2010 ONR Naval S&T Partnership Conference

Next Generation Technologies for Today's Warfighter

Directed Energy and Hypervelocity

Michael Deitchman

Revolutionary Research . . . Relevant Results

OFFICE OF NAVAL RESEARCH

DIRECTED ENERGY & HYPERSONICS

Directed Energy and Hypersonics

Programs featured at this conference include:

- Directed Energy
  - Free Electron Lasers, Fiber Lasers, Applied Electromagnetics, Weapons of Mass Destruction Detection Tools, and Counter Directed Energy Programs
- Electronic Warfare
  - Next Generation Airborne Electronic Attack, Distributed Electronic Warfare
- Hypersonic Technologies
  - Electromagnetic Railgun, High Speed Weapon technologies
- Materials Science
  - Materials for extreme environments, Enhanced Weapon technologies

Directed Energy

- **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.
  - Detection tools for ships to detect/classify potential threats at range, reducing boarding parties which stop shipping
- **Warfighter Payoff**
  - Graduated lethality
  - Low per engagement and life cycle costs,
  - Precise engagement/low collateral damage.
  - Rapid reaction to moving and/or swarming Time Critical Targets.
  - Ranged sensing of Weapons of Mass Destruction before a warfighter has to set foot on a suspect vessel
- **Research Opportunities:**
  - Free Electron Laser Weapons
    - (Injectors/Accelerators/Amplifier/Oscillator Designs)
  - Solid State (Fiber) Laser
  - Beam Control
  - Modeling & Simulation
  - Counter Directed Energy technology and applications
  - Detectors and sensors for special nuclear materials

Program Managers

Quentin Saulter
Directed Energy and
Free Electron Laser Innovative Naval Prototype

Peter Morrison
Maritime Laser Demo, WMD Detection, Counter Directed Energy

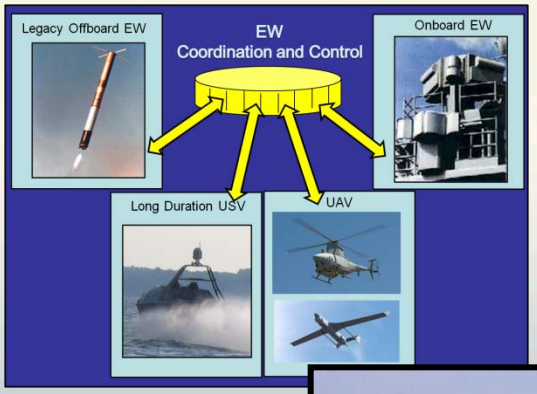
Electronic Warfare

- **Electronic Warfare/Electronic Attack**
  - Next Generation Airborne Electronic Attack (NGAEA) enhances suppression of enemy air defenses with greater jamming effectiveness through advanced radio frequency antenna array, power amplifier and exciter technologies
  - Distributed EW will network EW assets into a system-of-systems providing essential EW effects required to counter emerging threat system developments
- **Warfighter Payoff**
  - NGAEA provides increases in coverage. number /control of jamming beams, adaptability to threats and spectral purity while reducing fratricide and manufacturing cost
  - Distributed EW allows wide area deception via synchronized decoy control, electronic camouflage to dilute enemy engagement, and time-critical situational awareness of adversary emitters/activity
- **Research Opportunities:**
  - Broadband, high-power RF amplifiers, antenna array elements and beam control. Advanced countermeasures using Digital RF Memory (DRFM). Packaging and thermal management
  - Control/optimization/coordination of EW systems over a large area. Low-cost scalable systems for spectrum coverage, advanced processing, and threat handling capacity

Program Manager

Dr. Peter Craig

Electronic Warfare

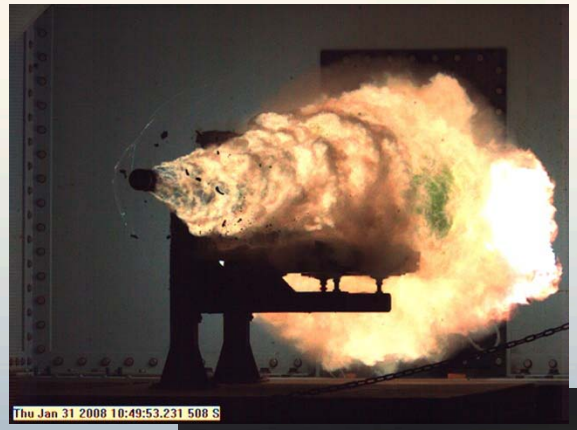


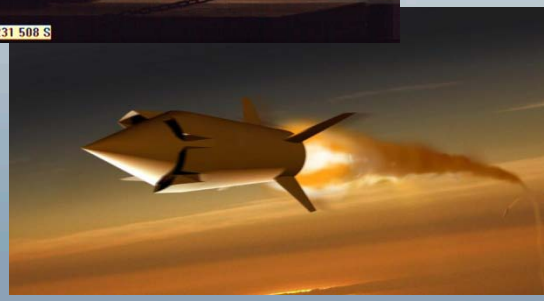
Hypersonic Technologies

- **Hypersonic Technologies Provides:**
  - Fully electric weapons, like the Electromagnetic Railgun, capable of launching projectiles greater than 200 nm in ~ 6 minutes.
  - Solid rockets, ramjet/scramjet, advanced turbine engines, and pulse detonations combustion propulsion advancements
- **Warfigher Payoff**
  - Fully electric weapons eliminate hazards of high-explosives in the ship and unexploded ordnance on the battlefield while delivering long range, precision volume fires in adverse weather conditions.
  - Propulsion investments lead to increases in stand-off range, decreased time-to-target, and increased fuel efficiencies
- **Research Opportunities:**
  - Electromagnetic Railgun requires high-density energy storage and power electronics. As well as high-strength, erosion resistant materials for increased rail life.
  - High efficiency fuel to air mixing techniques
  - High temperature radar components

Program Manager

Roger Ellis
ElecroMagnetic Railgun



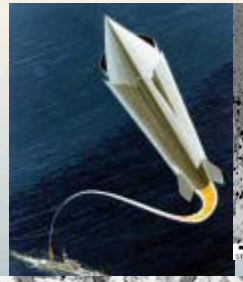


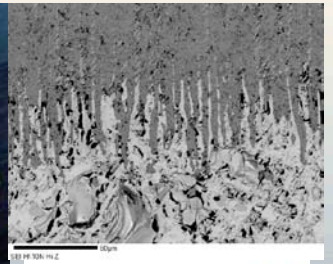
Materials Science

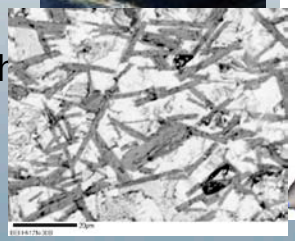
- **Materials Science Provides:**
  - High-Temp Materials for hypersonic leading edges and control surfaces, rocket motor nozzles, Electromagnetic Railgun nosetips. and load-bearing insulators where extrememly high temperatures (up to 2500C), high thermally-induced stresses, extreme acceleration loads, and oxidative environments limit the use of off-the-shelf solutions
  - New rocket motors will utilize energetic materials, insulators and high temperature erosion resistant materials
- **Warfighter Payoff**
  - Extended range, higher speed, and precision targeting, through a decrease in time to target and improved end-game maneuverability through demonstrated missile propulsion, airframe and control technologies.
- **Research Opportunities:**
  - Material challenges include withstanding sustained greater than 2000ºF soak for 10's of minutes for high speed long range cruise missiles, High Temperature Structural Insulators & Materials & Structures for Hypersonic Applications
  - Advanced composite case design incorporating increased stiffness with minimum thickness; Improved radome design and improved drive actuators for sustained high-speed environments
  - High energy solid propellants, propellant mechanical and chemical compatibility prediction methods, advanced insulators, thrust control devices, low erosion nozzles and high pressure composite motor cases.

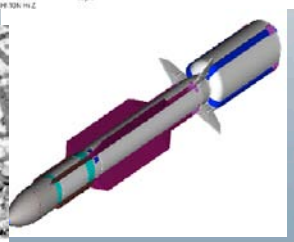
Program Manager

Eric Wuchina
Material Science









Other Program Officers You Should Meet

Name	Program	ONR Code	Breakout Room
Quentin Saulter	Directed Energy	35	Jefferson
Roger Ellis	Electromagentic Railgun	35	Jefferson
Joe Doychak	Jet Noise Reduction, Aerospace Propulsion	35	Jefferson
Peter Morrison	WMD Detection, Counter Directed Energy	35	Jefferson
Ken Heeke/ Roger Sullivan	Sea Strike Future Naval Capabilities	35	Jefferson
John Kinzer	Rotary Wing	35	Jefferson
Cliff Bedford	Energetic Materials	35	Jefferson
Malinda Pagett	Unmanned Aviation	35	Jefferson
Gil Graff	Hypersonic Weapons	35	Jefferson
Marc Steinberg	Intelligent Autonomy	35	Jefferson

Questions?