operational injuries. - Continued research to determine the safety and efficacy of perfluorocarbons in treating decompression sickness and arterial gas embolism. - Continued development of tools to prevent psychological stress and PTSD. - Continued efforts to model head and neck injuries due to accelerated forces; operational injuries. - Initiated research to enhance force readiness by mitigating the impact of environmental stressors. - Initiated development of Human Injury and Treatment (HIT) model to assess personnel survivability, optimal personnel treatment, and restoration of ship operational capabilities. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010. - Complete research to determine the safety and efficacy of perfluorocarbons in treating decompression sickness and arterial gas embolism. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. 				
<p><i>Title:</i> NAVAL NOISE-INDUCED HEARING LOSS (NIHL)</p> <p><i>Description:</i> The goal of this program is to reduce the incidence of NIHL by nearly 100%. This program employs a total systems engineering approach that includes advancements in medical technology, jet engine physics, personal protective equipments, and mitigation analyses. Similar/related research was previously funded within this PE.</p> <p>This is a new effort in FY 2010 in support of applied research efforts.</p> <p>FY 2011 to FY 2012 funding decrease is due to the realignment of research efforts to support development of Jet Noise Reduction initiatives (now funded in PE 0602236N)</p> <p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Initiated advanced research in medical prevention and treatment of NIHL and tinnitus (ringing in the ears). - Initiated advanced research to reduce noise at the source, i.e. jet engine quieting and flight deck noise reduction. - Initiated advanced research to improve personal protective equipment technology. 		5.774	5.603	2.995

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603729N: <i>Warfighter Protection Adv Tech</i>	PROJECT 2914: <i>Warfighter Protection Adv Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
- Initiated advanced research to study the incidence and susceptibility of NIHL and tinnitus, and to evaluate mitigation strategies.			
<i>FY 2011 Plans:</i> - Continue all efforts of FY 2010.			
<i>FY 2012 Plans:</i> - Continue all efforts of FY 2011. - Initiate research to reduce noise at the source, i.e., shipboard, jet engine quieting and flight deck noise reduction.			
Accomplishments/Planned Programs Subtotals	17.701	18.076	18.119

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• 0602236N: <i>WARFIGHTER PROTECTION WARFIGHTER SUSTAINMENT APPLIED RESEARCH</i>	3.770	5.059	6.220	0.000	6.220	5.996	4.447	2.268	0.565	0.000	28.325

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Efforts within this PE are measured at two levels. At the lower level, each is measured against technical and financial milestones on a monthly basis. Annually, each project is reviewed in depth for technical and transition performance by the Chief of Naval Research (CNR).

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603729N: <i>Warfighter Protection Adv Tech</i>				9999: <i>Congressional Adds</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	33.361	-	-	-	-	-	-	-	-	0.000	33.361

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
<i>Congressional Add:</i> Naval Special Warfare Performance and Injury Prevention Program	1.992	-
<i>FY 2010 Accomplishments:</i> This effort provided research in support of Navy SEAL Special Boat Team 22 to strategically maximize human capital by reducing the rate of unintentional musculoskeletal injury, sharpen battlefield performance, optimize military readiness, extend the tactical life cycle of the Operator, and enhance quality of life of the Operator after service.		
<i>Congressional Add:</i> CW Bill Young Marrow Donor Program	31.369	-
<i>FY 2010 Accomplishments:</i> This effort supported the research of the C.W. Bill Young Bone Marrow Donor Recruitment and Research Program.		
Congressional Adds Subtotals	33.361	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603747N: <i>Undersea Warfare Advanced Tech</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	74.178	49.276	37.121	-	37.121	28.864	34.190	33.607	28.246	Continuing	Continuing
2916: <i>Undersea Warfare Advanced Technology</i>	66.020	49.276	37.121	-	37.121	28.864	34.190	33.607	28.246	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	2.182	-	-	-	-	-	-	-	-	0.000	2.182
9999: <i>Congressional Adds</i>	5.976	-	-	-	-	-	-	-	-	0.000	5.976

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

All Navy advanced technology development in undersea target detection, classification, localization, tracking and neutralization is funded through this PE. The related technologies being developed are aimed at enabling Sea Shield, one of the three core operational concepts detailed in the Naval Transformational Roadmap. Associated efforts focus on new Anti-Submarine Warfare (ASW) operational concepts that promise to improve wide-area surveillance, detection, localization, tracking and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. The focus is on leveraging technologies that will protect the country's current capital investment in surveillance, submarine, surface ship and air ASW assets.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603747N: <i>Undersea Warfare Advanced Tech</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	73.636	49.276	39.541	-	39.541
Current President's Budget	74.178	49.276	37.121	-	37.121
Total Adjustments	0.542	-	-2.420	-	-2.420
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	0.556	-			
• SBIR/STTR Transfer	-1.495	-			
• Program Adjustments	-	-	-1.877	-	-1.877
• Section 219 Reprogramming	1.521	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.543	-	-0.543
• Congressional General Reductions Adjustments	-0.040	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: *Congressional Adds*

Congressional Add: *Underwater Explosives and Warhead Research*

Congressional Add: *ASW Research Prog - Cong*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	2.988	-
	2.988	-
	5.976	-
	5.976	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603747N: <i>Undersea Warfare Advanced Tech</i>				2916: <i>Undersea Warfare Advanced Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2916: <i>Undersea Warfare Advanced Technology</i>	66.020	49.276	37.121	-	37.121	28.864	34.190	33.607	28.246	Continuing	Continuing

A. Mission Description and Budget Item Justification

All Navy advanced technology developments in undersea target detection, classification, localization, tracking and neutralization are funded through this project. Technologies being developed within this project are aimed at enabling Sea Shield, one of the three core operational concepts detailed in the Naval Transformational Roadmap. Associated efforts focus on new ASW operational concepts that promise to improve wide-area surveillance, detection, localization, tracking and attack capabilities against quiet adversary submarines operating in noisy and cluttered shallow water environments. Related efforts are aimed at leveraging technologies that will protect the country's current capital investment in surveillance, submarine, surface ship and air ASW assets.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: ANTI-SUBMARINE WARFARE (ASW) DISTRIBUTED SEARCH	2.680	4.367	3.742
<p>Description: ASW Distributed Search focuses the development of technologies for the non-covert tactical search for undersea targets ranging from hours to weeks using automated sensor systems deployed around operating areas including along key transit routes to protect naval/maritime forces, around temporarily fixed sea base regions and naval force operating areas, or around fixed defensive regions and areas of interest such as key US/Allied ports. "Non-covert" implies availability of airborne assets for sensor deployment (although other means may also be used), and the ability to employ active sonar along with passive and non-acoustic methods. "Search" is conducted in concentrated areas, typically exploiting cues received from surveillance systems. The submarine target must be detected beyond its weapons release range. The objective is to develop rapidly deployable systems employing automated detection and classification capabilities for use in both shallow and deep water operating environments. Distributed Search supports the ASW protected passage Maritime Shield operational constructs. Related efforts include the development of distributed systems employing optimization as well as active acoustic sensing and processing techniques, navy-unique transduction and underwater networking technology. Efforts also include the development of Unmanned Undersea Vehicle-based and affordable off-board deployable sensing systems employing persistent detection concepts and components. These efforts provide an extended reach of organic platform-based systems through the use of new sensor concepts, improved materials for advanced sensors, optimized deployment, employment, and automated operation of distributed sensor fields. The cornerstone of Distributed Search is the development of rapidly deployable, long-endurance active sensors with automated processing suitable for use in a wide variety of operational environments.</p> <p>Increase from FY 2010 to FY 2011 due to ramping up of High-Fidelity Active Sonar Training Program.</p> <p>Decrease from FY 2011 to FY 2012 due to the completion of Future Naval Capability (FNC) Distributed System Processing.</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603747N: <i>Undersea Warfare Advanced Tech</i>	PROJECT 2916: <i>Undersea Warfare Advanced Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued development of Distributed Systems Processing (DSP) threat submarine feature association and field tracking algorithms for active and passive distributed acoustic ASW systems. - Initiated development of high fidelity computer-based simulation training with linked architecture that supports ASW training from the operator-level to the ASW Commander-level applicable to both surface and air platforms. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue FY 2010 efforts. - Complete development of Distributed Systems Processing (DSP) threat submarine feature association and field tracking algorithms for active and passive distributed acoustic ASW systems. Technologies will transition to the Maritime Surveillance System Program Office, NAVSEA PMS-485. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Continue all efforts of 2011 less those noted as completed above. 			
<p>Title: ANTI-SUBMARINE WARFARE (ASW) PERFORMANCE ASSESSMENT</p> <p>Description: The goal of this work is to integrate ocean and atmospheric environmental characteristics with sensor performance predictions in order to develop algorithms and Tactical Decision Aids (TDAs) that will accurately predict overall sensor performance in a given environment in near real-time for both present and future situations. The results of these research efforts in conjunction with embedded state-of-the-art command and operator-level training will facilitate the optimum employment of ASW sensor systems, thus increasing their effectiveness and potentially decreasing the number of sensors used to provide coverage in a given area. This work will provide operational commanders with sensor performance predictions which allow them to accurately judge the performance of those sensors, as well as information with which to deploy them for the greatest operational effect. It will also provide information as to how the performance evolves over time due to effects such as the deformation of sensor locations by currents, sound velocity profile changes, geologic magnetic interference changes, or changes to the optical properties of the water, etc. The effort includes performance predictions for fields of sensors as well as individual sensors themselves and applies to both acoustic and nonacoustic sensors.</p> <p>Work includes development of ASW sensor and system performance models, and realistic simulations and measures of effectiveness that incorporate and exploit critical environmental knowledge. It includes efforts to couple ocean dynamics and acoustics, characterize ambient noise in the littorals, measure and model acoustic and optical propagation and scattering in complex environments, develop algorithms to extract environmental information from through-the-sensor measurements and quantification and prediction of uncertainty. This information is combined with the operating characteristics of particular sensors (or groups of sensors) to provide predictions of sensor performance in the environment at that particular time and in the future.</p>	4.750	4.347	3.915

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603747N: <i>Undersea Warfare Advanced Tech</i>	PROJECT 2916: <i>Undersea Warfare Advanced Technology</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<p>The predictions will also include assessments of the prediction uncertainty due to environmental measurement and sensor performance uncertainties.</p> <p>This work aligns principally with the Assure Access and Hold at Risk S&T Focus Area in the Naval S&T Strategic Plan and contributes measurably to the Operational Environments S&T Focus Area strategic objectives.</p> <p>The FY 2010 to FY 2011 funding decrease is due to the completion of Future Naval Capability (FNC) - Placement of Active ASW Distributed Systems (PAADS).</p> <p>The FY 2011 to FY 2012 funding decrease is due to the phasing down of FNC - Drifting System Placement and Source Control Algorithm.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued a research effort focusing on distributed system in-situational environmental characterization and system monitoring. - Continued a research effort to determine the placement of and follow-on control and pattern keeping of acoustic sources and mobile distributed sensor systems. - Continued research effort aimed at the ideal placement of acoustic sources and drifting sensor systems. - Completed algorithm testing of uncontrolled drifting systems using a simulator. - Completed test planning of source algorithms to be used to determine the optimal initial placement of uncontrolled drifting distributed systems. - Completed development of algorithms to optimize the initial placement of uncontrolled drifting systems. - Completed development of a simulator for placement of uncontrolled drifting systems. This effort is intended to transition to Program Executive Office Air ASW, Assault and Special Mission Programs (PMA-264). The agreement is being negotiated and the details will be entered after the TA is signed. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. 			
Title: ANTI-SUBMARINE WARFARE (ASW) SURVEILLANCE		45.453	33.516
Description: ASW Surveillance focuses on dramatically improving detection, classification, and localization capabilities in large ocean areas relative to the capabilities of legacy ASW surveillance systems. The related technologies support the conduct of			21.088

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603747N: <i>Undersea Warfare Advanced Tech</i>	PROJECT 2916: <i>Undersea Warfare Advanced Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>covert wide-area surveillance ranging from one day to six months. The objectives are to develop and demonstrate technologies that provide clandestine indications and warnings in far forward and contested operating areas and in complex operational environments against all submarine threats including new threats with unknown target signatures and tactics. Covertiness implies use of non-observable platforms and/or deployed automated sensors employing passive sonar or other non-detectable methods. The surveillance process includes initial detection and classification. Efforts include the development of Unmanned Undersea Vehicle-based and affordable off-board deployable sensing systems employing a wide variety of surveillance concepts and components. These efforts focus on alternative detection phenomena, vector/tensor sensors, automated acoustic processing, more compact and longer lasting power sources, and high bandwidth acoustic communications links.</p> <p>The FY 2010 to FY 2011 funding decrease is due to the completion of Future Naval Capability (FNC) - Deployable Autonomous Distributed System (DADs); PALANTIR; and Submarine Track and Trail.</p> <p>The FY 2011 to FY 2012 funding decrease is due to the ending of the Persistent Littoral Undersea Surveillance (PLUS) INP. Remaining funds for PLUS in this activity are for a demonstration effort that will be used to illustrate its potential utility.</p> <p><i>FY 2010 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued the On-Demand Detection Classification and Localization (ODDCL) effort focusing on the development of sensor and platform designs and key components compatible with a notional Concept of Operations. - Continued system level design and integration for ODDCL. - Continued development of a tactical area prototype system for Persistent Littoral Undersea Surveillance (PLUS). - Continued a PLUS prototype system simulation test in preparation for FY 2011 at-sea experiments. - Continued analysis of data collected during the FY 2010 PLUS at-sea experiments. - Continued two at-sea experiments focused on increasing system persistence capabilities. - Completed Submarine Track & Trail (STT) Baseline advanced research efforts in the areas of advanced undersea sensors, communications, autonomy, and sensor data collection and analysis to support tracking algorithm and automated processing development. - Completed DADS deployability, survivability and classification performance improvement effort. - Completed testing of the Palantir (a non-acoustic surveillance system) sensor system. - Completed tactical test planning for the Palantir sensor. - Completed DADS at-sea classification performance improvement testing. - Completed at-sea testing of integrated STT submersibles and evaluate overall system performance. - Completed DADS deployability, covert communications and survivability testing. - Completed at-sea demonstrations of STT submersible with fully integrated sensor package. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603747N: <i>Undersea Warfare Advanced Tech</i>	PROJECT 2916: <i>Undersea Warfare Advanced Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Initiated system level integration and testing for ODDCL. - Initiated development of a vector sensor towed array and associated signal processing with performance nominally equivalent to a "thin-line" (TB-29) twin-line towed array to be compatible with the existing TB-29 array handling system. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Complete a PLUS prototype system simulation test in preparation for FY 2011 at-sea experiments. - Complete two at-sea experiments focused on increasing system persistence capabilities. - Initiate a PLUS prototype system simulation test in preparation for FY 2012 at-sea experiments. - Initiate analysis of data collected during the FY 2011 PLUS at-sea experiments. - Initiate two at-sea experiments focused on increasing system adaptation and optimization capabilities. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011 less those noted as completed above. 			
<p>Title: UNDERSEA WEAPONRY</p> <p>Description: Undersea Weaponry focuses on the development of enabling technologies to counter threat submarines and surface vessels by increasing Probability of Kill (PK) and platform survivability. Weapon technology focus areas include: the Lightweight Torpedo Technologies (LTT) and the Compact Rapid Attack Weapon (CRAW) projects. The ultimate goal of this activity is to provide revolutionary capabilities needed to fill Sea Shield Warfighter Capability Gaps, to accommodate unique payload limitations through the development of modular and reduced sized undersea weapons based on common technology enablers (where possible), and to provide improved submarine cuing/wide area search in deep and shallow water ocean areas while providing the capability to rapidly transition the submarine mission to engagement/neutralization.</p> <p>The FY 2010 to FY 2011 funding decrease is due to the completion of the Future Naval Capability (FNC)- Lightweight Torpedo Technologies.</p> <p>The FY 2011 to FY 2012 funding increase is due to a new Future Naval Capability - Torpedo Common Hybrid Fuzing System starting in FY 2011.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of a reduced size/weight CRAW for air deployment. This effort will include sensor, guidance and control, warhead, propulsion, and air frame integration tasks. 	13.137	7.046	8.376

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603747N: <i>Undersea Warfare Advanced Tech</i>	PROJECT 2916: <i>Undersea Warfare Advanced Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued CRAW in water data collection to support development of guidance and control algorithms enabling an ASW offensive capability in the Common Very Lightweight Torpedo. - Continued tests to support the development of a CRAW warhead that will achieve required performance against submarine targets, and demonstrate feasibility of achieving final goal. - Continued in-water data collection on CRAW homing in presence of countermeasures. - Continued LTT integration of broadband and adjunct sensors for in-water data collection to result in a new dual-mode sensor guidance and control system for at-sea testing. - Continued feasibility investigations under LTT to quantify adjunct sensor configurations and signal processing approaches to enable positive discrimination of artificial targets at standoff ranges. This feasibility investigation is expected to result in five (5) new patent applications. - Continued LTT sensor package development to achieve integrated coherent broadband sonar and novel adjunct sensors homing and classification capabilities for lightweight torpedo (LWT). - Continued development and integration of adjunct sensors into a lightweight torpedo sensor and design signal processing and data fusion techniques to improve target classification in areas of high contact density. - Continued in-water data collection for development of advanced counter countermeasure processing, weapon-to-weapon acoustic communication and a salvo vehicle intelligent controller. - Continued demonstration of LTT underwater acoustic communications capability to enable coordinated attack and net-centric connectivity. - Continued demonstration of LTT weapon salvo capability utilizing behavior-based control. - Completed a high fidelity weapon frequency model development effort to parallel adjunct sensor developments and provide accurate synthetic data for algorithm design and measurement. - Completed LTT feasibility investigations to select the stealth and propulsion technologies for future integration as a low cost propulsion replacement for the Mk 54 LWT. - Completed further development of advanced fusing technology for LWT as part of the LTT FNC project. - Completed LTT feasibility investigations and selected geo-coordinate based navigation system technologies and connectivity methods (i.e. acoustic communications, fiber link) for future development of technologies for LWT demonstration. - Completed data collection for LWT broadband and counter-countermeasures in the harsh shallow water environment of the Shore Bombardment Area site off the Southern California Off-Shore Range using an experimental test vehicle fitted with a broadband Mk 54 array. - Completed feasibility assessment of LTT to best utilize precision targeting and distributed sensors for weapon employment from high altitude and standoff range. - Completed development of a high channel count LTT broadband transmitter. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603747N: <i>Undersea Warfare Advanced Tech</i>	PROJECT 2916: <i>Undersea Warfare Advanced Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Completed development and integration of a total LTT system prototype in the Mk 54 torpedo form factor for at sea demonstrations. - Completed development of an integrated LTT set-to-hit simulation capability to evaluate weapon performance gains to include robust representations of component technologies developed and demonstrated under the LTT project. - Completed design and development of an integrated LTT full system prototype consisting of hardware and software upgrades for final at-sea demonstrations to be conducted in FY 2010. - Initiated and completed at-sea demonstration and assessment of LTT full system prototype. - Transitioned demonstrated Lightweight Torpedo Technologies to PE 0604610N (Lightweight Torpedo Development). <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2010 less those noted as completed above. - Initiate new FNC Program for Torpedo Common Hybrid Fusing System. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts of FY 2011. - Complete development of a reduced size/weight CRAW for air deployment. This effort will include sensor, guidance and control, warhead, and air frame integration tasks. - Complete CRAW in water data collection to support development of guidance and control algorithms enabling an ASW offensive capability in the Common Very Lightweight Torpedo. - Complete tests to support the development of a CRAW warhead that will achieve required performance against submarine targets, and demonstrate feasibility of achieving final goal. - Complete in-water data collection on CRAW homing in presence of countermeasures. 			
Accomplishments/Planned Programs Subtotals	66.020	49.276	37.121

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• 0602747N: <i>UNDERSEA WARFARE APPLIED RESEARCH</i>	9.499	8.594	11.393	0.000	11.393	11.135	10.088	6.334	1.930	0.000	58.973

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603747N: <i>Undersea Warfare Advanced Tech</i>	PROJECT 2916: <i>Undersea Warfare Advanced Technology</i>

E. Performance Metrics

Improve target detection, localization, and tracking and increase attack capabilities by providing the following capabilities:

- Localization of 85% or more of enemy submarines in far forward or contested waters with false locations of less than 10% of total calls.
- Effective cueing of an attack from a distance of up to 200nm.
- Improvement of the Lightweight Torpedo (Mk 54). Specific improvements are classified.
- Extending deep water active distributed system lifetime to a few months with a probability of detection (Pd) of 90% within 4 hours (field configuration) or 90% per crossing (barrier configuration), with a False Alarm Rate (FAR) of no more than 4/day.
- Delivery from a Vertical Takeoff Unmanned Air Vehicle (VTUAV) and/or a long-range, high-speed Unmanned Air Vehicle (UAV) a compact undersea weapon capable of a high Probability of Kill (PK) given precise target localization.
- Detection and localization performance with a single-line vector sensor array nominally equivalent or superior to that of two coherently processed TB-29A arrays. Acquisition costs to be competitive with the cost of a current TB-29A and at least 30% less than the cost of two arrays. Sensor and telemetry packaging will be adequate to achieve neutral buoyancy in an existing TB-29A form factor with array power efficiency greater than 75%. Array handling will be compatible with the existing TB-29 handling system.

Increase sensor to shooter performance and the effective lifetime of distributed ASW search systems by:

- Achieving a drifting active distributed system lifetime of at least two days in areas of tactical significance while maintaining required system performance with a minimum number of sensor nodes.
- Maintaining an effective lifetime of a month for mobile active distributed systems when subjected to the action of eddies from a major ocean current.
- Predicting reseed 6 hours before performance degrades.
- Holding the Area of Uncertainty (AOU) to no larger than 10 nm² for an hour after initial detection through the control of the coherent sources.

Through a combination of better Anti-Submarine Warfare (ASW) command-level training and improved operator training provide the following:

- Improve the ability of active sonar operators to detect targets and reject potential false alarms compared to current simulation based training.
- Increase Pd by 50%.
- Provide a decrease in FAR by a factor of two.
- Provide a reduction in the probability of a hit on a High Value Unit (HVU) by a factor of two.
- Improve the ability of the ASW Commander to position assets to increase coverage, reduce active system interference and deal effectively with competing missions.
- Reduce training cost by greater than 80% and increase the frequency of training opportunities by greater than 600% relative to live training.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE					PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603747N: <i>Undersea Warfare Advanced Tech</i>					4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	2.182	-	-	-	-	-	-	-	-	0.000	2.182

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: Naval Innovative Science and Engineering</p> <p>Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.</p> <p>FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:</p> <ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 	2.182	-	-
Accomplishments/Planned Programs Subtotals	2.182	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603747N: <i>Undersea Warfare Advanced Tech</i>				9999: <i>Congressional Adds</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	5.976	-	-	-	-	-	-	-	-	0.000	5.976

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
<i>Congressional Add:</i> Underwater Explosives and Warhead Research	2.988	-
<i>FY 2010 Accomplishments:</i> This effort developed the next generation of explosives and warheads that can defeat both submarines and surface targets, such as mines, and also be used successfully against new or evolving threats. This effort enhanced the U.S. Navy's ability to protect strategic sea lanes and ensure they remain open to commercial and military traffic.		
<i>Congressional Add:</i> ASW Research Prog - Cong	2.988	-
<i>FY 2010 Accomplishments:</i> This effort provided research into sensor development, understanding of environmental clutter and noise, automated signal processing for novel classification approaches, and demonstration of systems like Unmanned Undersea Vehicles to carry sensors, at oceanographic institutions as a way of broadening the research base in this area.		
Congressional Adds Subtotals	5.976	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE								
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603758N: <i>Navy Warfighting Exp & Demo</i>								
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	50.537	53.177	50.157	-	50.157	53.447	54.006	60.635	77.068	Continuing	Continuing
2918: <i>Navy Warfighting Experiments and Demo</i>	50.537	53.177	50.157	-	50.157	53.447	54.006	60.635	77.068	Continuing	Continuing

A. Mission Description and Budget Item Justification

This Program Element (PE) addresses the development of recent technology breakthroughs to meet current operational needs from a subscale proof-of-principle into a full-scale prototype for warfighter experimentation during laboratory and operational demonstrations, Fleet Battle Experiments (FBE), Limited Objective Experiments (LOEs) and Sea Trial Exercises. The key aspects of this PE are divided into four areas: (1) SwampWorks develops and demonstrates newly invented or recently discovered technologies that address emergent and enduring operational problems in an accelerated timeframe; (2) Naval Warfare Experimentation develops prototypes of recent technology breakthroughs and provides them to the warfighter for experimentation during FBEs, LOEs or Sea Trials; (3) Tech Solutions develops rapid response science and technology prototypes addressing Fleet/Force needs identified by Sailors and Marines at the deckplate level; and (4) Operations Analysis provides the Navy and Marine Corps the means to identify capability needs that can be addressed with science and technology solutions.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	52.373	53.177	63.292	-	63.292
Current President's Budget	50.537	53.177	50.157	-	50.157
Total Adjustments	-1.836	-	-13.135	-	-13.135
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.112	-			
• SBIR/STTR Transfer	-1.064	-			
• Program Adjustments	-	-	-12.957	-	-12.957
• Section 219 Reprogramming	-0.638	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.178	-	-0.178
• Congressional General Reductions Adjustments	-0.022	-	-	-	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy

DATE: February 2011

APPROPRIATION/BUDGET ACTIVITY

1319: *Research, Development, Test & Evaluation, Navy*
BA 3: *Advanced Technology Development (ATD)*

R-1 ITEM NOMENCLATURE

PE 0603758N: *Navy Warfighting Exp & Demo*

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603758N: <i>Navy Warfighting Exp & Demo</i>	PROJECT 2918: <i>Navy Warfighting Experiments and Demo</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2918: <i>Navy Warfighting Experiments and Demo</i>	50.537	53.177	50.157	-	50.157	53.447	54.006	60.635	77.068	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project focuses on the development of recent technology breakthroughs to meet current operational needs from a subscale proof-of-principle into a full-scale prototype for warfighter experimentation during laboratory and operational demonstrations, FBE, LOEs and Sea Trial Exercises.

The funding level decreases from FY 2011 to FY 2012 are the result of POM-12 refresh of ONR Leap Ahead portfolio as approved by DON S&T Corporate Board.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: NAVAL WARFARE EXPERIMENTATION	28.735	19.704	19.789
<p>Description: The objective of this project is to capitalize on recent technology breakthroughs to develop prototypes quickly and provide them to the warfighter for experimentation during laboratory and operational demonstrations, Sea Trials or LOEs. Current efforts include experimentation with electronics warfare (EW) technologies, development of test simulation technology for ship affordability, technology to advance riverine warfare operations, development and demonstration of real time situational awareness technologies, power and energy for unmanned vehicles, and technology investigation studies.</p> <p>The funding level decrease in FY 2011 is due to completion of additional experimentation initiatives funded initially in FY 2010.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued concept based technology program efforts. - Continued experimentation efforts with technologies developed in SwampWorks/Tech Solutions. - Continued to identify promising technology breakthroughs that can be prototyped and delivered to the warfighter for experimentation. - Continued development and demonstration of real time situational awareness technologies. - Continued Ship Affordability program to examine ship designs and construction processes and develop technologies that can significantly reduce the costs to conceive, design and construct naval ships. - Continued DDG-51 fuel efficient power & propulsion demonstrator effort. - Continued and completed Maritime Domain Awareness (MDA) augmentation. - Continued and completed effort to develop and demonstrate an integrated, affordable and minimally manned warfighting sensor capability to provide adaptive persistent surveillance leading to Operational Adaptation by Naval forces in defeating the Asymmetric and Irregular Warfare threat. 			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603758N: <i>Navy Warfighting Exp & Demo</i>	PROJECT 2918: <i>Navy Warfighting Experiments and Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued effort to develop and demonstrate integrated intelligence, surveillance, observation, and navigation technologies into a common operation picture accessible throughout the U.S. Government. - Continued development of network attack option models for near real time forensics and social network mapping. - Completed development of Autonomous Underwater Vehicle (AUV) large sensor network for persistent pervasive surveillance. - Completed at sea laser technology experimentation. - Completed effort to demonstrate shipboard high temperature degaussing technologies. - Initiated and completed advanced coupling for integrated in line high speed generator energy storage effort. - Initiated and completed experiments to demonstrate shipboard high efficiency solid state lighting technologies. - Initiated technology experimentation for Total Ownership Cost (TOC) reduction. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all FY 2010 efforts, less those noted as complete above. - Complete development of network attack option models for near real time forensics and social network mapping. - Initiate efforts to develop and demonstrate technologies to meet current or emerging operational needs. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all FY 2011 efforts, less those noted as complete above. - Initiate efforts to experiment and demonstrate technologies to meet current or emerging operational needs. 			
<p>Title: OPERATIONS ANALYSIS</p> <p>Description: The objective of this project is to provide operational analysis through studies, analyses, gaming and experimentation to identify Navy and Marine Corps capability needs that can be addressed with Science and Technology (S&T) solutions. The effort includes core analysis of S&T programs, military utility/capability gaps analyses, war gaming, structured experimentation events, the articulation of the results of that analysis and wargaming, and the development of innovation strategies and messages resulting from these analyses. Recent work includes development and execution of an Electromagnetic Railgun Innovative Naval Prototype (INP) Simulation Experiment (SIMEX); participation in additional SIMEX design, data collection and analysis events; wargame design in support of the ONR Office of Innovation; analytical, strategic planning, and wargaming support; organizing and conducting workshops and symposia that increase innovation outreach; and participating in Red Teaming and conceptual analysis.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued to conduct Military Utility Analyses of Future Naval Capability technologies. - Continued to conduct capability gaps analyses to identify areas that can be addressed with products from the S&T portfolio. - Continued to conduct SIMEX development, execution, data collection and analysis. 	2.799	2.864	2.855

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603758N: <i>Navy Warfighting Exp & Demo</i>	PROJECT 2918: <i>Navy Warfighting Experiments and Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<p>- Continued to conduct wargame design in support of the ONR Office of Innovation.</p> <p>- Completed the design and execution of the Electromagnetic Railgun INP SIMEX to explore operational utility of the technology in different scenarios.</p> <p>FY 2011 Plans:</p> <p>- Continue all FY 2010 efforts, less those noted as complete above.</p> <p>FY 2012 Plans:</p> <p>- Continue all FY 2011 efforts.</p>			
<p>Title: SWAMPWORKS</p> <p>Description: SwampWorks seeks to develop and demonstrate technologies that address emergent and enduring operational problems in an accelerated timeframe. Some of these technologies may end up in the hands of the warfighter for experimentation, or may culminate in a significant exercise that demonstrates capability then transitions into the Acquisition Program of Record (POR). Examples of recent successes are the half-length torpedo which led to the development of the SwampWorks Broadband Sonar and transitioned to the Mk 48 Advanced Capability program and the Aircraft Carrier Situational Awareness System, which will be incorporated into a POR. Examples of current efforts include a high resolution sonar for the new lightweight torpedo, energy storage and reduced energy consumption technologies, coherent stand-in jammer, full ship shock test simulation, effective active acoustics simulation, power and energy for unmanned vehicles, and technology investigation studies.</p> <p>The increase in funding in FY 2011 is due to an increased emphasis in developing and demonstrating technologies that address emergent and enduring operational problems in an accelerated timeframe. Among the efforts pursued during FY 2011 are advanced development of DC power components and systems for shipboard applications; development of advanced unmanned systems; development of advanced technologies for the new generation of DDG-51; increased emphasis on electronic warfare, reduction of Total Ownership Costs (TOC), and autonomy capabilities; and rapid development of advanced technologies that directly support Navy priorities due to shifting theatres of operation.</p> <p>The funding level decreases from FY 2011 to FY 2012 are the result of POM-12 refresh of ONR Leap Ahead portfolio as approved by DON S&T Corporate Board.</p> <p>FY 2010 Accomplishments:</p> <p>- Continued to identify enduring and emergent operational barriers identified by naval leadership and responded with relevant technology developments and demonstrations.</p> <p>- Continued novel heavy fuel propulsion system development.</p>	10.467	21.062	17.900

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603758N: <i>Navy Warfighting Exp & Demo</i>	PROJECT 2918: <i>Navy Warfighting Experiments and Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued and complete development of electronic warfare technologies that are responsive to fleet needs to counter emerging threats. - Continued and completed flight deck non-skid project. - Continued disruptive commercial technology studies at varied military, government, and educational institutions. - Completed thermal management project. - Completed underwater communication technology development project. - Initiated exploration of technologies to address emergent EW threats for surface and air platforms. - Initiated high risk/high payoff projects to explore significant reduction in TOC. <p>FY 2011 Plans:</p> <ul style="list-style-type: none"> - Continue all FY 2010 efforts, less those noted as complete above. - Initiate efforts to develop technologies to meet current or emerging operational needs. - Initiate investment in submarine control surface technologies to provide improved maneuvering capabilities and drastically reduce TOC. Programs include but are not limited to the Virginia class, and Ohio Class replacement programs. - Initiate investment in advanced electronic warfare technologies; projects are expected to be classified at a higher level. - Initiate investments in technologies to reduce TOC for the new generation of DDG-51 vessels. - Initiate investment in technologies to improve the new DDG-51, with specific focus on advanced propulsion, and power generation and distribution. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all FY 2011 efforts. - Initiate efforts to develop and demonstrate technologies to meet current or emerging operational needs. 				
<p>Title: TECH SOLUTIONS</p> <p>Description: Tech Solutions develops rapid response S&T solutions to immediate Fleet/Force needs identified by individual warfighters at the deckplate level. Sailors, Marines and Science Advisors submit their issues throughout the year via the Tech Solutions website, email, phone, or chain of command. Projects are initiated as requests come in and are completed in approximately twelve to eighteen months.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Developed, demonstrated and delivered technical solutions to all projects identified in the previous fiscal year. - Initiated development of projects that provide solutions to problems identified by Science Advisors and the Fleet/Force to address emergent critical needs. <p>FY 2011 Plans:</p>		8.536	9.547	9.613

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603758N: <i>Navy Warfighting Exp & Demo</i>	PROJECT 2918: <i>Navy Warfighting Experiments and Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Developed, demonstrated and delivered technical solutions to all projects identified in the previous fiscal year. - Initiated development of projects that provide solutions to problems identified by Science Advisors and the Fleet/Force to address emergent critical needs. <p><i>FY 2012 Plans:</i></p> <ul style="list-style-type: none"> - Developed, demonstrated and delivered technical solutions to all projects identified in the previous fiscal year. - Initiated development of projects that provide solutions to problems identified by Science Advisors and the Fleet/Force to address emergent critical needs. 			
Accomplishments/Planned Programs Subtotals	50.537	53.177	50.157

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Overall metric goals are to transition the 6.3 advanced technology projects into acquisition programs of record, demonstrate successful technologies to enable new operational concepts, and enable the production of technology products such as proofs of concept and manufacturing packages. The performance of the work funded in this PE is reviewed at several levels to ensure that the investment is relevant and productive. At the macroscopic level, the investment is coordinated with Navy Warfare Development Command and Commander, Fleet Forces Command to address the goals and objectives identified for Sea Trials and LOEs. At the microscopic level, the work funded in this PE is reviewed periodically by the Program Manager to ensure the investment is meeting the goals defined for each project. This review includes feedback collected from the warfighter community on all Sea Trials and LOEs to support the Program Manager's assessment of the value and relevance of each investment. Furthermore, the entire program is reviewed yearly by the Chief of Naval Research.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603782N: <i>Mine and Expeditionary Warfare Advanced Technology</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	31.804	21.941	6.048	-	6.048	11.864	17.926	24.496	30.277	Continuing	Continuing
2917: <i>Shallow Water MCM Demos</i>	27.631	21.941	6.048	-	6.048	11.864	17.926	24.496	30.277	Continuing	Continuing
4027: <i>Naval Innovative Science and Engineering</i>	2.580	-	-	-	-	-	-	-	-	0.000	2.580
9999: <i>Congressional Adds</i>	1.593	-	-	-	-	-	-	-	-	0.000	1.593

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (Feb 2009). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE primarily develops and demonstrates prototype Mine Countermeasures (MCM) and Expeditionary Warfare system components that support capabilities enabling Naval Forces to influence operations ashore. Third-world nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, including new generation mines having sophisticated performance characteristics, throughout the littoral battlespace. Real world operations have demonstrated the requirement to quickly counter the mine threat. Advanced technologies must rapidly detect and neutralize all mine types, from deep water to the inland objective. This program supports the advanced development and integration of sensors, processing, warheads and delivery vehicles to demonstrate improved Naval Warfare capabilities. It supports the MCM-related Future Naval Capabilities (FNC) Enabling Capabilities (ECs). Within the Naval Transformation Roadmap, this investment will achieve one of three key transformational capabilities required by Sea Shield as well as technically enable the Ship To Objective Maneuver (STOM) key transformational capability within Sea Strike.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603782N: <i>Mine and Expeditionary Warfare Advanced Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	30.256	21.941	9.135	-	9.135
Current President's Budget	31.804	21.941	6.048	-	6.048
Total Adjustments	1.548	-	-3.087	-	-3.087
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.179	-			
• SBIR/STTR Transfer	-0.604	-			
• Program Adjustments	-	-	-2.975	-	-2.975
• Section 219 Reprogramming	2.332	-	-	-	-
• Rate/Misc Adjustments	-	-	-0.112	-	-0.112
• Congressional General Reductions Adjustments	-0.001	-	-	-	-

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

Congressional Add: *JEOD Driver Situational Awareness Sys*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	1.593	-
	1.593	-
	1.593	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603782N: <i>Mine and Expeditionary Warfare Advanced Technology</i>				2917: <i>Shallow Water MCM Demos</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
2917: <i>Shallow Water MCM Demos</i>	27.631	21.941	6.048	-	6.048	11.864	17.926	24.496	30.277	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project primarily develops and demonstrates prototype MCM technologies that support a range of capabilities enabling Naval Forces to influence operations ashore. Third-world nations have the capability to procure, stockpile and rapidly deploy all types of naval mines, including new generation mines having sophisticated performance characteristics. Recent operations have demonstrated the requirement to counter the projected mine threat. Advanced technologies are required to rapidly detect and neutralize all mine types, from deep water to the inland objective. This project supports the advanced development and integration of sensors, processing, warheads and delivery vehicles. It supports the MCM-related FNC ECs.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
<p>Title: MINE/OBSTACLE DETECTION</p> <p>Description: This activity focuses on developing and demonstrating technologies that support detection, classification, identification and multi-sensor data fusion of mine and obstacle data to speed tactical timelines and increase operator standoff. Efforts include: electro-optic sensors/systems to enable Unmanned Aerial Vehicle (UAV) rapid minefield reconnaissance and precise mineline location from Very Shallow Water (VSW) through the Beach Zone (BZ); sensors/systems to enable cooperating Unmanned Underwater Vehicles (UUVs) to perform wide-area reconnaissance and assault lane reconnaissance/preparation from shallow water through the Surf Zone (SZ); sensor development for detection and classification of buried mines; technologies for MCM Mission Modules for the new Littoral Combat Ships (LCS); and sensor data fusion to enable a theater mine warfare common operating picture and own ship protection. This activity supports the development and transition of technologies for the MCM-related FNCs.</p> <p>This S&T investment supports the Joint Requirements Oversight Council of the Joint Chiefs of Staff and Office of the Chief of Naval Operations (OPNAV) validated requirements for MCM. This S&T investment of mine and obstacle detection provides critical S&T transitions to the Mine Warfare Mission package of the Navy's new LCS. This investment in MCM S&T is reported as part of OPNAV's annual report to Congress in the MCM Certification Plan. This plan is reviewed and approved by the Office of the Secretary of Defense, and any deviations in ONR's reported S&T funding for MCM throughout the Future Years Defense Plan must be reported and justified through Navy and OSD. Further, the MCM S&T investment plan structure is reviewed and authorized by the Navy's Technology Oversight Group that approves ECs, their supporting products, and funding profiles.</p> <p>The FY 2010 to FY 2011 funding decrease is due to the completion Future Naval Capability (FNC) - SHD-07-03 - Tactical UAV Sensor for Detection of Minefields (Buried Mines) in the Beach Zone.</p>	19.347	18.423	6.048

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603782N: <i>Mine and Expeditionary Warfare Advanced Technology</i>	PROJECT 2917: <i>Shallow Water MCM Demos</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
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The FY 2011 to FY 2012 funding decrease is due to the completion of Future Naval Capability (FNC) - SHD-07-01 - Buried Mine Sensor and Processing Development for Detection, Classification and Identification of Buried Sea Mines; MCM Data Fusion Techniques Using Multiple Unmanned Sensors and Systems; MCM Systems for Littoral Combat Ship, Advanced Flight, Mission Modules; and Undersea Cooperative Cueing and Intervention for MCM Operations.

FY 2010 Accomplishments:

- Continued advanced processing development for Low Frequency Broad Band to enable rapid detection, classification and identification of buried sea mines.
- Continued development of multi-platform fusion from high-resolution mine hunting systems (e.g. AN/AQS-20) for improved mine detection and avoidance.
- Continued multiple unmanned system MCM data fusion techniques for reduction in false alarms and reduction in tactical timelines.
- Continued technology development for multiple UUV Undersea Cooperative Cueing and Intervention in support of MCM operations.
- Continued planning for assault breaching systems exercise involving the mine detection systems.
- Completed development of Tactical Unmanned Aerial Vehicle (TUAV)-based SZ/BZ buried minefield detection capability.
- Completed field testing of prototype airborne buried mine sensors.
- Completed integration of buried mine sensors onto airborne platform and begin flight testing.
- Completed technology development, integration and early demonstration planning for MCM Mission Module systems for Advanced Flight LCS.
- Initiated development of iPUMA/Synthetic Aperture Sonar system to provide the first non marine mammal based mine detection and classification capability for confined or highly obstructed areas.
- Initiated development of Small Acoustic Color/Imaging Sonar system to provide the first non marine mammal detection, classification and identification capability for very shallow water (VSW) and reduce the false-alarm rate by x20 for all VSW mine threats.
- Initiated development of Long Range Low Frequency Broadband (LRLFBB) Sonar to significantly increase the minehunting area coverage rate.
- Initiated Phase 2 of Advanced Mission Module Technology Development.

FY 2011 Plans:

- Continue all FY 2010 efforts, less those noted as completed above.
- Complete planning and demonstration for combined assault breaching systems exercise involving the mine detection systems.
- Complete technology development for multiple UUV/Unmanned Surface Vehicle (USV) Undersea Cooperative Cueing and Intervention in support of MCM operations.

	FY 2010	FY 2011	FY 2012

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603782N: <i>Mine and Expeditionary Warfare Advanced Technology</i>	PROJECT 2917: <i>Shallow Water MCM Demos</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2010	FY 2011
<ul style="list-style-type: none"> - Complete Phase 2 of Advanced Mission Module Technology Development with a final demonstration. - Complete development of multi-platform fusion of high-resolution mine hunting systems (e.g. AN/AQS-20) for improved mine detection and avoidance. - Complete multiple unmanned system MCM data fusion techniques for reduction in false alarms and reduction in tactical timelines. <p>FY 2012 Plans:</p> <ul style="list-style-type: none"> - Continue all FY 2011 efforts, less those noted as completed above. - Initiate development of the compact Modular Sensor Suite for real time detection and classification of surface and near surface moored and drifting mines. - Initiate development of Mine Drift Prediction Tactical Decision Aid. 			
<p>Title: MINE/OBSTACLE NEUTRALIZATION</p> <p>Description: Mine and Obstacle Neutralization activity is focused on improving the capability to neutralize mines and obstacles from deep water through the beach exit zone. Efforts include the development of technologies for: stand-off breaching of mines and obstacles in the SZ/BZ; minesweeping and jamming of sea mines; and Autonomous Underwater Vehicle (AUV) neutralization of sea mines. Stand-off breaching efforts demonstrate a mine and obstacle breaching capability that is enabled by precision weapon guidance and Intelligence, Surveillance, and Reconnaissance (ISR), and delivered by Naval Tactical Aircraft (TACAIR) and USAF Bombers. Tactical performance of existing unitary bombs is being demonstrated. Other efforts will demonstrate a tactical countermine dart and dispenser concept. The minesweeping effort develops a mission package for deployment on Unmanned Surface Vehicles (USVs). Also, efforts will focus on improving an existing breaching weapon fuze and developing a precision assault lane marking navigation capability. This activity supports the development and transition of technologies for the MCM-related FNC ECs.</p> <p>The FY 2010 to FY 2011 funding decrease is due to the completion of Future Naval Capability (FNC) - AUV Technology for Neutralization of Mines in the Very Shallow Water; Precision Assault Navigation in Mined Environments and Assault Lane Marking; and Standoff Assault Breaching Weapon Fuze Improvement.</p> <p>The FY 2011 to FY 2012 funding decrease is due to the completion of Future Naval Capability (FNC) - AUV Technology for Neutralization of Littoral Mines.</p> <p>FY 2010 Accomplishments:</p> <ul style="list-style-type: none"> - Continued development of an autonomous mine neutralization system for VSW MCM. - Continued development of an AUV system for neutralization of littoral mines. 		8.284	3.518
			-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603782N: <i>Mine and Expeditionary Warfare Advanced Technology</i>	PROJECT 2917: <i>Shallow Water MCM Demos</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012
<ul style="list-style-type: none"> - Continued planning for assault breaching systems exercise involving the unitary warheads, precision navigation and lane marking. - Completed development effort to extend effectiveness of unitary warheads to greater depths and initiated planning of flight demo with Naval Special Clearance Team 1. - Completed technology development of precision navigation capability for targeting, safe navigation through assault lanes including lane marking. - Completed flight demonstration of the Joint Direct Attack Munition (JDAM) Assault Breaching System (JABS) with tactical mines in very shallow water. - Completed development of an autonomous mine neutralization system for VSW MCM. - Completed development of advanced Mine Warfare Mission module capabilities in support of the LCS Mine Warfare mission. - Initiated development of autonomous behaviors to improve neutralization efficiency of littoral sea mines. - Initiated Phase 2 of Advanced Mission Module Technology Development. <p><i>FY 2011 Plans:</i></p> <ul style="list-style-type: none"> - Continue all FY 2010 efforts, less those noted as completed above. - Complete assault breaching systems exercise involving the unitary warheads, precision navigation and lane marking. - Complete development of AUV system/technologies for neutralization of littoral sea mines. - Complete development of autonomous behaviors to improve neutralization efficiency of littoral sea mines. - Complete Phase 2 of Advanced Mission Module Technology Development with a final demonstration. - Initiate and complete demonstration of autonomous neutralization of littoral sea mines. 			
Accomplishments/Planned Programs Subtotals	27.631	21.941	6.048

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• 0602782N: <i>MINE AND EXPEDITIONARY WARFARE APPLIED RESEARCH</i>	15.934	11.308	6.951	0.000	6.951	2.046	1.257	0.505	0.000	0.000	38.001

D. Acquisition Strategy
Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603782N: <i>Mine and Expeditionary Warfare Advanced Technology</i>	PROJECT 2917: <i>Shallow Water MCM Demos</i>

E. Performance Metrics

The overall metrics of this advanced technology program are the development of technologies supporting the Mine and Expeditionary Warfare challenges of reducing the MCM tactical timeline from months to days and eliminating the need for Navy divers and manned equipment to enter minefields. Another important metric is the scheduled transition of 6.3 advanced technology projects from the FNCs program into Navy and Marine Corps acquisition programs at agreed upon Technology Readiness Levels. Technology-specific metrics include: Mine warfare data fusion capabilities yielding a 10%-25% reduction in time and risk to mine hunting activities; Mine hunting sensors - Probability of Detection = 95%, Probability of Identification of Proud Mines = 90%, Probability of Classification of Buried Mines = 80%; Unmanned Systems for MCM sized for inclusion in the Littoral Combat Ship Mine Warfare Mission Package; MCM sensors sized, packaged and capable of 12 hour missions with a search rate greater than .05 square nautical mines per hour; Mine sweeping: Modular magnetic and acoustic influence sweeping systems packaged for deployment from Unmanned Surface Vehicles; Minesweeping single sortie coverage > 9.4 square nautical miles at 20 nautical miles per hour during a 4 hour mission up to Sea State 3; Surface-laid mine and obstacle breaching capability > 90% in the Beach Zone (BZ) using unitary warheads, and > 80% in the Surf Zone (SZ).

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603782N: <i>Mine and Expeditionary Warfare Advanced Technology</i>				4027: <i>Naval Innovative Science and Engineering</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
4027: <i>Naval Innovative Science and Engineering</i>	2.580	-	-	-	-	-	-	-	-	0.000	2.580

A. Mission Description and Budget Item Justification

Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012
Title: Naval Innovative Science and Engineering	2.580	-	-
Description: Funding supports research and development efforts as directed under Section 219 of the fiscal year 2009 Duncan Hunter National Defense Authorization Act.			
FY 2010 Accomplishments: Section 219 (Naval Innovative Science and Engineering) included in the FY 2009 Duncan Hunter National Defense Authorization Act, established mechanisms whereby the director of a naval laboratory may utilize up to three percent of all funds available to the laboratory to sponsor individual projects for:			
<ol style="list-style-type: none"> 1. Innovative basic and applied research that is conducted at the laboratory and supports military missions; 2. Development programs that support the transition of technologies developed by the defense laboratory into operational use; 3. Development activities that improve the capacity of the defense laboratory to recruit and retain personnel with needed scientific and engineering expertise; and 4. The revitalization and recapitalization of the laboratories. 			
Accomplishments/Planned Programs Subtotals	2.580	-	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

The overall metrics of Section 219 is to increase retention and recruitment; number of advanced degrees, patent awards, and technical papers; successful technology transition to the warfighter; and laboratory ability to conduct innovative research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Navy **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
1319: <i>Research, Development, Test & Evaluation, Navy</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603782N: <i>Mine and Expeditionary Warfare Advanced Technology</i>				9999: <i>Congressional Adds</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	1.593	-	-	-	-	-	-	-	-	0.000	1.593

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011
Congressional Add: JEOD Driver Situational Awareness Sys	1.593	-
FY 2010 Accomplishments: This effort developed better analytical tools and up-to-date training curriculum to Joint Explosive Ordinance Disposal Diver (JEOD) forces so they can not only better detect adversaries' evolving tactics, training, and procedures (TTPs) but can rapidly adapt to and defeat the enemy's evolving capabilities in the battlefield while minimizing casualties.		
Congressional Adds Subtotals	1.593	-

C. Other Program Funding Summary (\$ in Millions)

N/A

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Congressional Interest Items not included in other Projects.

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