

NOT FOR PUBLICATION UNTIL RELEASED BY THE
HOUSE ARMED SERVICES COMMITTEE
TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES SUBCOMMITTEE

STATEMENT OF
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BEFORE THE
TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES SUBCOMMITTEE
OF THE
HOUSE ARMED SERVICES COMMITTEE
ON
DEFENSE SCIENCE & TECHNOLOGY POLICY AND
THE FISCAL YEAR 2009 BUDGET REQUEST

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Introduction

It is an honor to appear before you to update you on Science and Technology (S&T) efforts within the Department of the Navy and to discuss how the President's Budget Request for FY 2009 supports the Navy and Marine Corps team.

The Naval S&T challenge is to enable revolutionary operational concepts that support the Navy and Marine Corps vision of the Secretary of the Navy, Chief of Naval Operations and Commandant of the Marine Corps. They envision a force that is expeditionary, distributed, persistent, forward deployed and capable of prevailing in any scenario manifested by today and tomorrow's threat environments. Leveraging innovative concepts, advanced technologies, and new business practices to increase fighting effectiveness, the Office of Naval Research (ONR) S&T portfolio plays an increasingly critical role in the Navy and Marine Corps' strategic vision.

In order for our S&T enterprise to address critical problems facing today's fleet and force, as well as the Navy/Marine Corps of tomorrow – we must do three things: First, focus on areas that provide the biggest payoff for the Navy/Marine Corps of the future. Second, be innovative in our thinking, science, and business processes. Third, improve our ability to transition S&T to acquisition programs and into the Fleet. The President's Fiscal Year 2009 Budget requests \$1.84 billion in the Navy S&T portfolio to accomplish these goals. This reflects a 6% increase over the requested FY 2008 level.

S&T Strategic Plan

Early in 2007, an updated Naval Science and Technology Strategic Plan was approved by Navy and Marine Corps leadership. It ensures alignment of Naval S&T with current Naval missions and future capability needs. It also ensures that S&T has a long-term focus, responds to near-term requirements, and makes our vision clear to decision makers, S&T partners, customers and performers. The Strategic Plan identifies 13 key areas where S&T investment will have high payoff in supporting the Navy and Marine Corp requirements. Those areas are:

NAVAL S&T STRATEGY FOCUS AREAS

- Power & Energy
- Operational Environments
- Maritime Domain Awareness
- Asymmetric and Irregular Warfare (Combating Terrorism)
- Information, Analysis and Communication
- Power Projection
- Assured Access and Hold at Risk
- Distributed Operations
- Naval Warrior Performance and Protection
- Survivability and Self-Defense
- Platform Mobility
- Fleet/Force Sustainment
- Affordability, Maintainability, Reliability

Examples of work we are doing in these areas include:

In the Information, Analysis and Communication Focus Area we are working to enhance decision making tools, reduce information overload, and prevent disruption-causing degradation to enable a commander's decision making at both tactical and strategic levels. We want to promote rapid, accurate, decision making by providing decision aids, enhanced communication networks, and security in an increasingly active cyber war environment. We have identified key research topics that will move us toward achieving these goals.

In the Naval Warrior Performance and Protection Focus Area, our goal is to enhance warfighter performance in all environments through training technologies, human systems integration, and casualty management. We want to shorten training time, maximize training impact, enhance understanding of human cognition and stress in combat environments, and equip forces with the resilience to successfully adapt to a full range of military experiences and threats. We are concerned with issues ranging from providing lighter armor and equipment, to human factors associated with organizational design and resource management.

In the Affordability, Maintainability and Reliability Focus Area, we want to reduce acquisition and life cycle costs for platforms and systems through new design tools, reduced maintenance, intelligent diagnostics, and automation. We want to make platforms affordable, durable, reliable, predictable, energy efficient, wear and corrosion resistant, at the same time we reduce manpower requirements. We have identified key research topics to move us toward achieving these goals.

Executing the Strategy

We execute our Basic Research (6.1) thru Advanced Technology Development (6.3) funds by breaking the S&T continuum down into three key areas – Discovery and Invention (D&I), Innovative Naval Prototypes (INP), and Future Naval Capabilities (FNC).

Discovery & Invention

Discovery and Invention (D&I) is basic research and early applied research (6.2) focusing on areas where we have unique naval needs or support capabilities essential to the naval mission. We believe investment in this area is necessary to ensure we maintain technical advantages for our Naval forces. The D&I vision is to develop Naval-relevant fundamental knowledge, provide the basis for future Navy/Marine Corps systems, and maintain the health of the Defense Scientist and Engineer workforce.

Approximately 41% of our S&T investment is in our D&I program. This represents a \$75M increase over our FY 2008 Budget request. This increase supports our historically strong commitment to the foundational work done in D&I and reflects the desire of the Congress, President and Secretary that we maintain a robust and vibrant Basic Research investment. We allocate that money across core research areas through a rigorous process to weigh relevance, impact on the Navy/Marine Corps mission, and potential for innovative performance in order to select the best mix of research areas and projects. This builds the foundation of our S&T portfolio, developing a broad base of scientific knowledge and innovation from which our INP, FNC, and quick reaction efforts are generated.

One new initiative in this area is a Basic Research Challenge Program designed to stimulate new investments focused on opportunities that exist in the seams between technical fields of science. These represent new areas of research for ONR with an ability to attract new researchers in such areas as: 1) Quantum Information Sciences and the Future of Secure Computation, 2) Autonomous Devices for Advanced Personnel Treatment, 3) Brain Imaging of Active Cognition in Mobile Environments, and 4) Compressed Sensing for Networked Information Processing.

In 2007 we conducted a rigorous review of approximately half the D&I portfolio. An external panel (including experts from university, industry, and other DoD organizations) examined research areas to assess performance with respect to Naval impact, S&T quality, and programmatic risk. The panel also reviewed overall direction of the portfolio, evaluated whether there were promising research areas we had not invested in, and additional opportunities for collaboration. The panel found that overall performance of the D&I portfolio was very strong; while encouraging expanded collaboration in multidisciplinary areas such as sensors, autonomy, and networking. We will conduct another peer-review of the other half of the D&I portfolio this June.

Highlights of contributions resulting from D&I investments include:

Human Behavior Modeling, with the goal of developing instructional systems and models of human cognition and performance, supports the design of advanced, simulation-based, Naval training systems. Accurate modeling of individual behavior poses only moderate technical challenge, but computational modeling of groups, teams, crowds, and organizations is highly

challenging and involves modeling communication, co-ordination, group cohesion, and cultural influences. This program seeks to develop realistically behaving synthetic crewmates and adversaries to provide challenging training for Navy and Marine Corps warfighters with effectiveness and affordability far exceeding what is currently available. Elements of this program, such as modeling of synthetic insurgent forces for Marine Corps urban warfare training, transitioned to the U. S. Marine Corps (USMC) Deployable Virtual Training Environment Program in FY 2007.

An important enabling component of D&I is the Defense University Research Instrumentation Program (DURIP), designed to support the university research infrastructure essential to high quality Navy relevant research. This instrumentation program complements other Navy D&I programs by supporting the purchase of high cost research instrumentation necessary to carry out cutting-edge research. ONR awarded 68 grants to universities to purchase instrumentation to support D&I research in FY 2007, expects to award approximately 80 grants for that purpose in FY 2008, and estimates the award of 140 grants for that purpose in FY 2009.

One of the largest contributions made through D&I investments is development and sustainment of the S&T workforce. In tandem with participants in the Naval Research Enterprise (NRE), we provide outreach, education and research opportunities to a diverse population of undergraduate and graduate students, fellows, future faculty members and researchers. This is achieved through specific programs which expose students and researchers to the work done at Naval laboratories, as well as other research opportunities. We support the HBCU/MI community through targeted education and research partnerships. Through a variety of demonstration, apprentice, awards, and graduate programs, we encourage young men and women to consider and explore S&T careers in academia, the Naval labs, and industry.

Innovative Naval Prototypes

The Innovative Naval prototype (INP) program continues to show great progress in 2007-2008 and the FY 2009 investments will keep it on track. INPs are the primary portion of our Leap Ahead Innovations portion of the S&T continuum which is \$197M or 11% of the budget request. They focus on those high risk, high payoff, game changing opportunities emerging from the D&I portfolio that can have a significant impact on naval capabilities if we can mature the technology sufficiently. Because these efforts are often discontinuous, disruptive technologies that may represent radical departures from established requirements and concepts of operations, they are approved and overseen by the DoN S&T Corporate Board consisting of the Assistant Secretary of the Navy (RD&A), the Assistant Commandant of the Marine Corps and the Vice Chief of Naval Operations. The goal is to prove out the concepts and mature the technology within 6-12 years to allow informed decisions on whether to transition it to an acquisition program of record and to have significantly reduced the technological risk at the time of transition.

We have seen major milestones met in all four of our current INPs. We have developed and tested a new more powerful lab gun in our Electromagnetic Rail Gun program. Our tactical satellite program has met all of its goals and will complete in FY 2010 with most of the technology and some of the people transitioning to the Operationally Responsive Space program. We completed a major trial of our Persistent Littoral Undersea Surveillance (PLUS) program and

conducted a major Autonomous Underwater Vehicle (AUV) trial with over 70 vehicles from all over the world participating. Finally, we have selected three intriguing concepts for further design and model testing in our Seabasing Enabler program. Additionally, we have increased investments in our D&I programs in anticipation of starting two new programs targeted for FY 2010 – moving the Navy to fight at the speed of light by bringing high power laser technology to sea for ship defense and dominating the electromagnetic spectrum through the development of multifunction apertures for all classes of ships. A key component of this effort is to look at the ability to bring the concepts of open architecture to hardware systems as well as software.

Future Naval Capabilities (FNCs)

One of our highest priorities continues to be improving transition of deployable S&T products, more rapidly and with less risk to acquisition managers or directly to end users. We are building regular, early partnerships between scientists and acquisition managers in an effort to improve transition. It is critical that acquisition managers understand what capabilities and technologies are on the way from S&T and that they determine how they best fit in their program of record, well before they arrive. It is equally important for S&T managers to understand factors driving acquisition managers, and be sensitive to when acquisition managers are best able to handle new technologies and when the window for inclusion of new technology is closing. In the past, that relationship was often established too late for us to be as effective as we could be.

While not the only means for S&T to transition to the Fleet, our Future Naval Capability (FNC) program is the most critical component of our transition strategy. FNC investments were restructured in 2005 to better align this “requirements-driven, transition-oriented” portion of the S&T portfolio to Naval Capability Gaps identified by OPNAV and Marine Corps Combat Development Command (MCCDC) through the Naval Capabilities Development Process.

As opposed to high-risk/high-payoff INP projects, FNCs involve more near-term projects. FNCs are included in the portion of our budget focusing on Acquisition Enablers (totaling \$655M or about 36% of our overall budget). The FNC process delivers maturing technologies to acquisition managers for timely incorporation into platform, weapon, sensors, and process improvements.

FNC projects are based on earlier D&I investments, where technology has matured to the point that they can achieve a Technology Readiness Level (TRL) of 6 or better within 3-5 years. FNC projects are selected annually to address specific capability gap needs, with final prioritization approved by a 3-Star Technology Oversight Group (TOG) representing OPNAV/USMC, U.S. Fleet Forces Command (USFF), Assistant Secretary of the Navy for Research, Development and Acquisition (ASN-RDA) and ONR. Enabling Capabilities (ECs) selected represent the highest Navy/Marine Corps priorities.

All approved technology products are required to have Technology Transition Agreements that document the commitment of the resource sponsor, acquisition program, and ONR to develop, deliver and integrate products into new or upgraded systems that can be delivered to Fleet/Force. Every FNC product’s progress and transition status is reviewed annually. Products that no longer have viable transition paths are terminated and residual funding used to solve unexpected

technology development problems with existing ECs, or start new ECs, in strict compliance with established DoN priorities.

There are currently 169 FNC projects underway in various stages of their 3-5 year development. 36 are expected to complete and transition in 2008. The FY 2009 budget request continues funding for the remaining projects and initiates an additional 28. FY 2008 transitions include algorithms and computer programs for integrating real-time sensor data and non-real time data to reduce target track and identification conflicts; integrating object recognition and tracking algorithms, machine vision, multiple network video streams, geospatial data and operational context to flag atypical activity and recognize known threats;

We plan to complete and transition an additional 20 projects in FY 2009. They include a single stress tolerance metric for implementation into the Aviation Selection Test Battery, a buoy-based deep water active surveillance system to maximize Anti-Submarine Warfare engagements, and upgrades to guided and unguided weapons through the addition of fire and forget/off boresight capability.

The critical measure of success of this program is whether the project met its technology requirements and exit criteria, and whether the acquisition program manager has transition funding within the program plan to accept and integrate the FNC product into the program. As shown in the table below, we have had good success in this effort and continued to improve our transition rate from 2005 to 2007. We expect equally strong performance in 2008.

FNC Transition Summary	FY05		FY06		FY07	
	# Products	% Plan	# Products	% Plan	# Products	% Plan
Products Planned to Complete	30		27		41	
S&T Completed or near complete with Manageable Risk	28	93%	26	96%	39	95%
S&T Completed or Near Complete and Transition Funds Programmed	20	67%	25	93%	29	71%
S&T Completed or Near Complete and Transition Funds Planned	4	13%	0	0%	8	20%
S&T Completed and No Transition Funding	4	13%	1	4%	4	10%

Increases and Decreases in FNC Funding Levels

Because FNC investments are not level funded, but focus on the most pressing capability gaps identified each year, they generate movement in funding levels for the associated PEs from year to year. Since FNC investments mature and develop technology products over a 3-5 year period, the Technology Readiness Level (TRL) of the underlying products moves from 6.2 PEs to 6.3 PEs. Typically, but not always, the first year of an EC is predominantly 6.2; the final year is predominantly 6.3 – with a mix of 6.2/6.3 in-between. Furthermore, in a given year, as products are delivered and transition to Advanced Component Development and Prototypes (6.4) funding, new FNC projects are not necessarily in the same PEs as those just completed. Although these changes may appear to be PE program growth, they actually reflect realignment of funds in

response to successful technology transition – coupled with reprioritization based on evolving Naval needs and requirements.

Current S&T Program Highlights

In the Naval S&T portfolio there are a wide range of projects either entering the fleet or poised to do so in a short time. I have included examples of those efforts with respect to the direct impact they will have on Sailors and Marines, both today and in the future.

Manpower, Personnel, Training and Education (MPT&E)

For FY 2008, ONR's Capable Manpower FNC is focused on developing innovative, technology-based products to support Navy/Marine Corps Human Capital programs. These include manpower, personnel, and training products that will provide new approaches to selection, classification, training, distribution, assignment, and job performance to ensure that future combatants and sea-service components are properly staffed for optimal readiness.

In the domain of manpower and personnel the Force Utilization Through Unit Readiness and Efficiency (FUTURE) program blends behavioral research and economic theory in a virtual experimental environment. It employs artificial intelligence and optimization techniques to create simulation-based decision support tools to determine resource allocation and cost-benefit assessments across units and battle groups. Web-based tools house a multifaceted simulation environment to assess the impact of alternative human resource allocation policies on individual, team, and unit efficiency, readiness, and costs. This research provides unprecedented visibility over costs, enables Navy to decentralize human resources management, and enables a deeper understanding of how policies and incentive options affect behavior.

Human Systems Integration training products are under development to enable advanced design methodologies and tools supporting rapid, spiral, human-centered design processes which will support the total life cycle of complex naval systems. Further, Capable Manpower is studying methodologies to improve commanding officer/crew situational awareness in the increasingly stressed tactical and strategic operations of the 21st Century.

We are working to improve training for Expeditionary Warfare by developing and evaluating company/battalion-level command and control (C2) performance support systems, automated performance assessment, real-time/model-based performance diagnosis and training strategies. This will support multi-tasking in team environments, provide system assistance based on dynamic monitoring of user-state and system-state, and increase skill proficiency and retention.

Infantry Immersion Trainer

The Infantry Immersion Trainer (IIT) is a revolutionary training system that prepares Marines and Sailors for deployment to today's battlefields. The facility uses virtual reality, actual physical structures, and live role players to re-create foreign urban scenes – right down to the sounds and smells – to give troops the necessary skills to win and survive in battle. The first IIT facility opened in December, 2007, at Camp Pendleton. The IIT environment places warfighters

in a realistic combat scene, confronting them with a range of possible scenarios that require split-second decisions and action. The high-tech simulation provides a safe environment for learning how to prevent fatal errors before being exposed to the real threat. IIT uses sets, sound systems and special effects – including holograms and pyrotechnics – to simulate a Southwest Asian village in the midst of combat. Equipped with laser-tag-like weaponry, Marines walk through realistic dwellings, alleys and other settings, encountering civilians and enemy combatants for a more realistic training experience.

IIT software-based systems allow for rapid improvement of training delivery and the simulated scenarios can be tailored to suit mission or individual needs. Repeatable and scaleable scenarios increase skills in less time, and sights, sounds, and smells of combat are reproduced in exacting detail. A second IIT facility is scheduled to open at the Marine Expeditionary Rifle Integration Facility in Quantico in 2008. The IIT system incorporates several ONR-sponsored technologies, DARPA initiatives in game-based simulators, as well as technologies sponsored by the U.S. Army Research Development and Engineering Command's Institute for Creative Technologies at the University of Southern California.

Marines in the Urban Environment

Urban combat presents challenges above and beyond those present in rural combat or more open environments. Particularly challenging are communications, GPS reception, intelligence collection and dissemination, and observation and location of enemy forces. Building, walls, and similar structures, along with their complexity, make urban combat costly in time, effort, and forces required.

We are working to develop technologies that will give our forces distinct advantages in urban combat. In conjunction with Army and DARPA efforts, we are advancing “See-thru-walls” technology to enable Marines to locate people inside buildings and individual rooms prior to entering. This will help take the initiative from the enemy and give it to our Marines, while increasing force protection at the same time.

Finally, work continues to develop “trajectory shaping” for the 81mm mortar to allow precision fires in an urban environment. The 81mm mortar is organic to Marine Infantry Battalions and can provide immediate fire support. The complexity and structures of the urban environment greatly limit accuracy and effectiveness of these weapons. The ability to “shape” the trajectory will allow greater use, accuracy, and effectiveness of these weapons.

Improvised Explosive Devices (IEDs)

Working closely with the Joint IED Defeat Organization (JIEDDO), ONR funds research efforts aimed at attacking both IED networks and devices, as well as enhancing training for our forces. We are committed to research complementary to other DoD and U.S. efforts and to fostering collaboration with our allies.

In conjunction with work in other agencies, ONR is investing in prediction efforts involving dynamics of terrorist movements, analysis of human activity associated with placement,

uncovering support networks, tracking factory locations and events, bio-forensic profiling for tracing place of origin, and dynamic analysis of suicide bombing. These projects anticipate future threats, as well as put us in a better position to respond as conditions change.

Detection efforts are geared towards enhancing the ability to achieve persistent surveillance of the battlespace – understanding, identifying, and locating activities associated with manufacture, transport, and placement of IEDs. Near-term initiatives include the Marine Corps Advanced Technology Development efforts to neutralize IEDs through improved countermeasures as well as locating and directly attacking the device.

ONR is heavily involved in maturing technologies and concepts that support the Joint Light Tactical Vehicle, advanced lightweight personnel protective equipment, and medical prevention and treatment of traumatic injuries to our Sailors and Marines. In addition, ONR has increased emphasis on countering IED threats in the Riverine environment. This environment poses unique challenges different from their land counterparts.

As the science behind these approaches matures, we continue to work closely with JIEDDO, and other organizations, for implementation in mature systems and push the enhanced capabilities forward for the warfighter. Through the outreach efforts of our program officers and the ONR Global office, we continue to expand and enhance our collaboration with international partners.

Medical Research related to IEDs and Hearing Loss Prevention

ONR continues to work closely with the medical community to understand the devastating effects from IEDs and has collaborated with many organizations to develop a tool to connect medical and event data to allow in-depth analysis. Warfighter Protection Advanced Technology Development efforts include modeling of human response to blast, ballistic, and blunt trauma effect, as well as modeling physical and cognitive effects of blast exposure and conditions arising from traumatic brain injury.

Another area of emphasis is on reducing the damage caused by personnel operating in high noise environments. We have been challenged by Navy and Marine Corps leadership to address this problem and are working closely with the medical, acquisition and S&T communities to attack this from multiple approaches to reduce the noise generated, attenuate what noise still exists, monitor and assess exposure, and warnings and procedures to ensure that exposure does not become damaging and finally treatment in the event potentially damaging exposure does occur.

Vertical Lift

In recognition of the important role, and potential enhanced capabilities, of rotorcraft in current and projected combat operations, humanitarian relief, and other important Naval missions, ONR continues to invest in vertical lift technology. The current program includes research into new concepts such as a dual ducted fan vehicle for urban operations, vehicle systems for automated resupply, and options for a future Joint Multi-Role aircraft.

Technologies of particular interest to Naval applications, such as durable composite structures and modeling of ship and air wake interactions, including air vehicle dynamic interfaces, are being developed. Technology investments to enable future high speed vertical lift aircraft are being leveraged through partnership with the Army and Defense Advance Research Projects Agency (DARPA) in the Joint Heavy Lift (JHL) program. The ship compatibility attributes of a potential future JHL are also being investigated.

ONR continues its commitment to the rotorcraft community by partnering with the Army and Federal Aviation Administration (FAA) in applied research investment via the National Rotorcraft Technology Center (NRTC). These investments not only show benefits from the synergy of collaborative planning and execution, but are cost shared by the Center for Rotorcraft Innovation, a consortium of industry and academia.

In basic research, our long-term vision for Vertical Take Off and Landing (VTOL) aircraft combines improved Naval mission effectiveness, increased affordability, maintainability, reliability, and unprecedented levels of safety and survivability for aircrews. To achieve these breakthroughs we will join with the Army in the Vertical Lift Research Center of Excellence, with participation from Navy labs, Air Force, NASA researchers, and the most highly qualified and innovative performers from academia.

Power Projection and Time Critical Strike

Revolutionary Approach To Time Critical Long Range Strike (RATTLRS) is a Navy, Air Force, NASA, and OSD interagency cooperative program, to develop a high speed non-afterburning turbine, Mach 3 flight demonstration program for a future expendable high speed strike weapon, while also enabling potentially new options for access to space. We are projecting to achieve first flight in FY 2009, with a non-afterburner high-Mach turbine engine accelerated flight demonstration.

While still being developed, RATTLRS has already generated interest, support, and transitioned some subsystems technologies into advanced applications. For example, the Air Force Research Laboratory (AFRL) and DARPA, transitioned the RATTLRS core engine to further development for the joint HiSTED (High-Speed Turbine Engine Demonstration) program and plans to ground test the engine near Mach 4 flight conditions in 2008.

Additionally, the DARPA/USAF Falcon HTV-3X Program is developing a turbine based combined cycle (turbojet/dual-mode scramjet) propulsion testbed known as Blackswift. The Falcon program plans to use RATTLRS core engine for its turbine accelerator, as well as RATTLRS airframe fuselage and control surface manufacturing techniques.

Affordable Platforms

ONR efforts such as the Navy Manufacturing Technology (ManTech) Program and our Enterprise & Platform Enablers FNC contribute to improving affordability in acquisition programs and throughout the lifecycle of systems and platforms.

The CNO's directive on affordability and cost-cutting in shipbuilding led to a major restructuring of the Navy ManTech portfolio in 2006. This reemphasis led ManTech to focus on shipbuilding solutions that cut acquisition costs. Currently, ManTech has focused shipbuilding affordability initiatives with four platforms: DDG 1000, CVN 21, Littoral Combat Ship, and VIRGINIA Class Submarines.

For example, the Virginia Class Submarine (VCS) Focused Initiative has 31 active projects with approximately 24 more slated to begin later in FY 2008-09. Projects are focused on developing and transitioning process improvements involving Design for Production, Production Planning, Schedule Compression, and Outfitting. ManTech, in concert with the contractors and Program Office, bi-annually assesses likely cost savings resulting from implementation of the developed technology. In the most recent assessment, 33 VCS projects were reviewed involving a combined ManTech investment of approximately \$28.0M, with resulting savings estimated to exceed \$36.3M per hull.

The FNC program has been equally active in this area with technologies transitioning in FY 2007 in such areas as engine turbine technology, advanced coating and components, improved aircraft circuit breaker designs, non-destructive testing of composite structures, and corrosion reduction. It has been estimated that these programs alone will save more than \$1.8B over the lifecycle of the numerous systems and platforms where they will be applied.

Future Power Systems

ONR is investing in advanced technologies for high efficiency electrical systems and equipment to meet the increasing electric power requirements for advanced weapons, launchers and defense systems aboard ships and submarines. Our S&T focus is on technologies and system architectures to increase power and energy densities and energy efficiency, with the goal of reducing the impact of high-power electrical power systems on ships. These efforts directly support NAVSEA's Electric Ship Office's (ESO) Next Generation Integrated Power Systems Roadmap.

In coordination with the OSD focus on energy security, we initiated a Naval Future Fuels effort to investigate the impact of new fuel formulations on Naval machinery. Additionally, we are using the FY 2008 committee initiative for alternative energy to augment and expand Department programs in energy security related programs in advanced, high efficiency solid oxide and direct boron hydride fuel cells and continue to support research in methane hydrate, biomass, wave action, and other alternative sources of energy.

Electromagnetic Warfare and Cyberspace

This budget request continues a strong investment in our ability to ensure we can operate while inhibiting an adversary's ability to use the electromagnetic spectrum. Additionally we have strengthened our investment in cyber space, particularly in the areas of protection, information assurance, anti-tamper protections, information and software science. Recent CNO Strategic Studies Group work on cyberspace and maritime operations has helped us think through how to

best focus those investments to maximize support for naval operations in the future. We are coordinating closely with the initiatives that OSD, Air Force and DARPA have in this area.

Marine Mammals and the Environment

A significant S&T effort is dedicated to effective and responsible stewardship of the marine environment, and this specifically includes the impact of national security requirements and activities on fish and marine mammals. Navy is the worldwide leader in marine-mammal research, with ONR spending approximately \$13 million annually on research to understand how marine mammals may be affected by sound. Total Navy investments represent a majority of the dollars spent on this research in the U.S., and nearly half spent worldwide.

As I reported last year, the Navy collaborates with universities, institutes, industry, conservation agencies, and independent researchers around the world to better understand what combinations of ocean conditions, geography, and sonar usage could potentially impact marine mammals and the environment. Congress has been generous in support of these programs and I look forward to continued partnership in achieving the goal of better protecting the marine environment.

Notable progress was made last year and we are accelerating investments in this research in FY 2008 and 2009. We are specifically leveraging the capabilities for Marine Mammal Monitoring on Ranges (M3R) at the Atlantic Undersea Test and Evaluation Center (AUTECE), by taking advantage of that resource in our Behavioral Response Study. In addition we are exploring use of radar and autonomous underwater gliders equipped with hydrophones to detect marine mammals in our Accelerated Monitoring Technologies program, with the goal of improved detection of marine mammals over current methods without interfering with training realism both on and off range.

Understanding the Sea

We are a Service of the Sea and must continue to research and understand the marine environment to better understand how to use it to support Naval missions. Highly capable research vessels are critical to the success of our basic and applied programs in ocean sciences. Since 1972, ONR has partnered with the National Science Foundation and other agencies in the University National Oceanographic Laboratory System (UNOLS) to allow joint scheduling and operations of a fleet of research ships used by the academic oceanographers.

The FY 2009 Budget request continues that partnership with the next generation of Ocean Class research vessels. It funds a Phase I award for the Functional Design by the Program Executive Office (PEO) Ships. This will support a planned Phase II award in FY 2011 to start construction of the lead ship with planned delivery in FY 2014.

Conclusion

I want to thank you again for the opportunity to discuss initiatives undertaken by Naval S&T and your Navy/Marine Corps team and for your strong support of our effort in the past. The FY 2009 President's Budget request is about both prevailing in today's wartime environment and bridging

to a strong, flexible, and pre-eminent Naval force in the future. Building that bridge requires careful S&T investments that will protect this nation and our war fighters long into the future.

In executing the S&T Strategic Plan, we must monitor, assess and leverage emerging S&T in a global environment. The worldwide movement of technology and innovation demands that we be able to take advantage of emerging ideas and science wherever they originate, and we have an aggressive worldwide presence to ensure we do just that.

We continue to focus the majority of our investment on external performers – those outside the Naval R&D system in order to tap into the full spectrum of innovative thinking and discovery. Nevertheless, we need to nurture the world class skills and innovation that exist within our lab system, especially at the Naval Research Laboratory (NRL).

Investments must be balanced between long range discoveries from Basic Research and near term products of 6.3 programs. We must ensure the S&T well remains deep in support of the next generations of Sailors and Marines, while focusing on transition of innovative concepts and technology to today's warfighters – all at the same time. S&T is not an end in itself, but a means to the end of supporting our Sailors and Marines today and in the future.

We have a near term focus on Iraq and Afghanistan and a long term focus on strengthening the Navy and Marine Corps ability to meet any challenge in any security environment. We are moving toward greater integration of capabilities, more effective partnership between research and acquisition worlds, and a broader vision of how to achieve shared goals with DARPA, Army and Air Force research organizations. This is evidenced by the Navy S&T Strategic Plan, by real increases in the President's FY 2009 S&T budget, and by the fact that approximately 10% of our portfolio involves ONR partnerships with these and other organizations.

I believe the state of our S&T investments is sound, represents careful stewardship of taxpayer dollars, and will make significant contributions to our war fighters as they serve in defense of the United States, both today and in the future. Thank you again for your support.