Non-Lethal Directed Energy – Radio Frequency (RF) / High Power Microwave (HPM)

Non-Lethal Weapons Research and Technology Development

Industry Day

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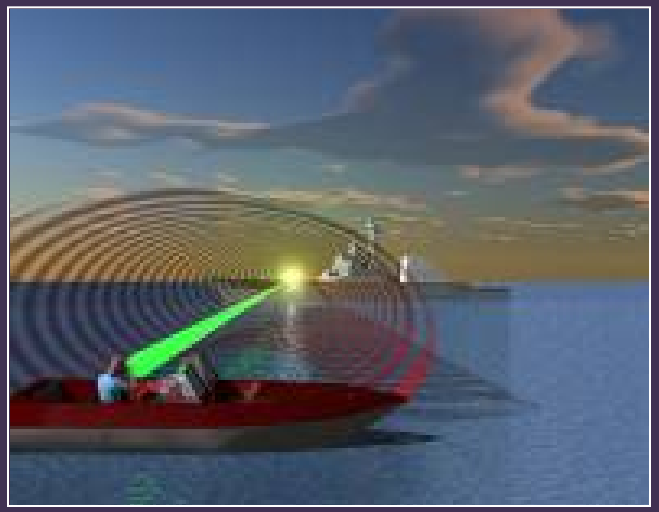
http://jnlwp.defense.gov

Background

- RF/HPM directed energy technologies provide for unique non-lethal (counter-materiel and counter-personnel) effects with extended range.

- Though their operational utility is desirable, the use of RF/HPM directed energy weapons remains limited due operational range, size, weight, and cost.

- The JNLWD is focused on developing advanced RF/HPM technologies to enable smaller, lighter and more capable non-lethal directed energy weapons.



Technical Objectives

- Determine the feasibility of new concepts and technologies that enable smaller, lighter and more capable non-lethal directed energy weapons and address multiple types of targets

- Develop and demonstrate novel RF/HPM technology breadboards and prototypes to address various targets
  - Personnel
  - Vehicles
  - Vessels
  - Aircraft
  - Threat electronics
  - Facilities

- Integrate improved RF/HPM technologies with existing systems and platforms

Relevant Work

- Solid State High Power Microwave (HPM) Source
  - Performers:
    - Los Alamos National Laboratory
    - NSWC Dahlgren
  - Focus/Performance Goals:
    - Develop a 50 MW, dielectric based Non-Linear Transmission Line (NLTL) source for HPM applications
      - Multi-frequency waveforms from a single source vice multiple tubes
    - Perform lab and field testing of a Low Power NLTL breadboard source to verify feasibility
    - Investigate new waveform regime for RF Vehicle Stopping (shorter pulse & multiple frequency)
  - Project terminated due to material science immaturity

Relevant Work

- Short Pulse / Low Duty Cycle Assessment
  - Performers: NSWC Dahlgren
  - Focus/Performance Goals:
    - Identify effective vehicle/vessel stopping waveform parameters with low average power requirements, enabling a substantially smaller RF Vehicle Stopper system
      - Implement effects-based design
    - Complete laboratory and open air vehicle/vessel susceptibility testing
    - Compare results to current vehicle and vessel stopping data
    - Perform a system trade-off analysis to determine the benefits of a short pulse vehicle/vessel stopping system compared to the RFVS demonstrator design in terms of size, weight, and effectiveness

Relevant Work

- Compact, High Gain, HPM Antennas
  - Pennsylvania State University – Meta-materials
  - University of Missouri-Columbia – Advanced Dielectrics
  - Focus:
    - Assess the feasibility of applying dielectrics and meta-materials to enable the development of compact, high-gain antennas for preferred frequencies and output power levels employed by non-lethal high power microwave applications

- Advanced High Energy Density Capacitors
  - University of Missouri-Columbia
  - Focus:
    - Assess feasibility of new materials to develop smaller, high-voltage capacitors to reduce size of high power microwave subsystems

Relevant Work

- Thermal Management Phase I Small Business Innovative Research (SBIR)
  - Topic #: Navy102-110
    - Advanced Cooling Technologies, Inc. (M67854-11-C-6506)
    - Allcomp, Inc. (M67854-11-C-6507)
    - International Mezzo Technologies (M67854-11-C-6508)
    - Altex Technologies (M67854-11-C-6509)
    - Thermal Form & Function, Inc. (M67854-11-C-6510)
  - Focus:
    - Design next generation cooling/thermal management system to meet identified system performance specifications relevant to vehicle stopper systems and the 30 kW ADT systems.
- Thermal Management Phase II SBIR (Pending Award)
  - Focus:
    - Fabricate and test cooling/thermal management design.
    - Conduct system analysis and design tradeoffs.

Research & Development Tasks

Enabling Technologies:

Compact, Steerable High Gain Antenna
Short Pulse Regime Sources
Long Pulse Regime Sources
Prime Power Systems
Thermal Management Systems

- *Reduced size & weight*
- *Improved capability*

Existing System Demonstrators/Prototypes:

Multi-Frequency RF Vehicle Stopper
RF Vessel Stopper
Non-Lethal Unmanned Aerial Vehicle HPM Payload
Pre-Emplaced Electric Vehicle Stopper

Potential Platforms:

Light Tactical Vehicles
Unmanned Vehicles/Vessels
Unmanned Air Vehicles

Research & Development Tasks

General types of tasks required for RF/HPM technology and development:

- Feasibility studies and technology assessments
- Target vulnerability tests utilizing effects-based design approach
- Build, test and demonstration of component technologies
- Comparison of novel approaches with existing technologies
- Integration of component technologies with existing breadboard and prototype systems
- Integration onto various platforms

Capabilities

General capabilities and expertise that may be required to execute planned RF/HPM technology tasks:

- Engineers/Scientists with expertise in
  - High power microwaves
  - Pulsed power
  - High power vacuum tubes
  - Other high power sources (NLTL's, FEGs, etc.)
  - Antennas
  - Prime power
  - Power conditioning
  - Computational electromagnetics
  - Statistical electromagnetics
  - Physics
  - Electrical engineering
  - Materials science
  - Statistics (design of experiment, data Analysis, linear regression, etc.)
  - Systems integration
  - Systems engineering
- Facilities and equipment to develop, build, and test component technologies, subsystems, and systems
- Facilities to perform electromagnetic vulnerability tests, antenna characterizations, and high power source characterizations.

Questions?

Please submit questions by 29 June 2012:

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