

2012
**ONR Naval
S&T Partnership
Conference & ASNE Expo**

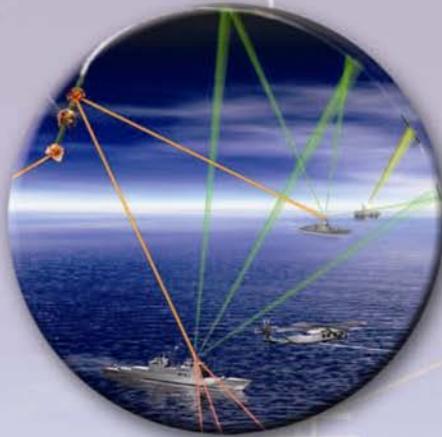
**Opportunities in
Power Projection
and Integrated Defense**

Mr. Michael B. Deitchman
Deputy Chief of Naval Research
Naval Air Warfare and Weapons (Code 35)





Research Areas



Integrated Layered Defense



Time-Critical Precision Strike



Future Naval Fires



Extended Threat Neutralization

Long Range RF Find, Fix & ID (LRRFFFID)



LRRFFFID Provides:

- Technology for the automated classification and identification (ID) of surface ships at long range, day or night, in any weather, using radio frequency (RF) sensors

Warfighter Payoff:

- Sensors provide location, course, and speed of contacts within the field of view
- Contact ID supports more robust track continuity as well as a greater ability to surmise contact intent

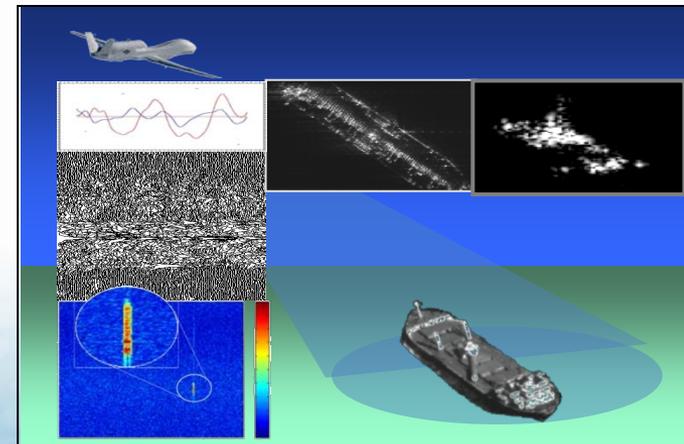
Research Opportunities:

- Novel approaches for improved ID of maritime contacts at long range with RF sensors
- Back-end processes to automate data-basing, query, and retrieval of ID characteristics and information within a tactically relevant timeframe



Dr. Michael Pollock

**Program Manager
Surface & Aerospace Surveillance**





Next Generation Airborne Electronic Attack (NGAEA)

NGAEA Provides:

- Enhances suppression of enemy air defenses with improved antenna array and radio frequency (RF) power amplifier technologies
- Increases jamming performance with advanced beamformer and exciter technologies

Warfighter Payoff:

- Next Generation Jammer capable of generating more AEA capacity and capability with reduced costs and adaptable, modular architectures

Research Opportunities:

- Broadband, high-power RF power amplifiers
- Broadband antenna array elements and beam control
- Advanced countermeasure techniques generation using digital RF memory (DRFM)
- Packaging and thermal management



Dr. Peter Craig

EW Program Manager





Multi-Target Laser Designation (MTLD)

MTLD Provides:

- Effective force multiplication by **simultaneous** semi-active laser (SAL) weapon designation of multiple targets with a single platform

Warfighter Payoff:

- Automated target track and engagement
- Addresses multiple, maneuvering surface threats
- Reduces manned aircraft threat-exposure time

Research Opportunities:

- Precision multi-target tracking
- Cost-effective mechanical Gimbal replacements
- High-agility steering mirrors and high PRF lasers
- Processing to optimize energy-on-target and signature discrimination



Dr. Ravi Athale

EO/IR Sensor Program Manager





Energetic and Reactive Materials

Energetic and Reactive Materials Provides:

- Next generation of energetic ingredients, a pillar for advanced propellants and explosives applications
- Computational solutions (from atomistic through continuum level) to meet Insensitive Munitions (IM) requirements
- Reduce energetic material sensitivity toward initiation by external unplanned stimuli without reducing performance

Warfighter Payoff:

- Naval power projection with safe, cost-effective ordnance with adaptable effects
- Enhanced delivered energy in compact volumes
- Resistance to catastrophic failure in extremely stressful environments
- Scalable effects to reduce logistics burden

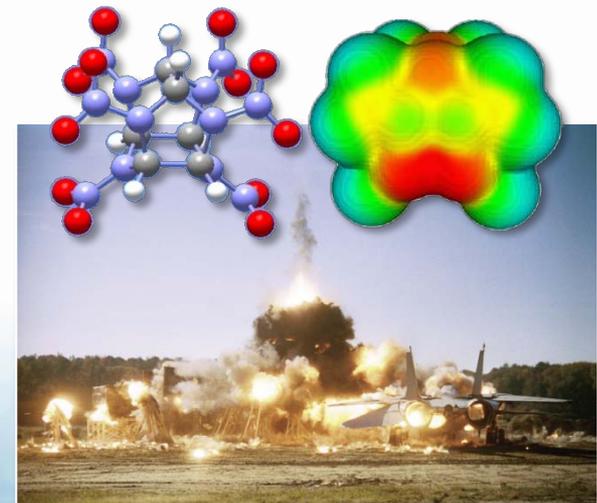
Research Opportunities:

- Energetic Material Ingredients:
- Advanced Solid Rocket Motor Propellants
- Coulomb Explosions
- Reactive Material Composites



Dr. Clifford Bedford

Program Manager
Advanced Energetic Materials





Counter-Directed Energy Warfare

Counter-Directed Energy Warfare Provides:

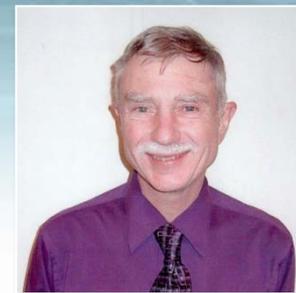
- Science and technology that will lead to systems that protect and defend naval forces against high-energy-laser and high-power-microwave directed energy weapons
- Education and training of future scientific and military leaders in both directed energy warfare and counter-directed energy warfare technology
- Raised awareness in the Directed Energy Weapons community of growing need for countermeasures as threats develop

Warfighter Payoff:

- Detect, Locate & Identify Threats
- Obscure, Deflect or Nullify lethal mechanism
- Counter-Offensive Defeat of Critical Elements

Research Opportunities:

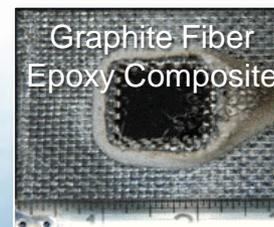
- Laser protective paints & structures for UAVs & other assets
- Off-axis high energy laser detection theory & warning devices
- High energy laser beam propagation effects in maritime atmosphere
- Creation of atmospheric shields
- Adaptive nonlinear metamaterial surfaces to suppress high power microwave effects
- Wave chaos approach to HPM damage mitigation



Dr. Lewis DeSandre
Counter-Directed Energy Warfare
Program Manager



Determination of DEW threat



Graphite Fiber
Epoxy Composite



Aluminum

Characterization of Material Response



Free Electron Laser

Directed Energy Provides:

- An effective/affordable point defense capability against many surface and air threats, Anti-Ship Cruise Missiles, and Swarms of small boats
- Allows an unlimited magazine with speed-of-light delivery

Warfighter Payoff:

- Graduated lethality
- Low life cycle cost (~\$50 per engagement)
- Multi-mission / scalable
- All electric for deep non-explosive magazine
- Precise engagement/low collateral damage
- Rapid reaction to moving and/or swarming Time Critical Targets

Research Opportunities:

- Free Electron Laser Weapons
 - (Injectors/Accelerators/Amplifier/Oscillator Designs)
- Solid State (Fiber) Drive Laser
- Beam Control
- Modeling and Simulation



Mr. Quentin Saulter

Program Manager





Solid State Laser Technology Maturation

Solid State Laser Weapons Provide for the Navy:

- An effective/affordable point defense capability against many surface and air threats, Anti-Ship Cruise Missiles, and Swarms of small boats
- Allows an unlimited magazine with speed of light delivery
- Detection tools for ships to detect/classify potential threats at range, permitting options of non-lethal or employing other weapons



Mr. Peter A. Morrison

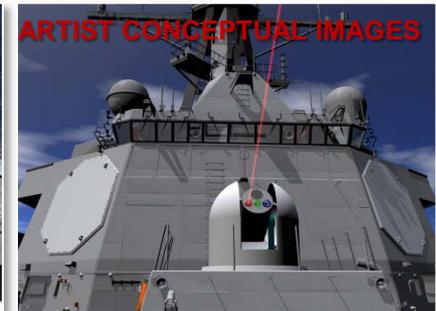
Program Manager

Warfighter Payoff:

- Graduated lethality
- Low per engagement and life cycle costs,
- Precise engagement/low collateral damage
- Rapid reaction to moving, swarming Time Critical Targets
- Ranged sensing of Weapons of Mass Destruction before a warfighter has to set foot on a suspect vessel

Program Goal:

- Design and build Advanced Development Model (ADM) prototypes(s) Solid State Laser Weapon suitable for installation on U.S. Naval Flagged Surface Combatant, (LCS or DDG) and tested at sea by 2016



US Navy Photograph, APRIL 2011, UNCLASSIFIED - PUBLICALLY RELEASEABLE





Railgun Technologies

Railgun Technology Provides:

- Electromagnetic Railgun is a multi-mission weapon system that uses electricity instead of gun powder capable of launching projectiles up to MACH 7 and ranges greater than 100 nm

Warfighter Payoff:

- Reduced cost per kill
- Deep magazines
- No unexploded ordnance on battlefield
- Minimum collateral damage
- Persistent, volume & precision fires
- Multi-mission potential



Research Opportunities:

- Advanced thermal management techniques for long (10-meter), slender metal rail structures
- Extended service life for materials and components in harsh environment
- High-strength, dielectric, structural materials
- High-speed, high-current metal-on-metal sliding electrical contact
- System interfaces between high-power loads and platform power distribution
- Compact pulsed power systems and power electronics
- High-conductivity, high-strength, low-density conductors
- Repetitive rate switches and control technologies
- Aero thermal protection systems for flight vehicles
- High-acceleration tolerant electronic components and structural materials



Mr. Roger Ellis

**Electromagnetic Railgun
Program Manager**



Hypervelocity Projectile



Hypervelocity Projectile Program Objectives:

- Modularity – incorporate capabilities to meet multiple mission requirements in the areas of Naval Surface Fire Support (to include potential in-flight retargeting), Anti-Surface Warfare, Cruise Missile Defense, and support future requirements for additional mission areas
- Commonality- design, develop, fabricate, test and demonstrate a guided hypervelocity projectile compatible with conventional gun systems and future railgun systems

Warfighter Payoff:

- Multi-mission capability
- Multi-platform application
- NSFS ranges – at least double current capability
- Reduced unit cost to permit volume fires

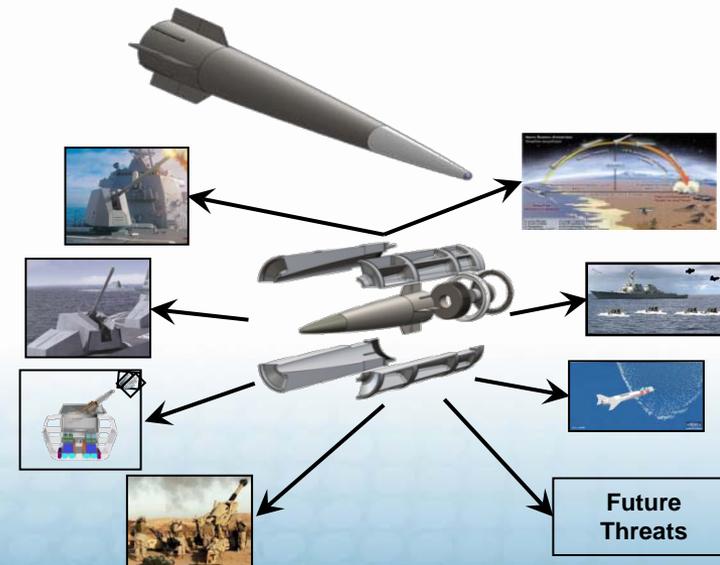
Research Opportunities:

- High G launch survivability (miniaturized high-G tolerant guidance electronics and control actuation systems, militarized GPS receivers, and compact fuzing/safe & arm)
- High density electronics packaging and miniaturization
- Advanced energetics
- Lightweight-high strength composite materials, heat resistive-thermal managing materials for aero-thermal management



Ms. Sarwat Chappell

Program Manager





Future Naval Capabilities

Future Naval Capabilities Provide:

- Maturation of applied research to system and subsystem demonstrations in a relevant environment (TRL-6)
- Products for transition to Programs of Record in accordance with tripartite Technology Transition Agreement
- Solutions to identified warfighter gaps

Warfighter Payoff:

- Increased warfighter capabilities
- New and improved weapons systems
- Total Ownership Cost reduction

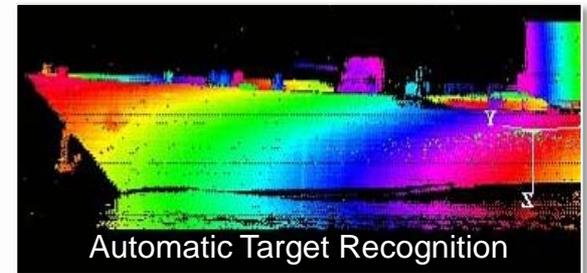
Technology Maturation Opportunities:

- Disparate, collaborative weapon behavior
- Hypervelocity projectiles
- Directed energy
- Advanced warheads
- Miniaturization technologies



Mr. Ken Heeke

Program Manager, FNC Director





Where You Should Meet These Program Officers

| Name | Program | ONR Code | Breakout Room |
|---------------------|----------------------------------------------------------------|----------|---------------|
| Dr. Michael Pollock | Surface & Aerospace Surveillance | 31 | Fairfax |
| Dr. Peter Craig | Electronic Warfare | 31 | Fairfax |
| Dr. Ravindra Athale | EO/IR Sensors | 31 | Fairfax |
| Dr. Cliff Bedford | Energetic Materials | 35 | Jefferson |
| Dr. Lewis DeSandre | Weapons of Mass Destruction Detection, Counter-Directed Energy | 35 | Jefferson |
| Mr. Quentin Saulter | Free Electron Laser | 35 | Jefferson |
| Mr. Peter Morrison | Solid State Laser Technology Maturation | 35 | Jefferson |
| Mr. Roger Ellis | Electromagnetic Railgun | 35 | Jefferson |
| Ms. Sarwat Chappell | Hypersonic Weapons | 35 | Jefferson |
| Mr. Ken Heeke | Future Naval Capabilities | 35 | Jefferson |

Questions?