

# ***ONR Electronic Warfare S&T Industry Day***



*Revolutionary Research . . . Relevant Results*

**18 December 2012**

**Dr. Peter Craig**

**Electronic Warfare Program Manager**

**C4ISR Department**

**Office of Naval Research**

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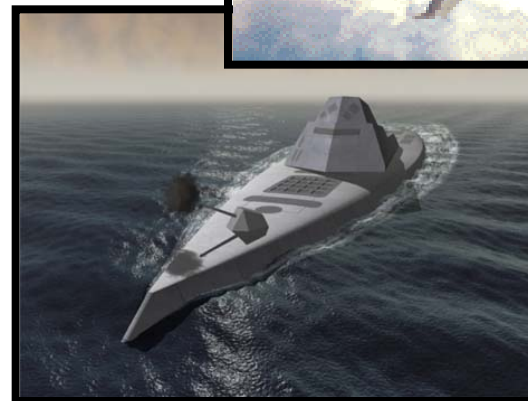
# Office of Naval Research Science & Technology



***ONR Mission:*** To plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the preservation of national security; and to manage the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test, and evaluation.

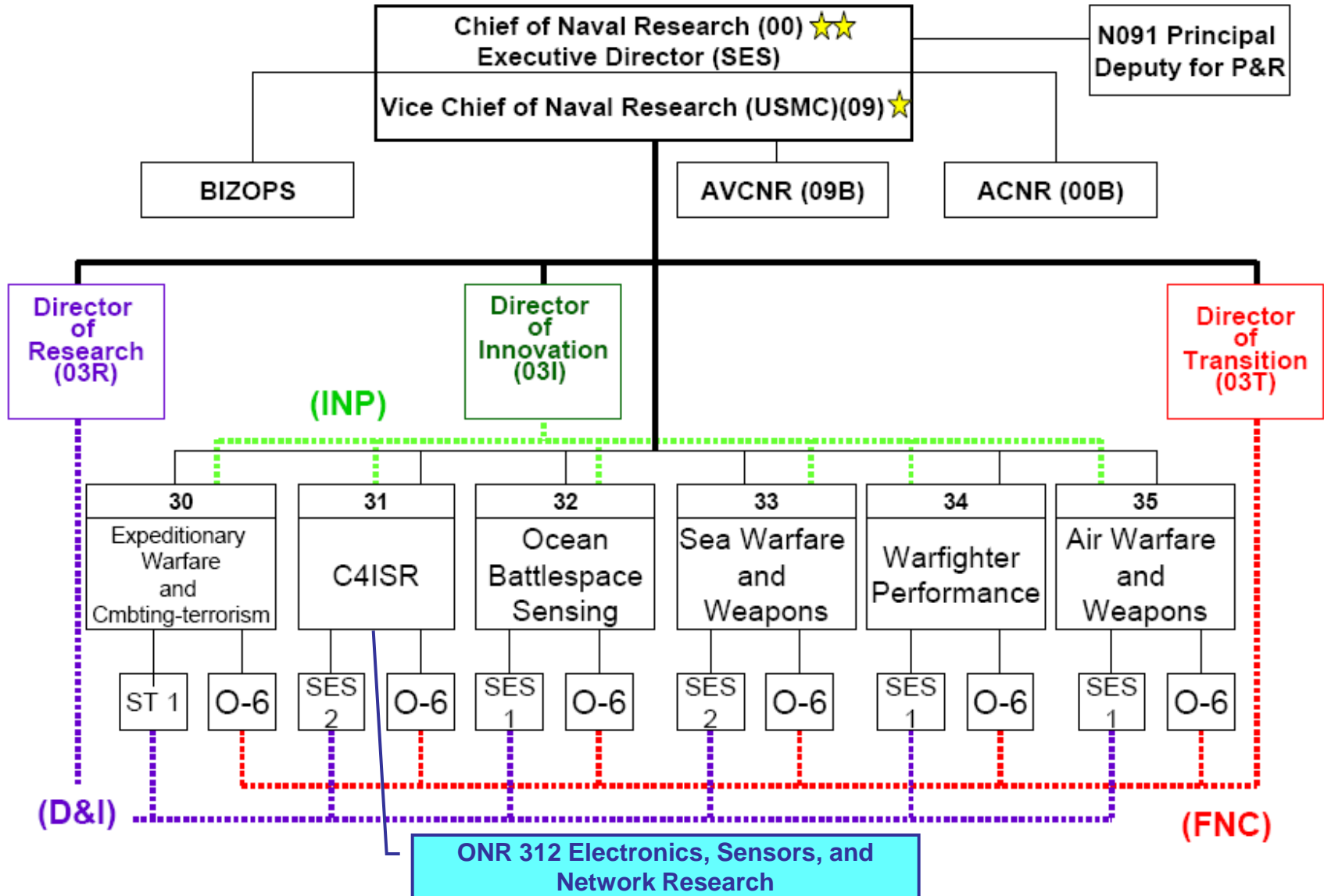
***Naval S&T Vision:*** Sponsor scientific research and technology to:

- ***Pursue revolutionary capabilities for Naval forces of the future,***
- ***Mature and transition S&T advances to improve naval capabilities,***
- ***Respond to current critical needs,***
- ***Maintain broad technology investments to anticipate and counter potential technology surprise.***





# Office of Naval Research Organization (S&T)

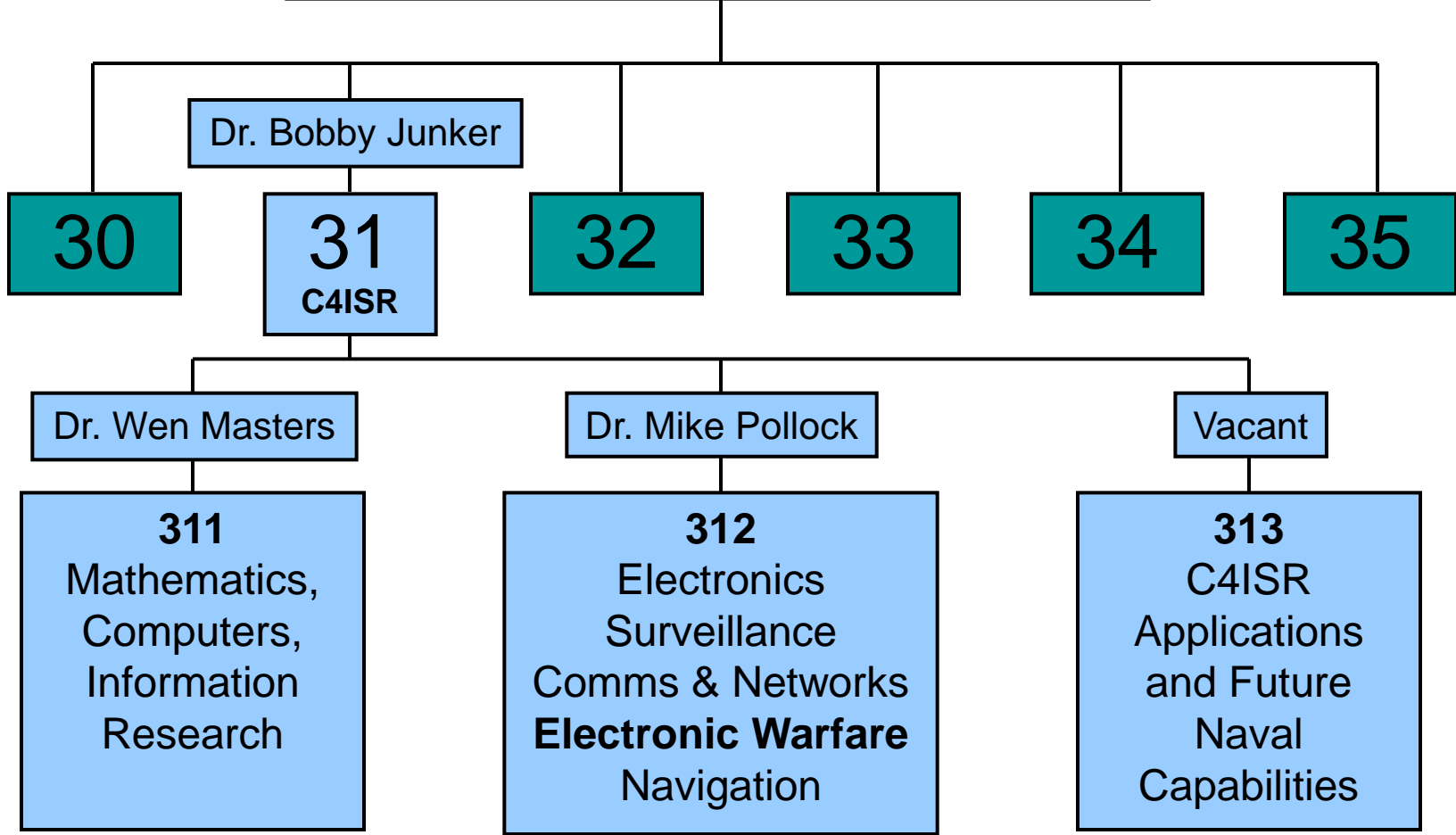




# ONR Organization - S&T



## Chief of Naval Research





# ONR 312 Electronic Warfare



## Electronic Warfare Technology Program

<b>Dr. Peter Craig</b> EW Program Manager	<b>Mr. Dave Tremper</b> EW Program Officer
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<b>Dr. Vince Cassella</b> EW Program Officer	<b>Dr. Kevin Rudd</b> EW Program Officer
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<b>Mr. Bob Kusuda</b> CACI	<b>Mr. Tom Jesswein</b> CACI
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### 6.2 Discovery & Invention

Distributed EW Assets  
CM for Emerging Threats  
EO/IR Countermeasures  
Wideband ES – Sensing/Processing

Adaptive EW Signal Processing  
Antennas and Components  
Multi-Band Lasers  
Wideband EA – Components/Techniques

EW Modeling & Simulation  
Network Centric EW  
Multi-Mode CM Techniques  
High Power mmW Transmitters

### Future Naval Capabilities (Sea Strike, Sea Shield, ForceNet & Expeditionary Maneuver Warfare)

Surface/Subsurface  
Enhanced SEWIP  
Enhanced NULKA  
Next Gen CM for SMD  
Submarine Survivability – EW  
EW Battle Management

Air  
Next Generation Airborne EW  
CM for Advanced Imaging IR Seekers  
CM for Millimeter Wave Seekers  
Identification and Defeat of EA Systems  
Collaborative Electronic Attack (NEW)

Marine Corps  
Future Joint Counter  
Radio-Controlled IED EW  
Hostile Fire (HF) Suppression

### SBIR/STTR EW Technologies



# Doing Business with ONR



## Business Opportunities

- Broad Agency Announcements (BAA)
- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR)
- Multidisciplinary Research Program of the University Research Initiative (MURI)
- Defense University Research Instrumentation Program (DURIP)
- DoD Experimental Program to Stimulate Competitive Research (DEPSCOR)

Detailed information can be found on the ONR website

<http://www.onr.navy.mil/en/Contracts-Grants.aspx>



# What is Electronic Warfare? Joint Service Definition



**Development of technologies that maximize the operational use of the electromagnetic (EM) spectrum by U.S. forces, ...while denying same from the enemy, ...by using EM means to detect and attack enemy sensor, weapon and command infrastructure systems**

- Immediate battlespace recognition of hostile scenario/intent and optimized, automated response decisions**
- Electronic denial, degradation, disruption or destruction of enemy C4ISR, IADS, acquisition and associated targeting/weapon systems**
- Timely EM control over the entire battlespace: temporal, spectral, spatial**



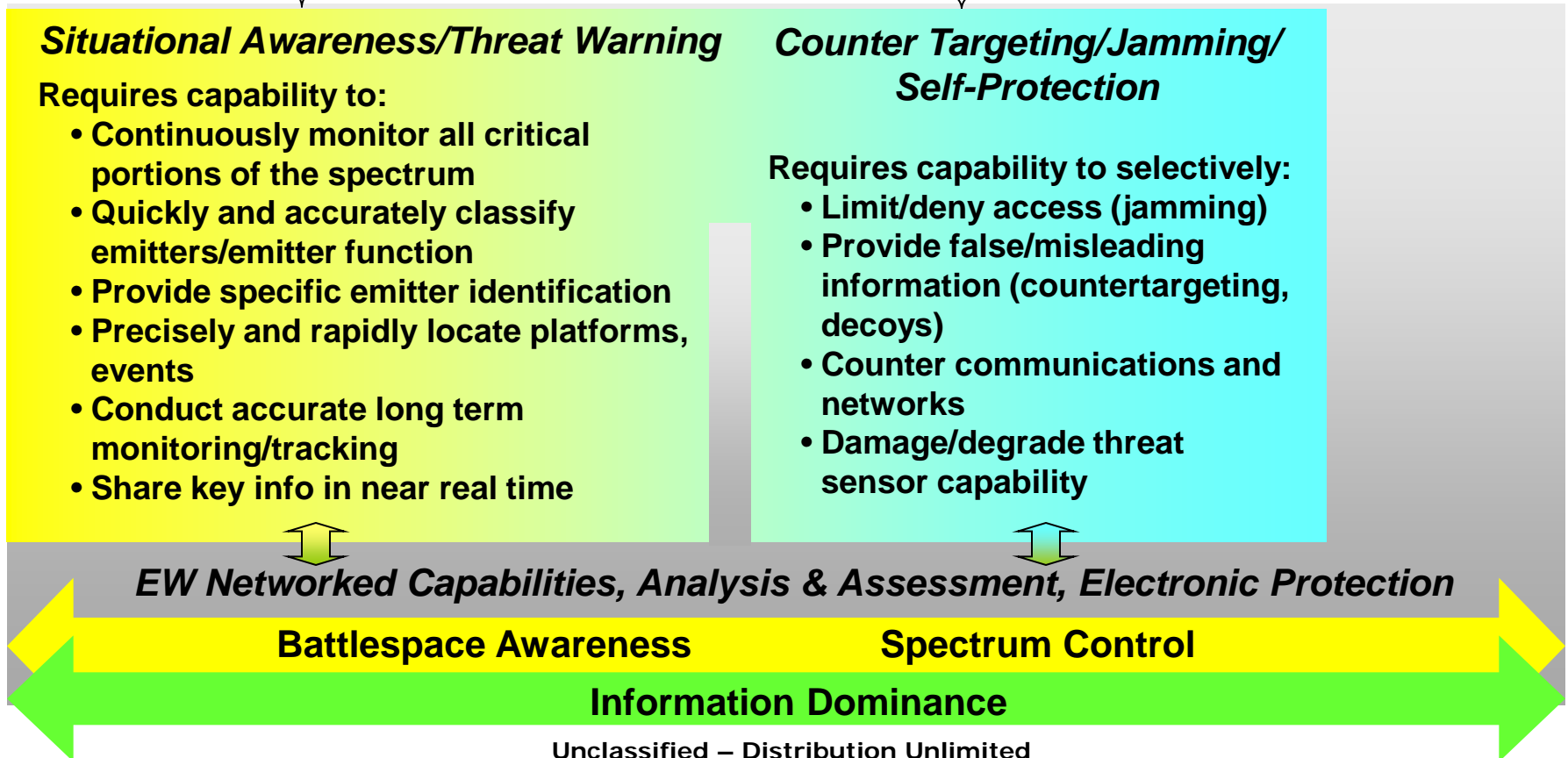
# Electronic Warfare in Perspective



## The RED Kill Chain...



## ... and the Electronic Warfare Response Chain...







# Electronic Warfare Terminology

## DoD / JCS Definitions



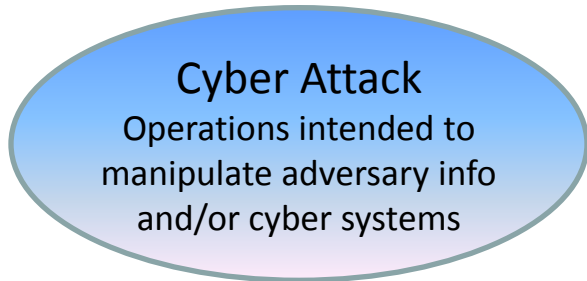
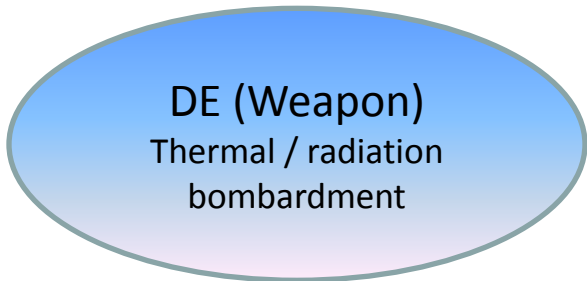
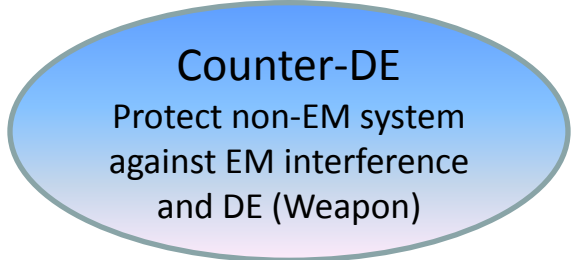
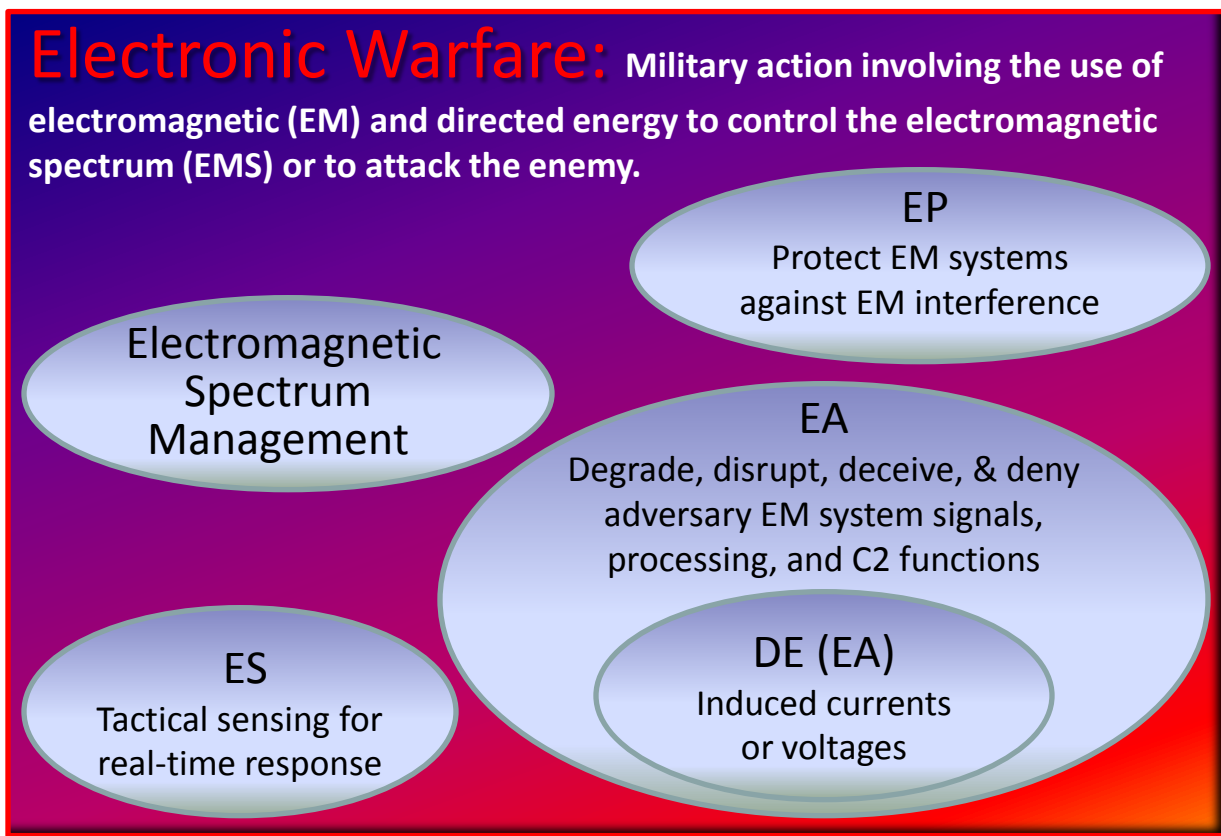
**Electronic Warfare (EW):** “Any military action involving the use of EM radiation ... to control the EM spectrum or to attack the enemy.”

- **Electronic Warfare Support (ES):** Actions to search for, intercept, ID & locate intentional / unintentional EM sources for the purpose of immediate threat recognition
  - Provides information/data for immediate decisions regarding operations & tactical actions (avoidance, targeting, cueing)
- **Electronic Attack (EA):** Use of EM ... to attack with the intent of degrading, neutralizing or destroying enemy combat capability
  - Includes jamming, EM deception, decoys/expendables
- **Electronic Protection (EP):** Actions taken to protect ... from any effects of friendly or enemy employment of EW that degrade, neutralize, or destroy friendly combat capability



# Electronic Warfare Terminology

## Scope & Domain Boundaries within the EMS





# ONR Electronic Warfare S&T Area Objectives



## **Dominate the Spectrum**

Pervasive Spectrum Awareness - **Know who is out there, where they are, and what they are doing...**

Requires capability to:

- Continuously monitor all critical portions of the spectrum (RF/EO/IR)
- Quickly and accurately classify emitters/emitter function
- Provide Specific Emitter Identification (SEI)
- Precisely and rapidly locate platforms, people, things, events
- Conduct accurate long term monitoring/tracking
- Network sensors and share key info in near-real time

ES

Effective Spectrum Control - **Determine who sees what...**

Requires capability to selectively:

- Limit/deny access (jamming) (RF/EO/IR)
- Provide false/misleading information (countertargeting, decoys)
- Damage/degrade threat sensor capability (RF/EO/IR)

EA

Unrestricted Spectrum Access for Blue Forces – **Protect our own ISR capabilities...**

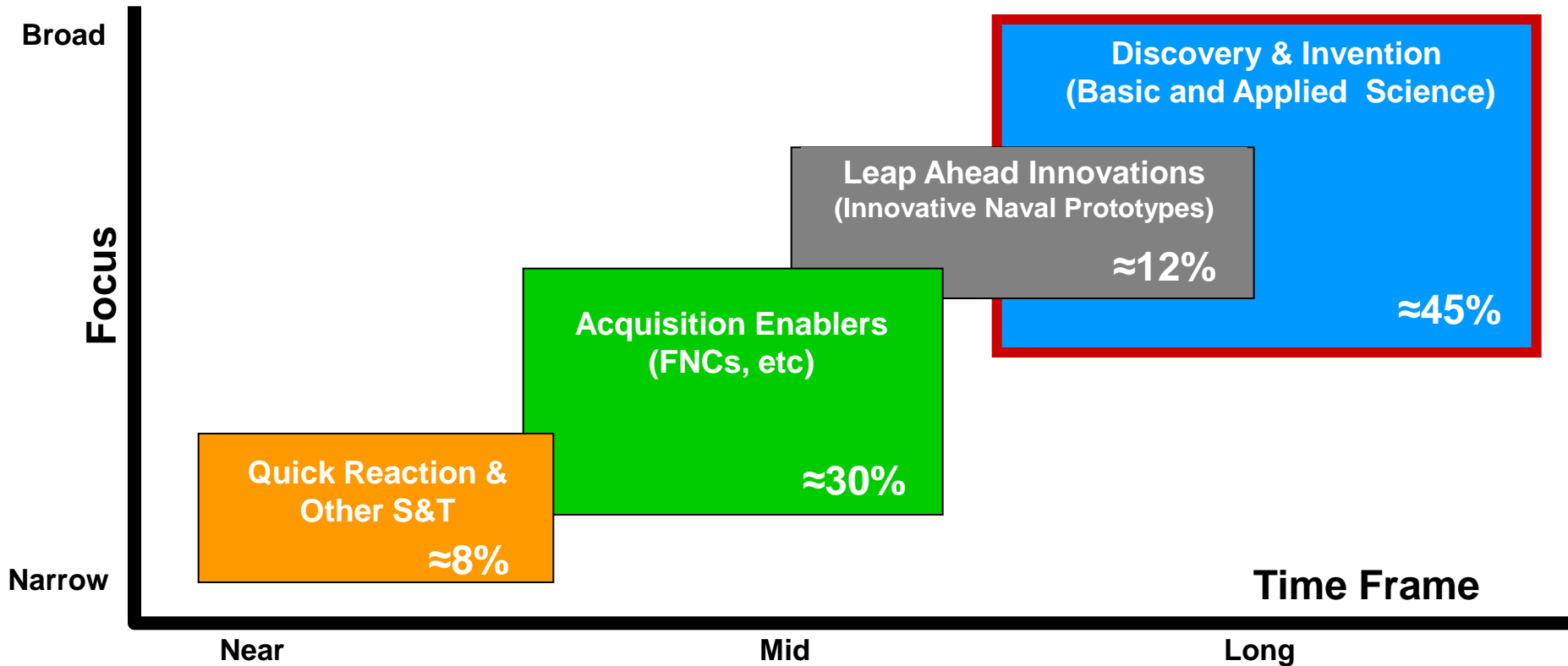
Requires capability to:

- Negate the impact of hostile jamming on U.S. and allied sensors (RF/EO/IR)
- Preserve the integrity of critical networks and data links
- Precisely navigate and target weapons in a GPS-denied environment

EP



# ONR S&T Portfolio Balance



### Quick Reaction

- Tech Solutions
- Experimentation
- MC S&T (MCWL, JNLW, etc.)

### Acquisition Enablers

- Future Naval Capabilities
- Warfighter Protection
- Capable Manpower
- LO/CLO

### Leap-Ahead Innovations

- Innovative Naval Prototypes
- NSPs
- Swampworks

### Discovery & Invention

- Basic & Early Applied Research
- National Naval Responsibilities
- Education Outreach HBCU/MI



# ONR Portfolio Characteristics



	Direct Fleet Support / Quick Reaction	Future Naval Capability (FNC)	Innovative Naval Prototype	Discovery and Invention (D&I)
<b>% of Portfolio</b>	~8	>30	~12	>45
<b>Focus</b>	Solving emergent fleet / force needs	Transitioning mature S&T to acquisition program of record	Demonstrating Leap-ahead technology	Expanding frontiers of knowledge in areas of naval interest
<b>Motivation</b>	Fleet-identified need	OPNAV-identified capability gap	Significant military advantage	General Naval needs and opportunities
<b>Example</b>	IED Jammer	Enhanced NULKA Payload	Integrated Topside (INTOP)	Real-time EW Effectiveness Monitor
<b>Type of Innovation</b>	Disruptive or sustaining.	Sustaining - makes an existing capability better	Disruptive - makes an existing capability obsolete	Disruptive or sustaining.
<b>Time frame</b>	1-2 years	3-5 years	4-8 years	continuing
<b>Typical TRL entry point</b>	TRL-4 to TRL-5	TRL-3	TRL-2 to TRL-3	TRL-0 to TRL-2
<b>Typical TRL end point</b>	TRL-7	TRL-6	TRL-6	TRL-3 to TRL-4
<b>Technical Difficulty</b>	Medium	Medium	High	High
<b>Operational Integration Complexity</b>	Medium	Usually straightforward	High	N/A
<b>Approval Level to start a program</b>	ONR Corporate	Technology Oversight Group (3-Star)	DON Corporate Board (4-Star)	ONR Department



# Technology Readiness Levels



- 1. Basic principles observed and reported.** Example: Paper studies of a technology's basic properties.
- 2. Technology concept and/or application formulated.** Example: Limited to analytical paper studies.
- 3. Analytical and experimental critical function and/or characteristic proof of concept.** **D&I**  
Example: Components that are not yet integrated or representative.
- 4. Component and/or breadboard validation in laboratory environment.** Example: Integration of "ad hoc" hardware in a laboratory.
- 5. Component and/or breadboard validation in relevant environment.** Example: "High fidelity" laboratory integration of components.
- 6. System/sub-system model or prototype demonstration in a relevant environment.** Example: Testing a prototype in a high fidelity laboratory environment or in a simulated operational environment.
- 7. System prototype demonstration in an operational environment.** Example: Testing the prototype in a test bed aircraft.
- 8. Actual system completed and qualified through test and demonstration.** Example: Developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
- 9. Actual system proven through successful mission operations.** Example: Using the system under operational mission conditions.



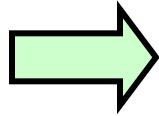
# ONR EW S&T Development Process Annual D&I Refresh



**Sep - Oct**

**ONR EW S&T Future Vision**

- Capability gaps (OPNAV guidance, NARG's)
- Roadmaps (S&T, Acquisition)
- Emerging threats (intell reporting)
- Technology trends (to avoid surprise)



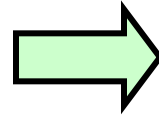
**Nov - Jan**

**D&I BAA**

- Industry
- Academia

**D&I Solicitation**

- NRL
- Warfare Centers
- FFRDC / UARC



**February**

**Review White Paper Submissions**

- Evaluate technical merits/innovation, Naval relevance, prior experience, cost realism
- Down-select roughly 2x \$\$ available

**March**

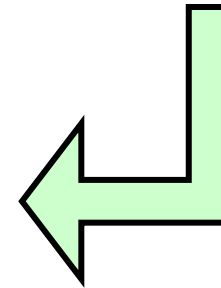
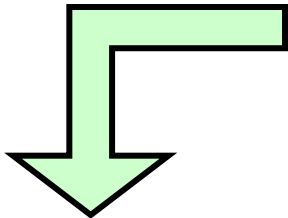
**EW S&T Review (Gathering) – Invitation Only**

**Agenda:**

- EW Requirements view (OPNAV, HQMC)
- EW Acquisition view (NAVSEA, NAVAIR, MCSDC)
- Briefings of current D&I, SBIR, FNC efforts
- Briefings of proposed D&I new starts for following FY

**Actions:**

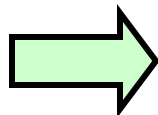
- Invited reviewers advise on D&I new start selection
- Begin dialog regarding new FNC needs
- De-conflict with other service reps (Army, Air Force)



**April - May**

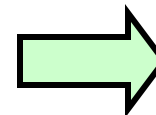
**Select new D&I projects**

- Request full proposals



**Jun - Aug**

- Initiate contract actions
- Prepare FM documentation



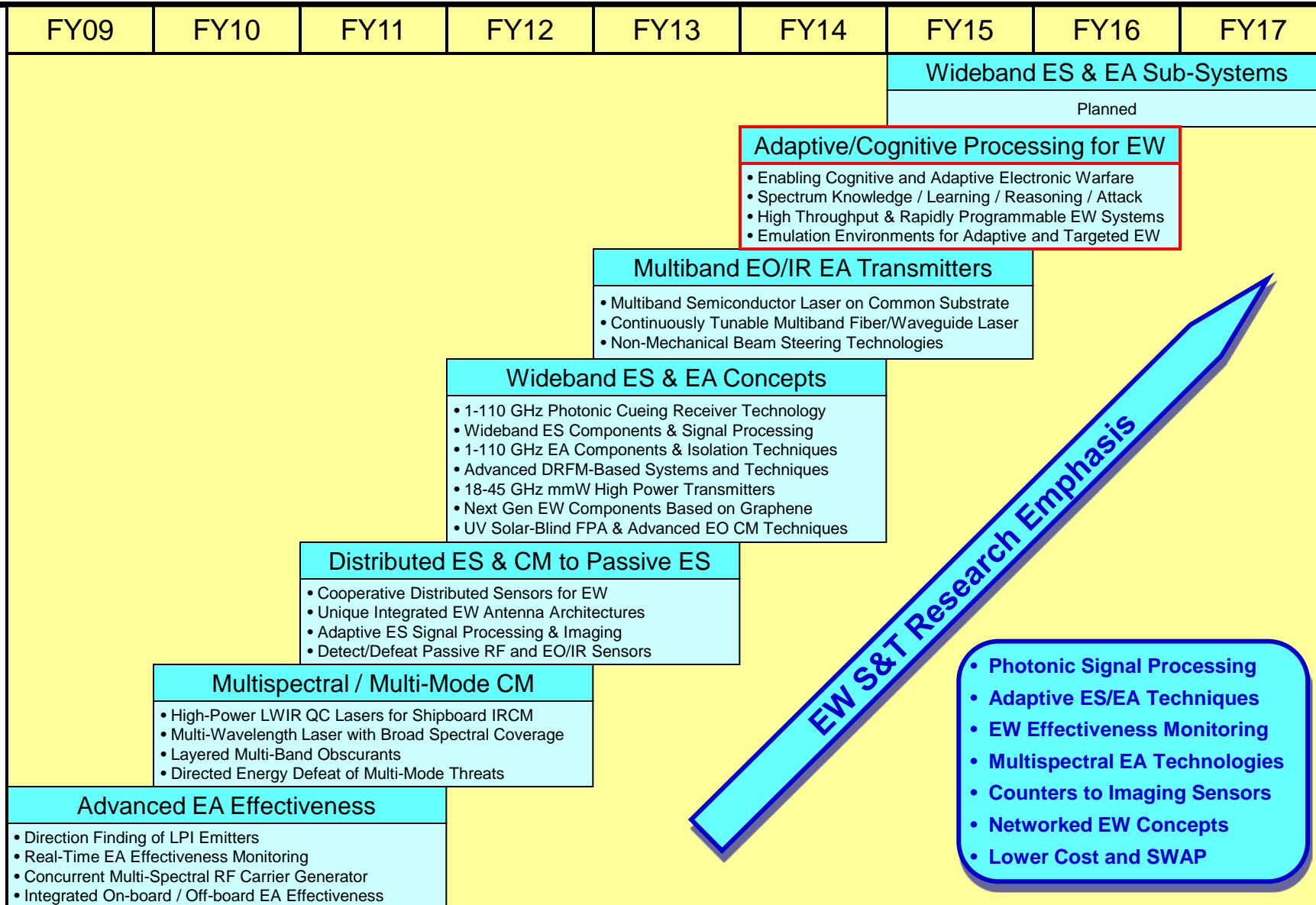
**Oct - Jan**

- Award Contracts
- Send Funding Documents



# ONR 312 EW D&I Products

## Completed, Current, and Planned







# Future EW Vision



Elements of Future EW Systems	Objective Capability (What?)	Enabling Technology (How?)
<b>Distributed</b>	Maximize EW spatial coverage with a minimum of resources without permitting single point failures	Small, lightweight, power efficient ES / EA payloads for manned and unmanned vehicles (UAV, USV, UUV, UGV)
<b>Coordinated</b>	Maximize effectiveness of EW across on/off-board assets, manned / unmanned platforms, kinetic / non-kinetic resources	Multi-asset, coordinated kinetic / non-kinetic M&S; multi-platform ID / targeting / tracking / EA techniques and algorithms
<b>Multispectral</b>	Maximize EW spectral coverage (EO-IR-mmW-RF) and minimize spectral gaps that can be exploited by hostile forces	EO/IR/RF receiver / transmitter sub-systems and components with extended spectral coverage and ultra-wide bandwidth
<b>Adaptive</b>	Maximize flexibility in dynamically responding to time critical, frequency agile emitters	Embedded ES / EA architectures with high-speed reactive ES processing and dynamic EA techniques generation
<b>Robust EP</b>	Maximize operational availability of ISRT sensor assets and preserve situational awareness in the presence of hostile EA	Dynamic / reactive / adaptive signal processing, hardened EO/IR/RF apertures and components
<b>Increased Combat Effectiveness</b>		



# DoD Electronic Warfare Joint Service EW S&T Priorities



## Technology Challenges (TCs) & Desired End States

TC1: Cognitive, Adaptive Capabilities

- **Effectively outpace adversary decision and technical options**

TC2: Coordinated / Distributed / Network-Enabled Systems

- **Spatially and temporally diverse responsiveness to dense and complex threat environments**

TC3: Preemptive / Proactive Effects

- **Real-time sensing, assessment and optimization of EA effectiveness**

TC4: Broadband / Multispectral Systems

- **Widest possible spectral extent to our control of the EMS**

TC5: Modular / Open / Software-Configurable Architectures

- **Timely deployment or insertion of advanced EW in response to rapidly changing conditions**

TC6: Advanced Electronic Protection Techniques & Technology

- **Allow unfettered operations in the increasingly dense EMS environment**



# ONR Discovery & Invention

## Last year: ONR BAA 12-008



### Multispectral Semiconductor Lasers

Develop and demonstrate a semiconductor-based, multi-wavelength laser source integrated on a single substrate and spanning multiple bands of the ultraviolet (UV), visible (VIS), near infrared (NIR), short-wave infrared (SWIR), mid-wave infrared (MWIR), and long-wave infrared (LWIR) spectrum with multiple discrete spectral line emissions.

### Continuously Tunable Multispectral Fiber/Waveguide Lasers

Develop and demonstrate an optical fiber/waveguide-based, multi-wavelength integrated laser source spanning multiple bands of the UV, VIS, NIR, SWIR, MWIR, and LWIR spectrum with continuously tunable output emissions.

### Non-Mechanical Beam Steering

Develop non-mechanical beam steering technologies that will allow coherent energy spanning multiple bands of the UV, VIS, NIR, SWIR, MWIR, and LWIR spectrum to be directed in a low divergence beam with minimal or no side lobes over an angular range covering not less than 120-degrees conical (threshold) up to a complete hemisphere (objective).

### Innovative EW Concepts

Explore truly innovative concepts in the EW areas of ES, EA, or EP which could fundamentally change the way naval forces conduct EW Operations.



# ONR Discovery & Invention

## Last year: ONR BAA 12-008



### Multispectral Semiconductor Lasers

- High Power Multispectral Laser on Hybrid Silicon Chip (NRL 5610)
- High Brightness Monolithic Multispectral Semiconductor Lasers (TeraDiode)

### Continuously Tunable Multispectral Fiber/Waveguide Lasers

- Novel Multispectral Fiber Laser Architecture (Q-Peak)
- Frequency Agile Fiber Laser Based on GaN Frequency Conversion (NRL 5620)

### Non-Mechanical Beam Steering

- Multispectral Optical Phased Array Beam Steering (UC Davis)
- Multiband Optical Phased Array Beam Former (HRL)

### Innovative EW Concepts

- Spatial-Spectral Holographic Rainbow Spectrometer (MSU)



# ONR Discovery & Invention

## This year: ONR BAA 13-005



## ONR BAA Announcement # ONR 13-005



- **Posted:** *19 November 2012*
- **Agency Name:** *Office of Naval Research*
- **Research Opportunity Title:** *Electronic Warfare Technology*
- **Program Name:** *Electronic Warfare Discovery & Invention (D&I)*
- **Response Dates:**
  - **White Papers:** *5 February 2013*
  - **Full Proposals:** *7 May 2013*



# ONR Discovery & Invention

## This year: ONR BAA 13-005



**ONR 312 Electronic Warfare (EW) seeks white papers for efforts that shall develop and demonstrate technologies for the next generation components and systems in Electronic Warfare. The primary emphasis of this BAA is on technologies towards**

**A. Enabling Cognitive and Adaptive Electronic Warfare**

- 1. Spectrum Knowledge**
- 2. Spectrum Learning**
- 3. Spectrum Reasoning**
- 4. Spectrum Attack**

**B. High Throughput and Rapidly Programmable EW Systems**

**C. Emulation Environments for Adaptive and Targeted EW**

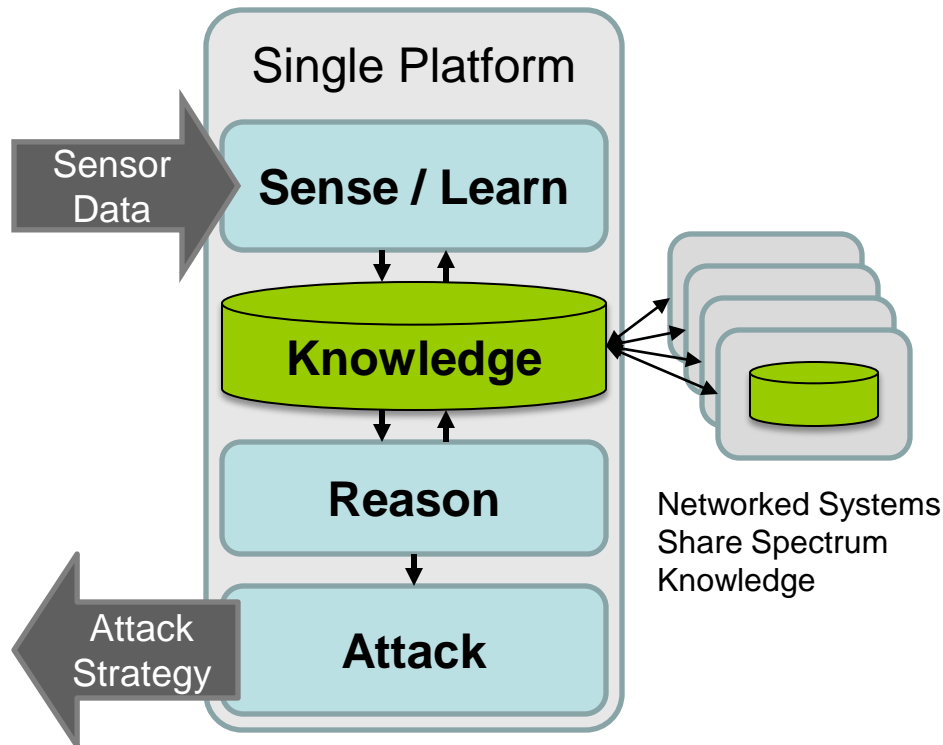
**D. Innovative EW Concepts**



# Enabling Cognitive and Adaptive Electronic Warfare



## Notional Functional Diagram



### A.1 Spectrum Knowledge:

Common framework for representing tactical EM spectral data.

### A.2 Spectrum Learning:

Techniques to learn and provide comprehensive knowledge about the spectrum and threat environment.

### A.3 Spectrum Reasoning:

Methods to reason about current spectrum conditions and threat knowledge (local and distributed) to develop real-time and resource optimized EA strategies.

### A.4 Spectrum Attack:

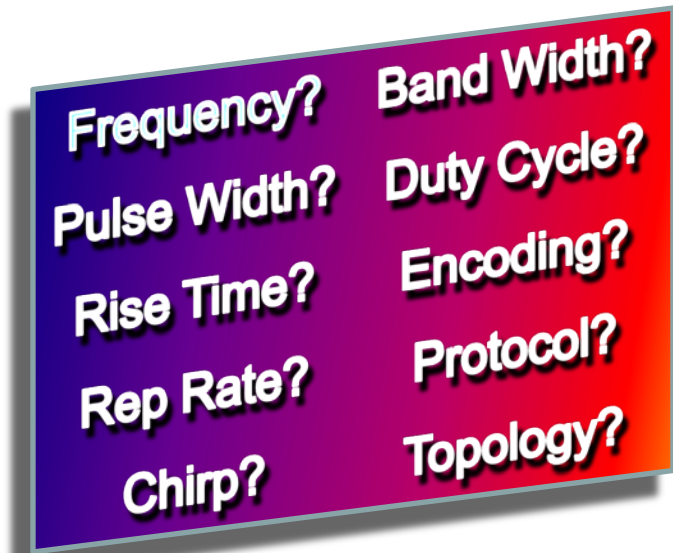
Leverage knowledge about a RF system's protocol and vulnerabilities to develop targeted and optimized EA strategies.



# Spectrum Knowledge



There is no common representation of complex electromagnetic spectrum data for use in tactical EW engagements

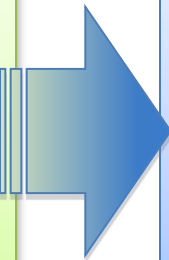


**Technology Challenges**

- Many sensors providing distinct, incomplete, and sometimes conflicting temporal, spectral, and spatial data
- Tactical EM environment is very dynamic

**Approaches**

- Leverage artificial intelligence and machine learning representations of knowledge applied to the EW domain



- Promotes cross-system and cross-platform sharing of real-time spectrum knowledge
- Enables modular development of cognitive EW systems

Further Reading (Given as reference only and not intended to guide BAA responses)  
[1] Langley, P., Laird, J. E., & Rogers, S. (2009). Cognitive architectures: Research issues and challenges. Cognitive Systems Research, 10, 141-160. (Specifically section 4.1 Representation of Knowledge)





# ONR Discovery & Invention

## ONR BAA 13-005 Research Area A1



### **A. 1. Spectrum Knowledge**

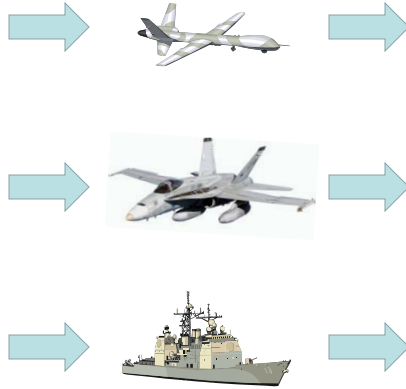
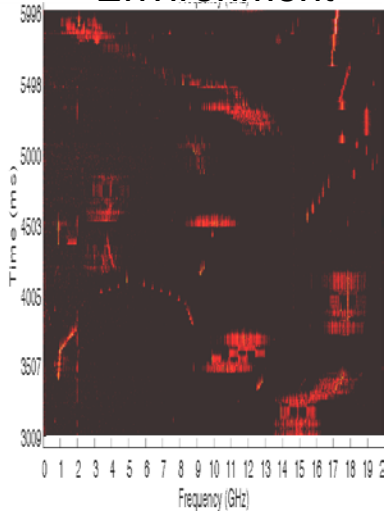
Develop a framework and standards to capture a priori and real-time spectrum knowledge. This framework should provide an open and common way to organize, share, and utilize dynamic data about spectrum and its users for **real-time electronic warfare applications**. Spectrum knowledge includes both static and dynamic parameters of RF emitters and networks including physical layer transmission properties, protocols, functionality, physical maneuver, network topologies, adaptive behaviors, EP modes, etc. **The framework should have the ability to maintain multiple hypotheses with likelihood estimates on aspects of measurements that are uncertain.** At a minimum, this framework should handle the common RF systems such as communications, radars, jammers, and precision timing and navigation systems. Existing standards and proven techniques in the artificial intelligence (AI) community for representing dynamic relationships and actions applied to knowledge should be leveraged if applicable and appropriate. In addition, standardization agreements (STANAG), spectrum standards, and EW protocols and tools should be leveraged if applicable. **The framework and representation should be open (within the US government and their contractors) and extensible. It should be independent to how spectrum knowledge is collected** and to the methods that consume or reason about knowledge (these are covered in the next subsections). The Offeror should include a plan for vetting their framework and standards to the appropriate industry, academic, and government community for feedback and critical review to increase probability for greater acceptance.



# Spectrum Learning



## Complex RF Environment

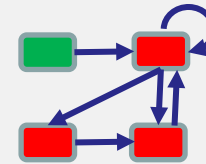


## Learned Spectrum Knowledge

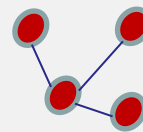
Threat ID

$[t_1, t_2, t_3, t_4]$

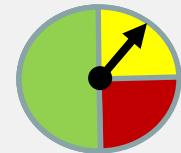
Threat Behaviors



Network Topologies



Real Time EA Effectiveness

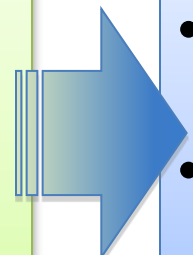


## Technology Challenges

- Congested and constantly changing RF environment
- Predicting EA effectiveness in real-time
- Collaborative threat systems have additional network layer behaviors and EP modes

## Approaches

- Advanced signal processing and data fusion techniques
- Machine learning algorithms applied to EM sensor data

- 
- Comprehensive spectral and situational awareness
  - Address known and unknown threats



# ONR Discovery & Invention

## ONR BAA 13-005 Research Area A2



### **A. 2. Spectrum Learning**

Investigate technologies and techniques to learn and provide comprehensive knowledge about the spectrum and threat environment. Non-traditional techniques and technologies are needed that can provide information beyond the physical layer properties such as frequency, bandwidth, and power. **Preference will be given to techniques that can be applied to existing sensors and avoid adding new hardware** to platforms with severe size, weight and power (SWAP) constraints. Of particular interest are technologies and techniques to learn or infer in real-time some, if not all, of the following from over-the-air observables:

- a. Comprehensive identification and location of all spectrum signals, emitters, and users with a focus on naval missions such as tactical strike and surface ship defense;
- b. Identification of the electronic order-of-battle of integrated defense networks;
- c. Identification and characterization of EP modes and adaptive threat strategies (especially in the presence of jamming);
- d. Identification of communication or radar network structures including functional topologies and hierarchal importance;



# ONR Discovery & Invention

## ONR BAA 13-005 Research Area A2



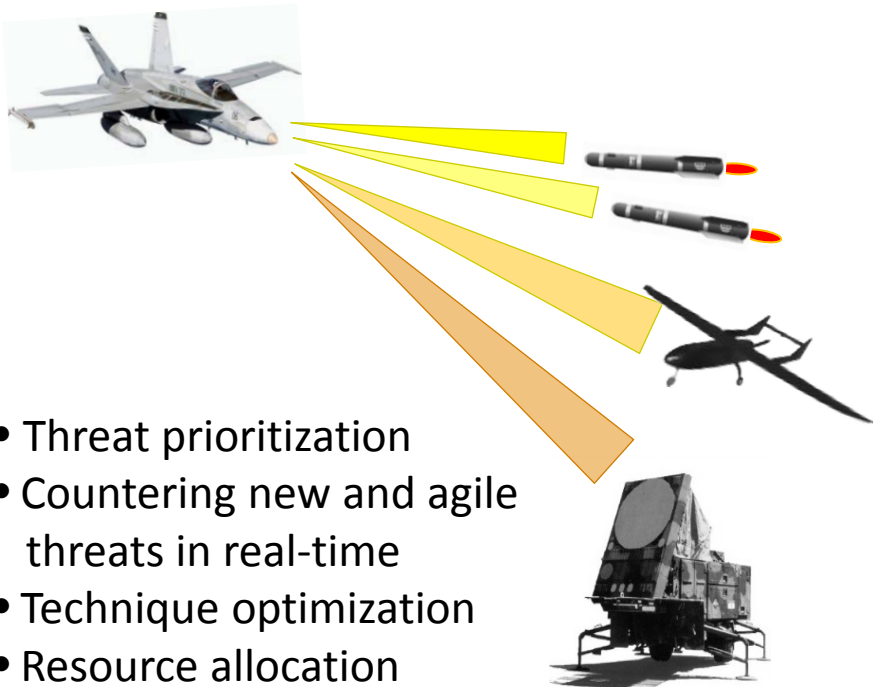
### A. 2. Spectrum Learning (continued)

- e. Identification and characterization of previously unknown communication or network protocols;
- f. Identification of the function and intent of radar systems;
- g. Assessment of the effectiveness of our own EA, i.e. an EW battle damage assessment (BDA); and
- h. Characterization of the RF propagation environment using both intentionally transmitted signals and signals of opportunity.

Offerors must include a realistic testing and validation plan for their proposed technology and directly describe how their approach compares to the current state-of-the-art. Proposed technologies that are pure signal processing techniques must address the expected receiver and computational requirements needed to execute their technique.

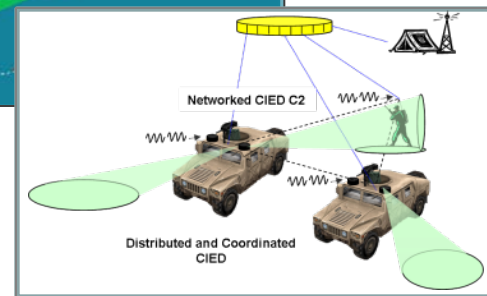
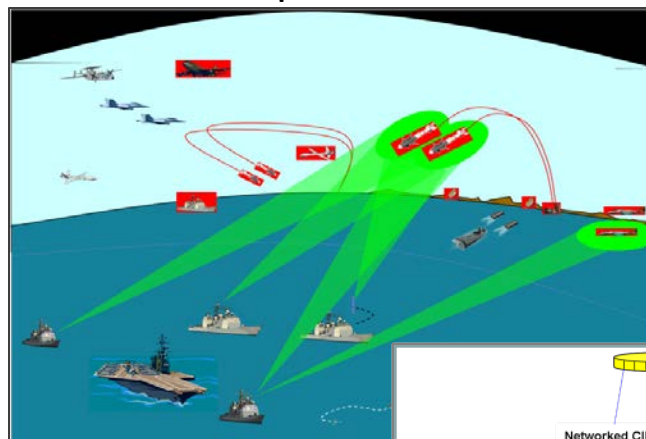


# Spectrum Reasoning



- Threat prioritization
- Countering new and agile threats in real-time
- Technique optimization
- Resource allocation

## Distributed Resource Optimization

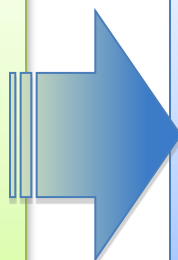


### Technology Challenges

- Countering multiple threats with limited resources
- Threat systems with agile waveforms and functions

### Approaches

- AI algorithms applied to high-level spectrum knowledge
- Local and distributed resource optimization methods



- Optimized EA strategies
- Distributed EW resource allocation



# ONR Discovery & Invention

## ONR BAA 13-005 Research Area A3



### A. 3. Spectrum Reasoning

Investigate methods to reason about current spectrum conditions and threat knowledge to develop real-time and resource optimized EA strategies. **The emphasis of this task is developing methods for prioritizing threats on-the-fly and mapping available EA resources to counter many simultaneous threats** (one-on-many scenarios). Methods to optimize distributed EW resources across many platforms to counter multiple threats are also of high interest (many-on-many scenarios). These methods should reason from available knowledge about the spectrum (including dynamically changing data and data with uncertainty) and knowledge of the current EW resources and available techniques to develop real-time optimized attack strategies. **Preference is given to methods that are applicable to all potential EW engagements** but scenario specific methods are also of interest. Specific scenarios could include real-time EW strategies for off-board decoys for surface ship defense or multiple ground-based communication jammers working in a dense RF environment. Other technologies of interest include: methods to reason about the best composition of actions to create an effective electronic attack against new threats or new threat modes; methods to optimize the allocation of EW resources at the platform level and the engagement level (e.g. optimize trajectory of multiple unmanned platforms to achieve an EW objective); and optimization and distribution of EA techniques across available EW assets to achieve the desired effect.



# Spectrum Attack



Develop non-traditional electronic countermeasure techniques that are more effective, efficient and covert than current EW methods.



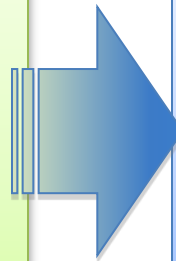
Autonomously discover and leverage vulnerabilities in threat hardware, protocol, operation methods, processing algorithms, software and firmware

## Technology Challenges

- Threat system complexity
- Large search space of countermeasure options

## Approaches

- Autonomous learning of threat operation
- Real-time search and optimization methods
- Automated open-air or hardware in-the-loop technique development



- Optimized EA strategies
- Automated technique development



# ONR Discovery & Invention

## ONR BAA 13-005 Research Area A4



### A. 4. Spectrum Attack

Investigate methods to leverage knowledge about a RF system's hardware, protocol, operation methods, processing algorithms, software, firmware, and vulnerabilities of these components to develop targeted and optimized EA strategies. **The end goal is to develop non-traditional electronic countermeasure techniques that are more effective, efficient and covert than current EW methods.** Technologies of interest include but are not limited to: methods to autonomously develop EW strategies based on sensing of protocol dynamics to attack targeted portions of the protocol to cause denial; automated search and optimization methods to develop targeted EA attacks; and network and target deception techniques that covertly deny the threat's operational effectiveness. **Preference is given to techniques that can identify vulnerabilities in real-time and exploit them to cause denial or deception.** Automated hardware-in-the-loop laboratory systems for targeted technique development, hardware and software reverse engineering, and vulnerability analysis are also of interest. **Preference is given to techniques that can be applied to all threats or a specific threat class** (e.g. radar, communications), but solutions targeted at specific, high-interest threats will also be considered.





# High Throughput and Rapidly Programmable EW Systems

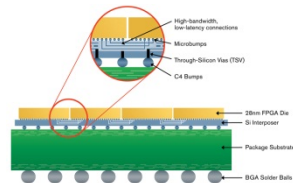
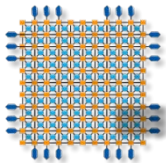


Recent advances in computing architectures\*

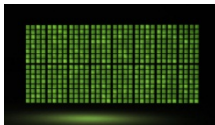
Open source processing and standards enable reconfigurable architectures\*

Coherent Logix HyperX (many-core processing)

Xilinx 3D IC's



NVIDIA 512 Core GPU



OSSIE



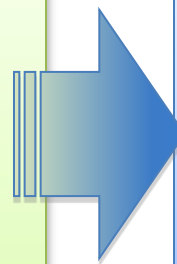
Also of interest are analog or digital techniques to reduce the amount of raw sensor data that needs to be processed.

## Technology Challenges

- Extreme bandwidth requirements
- Real-time signal processing algorithms require substantial computational resources

## Approaches

- New or hybrid computational architectures
- Analog or digital techniques to reduce the amount of raw sensor data that needs to be processed
- Leverage open standards and development environments



- Extremely high throughput EW systems
- Easily reconfigurable and upgradable

\* The technologies shown are given as examples of current technology trends and not intended to guide BAA responses.



# ONR Discovery & Invention

## ONR BAA 13-005 Research Area B



### **B. High Throughput and Rapidly Programmable EW Systems**

The objective is to develop enabling technologies for reconfigurable EW systems that have extremely high-volume processing capability. Future EW systems need to be able to consume a large amount of raw sensor data, extract high-level knowledge from this data, and then derive optimized EW attack strategies in real-time while operating over very large bandwidths. The software defined radio (SDR) concept has proven practical in the communication domain for providing a capability to rapidly develop, test, and deploy new processing techniques and waveforms. SDR's that run on general purpose processors (GPPs) can typically handle 10's of MHz of bandwidth. Field programmable gate arrays (FPGAs) and graphical processing units (GPU's) allow for larger data throughput processing but usually at the price of specialized code and algorithm development. **Technologies are desired that will enable rapidly reconfigurable, highly capable, and easily programmable software defined RF systems** that have at least an order-of-magnitude more processing capability than current state-of-the-art FPGA or GPU-based solutions. **The objective is a software defined RF system that is capable of performing high-level and real-time signal processing** operations (such as those described in sections A2 and A3) over not less than 3 GHz (threshold) and up to 10 GHz (objective) of RF bandwidth on platforms with severe SWAP constraints. Technologies of interest include but are not limited to high-performance, parallel, or hybrid computational architectures to provide a significantly higher processing capability and analog or digital signal processing techniques to drastically reduce the amount of raw sensor data required to be processed. **The goal is to minimize the amount of data that needs to be moved from system to system or platform to platform by processing it at the data source** (i.e. co-exist with the sensor) and only transmitting low volume metadata (metacontent). Offerors must directly describe how their approach compares to the current state-of-the-art.

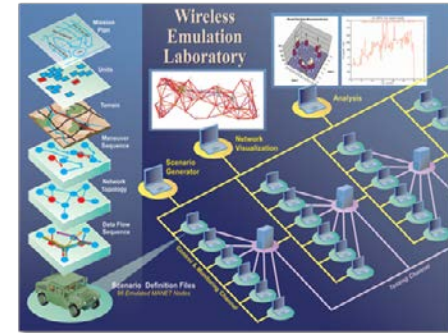


# Emulation Environments for Adaptive and Targeted EW

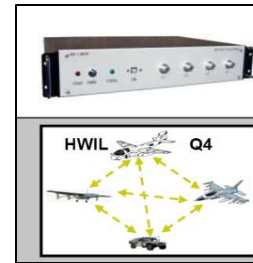
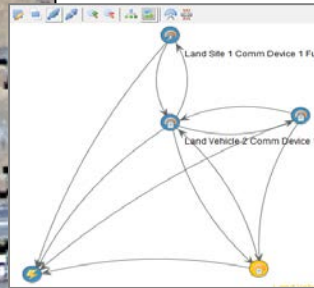


There are no common simulation, emulation, or hardware test beds that allow for rapid development and testing of wideband EW systems against adaptive threats in realistic environments.

## Wireless Emulation\*



NRL Builder\*



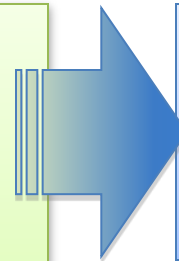
Hardware-in-the-loop emulation environments\*

### Technology Challenges

- Wide bandwidth requirements
- Agile and networked threats
- Complex EM environments
- Non-traditional technique development

### Approaches

- Hybrid emulation/simulation environments
- Common DoD shared testbed standards and components



- Rapid development of new EW systems and techniques
- DoD shared testing resources

\* The technologies shown are given as examples of current technology trends and not intended to guide BAA responses.



# ONR Discovery & Invention

## ONR BAA 13-005 Research Area C



### **C. Emulation Environments for Adaptive and Targeted EW**

The objective is to develop emulated RF environments or modeling and simulation (M&S) environments to enable the development, testing, and validation of advanced cognitive and targeted EW techniques and systems. As EW systems become more automated, the development of robust experimentation and validation methodologies are needed to ensure sufficient and optimal testing against future threats. This includes the development of a flexible hardware-in-the-loop or M&S testbed to test adaptive EW techniques, which could include the adaptation of existing testbeds to support testing of cognitive systems. This testbed should incorporate representative models of non-adaptive and adaptive or cognitive electromagnetic systems, e.g. radar, EO sensors, radios, and jammers. The testbed should provide a framework that allows for the incorporation of additional electromagnetic systems and realistic EM background environments. **The testbed should provide the ability for developers to prototype cognitive algorithms and visualize the performance of these algorithms.** This may include network topology discovery, threat discovery and identification, and location of assets. It should also support research into closed-loop techniques that rapidly identify threat behavior in order to anticipate and out-pace its actions.



# ONR Discovery & Invention

## ONR BAA 13-005 Research Area D



### **D. Innovative EW Concepts**

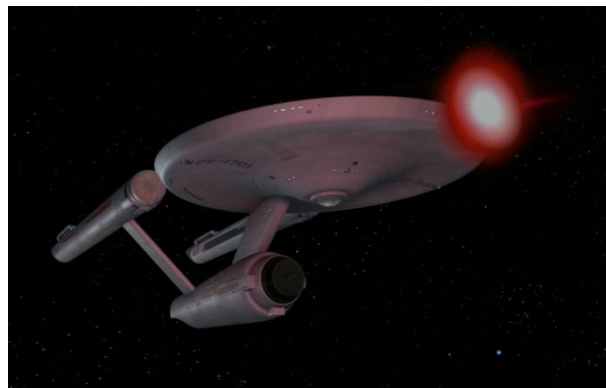
The objective is to explore truly innovative concepts in the EW areas of ES, EA, or EP which could fundamentally change the way naval (Navy and Marine Corps) forces conduct EW operations.

This sub-section should only be cited by proposals that do not fall within any of the other sub-sections of this Research Opportunity Description.

### **Examples of what I would consider “Innovative Concepts” (circa 1966)**



**Phaser™ Technology**



**Shield Technology**



**Romulan™ Cloaking Device**

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# ONR Discovery & Invention

## ONR BAA 13-005 Award Info



- In conjunction with the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC) and the U.S. Air Force Research Laboratory (AFRL), ONR plans to fund individual awards of \$500,000.00 to \$1,500,000.00 per year, using some combination of Budget Category 6.2 and Budget Category 6.3 funds. However, lower and higher cost proposals will be considered.
- The period of performance for projects may be from 12 to 36 months. Projects will have an estimated start date of 02 January 2014, subject to date of final award and availability of new fiscal year funds.
- Some portion of this budget may fund research requests in this program area received from Government entities outside of this BAA.



# ONR Discovery & Invention

## ONR BAA 13-005 Eligibility



- **All responsible sources from academia and industry may submit proposals under this BAA.**
- **University Affiliated Research Centers (UARC) are eligible to submit proposals under this BAA unless precluded from doing so by their Department of Defense UARC contracts.**
- **There will be no set asides for Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs).**
- **Some topics cover export controlled technologies. Research in these areas is limited to “U.S. persons” as defined in the International Traffic in Arms Regulations (ITAR) - 22 CFR § 1201.1 et seq.**



# ONR Discovery & Invention

## ONR BAA 13-005 Eligibility



- Navy laboratories and warfare centers, as well as other Department of Defense and civilian agency laboratories, and Federally Funded Research & Development Centers (FFRDCs), including Department of Energy National Laboratories, are **not eligible to receive awards under this BAA** and should not directly submit either white papers or full proposals in response to this BAA.
- **NOTE: Responses from these organizations are being solicited separately, though with the same guidance regarding research areas of interest, white paper format and deadlines.**





# ONR Discovery & Invention

## ONR BAA 13-005 Eligibility



- **Bottom line**: All civilian, industry, government, and military organizations are encouraged to submit white paper responses to the four ONR EW research areas as solicited.
- Once a proposed effort has been chosen for funding, ONR will determine the best method to proceed.
- If a contract or grant is required, then the guidance, clauses, and limitations of this BAA are applicable.
- If other means are more appropriate (direct funds transfer to DoD laboratory or warfare center, use of existing contract vehicle, etc.) then separate guidance and limitations may apply.



# ONR Discovery & Invention

## ONR BAA 13-005 White Papers



- The due date for white papers is no later than 3:00 PM (EST) on Tuesday, 5 February 2013. White papers received after the published due date and time are not eligible to participate in the remaining Full Proposal submission process and are not eligible for Fiscal Year (FY) 2014 funding. Each white paper should state that it is submitted in response to this BAA and cite the particular sub-section of the Research Opportunity Description that the white paper is primarily addressing.
- The only acceptable method for submission of white papers sent in response to the BAA is via electronic mail (email) to [312\\_EC@onr.navy.mil](mailto:312_EC@onr.navy.mil).



# ONR Discovery & Invention

## ONR BAA 13-005 White Papers



### White Paper Format

- Paper Size – 8.5 x 11 inch paper
- Margins – 1” inch
- Spacing – single spaced
- Font – Times New Roman, 12 point
- Number of Pages – No more than four (4) pages (excluding cover page, resumes, bibliographies, and table of contents). White Papers exceeding the page limit may not be evaluated.
- Format – one (1) electronic copy in Adobe PDF or Word 2007 DOCX delivered by email.



# ONR Discovery & Invention

## ONR BAA 13-005 White Papers



### White Paper Content

- **Cover Page**

Including BAA number, proposed title, administrative and technical points of contact (telephone and facsimile number; e-mail address)

- **Technical Concept**

Must address the following without exceeding the four (4) page limit:

1. Project Manager and/or Principal Investigator
2. Relevance to BAA Research Opportunity Description and specific sub-section being addressed ►
3. Technical Objective
4. Technical Approach
5. Deliverables
6. Recent technical breakthroughs that will reduce risk
7. Funding plan (requested funding per fiscal year, as well as total)

- **Operational Naval Concept**

Project objectives, the concept of operation for the new capabilities to be delivered, and the expected operational performance improvements

- **Operational Utility Assessment Plan**

Plan for demonstrating and evaluating the operational effectiveness of the research product in field experiments or tests in a sim environment ►



# ONR Discovery & Invention

## ONR BAA 13-005 Schedule



**The following schedule has been established to facilitate the submission of white papers and their follow-on review and possible selection for FY 2014 funding.**

<b>05 Feb 2013</b>	<b>White paper responses to EW research areas due to ONR</b>
<b>22 Feb 2013</b>	<b>ONR notify selected parties to prepare briefing for EW Review</b>
<b>11 Mar 2013</b>	<b>Quad Chart due to ONR</b>
<b>14 Mar 2013</b>	<b>Briefings due to ONR</b>
<b>20 Mar 2013</b>	<b>Oral presentations at the ONR EW S&amp;T Review</b>
<b>29 Mar 2013</b>	<b>ONR notify selected parties to prepare/submit full proposal</b>
<b>07 May 2013</b>	<b>Full technical/cost proposal due to ONR</b>
<b>04 Jun 2013</b>	<b>ONR notify selected parties of intent to fund efforts</b>
<b>02 Jan 2014</b>	<b>ONR issues awards</b>



# ONR Discovery & Invention

## ONR BAA 13-005 Evaluation Criteria



### **Evaluations will be conducted using the following evaluation criteria**

- **The four technical factors are of equal value**
  - Sub-elements under each factor will be considered but not separately scored
- **The four technical factors (1 – 4 below) are significantly more important than cost**
  - Importance of cost will increase with the degree of equality of the proposals or when the cost is so significantly high as to diminish the value of the proposal's technical superiority

#### **1. Overall scientific and technical merits of the submission**

- a. Degree of innovation,**
- b. Soundness of technical concept,**
- c. Awareness of the state of the art and understanding of the scope of the problem and the technical effort needed to address it, and**
- d. Successful achievement of goals will significantly reduce technical risk to a subsequent development effort.**

#### **2. Naval relevance, transition potential and anticipated contributions of the proposed technology to Electronic Warfare operations.**

- a. Technology addresses a Naval critical need,**
- b. Naval program or initiative depends on the technology,**
- c. Potential transition effort identified, and**
- d. Part of a joint service technology effort.**



# ONR Discovery & Invention

## ONR BAA 13-005 Evaluation Criteria



### Evaluation criteria (continued)

#### 3. Program structure and execution plan

- a. Level of technical risk appropriate for applied research,
- b. Clear statements of objectives, applicability to BAA, anticipated end state, and deliverables,
- c. Concise schedule with clearly identified milestones to objectively measure progress, and
- d. Timing is right (e.g. addresses current or future capability need, leverages recent S&T breakthrough or emerging COTS technology, constructive relationship with other on-going work , etc.).

#### 4. The qualifications, capabilities and experience of the proposed Principal Investigator (PI), team leader and key personnel who are critical in achieving the proposal objectives

- a. Offeror's experience in relevant efforts with similar resources,
- b. Ability to manage the proposed effort, and
- c. Offeror's overall capabilities, facilities, techniques or unique combinations of these which are integral factors for achieving the proposal objectives.

#### 5. The realism of the proposed cost and availability of funds



# ONR Discovery & Invention

## ONR BAA 13-005 Deliverables



**The following is a sample of reporting deliverables that could be required under a research effort. The following deliverables, primarily in contractor format, are anticipated as necessary. However, specific deliverables should be proposed by each Offeror and finalized with the contracting agent:**

- **Detailed Technical Data**
- **Technical and Financial Progress Reports**
- **Presentation Material(s)**
- **Other Documentation or Reports, as required**
- **Final Report**

**Research performed under contracts may also include the delivery of software, prototypes, and other hardware deliverables.**





# ONR Discovery & Invention

## ONR BAA 13-005 Facilities / GFE



- **Offerors are expected to provide all facilities (equipment and/or real property) necessary for the performance of the proposed effort. Any direct charge of facilities, not including deliverable items, must be specifically identified in the Offeror's proposal and approved by the Government prior to purchase.**
- **Any request to use Government owned facilities or Government Furnished Equipment (GFE) must be included in the Offeror's proposal and approved in advance by the cognizant Government official. After contract award, requests to use Government integration, test, and experiment facilities will be considered on a case by case basis based on availability and justification of need.**



# ONR Discovery & Invention

## ONR BAA 13-005 Classification



- All white papers and proposals are expected to be unclassified. However, confidential/classified white papers and proposals are permitted.
- In order to facilitate intra-program collaboration and technology transfer, the Government will attempt to enable awardees to work at the unclassified level to the maximum extent possible.
- If awardees use unclassified data in their deliveries and demonstrations regarding a potentially classified project, they should use methods and conventions consistent with those used in classified environments. Such conventions will permit the various subsystems and the final system to be more adaptable in accommodating classified data in the transition system.



# ONR Discovery & Invention

## ONR BAA 13-005 Summary



### Things ONR will look for in white paper submissions

- An understanding of Electronic Warfare principles and needs
- Innovative applications of cutting edge science and technology to address Electronic Warfare priorities
- Efforts that focus on enabling cognitive and adaptive EW, technologies for high throughput and rapidly programmable EW systems, emulation environments for adaptive and targeted EW, and innovative EW concepts
- Clear statements of the effort's objectives, applicability to Electronic Warfare, anticipated end state, and deliverables.
- Clear and concise schedule including intermediate milestones to objectively measure progress toward goals
- Funding request broken out by performing organization and Government fiscal year.



# ONR Discovery & Invention

## ONR BAA 13-005 Summary



### Things that will cause ONR to reject white papers

- Proposed effort is not Electronic Warfare related
  - Communications or navigation systems (counter comms/nav is okay)
  - Intel, reconn, surveillance (ISR) systems (counter ISR is okay)
- Proposed effort is not Discovery & Invention
  - Off-the-shelf solutions without any clear innovation
  - Demonstrations and field testing of existing systems or components to show military application
- Reliance on GFE/GFI without prior arrangement/agreement
- Poor program planning
  - No explanation or understanding of underlying S&T
  - Scattershot approaches with little methodology
  - Lack of intermediate milestones to gauge progress
  - No substantiation for requested budget



# ONR Discovery & Invention

## ONR BAA 13-005 Final Comments



- **ONR 312 EW will not entertain requests for individual meetings with industry representatives to discuss potential white paper submissions**
  - **No pre-selection of ideas or concepts**
  - **If in doubt, write the white paper and submit it**
- **This is your opportunity to ask questions**
  - **Written questions are permitted, but all questions and answers will be posted to the ONR BAA website**
- **White paper questions of a business nature can be submitted by e-mail through Tuesday, 22 January 2013**
  - **All questions and answers will be posted to the ONR BAA website**



# ONR Discovery & Invention Frequently Asked Questions (1)



## GENERAL QUESTIONS

**Question 1:** Will the briefing slides shown at the Industry Day be posted on the ONR website?

**Answer:** Yes.

**Question 2:** Will an attendance list be provided for Industry Day?

**Answer:** Yes, a list will be posted on the BAA website, minus those people who request their names be excluded.

**Question 3:** Who will be the evaluators of the white papers and proposals for this BAA? Will it be just yourself and Dr. Rudd?

**Answer:** The plan is to employ a panel of subject matter experts, consisting of government employees and support contractors who have signed non-disclosure agreements, to review all of the white paper submissions in response to the BAA.

**Question 4:** Does the parallel solicitation that has been distributed to government labs and warfare centers have the same deadline for white papers as the BAA?

**Answer:** Yes, everything is the same: the Research Areas, the deadline for white papers, the deadline for full proposals, and the other significant dates and times.

**Question 5:** Would you have any interest in receiving white papers that are outside the area of Electronic Warfare but still of great interest to the U.S. Navy?

**Answer:** No, the focus of this BAA is on Electronic Warfare so other responses would be inappropriate. For other topics of interest to the U.S. Navy, BAA ONR 13-001 may be more appropriate. However, you are encouraged to seek out the appropriate Program Officer within ONR that handles the technology area of interest and discuss the matter with him or her before submitting any white paper or proposal in response to BAA ONR 13-001. Consult the ONR website to determine the best point of contact.



# ONR Discovery & Invention Frequently Asked Questions (2)



## WHITE PAPERS

**Question 1:** In the white paper, do we need to select one of the suggested research areas in Section 6 that our technology area fits in or can it refer to multiple areas?

**Answer:** Please decide which is the primary research area from Section 6 of the BAA that you wish to address, but you are free to cite other research areas that also apply. We may assign groups of SME's to review the papers by research area so it is important to specify the area that you feel is best aligned to your technology. Research area D (other innovative EW concepts) should only be used for white papers that don't fit elsewhere.

**Question 2:** If we intend to write a white paper, are we limited to one white paper of four pages in length for any/all of the subsections listed under section 6 (Research Opportunity Description), or can we write a four page white paper for each subsection (A through D) we intend to address?

**Answer:** Any Offeror can submit as many white papers as they want to, but each individual proposed effort (with a defined technical objective, approach, and set of deliverables) should be limited to a single 4-page white paper. Each white paper should be able to identify a primary research area (A1/A2/A3/A4, B, C, or D) that it is addressing from Section 6 of the BAA (Research Opportunity Description), but can identify multiple additional secondary areas as well.

**Question 3:** Can a single company submit multiple white papers in which each one develops a separate piece of a system?

**Answer:** I would discourage this, since it would require all of the efforts to be funded to get a complete product. In general each white paper should stand on its own merits and not be tied to any other white papers.



# ONR Discovery & Invention Frequently Asked Questions (3)



## WHITE PAPERS (Continued)

**Question 4:** Our company requires proprietary information sent via email to be encrypted. Will this be a problem?

**Answer:** No, it should not be a problem but we will contact you if we are not able to open your encrypted document.

**Question 5:** Regarding encryption of the email for submission of the white paper, do you have a preferred encryption method?

**Answer:** No, but we recommend you investigate encryption features built into Adobe Acrobat Professional.

**Question 6:** We have a concept that may be classified but we do not have a classification guide to get a final determination. How would such a white paper be marked and submitted?

**Answer:** I'm not a security officer so I can't give you specific guidance on marking the paper but I recommend that you contact your company security personnel and mark the paper according to their directions. You should also submit the paper using the instructions in the BAA that refer to classified white paper submission (Section IV Application and Submission Information, Sub-Section 2 Content and Format of White Papers/Full Proposals).

**Question 7:** In the resume section of the white paper submission are we allowed to include information or experience about the company that we feel supports our efforts in these technical areas?

**Answer:** Yes, but I recommend such discussions be kept to a minimum. We do not want 75 page packets submitted that consist of a 4 page white paper and 71 pages of backup material. We will focus on the 4 page technical content and we request that the supplementary material be kept short and to the point.





# ONR Discovery & Invention Frequently Asked Questions (4)



## WHITE PAPERS (Continued)

**Question 8:** Will you provide reasons why a specific paper was not selected for funding?

**Answer:** I have attempted to provide reasons in the past but due to the large number of papers received it is impossible to provide critiques of all of them. Sometimes it is just a matter of the review panel deciding by consensus that certain white papers are better than the others. Sometimes two papers are equally good but the available funding will only support selecting one. In these instances it is almost impossible to define why one paper was accepted and the other was not.

**Question 9:** What happens to white papers that are not selected for further consideration? Is the information destroyed?

**Answer:** Yes

## ORAL PRESENTATIONS

**Question 1:** How long are the oral presentations that are given in March at the EW Program Review?

**Answer:** The presentations are 20 minutes long with a 10 minute question and answer period. Offerors that are selected to give an oral presentation will be provided with a briefing template that ensures the technical, programmatic and required background info is covered.

**Question 2:** You stated that during the oral presentations in March representatives of industry or academia would not be in the audience. Would the audience include proposers from the government?

**Answer:** Possibly, but under the rules for ethical conduct by government employees they are obligated to protect proprietary information and not use it to their own benefit.



# ONR Discovery & Invention Frequently Asked Questions (5)



## FULL PROPOSALS

**Question 1:** Will ONR request more full proposals to be submitted than there are resources to fund?

**Answer:** No, ONR will request full proposals from only those entities whose efforts they intend to fund starting in fiscal year 2014. However, if the final approved DoD budget for fiscal year 2014 includes less funding for ONR EW D&I efforts than is currently anticipated, it may be necessary to limit the awards to match the funding available.

**Question 2:** Is there a limit on the number of awards a single company can receive?

**Answer:** No. It is conceivable that a single company could win all the awards in a single year, though, of course, that's not likely.

**Question 3:** Is it possible to add additional subcontractors over the life of the three year effort?

**Answer:** We would have to see how the contract is set up but I would think it is possible. I know that over a three year period different things may occur but I would encourage you to have identified the people and companies you will be using up front and identify what part each plays in the overall effort. Changes that are necessitated due to unforeseen circumstances in the future would be resolved through modification of the initial contract.



# ONR Discovery & Invention Frequently Asked Questions (6)



## IRAD & DATA RIGHTS

**Question 1:** Is there an option to combine your funding with a company's IRAD?

**Answer:** Possibly. The question would be, "Is the government receiving any benefit in doing this?" It's not the practice of ONR to fund a company to build up their own capability without benefiting the government. There would most likely be intellectual property and data rights issues which would limit the government's ability to use the technology in other efforts they may fund later. ONR prefers to fund efforts that develop innovative ideas and innovative technologies for the benefit of the DoD community over those that solely benefit one company. If your proposed effort does involve IRAD technology or funding or other intellectual property that is protected in other ways (for instance, under a prior SBIR) you can still submit a white paper but the issue of intellectual property and data rights should be specifically pointed out in the white paper. If omitted in the white paper, it must certainly be addressed in the full proposal in Section II (Special Requirements), Sub-section 10 of the Required Technical Proposal Template (2011, Revision 8) that must be completed and submitted with the full proposal.

**Question 2:** Is there room for negotiation on this matter of the government retaining full data rights?

**Answer:** I understand that companies want to develop technology that they can later market to make money but I also have to protect the government's rights to use technology funded by government funds without having to constantly go back to the company to ask permission. Assertion of Data Rights is addressed in Section II (Special Requirements), Sub-section 10 of the Required Technical Proposal Template (2012, Revision 10) that must be completed and submitted with the full proposal. The rules governing data rights are prescribed in Defense Federal Acquisition Regulation Supplement (DFARS) clauses 252.227-7013, -7014 and -7018. All I can recommend is to submit a white paper with your idea and if it is selected then the submitted proposal should contain enough information regarding data rights that something can be worked out during the contracting negotiations that satisfies both parties.



# ONR Discovery & Invention Frequently Asked Questions (7)



## GOVERNMENT/INDUSTRY TEAMING

**Question 1:** Will you fund a company effort if they are also working with the Army or Air Force Research Labs?

**Answer:** Yes. Just because you are not currently working with a Navy lab should not prevent you from submitting a white paper. However, I would discuss the effort with my colleagues from the other services to determine if there is any background to the effort in their service. Each paper would be handled on a case-by-case basis.

**Question 2:** I'm curious as to the possibilities of combining a proposed effort with other government funded efforts that may happen.

**Answer:** Combining a proposed effort with other government funded efforts is possible, but the relationship and roles would need to be clearly explained and a list of specific deliverables unique to the ONR-funded effort would be needed.

**Question 3:** What is the best way to address this BAA and the separate government “Call for White Papers” for efforts involving combined government/industry efforts? Should the government lab submit a white paper to lead the effort, and in their list show all the participating industry/academic partners? Or should the government lab submit a white paper focusing on leading the transition of the initiative and suggest to the industry/academic partners to pair up and submit a separate white paper geared towards details of technical implementation?

**Answer:** We prefer to see a single proposed effort instead of a group of proposals with aligned efforts. If the government lab is in the position to lead a combined effort then it should be submitted in accordance with the Call for White Papers and not the BAA. The white paper should clearly indicate how the work will be divided among the participants, the roles of each, and recommend a contracting strategy for industry/academic participation (ONR contract (industry) or grant (academia)? Lab contract? Other contract vehicle?). Note that in such a combined effort the government lab participation should have a clear technical value-added and not just act as project manager or as a contracting facilitator.



# ONR Discovery & Invention Frequently Asked Questions (8)



## GOVERNMENT/INDUSTRY TEAMING (Continued)

**Question 4:** You've said we can submit papers that partner with a Navy lab. How specific do we have to be in the white paper with respect to how much industry does as compared to how much the Navy does?

**Answer:** You need to clearly delineate what role the Navy lab will play in the effort. You also have to ensure that the Navy is already on board to provide their level of participation. The Navy Principal Investigator should be identified and his resume included. Any partnership with the Navy must have already been established. ONR will not be the go between to set up this partnership. Also, if your effort requires the use or participation of Navy assets or test ranges these have to be arranged by you. ONR will not be a facilitator for your effort.

**Question 5:** Are there guidelines regarding working with Navy labs as opposed to without such partnerships?

**Answer:** No, there are no guidelines. Navy labs may be more cognizant of Navy needs and Navy applications in some cases, so that can be an advantage, but we have funded several efforts over the past few years that were from academia or industry without any participation from Navy labs or warfare centers. Partnering with a Navy lab will not get you any additional consideration during the evaluation process.

**Question 6:** Will representatives from any Naval Warfare Centers (NWCs) be in attendance at the Industry Day?

**Answer:** No NWC participation is planned for Industry Day. As explained in the BAA, it is up to the Offeror to make any arrangements for participation with an NWC in advance and that relationship needs to be spelled out in the white paper. ONR will not act as a facilitator for NWC involvement with non-government performers.

**Question 7:** Would a white paper that proposed partnering industry with the Coast Guard Research and Development Center be allowed?

**Answer:** I haven't worked with the Coast Guard before but I think that is something we could work out. I wouldn't let that stop you from submitting a white paper.



# ONR Discovery & Invention Frequently Asked Questions (9)



## **FUNDING**

**Question 1:** Is there a single pot of money to fund industry efforts and a separate pot for government efforts?

**Answer:** No, a single funding source will be used for all the selected efforts whether they are from industry, academia, FFRDC, UARC, government labs, or warfare centers. There are no earmarks for any Offeror or group of Offerors; the only consideration for funding decisions is the content of the proposal and the available budget.

**Question 2:** Is this funding you have sent aside for 2014 new starts affected by multiyear efforts from previous years and efforts from future years that may be funded?

**Answer:** No, this funding has been identified and set aside for each of the next three years to fund efforts in the Research Areas identified in the BAA.

**Question 3:** How many efforts will be funded in each year?

**Answer:** That depends on how much the selected efforts cost. As stated in the BAA we anticipate most efforts to cost around \$500K - \$1,500K per year for 3 years. It is always possible that higher priced efforts may be selected. However, if you proposed an effort costing \$6 million per year you would need to convince the panel of reviewers that your effort deserves a budget that is 4x above the norm and, quite frankly, that would be very difficult to do. Generally speaking, efforts that request more than \$1.5 million per year need to show a very compelling reason both technically and programmatically to convince the panel of reviewers that they are worthy of being selected.



# ONR Discovery & Invention

## Frequently Asked Questions (10)



### **FUNDING (Continued)**

**Question 4:** Over how many years will efforts be funded?

**Answer:** Generally, the efforts are three year efforts. One year and two year efforts are fine but if you have a four year effort you need to take a look at the schedule and see if there is any way to compress it down into three years.

**Question 5:** Is there additional funding available in the out-years?

**Answer:** Possibly, but those funds are currently planned to support new start efforts in those years and any funds used to continue current efforts will cut into the amount available for new starts.

**Question 6:** Regarding program funding, is there a profile that is considered more desirable than others?

**Answer:** Not necessarily, but the profile should make sense with respect to the effort being proposed. One would normally not expect the funding to be front-loaded but rather spread out over the life of the program, possibly with a slightly higher profile in the final year as testing and other more costly events occur. But whatever profile is proposed it must be justified by the program plan.



# ONR Discovery & Invention

## ONR BAA 13-005 Points of Contact



### Technical

**Dr. Peter Craig**  
**Electronic Warfare Program Manager**  
**Office of Naval Research (ONR 312)**  
**875 North Randolph Street, Suite 1112**  
**Arlington, VA 22203-1995**  
**E-mail: [peter.craig@navy.mil](mailto:peter.craig@navy.mil)**

### Business

**Ms. Rebecca Foster**  
**Contract Specialist**  
**Office of Naval Research (BD 0251)**  
**875 North Randolph Street, Suite W1272D**  
**Arlington, VA 22203-1995**  
**E-mail: [rebecca.foster@navy.mil](mailto:rebecca.foster@navy.mil)**



# Questions?



# ONR

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# ONR Discovery & Invention

## This year: ONR BAA 13-005



### Enabling Cognitive and Adaptive EW

Apply adaptive and machine learning algorithms to EW. Develop methods to represent real-time dynamic spectrum knowledge, sense and learn RF features and behaviors, and reason about threat systems and the environment to form electronic attack strategies on-the-fly. Specific areas include:

- Spectrum knowledge framework development
- Technologies for real-time spectrum inference
- Prioritizing EW actions and optimizing resources
- Non-traditional, efficient, and covert EA methods

### High Throughput and Rapidly Programmable EW Systems

Develop enabling technologies for reconfigurable EW systems that have extremely high-volume processing capability. The objective is a software defined RF system capable of performing real-time signal processing over not less than 3 GHz (threshold) and up to 10 GHz (objective) of RF bandwidth with low SWAP. The goal is to minimize the amount of data that needs to be moved from system to system or platform to platform by processing it at the data source.

### Emulation Environments for Adaptive and Targeted EW

Develop emulated RF or M&S environments to enable the development, testing, and validation of cognitive and targeted EW techniques and systems. This includes the development of testbeds to test adaptive EW techniques, including representative models of EM systems and realistic EM background environments. Testbeds should support research into closed-loop techniques in order to anticipate and out-pace agile threat behavior.

### Innovative EW Concepts

Explore truly innovative concepts in the EW areas of ES, EA, or EP which could fundamentally change the way naval forces conduct EW Operations.