

**Joint Non-Lethal Weapons Program  
Fiscal Year 2015 Non-Lethal Weapon Technologies**

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## INTRODUCTION:

This publication constitutes a Broad Agency Announcement (BAA) as contemplated in Federal Acquisition Regulation (FAR) 6.102(d)(2) and 35.016 and the Department of Defense Grants and Agreements Regulations (DoDGARS) 22.315(a). A formal Request for Proposals (RFP), other solicitation, or additional information regarding this announcement will not be issued.

The Office of Naval Research (ONR) will not issue paper copies of this announcement. ONR reserves the right to fund all, some or none of the proposals received under this BAA. ONR provides no funding for direct reimbursement of proposal development costs. Technical and cost proposals (or any other material) submitted in response to this BAA will not be returned. It is the policy of ONR to treat all proposals as sensitive competitive information and to disclose their contents only for the purposes of evaluation.

### I. General Information:

- A. Agency Name – Office of Naval Research  
One Liberty Center  
875 N. Randolph Street  
Arlington, VA 22203-1995
- B. Research Opportunity Title - Joint Non-Lethal Weapons Program – Fiscal Year  
(FY)15 Non-Lethal Weapon Technologies
- C. Program Name – Joint Non-Lethal Weapons Program (JNLWP)
- D. Research Opportunity Number – ONRBAA14-008
- E. Response Date -  
  
White Papers: 07/15/2014  
Full Proposals: 09/26/2014
- F. Research Opportunity Description -

The Office of Naval Research is soliciting proposals for: (1) applied non-lethal weapon (NLW) research; (2) early NLW technology development, and (3) rapid NLW development, test, and demonstration of next-generation NLW and capabilities. The objective of this BAA is to stimulate applied research, advanced technology development (ATD), and advanced component development and prototypes (ACD&P) to include rapid-prototyping, testing and evaluation of NLW technologies in an attempt to address known military needs.

For the purposes of this BAA, applied research is a systematic study to understand the means to meet a recognized and specific military need. It is a systematic expansion and application of knowledge/technology to develop useful materials, devices, and (non-lethal weapon) systems or methods. These non-lethal (NL) studies and analysis augment and support current JNLWP areas of interest as well as explore new NLW technology opportunities: This applied research includes experimentation and model development associated with the technology development of early system prototypes which have a technology readiness level (TRL) of 2-3. This applied research may be oriented to support the design, development, and improvement of the NL

prototype's components, subsystems, or systems and/or the development of new models, simulations, studies, or processes related to the development of these non-lethal weapon prototypes.

Applied NL research also focuses on mitigating specific technology challenge areas, often involving research and development of specific components, sub-systems, and systems, which compose a next-generation non-lethal device, munition, or weapon system. Specifically these technology challenges address key subsystem and component designs that in their current system performance, form-factor, cost, and/or weight are detrimentally affecting the military suitability of (or acceptance of) this next-generation non-lethal weapons system as a viable transition to a Joint Acquisition program of record. This applied NL research is supported via Science and Technology (S&T) Budget Activity (BA-2) funding budget line.

For the purposes of this BAA, ATD supports the research and development of next generation NLW laboratory and advanced breadboard system prototypes. This research supports the technology development, test, and evaluation of NLW components, subsystems, and systems which have been shown to mitigate known military needs. This research includes laboratory and field testing of laboratory-grade and advanced breadboard level system prototypes. It also includes performing model development, verification and validation as required, to support the development of these advanced technology prototypes. This research is supported by Budget Activity 3 (BA-3) funding and supports development of a system prototype with a TRL of 4-5.

**The information provided on the final stage of this BAA is provided for information only. If this final stage is awarded, it will be incorporated into an existing contract via contract modification subject to Section 819 of the Defense Authorization Act for Fiscal Year 2010.** The final stage of this BAA is the research, development, test, and evaluation of these fieldable system components, subsystems, and advanced system prototypes, i.e., the advanced component development and prototype (ACD&P) budget activity. This research includes performing studies, experimentation, and technical evaluations necessary to evaluate the effectiveness of these weapon systems in mitigating known Department of Defense (DoD) capability gaps and other urgent needs and requirements. These prototype technologies shall be evaluated and their military utility assessed as integrated into existing and future manned and unmanned platform dismounted military operations, and autonomous operations. The objective of this final stage of research is to fully evaluate these BAA technologies and advanced prototype systems so as to expedite technology transition from laboratory to operational use and facilitate transition of these technologies into formal DoD Acquisition programs of record. This research is supported by Research, Development, Test and Evaluation (RDT&E) Budget Activity (BA-4) and supports the evaluation and test of system prototypes with a TRL of 6-9.

The fourteen (14) technology focus areas for this BAA are outlined below. Note this is not a prioritized list of projects.

1. Non-Lethal Advanced Materials and Non-Lethal Payloads to Hail/Warn, Move, Deny Area, Suppress, and Temporarily Disable Individuals at ranges greater than (>) 100 meters
2. High Power Microwave Technologies for Counter-Material Missions
3. Compact Active Denial Technologies
4. Clear-a-Space Technologies
5. Human Electro-Muscular Incapacitation Technologies

6. Non-Lethal Directed Energy and Non-Directed Energy-based Technologies for Vehicle/Vessel Stopping & other Counter-Material Targets
7. Non-Lethal Laser Induced Plasma Effects for long range (> 100meter ) NL Counter-Personnel and Counter-Material Missions
8. Compact Non-Lethal Non-Pyrotechnic Flash-Bang Technologies
9. Compact Advanced Multi-Bang Flash-bang Technologies
10. Advanced Non-Lethal Technologies that Move/Suppress/Deny/Disable through Combine NL Effects on Individuals and Crowds
11. Compact Hail and Warn Technologies with long range (0-1500m) two-way communications
12. Compact, Low Cost Non-Lethal “Push-Back” – “Repel” Technologies
13. Human Effects and NLW Weapon Effectiveness Studies, Risk Assessments, and Evaluations
14. Other Next-Generation Non-Lethal Technologies

The fourteen (14) focus areas above are further broken down below to specific technology challenges at the prototype component, subsystem, and system level and this BAA seeks to mitigate known systems engineering and technical performance issues that are currently associated with a number of JNLWP-funded projects.

The JNLWP has funded related technology development under numerous programs. If Offerors are enhancing work performed under other JNLWP or DoD projects, they must clearly identify the point of departure and what existing work will be brought forward and what new work will be performed under this BAA.

ONR seeks proposals for efforts that shall develop and demonstrate technologies for next generation non-lethal devices, munitions, and weapons. All proposals, received under this BAA, must conform with United States (U.S.) domestic law, the international legal obligations of the U.S, including the law of war, and all DoD policies and regulations. White papers submitted in response to this BAA shall address technology developments in one or more of the following areas:

**1. Non-Lethal Advanced Materials and Non-Lethal Payloads to Hail/Warn, Move, Deny Area, Suppress, and Temporarily Disable Individuals at ranges greater than (>) 100 meters.**

A. Advanced Non-Lethal Materials and Non-Lethal Payloads:

Identify and demonstrate advanced materials or innovative non-lethal payloads that provide new or enhanced non-lethal counter-personnel and/or counter-materiel capabilities to enhance the warfighter’s ability to:

- i. Deliver intelligible voice commands and other long range warning capabilities to threat human targets at very long ranges (minimum of 600 meters - threshold, objective range of 1to 6 kilometers (km) in complex battlefield environments such as within vehicles and vessels, in high background noise environments, inside buildings and facilities, and in all weather conditions and operating light levels
- ii. Deny an area and/or access to an area to individuals or groups of individuals; applicable technologies include but are not limited to air-activated anti-

traction materials, low temperature fast curing synthetic concretes or hard epoxies, and/or fast curing sticky foams

- iii. Move individuals in and/or out of an area, closed or open areas
- iv. Suppress and/or degrade the operational capabilities of individuals or groups of individuals
- v. Temporarily disable threat individuals or groups of individuals
- vi. Stop/Disable threat vehicles and/or vessels at long ranges by employing counter-personnel non-lethal effects (move, deny area, and/or suppress) the vehicle driver or boat operator causing him or her to divert and/or bring their vehicle/vessel to a full stop. Applicable technologies could be but should not be limited to: fast acting low volume combustion modifiers (engine suffocates and combustion inhibitors), fast curing synthetic concretes or hard epoxy foams, low cost nets, low cost lightweight barriers, and other materials that will hasten or cause the vehicle and vessel engines to stall
- vii. Neutralize/disable threat weapons systems and facilities by employing counter-personnel (occupant/weapon system operator) technologies
- viii. This BAA is interested in advanced materials and non-lethal payloads for counter-personnel applications that could stimulate all of the human senses and produce a possible combined (synergistic) non-lethal effect as sought in paragraphs i-vii listed above. Concepts should be weapon or platform agnostic, i.e., these weapons systems shall be easily integrated on existing DoD weapon systems for the dismounted warfighter, and also on all types of small tactical manned or unmanned platforms
- ix. It should be noted that the JNLWP does not often fund the development of the delivery mechanism or platform that delivers this enhanced innovative non-lethal payload or munition; however the JNLWP may fund new innovative launching mechanism and payload delivery modalities that would greatly extend the current state-of-the-art of useful effective range, i.e., modalities that ensure: (1) safe, effective non-lethal payload delivery at muzzle-safe ranges, (2) safe, flight stable, and accurate/precise delivery of non-lethal payloads at extended ranges (greater than 200 meters), and (3) safe, effective delivery of non-lethal effects simultaneously to groups of individuals.

**B. Improved Blunt Impact Materials/Payloads:**

Develop and demonstrate long range blunt impact payload and/or system concepts commensurate with a 40 millimeters (mm) or less caliber munition that provides: (1) a maximum effective range > than 100 to 200 meters; (2) a minimum safe range of less than five (5) meters (objective is safe at the muzzle); (3) a precise (repeatable and accurate) flight stable round/trajectory of a non-lethal blunt impact payload; (4) an accurate flight stable round/trajectory that ensure optimum round hit accuracy and optimum round hit geometry of a non-lethal blunt impact payload; and (5) equally effective/safe non-lethal blunt impact effects delivered at the desired long ranges of 100 to 200 meters, as well as at the minimum safe range of 5 meters (safe at the muzzle desired). Concepts may include but are not limited to:

- i. Blunt impact payload materials with properties that enable effective/safe non-lethal effects at maximum ranges sought and equally effective/safe non-lethal

blunt impact effects at the short ranges (includes analysis proof of minimized risk of significant injury).

- ii. Blunt impact systems/munitions that adjust to the target's range to enable consistent effective engagement at short and long ranges, with minimal risk of injury.
- iii. Flight stable munitions that enable consistent target to round hit angles (necessary to assure optimized delivery of blunt impact effects and assured target attachment for those blunt impact round with embedded electrical probes, at all safe/effective round flight speeds (concepts could include constant velocity launchers and/or target range dependent auto-adjustable (energetic and/or non-energetic based) payload propulsion launching systems)
- iv. Flight stable munitions that enable accurate long range delivery of 40 millimeters (mm)-like munition payloads to the center of mass of a standing human target.
- v. Blunt impact materials that have adjustable material hardness and/or viscosity based on munition velocity or the amount of airflow around the munition, i.e., a material that softens and becomes more pliable when it is in motion and is in its hard form when its velocity is zero.

#### C. Improved Advanced Non-Lethal Materials

Develop and demonstrate improved non-lethal materials and geometries. The materials of interest are vast so as to encompass a number of known technology challenges within the various active JNLWP projects. Concepts may include but are not limited to:

- i. Advanced blunt impact munition materials to include advanced rubber/composite nose cone materials/geometries and/or a blunt impact payload(s) that maximize safe blunt impact force effects (inelastic collisions) and minimize the probability of skin penetration and ensure a minimized risk of significant injury to the eye, skin, bone, and internal organs. The goal is to maximize the blunt impact force by spreading this force over a wide area of the body and to take advantage of the internal structure (and geometry, e.g. the human eye and the eye socket) to minimize the potential for eye, skin, bone, and internal organ injuries.
- ii. Carbon Nanotube (CNT) materials configured in strands/strings/forests that enable high acoustic outputs of greater than 132 decibel (dB) per "speaker" element. This includes developing optimum CNT wrapping and stacking designs, improved thermal coupling efficiency of the strands, strings, or forests as configured in a sealed support structure with and without power amplifier and signal processing electronics and immersed in an optimal thermal shock medium such as a non-reacting noble gas or other optimum thermal coupling medium.
- iii. Malodorants. Malodorants shall be limited to non-lethal malodorants that are not considered riot control agents, i.e., the malodorant must not cause "sensory irritation" or any "disabling physical effects." The objective of these malodorants is to cause immediate repel effects to humans in open and confined spaces. This repel effect occurs with very small amounts (less than 8 ounces; 1/2 pint ) of malodorant material applied within an open or confined

space and often causes humans to: (1) leave a space (open or confined); (2) not enter a space (open or confined), and/or (3) discourage re-occupancy of humans in both open and confined spaces. This (repel) duration of effect can last 24 hours or more.

- iv. Other materials associated with the development and fabrication of directed energy weapons, to include DE source materials, antenna (power projection and beam transport) and optical materials, thermal management materials, and prime power materials.

## **2. Compact High Power Microwave Technologies for Counter-Material/Counter-Electronics Missions**

### **A. High Power Microwave (HPM) Technologies:**

- **New Compact HPM System Concepts:** Develop and demonstrate compact, lightweight high power microwave system concepts capable of achieving effective non-lethal counter-electronic effects, from temporary disruption to electronic component damage that is at a minimum “depot-repairable”. The goal is to achieve these targeted electronics on-board (civilian/commercial) vehicles and/or vessels at ranges greater than small arms range. Concepts must deliver sufficient field strength at range to generate stopping and/or disabling effects, and be waveform controllable to provide scalability of effects, from temporary disruption to (repairable) electronic component damage. Dedicated prime power sources shall power these radio frequency (RF)/HPM sources as integrated on these mobile platforms (to include hybrid battery-generator prime power systems). The threat vehicle shall be held stopped for a minimum of five (5) minutes (hold down time) with an assumed duty cycle time of three five (5) minute vehicle/vessel hold downs to occur within one (1) hour.
- **HPM System Component Improvements:** Develop innovative concepts to reduce the size, weight, and cost of current state-of-the-art HPM/RF vehicle/vessels stopping systems. This includes optimization and miniaturization of HPM/RF source component technologies, with improvements in overall HPM source efficiency, extension of source/system operational lifetimes, and increases in current state-of-the-art system reliability. Concepts should support the goal to achieve a full system HPM vehicle/vessel stopping system capability in an overall system form-factor or size of less than: threshold 4’x4’x4’ in volume and less than 2,000 pounds (lbs) in weight and objective 2’X2’X2’ in volume and less than 500 lbs in weight, including all of the required component subsystems (i.e., HPM/RF source, compact high gain antenna, prime power, thermal management, controls, and etc.)
- **Munition-Based and/or Hand-Held Compact RF/HPM Sources:**  
Paragraphs C( i) and C (ii) above support the development of stand-alone high power RF/HPM systems to support long range vehicle/vessel stopping and other non-lethal counter-materiel missions, such as the HPM disruption, neutralization, and defeat of threat weapon systems, fire control systems, security systems, surveillance systems, i.e., all devices that employ standard Information Technology electronic components (e.g., computers, communications networks, controllers, surveillance equipment, and

communication devices). This paragraph requests the development of more compact/effective munition-based and/or hand-held RF/HPM devices to support short-range and/or less challenging vehicle/vessel stopping and other counter-materiel missions. These munition-based and/or hand-held RF/HPM sources must be even more compact with a resulting system overall form-factor of : (1) a threshold size commensurate with a 66 mm munition or a system diameter less than 3 inches, and (2) an objective size commensurate with a 40mm munition or a system diameter less than 2 inches. This compact munition-based and/or hand-held HPM/RF device shall have a short-range (threshold effective range of 10 feet to an objective effective range of 100 meters). This HPM munition or hand-held device shall also produce an effective multiple pulse waveform with a capability to deliver 3-5+ counter-electronic RF/HPM pulses per target. This counter-electronic waveform can be either a wideband waveform operating with an effective power/waveband somewhere over the 100 Megahertz (MHz) to 10 Gigahertz (GHz) frequency space or it can operate at a narrowband single frequency, or a single set of frequencies operating again somewhere over this same frequency space.

B. Advanced HPM/RF Weapon System concepts/studies and early system prototype development may include:

- i. Identification of low average power HPM/RF waveforms
- ii. Improved cathode designs to include new materials research to increase operation lifetimes and system reliability of the HPM/RF sources
- iii. Non-linear dielectric materials to support HPM non-linear transmission line (NLTL) development
- iv. Compact high gain HPM antenna designs
- v. Compact prime power alternatives to include hybrid battery/generator power systems
- vi. Higher peak power RF/HPM sources
- vii. Advanced thermal management systems to support the long-term operation and sustainment of high power microwave/RF sources
- viii. Photoconductive switch-based HPM/RF Weapon Systems

C. Current Counter-Materiel HPM/RF Source technology needs:

- i. Long pulse regime sources for long range RF/HPM Vehicle/Vessel Stopping missions: Peak powers greater than 20 Megawatts (MW) with Pulse Widths (PWs) approximately 1 microsecond or greater; pulse repetition rates >150 Hz; electrical efficiencies - 60% (threshold), greater than 80% (objective)
- ii. Short pulse regime sources for long range RF/HPM Vehicle/Vessel Stopping missions: Peak powers greater than 50 MW with PWs of 1 – 500 nanoseconds (ns), and pulse repetition rates of greater than 300 hertz (Hz) @ 500ns PW to greater than 2 kilohertz (kHz) @ 1ns PW
- iii. Steerable high gain antenna system: Antenna gain of greater than 25 decibels – isotropic (dBi) and aperture area of less than 1 square meter

(m<sup>2</sup>) at L-band; steerability – azimuth: greater than plus or minus 45° threshold, 360° objective; elevation: greater than plus or minus 10° threshold, greater than plus or minus 45° objective; Commensurate system performance specifications for other frequency bands to be considered

- iv. Prime power systems: Average output powers of 50-250 kilowatt (kW); power efficiencies of 100 Watts/pound (W/lbs) (threshold) and 500 W/lbs (objective); size – 6,000Watt/cubic feet (W/ft<sup>3</sup>) (threshold); 16,000 W/ft<sup>3</sup> (objective)
- v. Frequency space: 100 MHz – 10 GHz with concentration on L and S-bands
- vi. Near Instant on: 0 to just a few seconds
- vii. Shoot on the move capability
- viii. Pan and tilt capabilities of the supporting compact RF/HPM antenna

- D. RF/HPM Target Susceptibility & Effectiveness Prediction Tools: Develop vehicle/vessel stopping effectiveness prediction tools to confirm effectiveness of HPM systems against new engine (vehicle/vessel) propulsion/fuel types, models, and configurations. Includes RF atmospheric propagation codes, HPM/RF Source Design codes, Operation and Effectiveness codes, Waveform to Target RF/HPM Counter-Electronic Coupling codes, and Statistical Waveform Effectiveness Analysis codes. Also includes antenna RF propagation codes with field maps and estimates of constructive and destructive multi-path and diffraction effects associated with these RF/HPM frequencies.
- E. Compact RF/HPM Antennas: Develop compact, lightweight, steerable, and high-gain antenna systems. The objective of this BAA is to develop long-range directed energy systems that can be used in a stand-alone configuration or integrated onto small tactical vehicles for a range of non-lethal applications. A key component to enable the development of these systems is antenna technologies that achieve the required performance in a compact size.

Antenna systems are sought that can operate at any frequency in the L or S-bands for High Power RF Weapon Systems. The desired performance specifications for each of these bands are summarized below:

- i. L-Band/S-Band

There is significant overlap of the desired performance specifications for L and S Band with some differences. Separate requirements are provided for those items where the specifications for L-Band and S-Band differ.

The L-band and S-band antenna (power) projection systems must be capable of being driven by HPM/RF sources (tubes or solid state) with outputs in either of the following two regimes while meeting or exceeding the key performance specifications.

(1) Long-pulse regime:

- a. Peak RF/microwave output power - >20 MW
- b. Pulse width - 1-10 microseconds
- c. Pulse Repetition Rate - >150 hertz (Hz)

(2) Short-pulse regime:

- a. Peak RF/microwave output power - >50 MW
- b. Pulse width - any within the range of 1 ns to 500 ns
- c. Pulse Repetition Rates - >300 (Hz)

L/S Band Key Performance Specifications:

The following are the threshold key performance specifications for both the Long-pulse and Short-pulse regimes:

L-Band Frequency Range of Interest: 1 – 1.6 GHz

S-Band Frequency Range of Interest: 2.5 – 3.5 GHz

Antenna Gain (L-band): 30 decibel isotropic (dBi)

Antenna Gain (S-band): 25-30 dBi

Aperture area (L-Band): less than (<) 3 square meters (threshold), <1.5 square meters (objective)

Aperture area (S-Band): <0.6 square meters (threshold), <0.3 square meters (objective)

Aperture depth (L-Band): <2 meter (threshold), <1 meter (objective)

Aperture depth (S-Band): <0.4 meter (threshold), <0.2 meter (objective)

Waveguide fed from the high power RF source

Aperture Area-Efficiency: >50%

Steerability- Azimuth (pan capability): plus or minus (+/-) 30 degrees in azimuth (threshold); +/- 60 degrees in azimuth (objective)

Steerability- Elevation (tilt capability): +/- 5 degrees in elevation (threshold); +/- 15 degrees in elevation (objective)

Steerability Method: To be fully described in the information provided by the submission

Voltage Standing Wave Ratio (VSWR): no greater than 1.5:1

Operating temperature range: -50 °Celsius (C) to +50 °C

Weight (L-band): <500 lbs (threshold), <250 lbs (objective)

Weight (S-band): <50 lbs (threshold), <10 lbs (objective)

Shock/Vibration Specifications: To be fully described in the information provided by the submission

System Reliability Specifications: greater than 10000 hour (hr) mean-time-between-failure (MTBF) desired

System Availability: > 0.99

- ii. Conventional, HPM Metamaterial-based, and/or small “paintable” nano-dipole antennas. The goal is to increase the aperture of the antenna system by employing the whole surface area of the military platform upon which this non-lethal weapon system is mounted upon.

F. Compact Thermal Management Systems (TMS) for HPM/RF Sources: Develop compact, lightweight and low cost thermal management systems for Active Denial Technology (ADT) and High Power Radio Frequency Vehicle/Vessel Stopper (RF) Systems. Active Denial Technology (ADT) and RF Vehicle Stopper devices need compact, lightweight, and low cost thermal management systems (TMS) to meet mission goals. Heat exchangers and conventional refrigeration systems strongly contribute to overall system volume, weight and cost. Innovative TMS concepts have been identified that can reduce volume by 50-60%, weight by 75-80%, and cost by greater than 50%. By reducing the size, weight and cost of this one subsystem of the HPM/RF weapons system, then we can reduce the overall size, weight and cost of the entire system by approximately 14%. This reduced TMS component goes a long way in helping us to meet the system goal of a factor of two in reduction in system volume, weight and cost of the overall RF/HPM weapons system. Under the proposed project, these new innovative heat exchanger technologies will be integrated into a next generation thermal management system and thus be part of the next-generation Compact ADT and RF Vehicle/Vessel Stopper system prototypes. This TMS design will be analyzed to show that steady and transient system performance meets the requirements for performance, volume, weight and costs as sought for these new system prototypes. In addition, the heat exchangers will be tested with phase change materials to evaluate performance augmentation. While meeting the new Compact ADT and RF Vehicle/Vessel Stopper prototype system requirements, the thermal management system technical approach followed for these prototype development efforts will also be viable for other directed energy weapons, as well as other civilian applications.

G. Prime Power Systems: Develop a small, lightweight, prime power system for Directed Energy Weapons (DEW) capable of producing large amounts of power in very short but numerous timeframes.

There is a growing need for an innovative, compact, light-weight prime power

system for high-power mm-wave and HPM/RF weapon systems. This topic seeks to explore innovative approaches to the development of a small, light-weight, prime power systems which are required for integration with small, compact: (1) solid-state ADT sources and (2) mobile, high-power microwave/ RF systems. The current form-factor of this technology is considered a limiting factor in producing a compact and mobile ADT or RF system. Power systems for DEWs can be quite different from continuous Alternating current (AC)/Direct current (DC) power generators or sources in that DEWs commonly need large amounts of power but in only very short, but numerous, timeframes. Notional examples of prime power systems that could potentially be applicable include, but are not limited to, load-following diesel and gasoline-powered conventional motor generator sets, rotating storage machines such as pulsed alternators that include flywheel-type energy storage elements, and turbine generator sets powered by distillate fuels similar to aviation jet fuel. An example load versus time profile for a non-lethal directed energy system would be 100% load for five (5) minutes and 25% load for 55 minutes each hour. Of interest are proposed power system concepts capable of achieving the following performance metrics:

- Average power output: 150 kW to 250 kW (The average output power specification is the maximum output power associated with 100% load operation. So, for the example load versus time profile of 100% load for 5 minutes and 25% load for 55 minutes, this would equate to 150-250 kW required for 5 -minutes and then 37.5-62.5 kW for 55 minutes).
- Fuel type: Jet Propulsion (JP)8 Fuel
- Fuel Efficiency: 210 kW/kg
- Operating temperature range: -50 °C to +50 °C
- Total Weight should be <500 lbs (threshold), <250 lbs (objective)
- Output voltage: 345 VDC +/- 10%
- Output of 36,000 W/ft<sup>3</sup> of size volume
- Output of 400 W/lb of system weight
- Efficiency: 96% efficient generator head (defined as: Generator Head is the part of the generator that produces the electrical output from the mechanical input supplied by the engine. It contains an assembly of stationary and moving parts encased in housing. The components work together to cause relative movement between the magnetic and electric fields, which in turn generates electricity.)

H. Solid State High Power Radio Frequency (HPRF) Sources. Recent advances in rare-earth metals and semiconductor materials with extremely high dielectric

constants coupled with novel high field-strength magnetic materials have spurred renewed interest in the field of solid state high power microwave and millimeter-wave generation sources. Typically these sources are rare-earth based and built in very small semiconductor mini-arrays. These arrays are then combined or stacked so as to optically combine the output of these small mini-arrays into one large aperture optical output source. Currently solid state HPRF arrays have low radiated power outputs and most manufacturers are “ganging” them together to produce a few watts of output power. To-date this approach has not been able to create enough power to be viable. Several Universities and large Industry teams, to include Defense Advanced Research Projects Agency (DARPA), are working to increase the array’s output powers as well as raise the array’s power added efficiency. Gallium Nitride (GaN) Arrays yields in W-band (95 GHz) are approaching 10’s of kilowatts in support of ADT applications for the U.S. Army. Lower frequency (HPM source) research from the 10’s of MHz to 10’s of GHz is also proceeding. The challenge is to achieve high output power with sufficient power-added efficiency so as to make the peripheral support equipment of these HPRF sources result in a manageable size and weight, i.e., the source’s overall system efficiency must be greater than 35%, with a goal of 60-70%+.

- i. Non-Linear Transmission Lines (NLTL). A sub-set of these new solid state HPM sources are called, NLTL. The NLTL approach to HPM eliminates the need for an electron beam, a vacuum tube-based system, and very high field (large and heavy) sets of magnets as is often required in conventional HPM sources. These NLTL sources also have other favorable attributes the NLTL generates: (1) novel HPM waveforms with a high degree of frequency diversity (this is not a common attribute for most current electron beam driven HPM sources); and (2) novel HPM waveforms with a high degree of control of the waveform’s amplitude, oscillating frequency, and temporal envelope has been demonstrated using NLTL systems at modest powers.
  - i. As this novel HPM source could be considered as part of section A above, this novel new HPM source design concept should be considered in this BAA as this HPM source produces a broad range of single frequency waveforms (with short pulse widths of approximately 1-100 nano second (ns)) but with also a broad range of sweeping frequencies waveforms with possibly very high (approximately 1kHz+) pulse repetition rates. These multiple frequencies/waveforms coupled with a high pulse repetition rate will provide a high degree of RF susceptibility to both vehicle and vessel engines and will do so with moderate overall pulse output power levels. Thus this novel HPM source, which operates in the short pulse (approximately nanosecond pulse width) regime, operates as an overall low average power HPM source.
  - ii. Photo-conductive Switch-based HPM. Another solid-state, megawatt-class high power microwave source technology to consider

in this BAA is based on a photoconductive semiconductor switch (PSCS) coupled with a ferromagnetic-based, coaxial NLTL HPM source. Under typical experimental conditions, this type of NLTL produces sharpened output rise times of approximately 100 picoseconds and microwave oscillations at 1-4 Gigahertz (GHz) that are generated due to damped gyromagnetic precession of the ferromagnetic material's axially pre-biased magnetic moments. This system could then provide MHz-pulse repetition frequency (prf) in burst-mode operation as well as provide some frequency agility in a single shot operation.

- I. Microwave/Millimeter Wave/Terahertz (THz) Lasers. A maser is a device that produces coherent electromagnetic waves through amplification by stimulated emission. The non-lethal weapons interest in masers is to develop a laser-like system that can project maser energy, either at microwave frequencies for counter-material counter-electronics missions or millimeter wavelengths for counter-personnel missions, or at THz frequencies for possibly both counter-personnel and/or counter-material missions.

Between 2006-2008, the JNLWP funded a Science and Technology (S&T) Laser ADT project. The objective of this project was to use two mode-locked solid state fiber lasers and via a laser heterodyning process, mix these two near-infrared wavelength (laser) beams through an acoustic-optical (AO) modulator to produce a collimated Active Denial System-like 95 GHz millimeter wavelength beam with ADS-commensurate power density. This S&T project produced a world record of 95 GHz energy at approximately 100-200 milli-watts (mW). But this Laser-ADT concept could not produce enough final output power to achieve the required ADS power density.

The technical challenge for this S&T project is the basic inefficiency (approximately 0.1%) of the acoustical-optical (AO) modulator. The JNLWP S&T project attempted to mitigate this inherent AO modulator inefficiency by developing a multi-pass optical design that would allow a 0.1% increase in overall system power per pass through the AO modulator. This design never allowed us to achieve more than 10 passes and so the 1% increase in power was not enough. Based on this performance achieved with this design, the JNLWP exercised a "No-Go" design for this project in FY2008. As with many JNLWP S&T projects with a technology "No-Go" decision the JNLWD is scheduled to re-look at this technology in five (5) years. This part of the BAA calls for the development and test of new compact microwave/millimeter wave/terahertz (THz) laser systems which operate at frequencies within the atmospheric windows of approximately 10MHz to 25000 GHz, and achieve counter-personnel "Repel" effects (with mm-wave systems) and possible counter-material (counter-electronics) effects (with microwave and THz systems). This BAA is also interested in THz frequencies for both counter-personnel and counter-material applications. THz Lasers can be used to detect and identify chemical agents at

range, identify concealed weapons at ranges beyond rifle range, and provide a non-lethal counter-electronic capability such as the ability to neutralize microprocessor-based consumer electronics, all without harming a human target.

- J. Explosively-driven HPM Sources. Another modality to produce high power microwaves is via the explosively-driven HPM system. These high power microwave systems are generally composed of four different sub-systems: (1) a battery driven prime power source utilizing some sort of capacitive or other energy storage, (2) a multiple stage flux compression generator as the main energy amplification device, (3) an integrated power conditioning system with inductive energy storage including a fast opening electro-explosive switches, and (4) some sort of cathode oscillator which acts as the microwave radiating source. Systems of this sort can be very small and have been known to deliver very high peak power levels approximately 200 MW or greater, but few have been able to generate more than one pulse. Target RF vulnerability studies have shown time after time that the probability of electrical component upset is directly proportional to the number of pulses applied. So single high power pulses can disrupt electrical systems, but your probability of system upset is greatly enhanced by increasing your number of pulse applied to the target. As such, for explosively-driven HPM sources to be considered under this BAA, they must have some way to produce more than one pulse per explosive event. In fact, a goal of this BAA would be to develop and test an explosively-driven HPM source that would yield at least 3-5+pulses per set of explosive events per HPM munition/system.
- K. Improved Cathode Source Lifetimes with minimal operational degradation & Improved Support System Modulators: Over the past few years, the JNLWP has developed several state-of-the-art high power HPM/radio frequency sources. Common to each of these technology development efforts have been the requirement to reduce the overall system size and weight, and to improve both power efficiency and power output of these new novel sources. These design improvements continue to be the most critical system performance parameters that our industry and government laboratory partners have faced. Optimizing these performance parameters in the development of these new vacuum-tube-based HPRF source designs, such as Magnetrons, Klystrons, Gyrotrons, and Cross Field Amplifiers to such a degree as that we have dropped operating tube voltages tremendously, have reduced system weights by 50 or more percent (%), and have increased source efficiencies by 30-40%. All of this has been good and has reduced the overall size, weight, and cost of these next-generation vehicle/vessel stopping counter-electronic system prototypes, but in nearly each case these gains have come at the sacrifice of both source cathodes operational lifetime and/or an increase in complexity (and correspondingly size and weight) of the system's modulator. S&T is required in each of these HPM source components from improved operations lifetimes of the source cathodes, to improved operating temperatures of the cathodes, to anti-cathode depletion designs and materials, to anti-cathode scoring

and beam pitting. S&T is also required to reduce the current size and weights HPRF source modulators. To-date many of the HPRF source manufacturers have “plumbed” the modulators in the simplest manners to support the high voltage tube. If one considers the modulator as part of the source then one can begin to select materials and subsystem components and their corresponding mounting geometries so that one can minimize both size and weight.

### 3. **Compact Active Denial Technologies (ADT)**

- A. Reduced ADT Source Size, Weight, and Cost: One of the more important technology challenges associated with this BAA is the development and study of innovative means to reduce the size, weight, and cost of the current Active Denial Systems (ADS). Thus one of the objectives of this BAA is to achieve the same capability to suppress, move, and deny (repel) as is currently being achieved by ADS System 1 or System 2, and to do so with a much smaller, lighter, and lower cost technology components and subsystems.

ADS System 1 and System 2 have similar performance specifications as they are both based on a 100 kW cryogenically-cooled commercial gyrotron source. Both produce spot-sizes on target of approximately 1.5 meters and both achieve the ADS-Repel effect with a power density across a uniform spot of approximately 2-3 watts per cm<sup>2</sup>. Both systems achieve the same range performance of approximately 1000 meters and they both have similar operation duty cycles of approximately 6 continuous minutes per hour, based on a hybrid battery/generator prime power system. The up-armored ADS System 2 currently weighs approximately 18,000 pounds and has a total system form-factor of 96” wide X 240” long X 86” high or 1147 feet cubed (ft<sup>3</sup>).

The JNLWD anticipates responses to this BAA will identify ADT system, subsystem, and component design enhancements that will produce a significant size and weight reduction to support the development of a next-generation Compact ADT system. The goal would be to reduce the size and weight our current AD capability. The current Compact ADT mm wave source, currently in S&T development, has an estimated volume of 36 ft<sup>3</sup> and a weight of greater than 1000 lbs. This BAA will produce a next-generation Compact ADT design that will meet or exceed these specifications.

These next-generation Compact ADT skid-plate demonstrator prototypes shall also facilitate integration into the payload sections of most small (manned) tactical vehicles and/or an unmanned platforms, with additional payload space still being available to allow use of these vehicles/platforms to support other missions and also with the ability to provide a “shoot on the move” capability with an effective minimum spot-size.

- i. Develop effective continuous wave (CW) compact ADT sources employing any effective mm-wave source technology such as vacuum tube-based, solid state, or laser-based sources. This 95 GHz next-generation compact ADT source is required to produce the same immediate human “repel effects” as achieved by the current Active Denial Systems with ranges in excess of small arms range and approaching 1000 meters. Also see paragraph 13 A of this BAA for topics associated with ADT human effects.
- ii. Develop/study innovative means to increase overall power output and

source/system power-added efficiency.

- a. Vacuum tube systems power outputs should range from 30-kW CW to 100-kW CW with system efficiencies of greater than 50%. Power coupling and optical coupling/combining techniques shall be considered but these designs must be “non-lossy”, i.e., they should be arranged so as to “gang” their outputs together and/or phase lock their signals together to produce a single high output mm-wave source beam from a set of small lower power mm-wave sources. This final output beam should be commensurate with common RF waveguide systems so as to be able to steer and direct the beam as per the beam transport specification given in paragraph 2 E above.
  - b. Solid State mm-wave source power outputs should range from 5 kW CW to 100 kW CW with system efficiencies of greater than 35%. For 95 GHz GaN solid state sources, individual source cells (monolithic microwave integrated circuits (MMICs)) should produce output powers of 3-5 W per MMIC and have power added efficiencies ( $P_{ae}$ ) of approximately 35+%. Other solid state MMICs shall be considered but MMIC output power and  $P_{ae}$  of this order are commonly required so as to limit the overall size of the final solid state ADT system to those performance standards sought in paragraph 3a above.
- iii. Develop and demonstrate affordable man-portable ADT systems. Develop lightweight one person carry weight compact ADT system (of 51 lbs or less), with a range of 0 to 50 meters threshold and 0 – 350 meters objective, an operational frequency of 95 GHz (or other effective ADT frequency), and have an effective power density (approximately 2.3 watts per square centimeter (watt/cm<sup>2</sup>) and spot size combination (approximately 12-18 inches) to ensure ADS-like repel effects in greater than 2 seconds. The 51 pound carry weight limit is recommended by the Army Science Board. As this is a single gear carry weight, it should not be confused with the typical one person pack/carry weight of 87 to 127 pounds. To achieve the operation ranges requested above will require large optical systems (made more compact with the integration of innovative RF Metamaterials and other special technologies described under paragraph 2 E. above) and high power sources generally following the 100 meter operational range capability for every 10 kW of power out. Thus 5 kW source outputs should net a system approximately 50 meters of effective range and 35 kW source outputs should net approximately 350 meter ranges. These man-portable systems must be 100% self-contained with compact thermal management and prime power systems capable of providing at a minimum of 250 to 350 five second “Shots” in this electronic magazine (between system power re-charges and thermal coolant pack change-outs) over an eight (8) hour duty cycle.
  - iv. Develop compact, lightweight, steerable, and high-gain W-band antenna systems. The JNLWD wants to develop directed energy systems that can be used in a stand-alone configuration or as integrated into a suite of scalable weapon systems on small tactical vehicles or other tactical manned and unmanned platforms. These scalable non-lethal weapons would have a range of hail and warn, non-lethal, and lethal application. A key component to enable the development of these non-lethal systems is the antenna

technology that would achieve the required performance in a compact size.

Antenna systems are sought that can operate at any frequency in the W-band in support of Active Denial Systems operating at 95 GHz, or potentially other ADT source frequencies in W-band and within the other mm-wave atmospheric windows. The desired performance specifications for each of these bands are summarized below:

### **W-Band Compact Antenna**

Power Handling Capability: 100 kW CW

Nominal Frequency of Interest: 95 GHz, others can be considered

Antenna Gain: > 53 dBi (threshold), > 59 dBi (objective)

Aperture area: < 0.45 square meters (threshold), < 0.2 square meters (objective)

Aperture depth: < 0.45 meter (threshold), < 0.25 meter (objective)

Quasi-optical fed from the high power RF source

Steerability- Azimuth (pan capability): plus or minus (+/-)

30 degrees in azimuth (threshold); +/- 60 degrees in azimuth (objective)

Steerability- Elevation (tilt capability): +/- 5 degrees in elevation (threshold); +/- 15 degrees in elevation (objective)

Steerability Method: To be fully described in the information provided by the submission

Voltage Standing Wave Ratio (VSWR): no > 1.5:1

Operating temperature range: -50 °C to +50 °C

Weight: less than 100 lbs (threshold), < 30 lbs (objective)

Shock/Vibration Specifications: To be fully described in the information provided by the submission

System Reliability Specifications: > 10000 hour mean-time-between-failure (MTBF) desired

System Availability: greater than 0.99

- v. Multiple Beam "Shoot on the Move" ADT. Current Active Denial Systems collimate and train one single large spot-size beam onto a single human target. This single human is exposed for maximum "safe" dose of roughly 3 to 5 seconds and then the antenna can be repositioned to expose another target. The current ADS optics is generally composed of a 3 meter or larger flat parabolic surface antenna (FLAPS™). This FLAPS antenna assembly can generally only shoot one single target at a time and must be trained in azimuth and elevation from one target to another target. One of the possible employment enhancements that was learned from many of the ADS military users assessments was the desire to achieve the ADS "repel" effect "simultaneously" on multiple human targets all within the same large field of regard (e.g. approximately 120 degrees in azimuth and 30 degrees in

elevation). To accomplish this “simultaneous” effect, this BAA will require the design of a new type of ADT antenna. One with a possible high scanning rate beam and a method to scan multiple targets in very short periods of time and yet still produces the instantaneous ADS Repel response. This BAA should encourage these new types of antenna concepts and this S&T research can be used to support the verification and validation of these new concepts.

In addition to a high speed scanning capability, the new ADT antenna design would also have to incorporate sufficient electronic and/or mechanical stabilization of the beam to accurately project and hold a ADT beam (with a sufficiently large effective spot-size) on a target. This would be further complicated by the fact that the target may be moving with respect to the ADT source. This movement could be due to host platform movement (e.g. ADT-source mounted on a vehicle) and/or due to movement of the target. All these design constraints are required to address a “shoot-on-the-move” requirement

Finally by achieving this antenna beam transport capability, with a 1 meter or less operational aperture, then this system can also incorporate some small element of system “stealth” and allow for a possible integration of the system onto a top-mounted turret of a small tactical vehicle. This minimizes top-side conflicts with other sensors/weapons systems, clears lines of fire and de-conflicts competing system fields of view. It requires less space within the hull of the vehicle for supporting electronics and control gear. By employing fast scanning beam transport techniques, then one can also support raster scanning of the targets to create most effective geometries related to the spot-size as well as define how many “simultaneous” targets can be affected in one field of regard. This BAA seeks a threshold of 6 targets per field of regard, with an objective of 12 targets per field of regard.

#### 4. **Non-Lethal Clear-a-Space without Entry Technologies**

##### A. Clear-a-Space and/or Cordon and Search Missions:

One of the most dangerous and difficult missions warfighters face is that of clearing buildings or other confined spaces. An example of this comes from the Marines Magazine, 29 June 2010 article by Lance Cpl. Benjamin Harris, entitle “Fallujah – Looking Back at the Fury”. This article describes the Marines November 2004 offensive to clear the insurgents from Fallujah. Altogether, 95 Americans lost their lives, and 560 were wounded. Also about 1,350 insurgents lost their lives in the city and coalition forces captured approximately 1,500 men. The increased use of asymmetric tactics by our adversaries requires warfighters to clear spaces where hostile forces intentionally fight while intermixed with civilians. Warfighters need a non-lethal solution to defeat these tactics which will reduce both friendly and civilian casualties. The technology developed as part of the mitigation of this military need may also have applicability and reduce casualties in the law enforcement community.

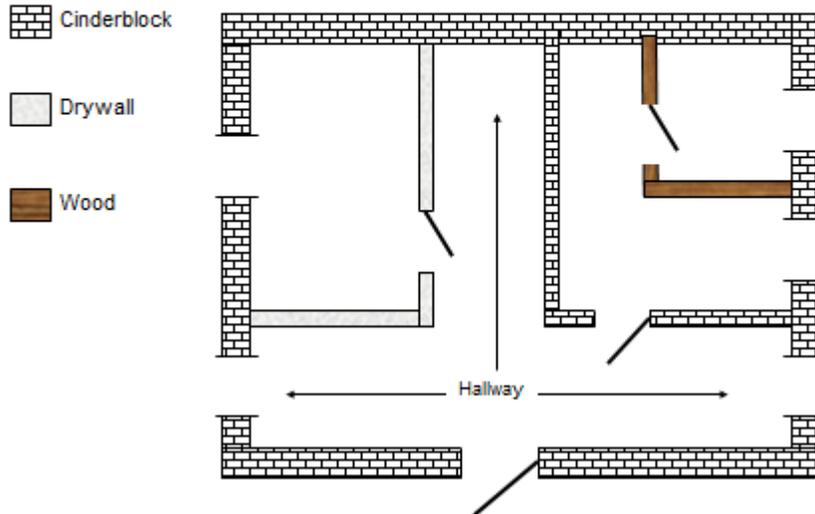
The goal of this topic is to develop concepts to non-lethally clear buildings (or simple structures) comprised of three (3) to five (5) rooms by friendly forces. Proposed concepts should ultimately set conditions for safer entry by friendly forces operating in urban terrain by preventing hostile resistance during the task of clearing a space.

- i. Viable approaches may be to disable occupants in place or clear occupants, both combatants and civilians, from the objective space, building or structure.
- ii. Proposed concepts should be of a non-chemical nature and must allow for the delivery of effects from a relatively safe distance (objective is beyond small arms) so that friendly forces will not have to enter the structure in order to initiate effects. Ideally, the capability will be able to be launched from a range between greater than 2 meters from the structure but ideally more than 100 meters from the structure, thus providing enhanced stand-off and improved safety for the warfighter.
- iii. The reversible effects will be temporary in nature, (i.e., approximately 15 minutes [Threshold] and approximately 45 minutes [Objective]).
- iv. The effects must minimize collateral damage, remain localized to the targeted structure and not cover adjacent buildings or open areas. All non-lethal material solutions shall be considered to mitigate this military need and must be consistent with our domestic law (e.g., Biological Weapons Anti-Terrorism Act (18 U.S.C. 175 *et seq.*)) and international legal obligations (e.g., Chemical Weapons Convention).
- v. Problem Definition with metrics: Clear a space without entry:
  - i. Clear
    1. All personnel (combatants and civilians)
    2. Personnel able to move on their own power
    3. Reversible effects on target
    4. Clear space within five (5) minutes
    5. Keep out personnel for seconds up to four (4) hours
    6. Minimal collateral damage
  - ii. Space
    1. Single-story building with multiple rooms (See Figure 1 below)
    2. Specific performance parameters will be based upon a representative scenario and verified and validated by the Services and Combatant Commands (COCOMs). Others will be facility dependent.
    3. Standard building materials that include wood, mud brick, plaster, steel, brick, and cement/block, etc.
  - iii. Building & Room Size
    1. Number of access points (doors & windows)
    2. Operators do not need to enter the building to initiate effect(s).
    3. Standoff is required
  - iv. Mission Need:
    1. The U.S. military desires the ability to engage targets located/positioned where the use of lethal fires is prohibitive.

# Notional “Space”



- Single-story, multiple-room, multiple-entrance



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Figure 1: Non-Lethal Clear-A-Space - “Example Space”

## 5. Human Electro-Muscular Incapacitation (HEMI) Technologies

- A. New HEMI System Concepts: Identify and demonstrate concepts that would provide an enhanced long-range, wireless, long-duration, non-lethal HEMI effect (waveforms) from g-hardened electronic packages that can be fired from an existing weapon system in the DoD inventory, i.e., from a weapon or munition with a threshold (maximum) form-factor size of a 40mm munition to an objective form-factor size of a nine (9) mm pistol round. Wireless long-range HEMI munitions should have the capability to disable single, few or many targets for durations of (threshold) thirty (30) seconds to durations of (objective) three (3) minutes or longer and at ranges in excess of 50 to 100 meters (threshold) to 100 - 300 meters (objective) with minimal risk of significant injury (RSI). It is preferred that munitions should be compatible with existing weapons platforms. It is expected that the performers of this research take full advantage of the current HEMI bio-effects knowledge that exists and can be found at the Defense Technical Information Center (DTIC). HEMI bio-effects information exists to select safe and effective HEMI waveforms as well as help the researchers develop safe and effective weapon duty cycles. The goal is to increase the duration of effect without increasing the current low risk of significant injury. These new HEMI rounds shall be flight stable so as to meet: (1) the target accuracy requirements, (2) the target attachment requirements, and (3) to mitigate the blunt impact RSI.
- HEMI S&T Challenge: Develop a HEMI capability to non-lethally disable point targets at ranges out to ranges beyond 100m and to disable human targets with a duration of 30 seconds (threshold) and 1 minute (objective). The HEMI S&T opportunities are:
    - Developing HEMI delivery platform with an acceptable blunt impact RSI.

2. Developing mechanism(s) to reliably engage targets at range (probability of hit, adherence to target).
3. Evaluation and correlation of tradeoffs of various electrical parameters and resulting biological effects.
4. Understanding injury criteria and mechanisms of HEMI exposures.

To meet these S&T challenges several S&T tasks are required to be performed such that the program must:

1. Improve 40mm projectile nose cone to mitigate blunt trauma per impact velocity and improve attachment to target.
2. Improve component design and integration to improve ballistic stability and probability of hit.
3. Perform animal and human subject testing of various electrical parameters to correlate pulse parameters with efficacy and RSI. All animal and human subject research shall be conducted in compliance with federal and Department of Defense (DoD) regulations. The performer shall comply with the requirements of DoD Instruction 3216.01 and SECNAVINST 3900.38C, regarding the use of animals in DoD-sponsored research, and with those of DoD Instruction 3216.02, regarding human subjects in DoD-sponsored research.
4. Identify and develop alternate HEMI delivery platforms to increase standoff range and probability of incapacitation while reducing blunt impact RSI.

ii. New Potting Materials or Potting Methods:

1. HEMI projectile has to deliver a HEMI stimulus-generating circuit to a target at extended ranges while minimizing the risk of significant blunt impact injury. One way to mitigate this risk is to reduce the mass of the projectile. A major contributor of the overall mass is the electronic potting material required to mechanically protect the circuit and prevent high voltage internal discharges. Current 40mm HEMI projectile designs contain 16 to 20 grams of potting material which approximately 20% of the circuit portion of the round's mass (or 17% of the total projectile mass).
2. Develop new potting materials and injection methods that can protect the circuit mechanically and electrically and substantially reduced the mass of the circuit assembly. The tight packaging of the circuit in the 40-mm form factor requires a material and/or method that can ensure that the potting material can properly flow in-between the circuit elements. These new potting materials will shift the center of mass of the current 40mm HEMI munition design and as such will require associated additional flight stability analyses as well as target attachment studies.

iii. Electrode Attachment to the Target:

1. A HEMI projectile at a minimum has to attach two electrodes to a target with a spacing of 8 to 12 inches at extended standoff ranges. Current designs employ multiple electrodes to ensure good electrical contact with the skin and that a complete plus and minus circuit is in place. The two electrodes have to provide an electrically conductive connection to the HEMI stimulus-generating circuit. The current 40mm HEMI projectile uses

barbed electrodes in the nose cone that are designed to directly attach to the target. A fracture disk is broken on impact that allows the aft portion of the projectile containing the second electrode to drop down 10 to 12 inches and complete the circuit. Proper target attachment has been identified as a major deficiency of the current 40mm design.

2. Propose innovative designs for attaching a minimum of two electrodes, properly spaced and connected to a HEMI stimulus-generating circuit, to a target at extended standoff ranges. Submissions must describe how the electrodes would be deployed, achieve optimal electrode spacing, and remain attached to the HEMI stimulus-generating circuit.
- iv. Additional HEMI S&T Challenges: Develop a HEMI capability to non-lethally disable **multiple** targets simultaneously at ranges out to ranges beyond 100m for a duration of up to one (1) to three (3) minutes. The HEMI S&T challenges seek to :
1. Develop a HEMI delivery platform with an acceptable blunt impact RSI.
  2. Develop a mechanism to reliably engage multiple targets; ensuring high probability of hit and electrode adherence.

To meet this HEMI engagement of multiple targets S&T challenges several S&T tasks are required to be performed such that the program must:

1. Design secondary mechanisms to accurately and safely deploy HEMI “sub-munitions” from a single or multiple HEMI delivery platform.
2. Design a delivery vehicle that does not directly impact the target, but deploys the HEMI effect to the target via favorable munition to target geometries and/or aspect angles.

## 6. Directed Energy and Non-Directed Energy-based Vehicle/Vessel Stopping Technologies

A. Vehicle Stopping & Vehicle Disable Technologies: A mission of the JNLWD is to identify, investigate, and develop technologies that can provide a safe, low-cost capability for non-lethally stopping both vehicles and vessels at significant keep out ranges to mitigate blast effects of improvised explosive devices and to stop vehicles and vessel outside a minimum “keep out range (KOR)”. Current capabilities available to our military forces to non-lethally stop threat vehicles require pre-emplacement of these non-directed energy-based vehicle stopping technologies. They include items such caltrops, spike strips, and entanglement nets. Some of these current vehicle stopping capabilities do not stop the vehicle but instead slow the vehicle (e.g., caltrops/spike strips), and others are single one time use (non-reusable), e.g., the Vehicle Lightweight Arresting Device. All must be pre-emplaced and none can easily be used to discriminate which vehicle is to be stopped.

Additionally, different vehicle stopping technologies perform differently as related to the actual vehicle stopping requirements. Vehicle stopping requirements for vehicle stopping at (permanent vs. semi-permanent) entry control points (e.g., forward area bases or small command posts) differ from the vehicle stopping requirements for snap check points, or convoy protection missions. Each of these vehicle stopping requirements have different performance requirements and as such different vehicle

stopping technologies can be considered for use to mitigate those specific capability needs. Thus limitations exist, specifically when one analyzes these known differences as associated with each potential vehicle stopping mission.

A second Science and Technology (S&T) requirement for this BAA topic is the need to disable vehicles. The term “Disable” in this context means “to render ineffective or unable to perform.” In the vehicle stopping context a viable scenario is employment of a vehicle stopper technology (directed energy (DE) or non-DE technology) that (eventually) brings the vehicle to a stop (0 mph) and then keeps the vehicle from moving. Another example is employing HPM vehicle stopper technologies. The HPM vehicle stopper technology would cause the engine to stall and via serpentine barriers the target vehicle would slowly come to a complete stop. As the target vehicle is kept in the HPM beam, the vehicle stopper would become a disable vehicle system as the HPM would keep the vehicles engine from re-starting and thus keep the vehicle motionless.

Thus this BAA topic seeks to develop vehicle stopping and disable vehicle technologies that:

- Stop small, medium, and large vehicles
- Disable vehicles (small, medium, and large) in place
- Reusable – low cost/use
- Compact/lightweight
- Target discriminant
- Pre-emplacement acceptable
- Effective for all classes/makes/ages of vehicle
- A technology that disables/stops the target vehicle(s) and includes a halting of the vehicle’s momentum

To accomplish these requirements will require S&T research to:

1. achieve an operationally suitable configuration (size, weight, power, effectiveness, cost), i.e. deployable from a small tactical vehicle as the threshold requirement and from a hand-held or munition-sized weapon for an objective requirement
2. achieve the ability to predict effectiveness across a large segment of the world’s potential target vehicle population,
3. achieve the ability to control effect scalability (soft/hard kill) of these vehicles, and
4. achieve and/or confirm effectiveness against new vehicle propulsion/fuel types.

Several S&T solutions should be considered to mitigate these vehicle stop/disable need to include (but not limited to):

- Reduce subsystem footprint requirements
- Identify low average power waveforms
- Increase RF source efficiency
- Consider compact prime power alternatives
- Apply existing novel dielectric materials for development of antenna “lens” and compact high energy density capacitors
- Develop effectiveness prediction tools

- Identify soft kill and hard kill RF/HPM engine vulnerability waveforms (Note: soft kill waveforms upset the engine control units (ECU) of the target vehicles causing the vehicle's engine to stall and remain stalled until the RF/HPM beam is removed from the target. This soft kill disrupts the ECU but does not damage the internal electronics which allows the engine to re-start and move on its own power once the beam is removed from the target. A hard kill waveform causes damage to the ECU electronics or disrupts the ECU software such that the ECU will require replacement for the target vehicle engine to re-start and move off on its own power. Leverage/adapt commercial technology advances (e.g., electric vehicle batteries, etc.)
  - Exploit advances in automotive technology: propulsion, electronics, remote diagnostics, communications
  - Develop new materials to enable development of compact high power antennas, novel RF sources, and compact pulsed power technologies
  - Develop higher peak power RF sources
  - Develop and evaluate new CM Vehicle Stopping technologies
  - Exploit recent advances in automotive control technologies
  - Leverage/adapt commercial automotive technology advances
- i. Non-Directed Energy-based Non-Lethal Vehicle Stopper (NLVS): This BAA topic seeks a next generation, low cost, lightweight non-DE-based vehicle stopper technology. This NLVS must enable the safe stopping of any size vehicle (small, medium, or large), with or without electronic ignitions, with gasoline, diesel, or all electric engines, and stop vehicles traveling up to 100km/hr through: (1) a fixed entry control point (ECP), or (2) a snap checkpoint, or (3) a snap checkpoint associated with a convoy protection mission. This vehicle stopper system should be capable of selective interdiction of vehicles and require little to no special requirements for fixed emplacement or special site preparation to include allowing for a hasty snap check point and/or convoy protection mission scenario. The most important attribute of this vehicle stopper system is that it must be non-lethal to the occupants of the stopped vehicles, i.e., its deployment and operation will result in minimal to no injury to the vehicle's occupants. Another desired attribute (which is a "nice to have" as opposed to a "got to have") for this vehicle stopper is that it is also expected to cause minimal damage to the targeted stopped vehicle. Thus the NLVS sought in this BAA is to include components and capabilities to ensure that the resulting vehicle stopper system: (1) does not allow the target vehicle to be able to back-out, drive through, or drive around the deployed vehicle stopper; (2) does not allow the target vehicle to cause a target vehicle roll-over or cause the driver to lose control of the vehicle after the target engages the vehicle stopper system; and (3) does not cause serious damage to the target vehicle or serious injury to the target vehicle's occupants. It is also preferable that the NLVS system or employed tactic, technique, or procedure incorporate a (e.g., friction-based) de-acceleration capability which ceases forward motion of the vehicle, i.e., to go from nominal typical driving speeds of 35 to 50 mph to 0 mph in less than four (4) to five (5) car lengths. The system shall be easily placed/dropped in or along the side of free traffic to support convoy protection mission scenarios. An additional desired capability sought for this NLVS would also be for this vehicle stopping mechanism to be able to also capture or affect the vehicle doors, or at least temporarily seal them, so the vehicle's occupants cannot get out of the vehicle and flee the scene. It is desired that this new vehicle stopping system not: (1) necessarily flatten the tires, (2) damage the axles, and (3) cause

significant body damage to the vehicle or its undercarriage. Another added capability would be for the vehicle stopper system to allow the stopped target vehicle to be released from its capture point in less than 5 minutes and allow the vehicle to proceed on its own power away from the capture point undamaged.

- ii. Directed Energy (DE) based or Conducted Energy (CE) based Non-Lethal Vehicle Stopper: This BAA topic seeks a next generation, low cost, lightweight DE or CE-based vehicle stopper which will enable the safe stopping of any size vehicle (small, medium, and large) with electronic ignitions (with gasoline, diesel, or all electric engines) traveling up to 100km/hr through a fixed entry control point (ECP), or a snap checkpoint, or at a snap checkpoint associated with a convoy protection mission. This vehicle stopper system should be capable of selective interdiction of vehicles and require little to no special requirements for fixed emplacement or special site preparation. The system is non-lethal to the occupants, yet is expected to cause minimal vehicular damage, to include a low cost/time to repair. The current vehicle stopping capabilities often employ restraining nets, such as Vehicle Lightweight Arresting Device (VLAD), Portable Vehicle Arresting Barrier (PVAB), etc., and they require pre-emplacment. These existing net-based vehicle stopping solutions often result in having some vehicle size/speed limitations as well as having logistic/employment challenges, and they are not often easily employable in convoy protection missions. The minimal capabilities sought for these next-generation DE and CM vehicle stoppers are that they should mitigate some of the following key non-lethal vehicle stopping needs to include: (1) stop any-sized vehicle; (2) be reusable – with a low cost per use; (3) be compact and lightweight; (4) be target discriminant and able to stop multiple vehicles in a line, one or more at a time; (5) can be pre-emplaced in or along the side of the road; (6) be effective for all classes/makes/ages of vehicle as long as they have electronic control units or electronic ignitions; (7) be employable from a small tactical vehicle without taking the majority of useable payload space/volume of the host vehicle; and (8) have a wireless standoff range greater than 200m (threshold) with a 360 degree steerability capability in azimuth and work at range when no pre-emplacment is required or possible. Specifically, this BAA seeks vehicle stopping that:

1. Is man portable and/or employable from a small UAV/UGV or small tactical vehicle
2. Halts the vehicle's momentum physically or includes the use of a tactic, technique, or procedure that will allow for a halting of the target vehicle's speed to 0 mph
3. Has a standoff range greater than 200m (threshold), greater than 1000m (objective)
4. Stops the vehicle with no canalization or serpentine required
5. Has a line of sight field of regard (with 360 degree beam steerability in azimuth) and coverage area of greater than 10,000 square meter (e.g., 3 lanes of traffic wide and 100 meters long)
6. Provides an effective capability for ECP snap check point, and convoy protection missions
7. Is effective against small, medium, and large vehicles
8. Is reusable, with low cost per use (less than \$100 per car stop)

B. Vessel Stopping Technologies: This BAA topic is focused on developing solutions to

support U.S. Navy and U.S. Coast Guard missions that require the stopping of watercraft either approaching or fleeing Navy/Coast Guard vessels or high value (sea-basing) platforms. Small boats pose a serious threat to United States Navy (USN) ships. The attack on the United States Ship (USS) Cole and the more recent attack on the Al Basra Oil Terminal are two examples that demonstrate the reality of this threat. The United States Coast Guard (USCG) is concerned with stopping small craft suspected of carrying contraband and to protect port facilities and ships from small boat attacks. Non-lethal weapons (NLW) are of interest to the USN and USCG because of the flexibility they offer and the reversibility of effects offered. The presence of civilians and the uncertainty of the intentions of a particular approaching vessel may be exploited by adversaries. Current options for stopping small vessels include: (1) the use of disabling fire with the intent to damage the threat boat engines, and (2) nets to entangle the propellers of the threat vessels. Disabling fire is potentially lethal and can destroy a boat's engine which results in the vessel having to be towed or scuttled. Propeller entanglement systems also have undesirable characteristics in that they may be ineffective against certain types of drives, and must be deployed ahead of the targeted vessel and can therefore be potentially avoided; in addition, it is difficult to remove the net from the propeller in open water so the target typically must be towed to port to be repaired.

A goal of the JNLWD is to identify, investigate, and develop technologies that can provide a capability for non-lethally stopping vessels at significantly long KOR to mitigate blast effects and to stop threat vessels outside a minimum KOR.

This BAA topic seeks to develop vessel stopping and disable vessel technologies that:

- Stop small (less than 40 ft) and medium (40 to 100 ft) vessels with higher (greater than 90%) effectiveness in all sea states
- Small Threat Vessel Standoff range greater than or equal to  $\geq 100$  m threshold and greater than 500 m objective in zone 1 of the Naval Vessel Protection Zone;
- Onset time less than or equal to 5 sec
- High probability of successful vessel stop in all sea states
- Near simultaneously stop/disable multiple vessels over a wide area approximately 1 miles square
- Employable from a small tactical vessel (e.g., a small (less than 40 feet) chase boat) as a threshold requirement to a small Rigid Hull Inflatable Boat (RHIB) or an unmanned platform as an objective requirement
- Stop large vessels (greater than 100 tons) while performing intercept and maintaining a min. standoff range of 2 Kilometers or more

To accomplish these requirements S&T research is required to:

1. achieve the ability to predict and validate effectiveness across the potential target vessel population for all engagement geometries
2. achieve an operationally suitable system configuration (optimized minimal size, weight and power - Size, Weight, and Price (SWaP), suitable effectiveness, and minimized cost)
3. confirm the effectiveness of the vessel stopper against new propulsion types
4. deliver sufficient electric-field strength at range for RF/HPM-based vessel

stoppers

5. evaluate possible compact/effective RF devices suitable for munition delivery
6. identify plausible material solutions able to arrest the momentum of a large vessel

Several S&T solutions should be considered to mitigate these vessel stop/disable needs to include (but not limited to):

- Develop vessel stopping effectiveness prediction tools
  - Perform Models and Simulations (M&S) to determine hull effects on RF propagation
  - Reduce subsystem footprint requirements
  - Identify low average power waveforms for RF/HPM-based vessel stoppers
  - Increase RF source efficiency for RF/HPM-based vessel stoppers
  - Consider compact prime power alternatives
  - Perform applied research using existing novel dielectric materials and meta-materials for development of antenna “lens” and compact high energy density capacitors for RF/HPM-based vessel stoppers
  - Leverage/adapt commercial technology
  - Exploit advances in maritime technology: propulsion, electronics, remote diagnostics, communications
  - Identify and develop new materials, such as non-linear dielectrics, to enable development of compact, highly-flexible, high-power RF sources, high-gain/high-power antennas, and pulsed power technologies/systems for RF/HPM-based vessel stoppers
  - Develop higher peak power RF sources for RF/HPM-based vessel stoppers.
  - Develop remote stop/shutdown command and control systems capability for large vessels (e.g., neutralize command, control, and communications equipment on the vessel bridge)
  - Develop new innovative lightweight and low-cost technologies that arrest the momentum of large vessels
- i. Non-Directed Energy-based Non-Lethal Vessel Stopper: This BAA topic seeks a next generation, low cost, lightweight Non-DE-based vessel stopper which will enable the safe stopping of small, medium, and large vessels. To date, the JNLWP has investigated various non-DE based small and medium vessel stopping technologies, many of which have been based on either entangling the propellers of the targeted vessels, or fouling the intakes to these vessel engines, or by blocking air-flow or water-flow into or around the vessel’s engine. In parallel with our JNLWP S&T investments, ONR has studied several non-DE-based and several DE-based large vessel stoppers as well as a small vessel stopping capability that employed a high energy laser.

Entanglement of a vessel’s propeller is a current capability that has been employed by both the USN and the USCG via the Running Gear Entanglement System (RGES). The RGES has been tested and its probability of propeller entanglement is not very high in mid to high sea states. One of the Technology Challenges of this BAA is to perform the necessary S&T to enhance propeller capture so as to bring the small vessel target to a stop even in high sea states.

This BAA topic seeks technologies that stop greater than 80% of the boats regardless of sea state.

Another set of non-DE-based vessel stopping technologies to be considered are based on the use of: (1) synthetic bulbous high viscosity polymer materials that either foul or entangle the propeller or jet-drive of the target vessel's engine; or (2) through use of materials that either modify or inhibit vessel engine combustion and/or cause the engine to overheat and shut down in a short period of time. Each of these non-DE small vessel stopping technologies offer the potential for a low cost, effective, safe and near term operational capability that other technologies cannot provide at this time. This topic seeks new innovative vessel stopping technologies that:

- 1) are not limited in deployment range to the target and employ technologies that facilitate the self-deployment of the capture device to support a quick and accurate "placement" of the device in front of the high speed target vessel(s) such that these target cannot easily evade the vessel stopping payload,
- 2) increase the overall effectiveness and repeatability of the vessel stopping payload, specifically as related to the probability of vessel capture versus operational sea state, local air/sea environment, and the ability to affect capture on all vessel hull types, vessel load outs, and vessel propulsion systems;
- 3) facilitates system deployability issues, to include: (1) overall payload weight and volume necessary to deploy the device directly "in front" of an evading threat vessel target, i.e., does this design allow for the capture of the target vessel at any aspect angle with the respect of the target vessel's trajectory and the vessel stopping payload's deployed trajectory, (2) environmental concerns related to "deploying" the "payload" in the open ocean or restricted waterways, and (3) line of sight with full 360 degree in azimuth field of regard and system deployability from a small manned or unmanned platform;
- 4) minimize and/or reduce limitations of vessel stopping due to either the speed of the target vessel and/or its size, shape, or weight, i.e., for Non-DE vessel stopping technologies, they must be able to stop large, medium, and small vessels at all typical operational speeds;
- 5) do not require any special storage requirements to include: (1) reserving large amounts of deck space to store and/or "arm" this vessel stopper system; (2) require no special requirements and/or subsystems to accurately deploy the payload; and (3) require no time-critical vessel stopping dependence associated with the deployment or launch of the payload and its self-deployment just before it hits the water in front of its intended vessel target.

Armed with a better understanding of the hydrodynamics and physical parameters involved with stopping high speed vessels, these next-generation non-DE-based vessel stopping systems may finally be realized with: (1) improved and repeatable vessel stopping effectiveness for high sea states, (2) reduced weight and volume resulting in greater standoff and smaller system size, and (3) potentially a lower cost

per capture when compared to existing propeller entanglement systems.

- ii. DE---based Non-Lethal Vessel Stopper: Another promising technology for providing a standoff vessel stopping capability that addresses many of the issues discussed in section i) above is the use of high power microwaves (HPM) and RF energy to stop/disable vessel engines by interfering with the vessel engine's control electronics. HPM has the advantages of: (1) speed of light delivery so it cannot be evaded, (2) environmental conditions (i.e., sea state, rain, etc.) do not significantly limit or degrade the effectiveness, (3) it is non-lethal to personnel in the wavebands of interest such as High Frequency (HF) to Terahertz frequencies, i.e., from 3 MHz - 3 THz and specifically in the HF, very high frequency (VHF), Ultra HF (UHF) (L Band, S Band, X Band, and W Band), SHF, and extremely HF (EHF) wavebands and (4) the effects are typically temporary so the vessels can be restarted after a short period of time and/or after minor repairs. The objective of this topic is to evaluate new innovative compact RF/HPM vessel stopping prototypes and to demonstrate optimized/ruggedized RF Vessel Stopping prototypes (TRL 7) that are suitable for high priority maritime missions (shown below). The mission areas that shall be considered for prototype development include:

- 1. PURSUIT and INTERCEPT

- a. Conditions and Standards
  - 1. Range: Close Proximity (less than 50 meters)
  - 2. Open and confined water
  - 3. Targets: Single to Few
- b. Missions
  - 1. Interdiction
  - 2. Illegal Immigration
  - 3. Counter Drug

- 2. CAPITAL ASSET PROTECTION

- 1. Conditions and Standards
  - 1. Range: 100 to 500 meters
  - 2. Open and confined water
  - 3. Targets: Single to Many
- b. Missions
  - 1. Pier Facility Protection
  - 2. Ship Protection
  - 3. Protection of Oil Platforms, etc.
  - 4. Defense against Swarming Boats

- 3. COUNTER PIRACY

- a. Conditions and Standards
  - 1. Range: 100-500 meters
  - 2. Open Water
  - 3. Large Geographic Area
  - 4. Targets: Single to Few

A variety of methods including but not limited to the following shall be used to determine the technology requirements of these proposed new RF/HPM Vessel Stopping prototypes to include:

- Collection and analysis of RF/HPM vulnerability data against new targets using existing and newly developed RF/HPM sources
- Development and validation of relevant simulations and predictive RF/HPM engine defeat vulnerability models
- Independent analysis to identify new RF/HPM source technology options
- Assessment of target trends both in the commercial marketplace and within the threat-user community
- Analysis of the effects data already collected by the US Government as it relates to the contractor's newly proposed RF/HPM source.

The JNLWP has collected a significant amount of HPM waveform vehicle/vessel engine vulnerability data. This data will be analyzed and leveraged so as to minimize and/or ensure no duplication of work with respect to newly proposed RF/HPM Vehicle and Vessel Stopping waveforms/source versus those that the Government has already tested. Note: The government will perform this RF/HPM vulnerability analysis on the white-papers submitted by Offerors and complete this analysis prior to the request for the full proposals.

## **7. Non-Lethal Laser Induced Plasma Effects for long range > 100meter NL Counter-Personnel and Counter-Material Missions**

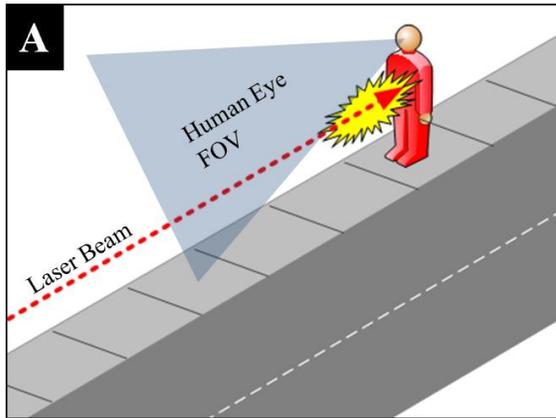
### **A. Non-Lethal Laser Induced Plasma Effects (LIPE):**

Producing a flash bang effect, dazzling light, and/or thermal effects has potential NLW applications. Directed energy weapons systems, in general, offer the potential for longer standoff ranges, line-of-sight targeting, speed-of-light engagement, scalability of effects, and high rate/volume of fire. Therefore, laser systems capable of delivering compelling non-lethal effects should be closely investigated to gauge the potential advantages and disadvantages when compared to more conventional, often kinetic, non-lethal munitions and systems.

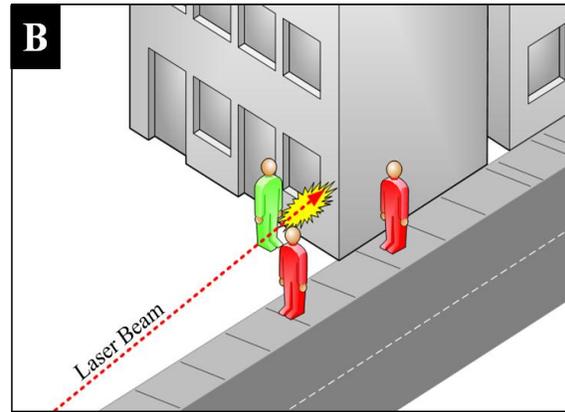
LIPE Requirements: High peak power (but low average power) ultra-short pulsed lasers, with pulse widths of a few nanoseconds to femtoseconds, can be modulated and employed to ionize small sections of air or small sections of materials on larger material surface, all of which can be near to or directly in front of threat human or materials targets. In theory these "plasma balls and/or plasma filaments" can be created anywhere in 3 dimensional space. The Internet shows that plasmas and plasma filaments have been created at the laser head ("muzzle") and out to 20+ km in the atmosphere. Here the size/diameter of the optics is what really defines the longer range capabilities, but laser power is also a factor. In creating and sustaining (sustaining the balls from seconds to minutes in duration) these sets of visible (typically blue) "plasma balls" and/or a "filaments of plasma", one can produce a number of useful non-lethal effects. The "plasma balls" can be formed in air and thus directly in front of the human targets (Figure 2A) or off of hard/solid targets near targets of interest (Figure 2B). These novel non-lethal effects can potentially provide long range hail and warn, long range area denial to people and vehicles/vessels, the ability to move people in, through, and out of an area, and the ability to suppress a threat human and their ability to accomplish military relevant goals against our forces. Specifically these non-lethal plasma effects can provide (in a non-kinetic manner):

- Seconds to minutes of sustainable multiple flash-bang effects with high pulse repetition rates of 10's to 100's of acoustic blasts at acoustic levels of 110-170 dB and high intensity 20 M candela "flashes" per second.

- ii. Scalable laser induced (thermal) effect (the sustainable plasma pulses “drills” through clothes to get to skin where the pulse begins to abate the human skin causing thermal discomfort.
- iii. Long range (greater than 2 kilometers) intelligible voice commands (Note: LIPE has the capability to produce intelligible voice commands out to 20 km).



**Figure 2a. LIPE in air in front of a target**



**Figure 2b. LIPE on a near solid surface**

LIPE BAA Topic: This BAA seeks options to design a non-lethal DE laser weapon system capable of creating laser plasma bursts at a range on the order of 100 meters threshold and 1000 meters objective all while keeping the optical system resilient and portable by military means (man-transportable and/or mountable on a small vehicle). Lasers utilized in non-lethal design would need to operate at wavelength of 1.54 microns or greater to ensure retinal safety from inadvertent ocular exposure, and assume as small of form factor as possible to support worse case 8 hours duty cycles, i.e., for nearly continuous supply of plasmas. Goals for intelligible auditory messages must be able to achieve much longer ranges from 1000 meters threshold to 6+ kilometers objective. This super long range hailing device must convey coherent/understandable audible messages but to also do so in the targets own natural language. The laser system should also be able to identify a target at these long range and then track and hold a moving target human or vehicle/vessel for the length of the message, thus the laser system must include auto-targeting beam steering with acceptable beam stabilization at these long ranges. This system’s ability to provide multiple non-lethal visual and auditory (flash-bang) cues directly at the target could greatly deter would be threats at very long ranges as well as support the escalation of force continuum by scaling up from simple long range hail and warn to flash-bang and thermal discomfort effects on the target and thus provide a very long range non-lethal deny, move, and/or suppress capability directly right at the long range target.

Currently several non-lethal mission needs are mitigated by employing several different non-lethal weapons. Long range hail and warn missions are mitigated by employing acoustic hailing devices and green dazzling lasers. Area denial, move, and suppression to individuals and groups of individuals is accomplished either by employing multiple rounds of long range flash-bang munitions or with the Active Denial System. Stop a vehicle/vessel missions are accomplished either by employing these same NL counter-personnel weapons at the

driver/operator of these vehicles/vessels or by employing long range high power microwave directed energy weapons to disable the target's on-board electronics. This novel long range non-lethal LIPE weapon could be the single non-lethal weapon that could mitigate all of these counter-personnel needs and/or vehicle/vessel stopping counter-materials mission needs.

The LIPE technology can provide more scalable effects at greater ranges than many of these current NLWs. This single LIPE technology could accomplish all these non-lethal mission needs in an appropriate order as well, i.e., from: (1) a low escalation of force (EoF) option with long range hail and warn (by providing intelligible speech at a distance in the threat target's own language), to (2) medium escalation of force with multiple high repetition rate very loud (130 dB – 179 dB) acoustic blasts with bright flashes), to (3) a higher escalation of force with thermal discomfort of the human target at range (by training the laser induced plasma "ball" up onto the human target). This single LIPE technology could also be employed to stop vehicles and vessels by either providing: (1) a low EoF option via intelligible messages delivered to the target in the vehicle, or (2) a medium EoF option via multiple flash-bang detonations against the windshield, or (3) a higher EoF option via the LIP "drilling" holes into critical parts of the vehicle or vessel.

## **8. Compact Non-Lethal Non-Pyrotechnic Flash-Bang Technologies**

### **A. Intrinsically-safe (non-pyrotechnic) flash-bang Grenade**

The goal of this BAA topic is to seek the development of a compact lightweight Intrinsically Safe Flash-bang Grenade (ISFBG). Flash-bang (or stun) grenades are diversionary devices that provide a situational advantage to tactical forces by temporarily creating physiological and psychological conditions that can briefly distract an adversary without causing undue collateral damage. A flash-bang grenade generates an instantaneous combination of sound, light, and pressure creating confusion and disorientation. These disorienting effects thus diminish a threat human's ability to move in or out of an area that we are trying to secure. They also deny areas to personnel by often "pushing or persuading" them to move out of an area and they most often suppress those personnel exposed to these effects to include degrading an individual or group of individuals ability to take threatening actions. Existing diversionary devices use a 'flash' component which can produce excessive smoke that obscures team member vision and, generate a brief but intense heat source that can ignite undesirable secondary fires. As such, it is problematic to use such devices in confined areas and those that are susceptible to fire such as aircraft, vessels, and vehicles (containing fuels). Consequently, tactical teams have a need for an intrinsically safe distraction device that will greatly diminish the threat from smoke and secondary fires, but can create the physiological and psychological effects of a conventional pyrotechnic flash-bang diversionary device.

As discussed, conventional flash-bang grenades generate an instantaneous combination of sound, light, and pressure. The blast overpressure associated with these conventional flash-bang grenades are typically run from 0.5 – 1.7 pounds per square inch (psi) measured at 6 feet from the source. Similarly the noise levels

associated with these blast run from approximately 134 dBA – 143 dBA (also measured at 6 feet from the detonated source). Finally the level of light intensity of these flashes associate with these conventional flash-bang grenades range from approximately 0.6 kilolux (KLux)/sec – 6 kLux/sec (as measured at approximately 11.2 feet from the detonating source). The objective of this BAA topic is to develop a non-pyrotechnic flash-bang grenade that would match or exceed the light, sound, and over-pressure specifications shown above, and achieved by conventional flash-bang grenades as well as accomplish these performance specifications in a system form-factor that is commensurate with existing (hand-thrown) conventional flash-bang grenades.

This capability is sought by a number of end users within the DoD and by other government agencies to include the USCG. To conduct effective Maritime Security and other National Defense missions such as clear a space missions, the non-pyrotechnic flash-bang grenade concept supports many of these associated capability needs. A non-fire igniting flash-bang device would be very useful in circumstances where armed dangerous subjects occupy or may occupy spaces aboard vessels which are inter-mixed with innocent civilians. Maritime and DoD mission scenarios which include a fire/explosion risk must employ safe and effective diversionary technologies that will mitigate these risks all the while providing a “prepare safe” capability in support of these non-lethal entry, clear, and apprehension operations for both Maritime and aircraft spaces. There are no known (non-chemically-based technologies) existing diversionary technology alternatives to support this need

The following diversionary performance specification table shows many of the relevant and implied flash-bang performance specifications that require some level of mitigation. This is not a comprehensive list but the list should initiate thought and facilitate the development of more optimum non-pyrotechnic flash-bang designs.

<u>Characteristic</u>	<u>Performance Specification</u>	<u>Comments</u>
Effectiveness	Sound	Decibel level produced by the device
	Flash	Light level of the flash in lux
	Overpressure	Level of pressure produced in psi
	Strobe Effect	Yes or no with strobe parameters
Safety	Safety Features	Render immediate-safe capability
		Visual aid w/count-down to device activation
		Delay feature with blast hands-safe design
Utility	Temperature Range	Operating temperature environment specs
	Size and weight	self-explanatory
	Battery Capacity	Level of capacity indicator
	Water/Humidity Ops	Device’s ability to operate in water/humid Op

Unit Cost	self-explanatory
Reusable/Rechargeable	self-explanatory
Storage and Shelf Life	Storage life and shelf life limitations
Mean Time Between Failure	self-explanatory
Durability	Shock/Vibration & drop limitations

One of the more important goals of this BAA topic is to ascertain the state-of-the-art in each of these non-lethal diversionary stimuli (light, sound, and overpressure) and see if all three stimuli can be combined to produce the levels of performance found with conventional flash-bang devices but to do so in a form-factor that is commensurate with a compact hand-thrown device similar to existing flash-bang grenades. Recent S&T investments in this area have shown no one system can meet all three flash-bang system specifications unless the subsystems are configured in a large (baseball bat-sized) form-factor. That large form factor has questionable military utility.

## 9. Compact Advanced Multi-Bang Flash-Bang Technologies

### A. Multi-Flash-Bang Technologies (pyrotechnic and non-pyrotechnic)

The objective of this BAA topic is to develop a multi-bang grenade design that would give operators a prolonged diversionary/dispersal effect on targets from a single grenade. This grenade can be pyrotechnic or non-pyrotechnic-based. If non-pyrotechnic then the design needs to meet all the requirements found in Focus Area 8 above and with the additional capability of providing a multi-(acoustic) bang capability in one grenade. If the design is pyrotechnic-based then the diversionary device should still follow and meet all the requirements found in section 8 above but the device can be initiated by energetic means. As shown above the conventional flash-bang grenades generate an instantaneous combination of sound, light, and pressure. The blast overpressure associated with these conventional flash-bang grenades typically run from 0.5 to 1.7 psi measured at six (6) feet from the source.

The end user has yet to select the required number of multiple (blast) bangs sought, but initial optical and acoustic blast modeling and simulation codes predict enhanced suppression effects occur on human targets when more than one flash occurs in the eye's field of view and when several acoustics blasts occur either simultaneously or many occurring in a few seconds. These enhanced suppressive effects occur in as small of number as 3-5 for flashes and acoustic blasts. Suppressive effects from a conventional flash-bang are minimal. These suppressive effects from overpressure also increase when there are 3-5 detonations occurring in as small of time as five (5) seconds. Thus these numbers will set our threshold design, but the objective performance specifications should be determined by additional modeling and/or where there is a marked increase in the overall suppression of the human target as the target or targets are exposed to successive flash-bang detonations (with flash, acoustic bang, and overpressure non-lethal stimuli).

The non-lethal flash (suppressive) effect from a conventional flash-bang grenade is temporary flash blindness. Flash blindness, as employed in flash-bang grenades, is not a permanent injury. The flash momentarily activates all of the photoreceptor cells in the eye and causes temporary flash blindness. Flash blindness is caused by bleaching

(oversaturation) of the retinal photo-pigment. As the photo-pigment returns to normal, so too does sight. The degree of temporary flash blindness or its correlate recovery time from the effects of flash blindness is dependent on a few key parameters, such as the function of total effective integrated energy in per flash and the number of flashes per short duration exposure, the size of the pupil, the state of adaptation prior to the flash, the size of the critical detail in the recovery target, the luminance of the target, the spectrum of the radiation, and individual variation in response.

There is a considerably large human effect database on flash effects to include some general rules of thumb for flash effects associate with flash-bang grenades. First rule is that there is an effect/effectiveness difference as a function of age and on dark eye adaptation. Strobging effects at specific optimum frequencies also showed that in flicker as well as in dark adaptation, the increase in threshold luminance is not a linear function of age, but that, at about the age of 40 there is a great increase in sensitivity to glare. Other key rules of thumb would be that:

- a portion of flash radiation that influenced the recovery times for foveal vision performance was in the visible region. The infrared had no effect on prolonging the recovery time following the flashes, even when it accounted for more than 50% of the total flash energy.
- there was a small but statistically significant effect in foveal vision recovery for different flash-field diameters of 2.50 to 10, with the smaller fields producing longer recovery times.

there is an approximately linear relationship between the log of the retinal illuminance times the duration of the flashes and log of the recovery times for the recognition of a 20/60 acuity target at 0.06 milli-lambert, over the range of 20 seconds to 130 seconds recovery time. There was no significant cumulative effect on recovery times with successive flash-bangs after the second flash when they were presented at intervals of separation of three or four minutes. There is an increase in flash recovery time for flashes that are occurring almost “simultaneously”. The new Human Effects Center of Excellence (HECOE) – developed Optical Effects Models now predict this increase in recovery time for near simultaneous flash-bangs.

there is an change in target recovery times following a flash that depends upon the type and size of the target flash employed, but the greatest effect/effectiveness difference was found in the variation between individuals as exposed to the same flash. There was a factor of about X2 between the means of the highest recovery time and lowest recovery time.

As discussed above the degree that the eye as adapted to the dark is key factor in the recovery time from flash blindness. In daylight the eye's pupil constricts, thus reducing the amount of light entering after a flash. At night, the dark-adapted pupil is wide open so flash blindness has a greater effect and lasts longer. Regardless flash blindness is a temporary effect. This form of “temporary injury” to the eye makes vision impossible for approximately five seconds or more or until the eye restores itself to its normal, un-stimulated state and as such makes this a very effective way to suppress threatening individuals or groups of individuals optically.

Suppressive auditory effects from flash-bang grenades are caused by the high intense short impulse of sound, i.e., the acoustic blast of the flash-bang. The acoustic blast of successive acoustic blasts from many “successive bangs” causes “auditory fatigue”.

Auditory fatigue is defined as a temporary loss of hearing after exposure to (impulse) sound. This results in a temporary shift of the auditory threshold known as a temporary threshold shift (TTS). This damage or injury can become permanent (permanent threshold shift, PTS) if sufficient recovery time is not allowed for before continued sound exposure. The change in TTS as a function of successive “bangs” is a function that must be observed when considering a multi-bang flash-bang as a non-lethal weapon, i.e., where no permanent injuries occur. HECOE’s Optical Effects model combined with its embedded Auditory v5.0 model predicts these types of injuries and should be employed to evaluate the change in auditory suppression (degree of TTS) to ultimately measure the degree of weapon effectiveness as a function of multi-bangs required.

There are two main types of auditory fatigue, short-term and long-term. These are distinguished from each other by several characteristics listed individually below:

#### Short-term fatigue

- full recovery from TTS can be achieved in approximately two minutes
- the TTS is relatively independent of exposure duration
- TTS is maximal at the exposure frequency of the sound

#### Long-term fatigue

- recovery requires a minimum of several minutes but can take up to days
- dependent on exposure duration and noise level[
- The loud blast is meant to cause temporary loss of hearing, and also disturbs the fluid in the ear, causing loss of balance.

For non-lethal multi-flash-bang grenades, we are concerned with short-term fatigue and long-term fatigue.

There is one final multiple “bang” flash-bang requirement that would greatly increase the effectiveness of this suppressive weapon and that would be to have intentional delay between the first bang and the flash. The goal would be to have the first acoustic blast occur, with its implied over-pressure. The human targets would sense and feel this effect and by human nature, they would turn to face and try to see/determine just what was the reason for this blast. By doing so they would increase the odds that the 1<sup>st</sup> flash would be within their field of view and thus improve the odds that optical suppress would occur along with the TTS from the 1<sup>st</sup> acoustic blast. Improving weapon effectiveness would reduce the number of acoustic blast required under this multi-bang requirement and it would also reduce the number of flashes required. This lowers risk of injury and lowers the power requirements of the device so as to make this multi-bang flash-bang grenade as small as possible.

### **10. Advanced Non-Lethal Technologies that Move/Suppress/Deny/Disable through Combine NL Effects on Individuals and Crowds**

Focus Areas 8 and 9 address the “Move/Suppress/Deny” parts of this military need by employing both light and sound in the form of flash-bang technologies. Focus Area 5 addresses the “Disable” part of this capability need by employing HEMI technologies. This BAA topic supports the development of new innovative non-lethal weapons that move, suppress, deny, and/or disable groups of individuals: not just one individual. The typical three “target size” categories applied to these needs are: point (or 1 human target); few (or 2 to 5 human targets); and many (greater than 5 human targets).

This BAA topic also seeks other non-lethal technologies with their corresponding non-lethal stimuli, either employed (synergistically) together in parallel or in serial or employed individually in parallel or serially so as to better mitigate and/or achieve these capability-gaps via combined effects.

All non-lethal stimuli shall be considered, individually and in combination to elicit combined non-lethal effects. This non-lethal combined effects concept should not be limited and as such several “pairings” of non-lethal stimuli should be considered in this non-lethal weapon effectiveness analysis. As the goal is to enhance the resulting non-lethal effects and corresponding non-lethal weapon effectiveness, these combined non-lethal weapon effects should achieve a greater level of effect than that which would be achieved individually. These “pairings” of non-lethal stimuli or weapons should not be limited to just two non-lethal stimuli or weapons but should include as many non-lethal stimuli or weapons as required. Relevant non-lethal stimuli would be combinations of forms of light and sound, active denial technologies, HEMI, non-irritating malodorants, blunt impact, thermal discomfort effects, plasma effects, and any other non-lethal stimuli effects.

The end-state of this BAA topic would be the development of a hand held combined effects non-lethal weapon which addresses the needs to move/suppress/deny/disable. This includes, but is not limited to, the ability to: (1) defeat snipers; (2) engage neutral and non-hostile crowds using non-lethal means; (3) defeat raids and perform route reconnaissance; and (4) assist in convoy protection, point defense, vehicle/vessel stopping and force protection missions.

The near-term desired capability would be to develop non-lethal weapons with combined effects that mitigate: Hail/Warn missions, Move missions, Deny Access missions, and Suppress missions to Individuals and Groups of Individuals from 0 to 1000m and for a duration of effect of 30 seconds or more. Technologies that employ combined effects should provide for effective ranges from 0 to 2000 meters or more and provide an extended duration of effect from 3 to 5 minutes. The associated S&T technologies challenges include developing and employing multi-sensory combinations of non-lethal stimuli to meet these extended effects/duration requirements and will also require development of more compact non-lethal stimuli delivery systems, to reduce weapon size, weight, and cost, support scalability of these non-lethal effects to allow for an escalation of force concept, consider combinations of directed energy and non-directed energy weapons to support speed of light delivery and large electronic magazines (and thus little to no ammunition storage issues), and consider combined effects weapons that support man-portable operations or at a minimum support easy integration onto small manned and unmanned tactical vehicles.

All combinations of non-lethal stimuli should be considered in this combined effects analysis to include performing non-lethal S&T research and development on (but should not be limited to):

- a systematic approach to combined effects and resulting weapons effectiveness
- human effects data on the individual non-lethal stimuli and on physiological and psychological effects of these combined effects being employed together against an individual and groups of individuals
- extended effects durations
- multi-function capabilities (i.e., does this non-lethal technology support other

possible DoD missions such as surveillance, communication, or intelligence gathering missions

- scalable effects from non-lethal to lethal and scalable effects that support both counter-personnel and counter-material missions

Also there should be no limitations in considering effective non-lethal weapons and/or non-lethal stimuli research and development (but not be limited to) on:

- next generation long range (2 to 6 km) acoustic hail and warn
  - lightweight compact carbon nano-tube acoustic sources.
  - application of effective acoustics waveforms, i.e., employing low frequency high sound pressure level (SPL) acoustic waveforms that both deliver very long range acoustic warning signals as well as intelligible voice commands in complex battlefield environments such as in the presence of high background noise, operation in complex battlefield atmospheres such as smoke, dust, wind, and all weather conditions with extreme heat and cold, and into complex environment such as into vehicles and vessel and into buildings and facilities.
- leveraging existing light and sound combined effects with other non-lethal stimuli to provide a long range hail and warn capability and a combined non-lethal stimuli that provides a more moderate and even short range non-lethal capability but one that escalates the force and addresses the deny, move, and suppress capabilities and mission needs.
- leveraging existing advanced non-lethal weapon systems that provide for these extend ranges and durations, which again provide some scalability of the effects from hail/warn, multifunctional capabilities (such as communication and surveillance) NLW.
- extended non-lethal effect durations.
- advanced delivery systems that are preferably hand-held, thus compact, low cost, and lightweight.
- advanced source alternatives to increase output power and efficiency.
- investigate technologies that produce the non-lethal stimuli effects at range or at the target, such as Non-Lethal Laser Induced Plasma Effects\_ technologies (see Topic Area 7), or technologies that employ ultrasonic acoustic heterodyne processes.

#### **11. Compact Hail and Warn Technologies with long range (0-1500m) two-way communications**

This BAA topic combines both the long range hail and warn requirement (as described in Focus Areas 1 and 7) with a long range listen-back capability. As non-lethal weapons are often employed as part of the escalation of force continuum which is bounded by shouting and shooting, long range hail and warn capability is typically the 1<sup>st</sup> non-lethal technology employed as the lowest form of force in this escalation of force continuum. It is often employed first for a number of reasons: (1) it provides non-lethal effects for both compliant and non-compliant threats to move and/or deny areas to these threats; (2) it can be very effective at considerably very long ranges; and (3) it can be scaled in certain battlefield environments to produce temporary suppressive effects. Note however that

when an acoustic hail and warn device is employed to produce temporary suppressive effects then this device can no longer be considered a hail and warn device. It is now an acoustic weapon. Again, as a hail and warn device it is not considered a weapon. Once it is designed to cause harm or injury, however slight (i.e., to produce these suppressive effects), it now must be considered a weapon and it would require a legal review. Also, when one adds the "listen-back" capability to this long range hail and warn device, then determination of intent on both compliant and non-compliant threats becomes much more clear and evident.

A non-lethal hail and warn device, or an acoustic hailing device (AHD) employed against a group of potential hostile targets can quickly and easily cause the complaint individuals to stop doing what they are doing and to leave the area immediately. This clarifies the situation as it identifies potential hostile intent by those individuals that stay in the area and it mitigates area denial, move, and clear-a-space mission needs for compliant targets. By greatly reducing the number of potential hostile targets then other higher forms of non-lethal escalation of force can be employed against the remaining targets. The final benefit of employing long range hail and warn is that these non-lethal technologies are generally not last large (in size or weight) and are relatively low-cost. Thus with this single low-cost non-lethal technology, we accomplish a number of our mission needs (against compliant targets) and we do so at very long ranges.

This long range hail and warn and long range listen back capability can also be applied to the vehicle/vessel stopper mission needs. Long range voice commands can: (1) influence vehicle and vessel operators by persuading the complaint ones to stop their vehicle or vessel); (2) persuade complaint occupants of a building and/or a facility to clear their space; and (3) persuade operators of potential threat weapons/systems to cease and make safe these weapons and other threat systems. A listen-back capability expands this combined effects capability and maximizes the determination of intent for both compliant and non-compliant threats. This additional listen-back capability allows the warfighter to ensure that the potential hostile target is receiving the long range hail and warn in their own language or languages as it "measures" the acoustic sound level at the target as projected by the AHD. This allows the warfighter to ensure his message is getting to the target and then he can issue specific commands to the target and observe both intent and the level of compliance. This listen back capability also allows the warfighter to "listen" to the threats internal discussions which allows for a real-time interaction and dialog with the threats and our warfighters.

The non-lethal long range hail and warn capability needs have been defined in many of the above BAA topic sections in this document. This BAA topic does not seek any additional hail and warn capabilities that are different than those discussed in the above sections. The goal would be to develop an effective hail and warning technology with performance specifications commensurate with those sought in Focus Areas 1 and 7, but with the final long range hail and warn capability out to a range of 1500 meters or more.

The additional capability sought in this BAA topic is the long range "listen-back" capability. To meet the 1500 meter range requirement, a listen-back capability could still be attained via either a long range passive acoustic (beam-formed) sensor system or via an active laser vibrometer/listening system. Each technology can be made fairly compact and low-cost and still meet this rather moderate range requirement. This listen-back capability supports many capabilities: it provides the desired long range intelligence supporting long range hail and warn missions by "listening" to the threats

discussions occurring real-time; it ensures that the long range hail and warn did in fact reach the intended threat targets with enough acoustic amplitude (SPLs) to allow the threat to understand and act of the provide voice commands; and for vehicle/vessel stopping applications it allows us to determine if we have in fact shut down and/or stalled the engine.

Thus this BAA topic should include but not be limited to an analysis of and the development of passive (beam-formed) acoustic sensors (commensurate with current unattended ground sensors) and/or active laser vibrometer-based listening devices. Given the modest range requirement of 1500 meters, the major discriminator between these designs should be based on resulting cost, weight, and size. Again other long range listening technologies should also be considered for this BAA topic, but it is preferable that these technologies all provide this long range “listen-back” capability based on a remote sensing capability.

## **12. Compact, Low Cost Non-Lethal “Push-Back” – “Repel” Technologies**

The objective of this BAA topic is to research and develop a non-lethal weapon system/device(s)/method that will effectively deny, move, suppress, and keep crowds at an effective “safe” distance from a “protected” site. This keep-out range from a “protected” site is required to be at a range of 100 meters threshold and 500 meters objective and with a full 360 degree perimeter around the “protected” site. The minimum size of a “protected” site will have a keep-out radius of 50meters. Any human within 100 meters of the incident site perimeter must be suppressed, denied, or moved to keep this individual from approaching the “protected” site. These “push-back” and/or repel effects must be non-lethal.

For this requirement “suppression” means that the crowd will be incapacitated in such a matter as being unable to aggressively and accurately fire weapons into the “protected” site. For the purposes of this BAA, Suppression and Disable have the following additional definitions:

- Suppression: suppress and/or degrade the operational capabilities of individuals or groups of individuals
- Disable: temporarily disable threat individuals or groups of individuals;

Thus the desired non-lethal effects include non-lethal effects that would greatly suppress and/or disable all threatening human targets outside of the 100 meter perimeter. The 100 meter completely suppress/disable zone is the minimum threshold requirement, if the device(s) can suppress/disable further out to approximately 500 meters then that would be a more desired (objective range) operational capability. See Figure 3 diagram below.

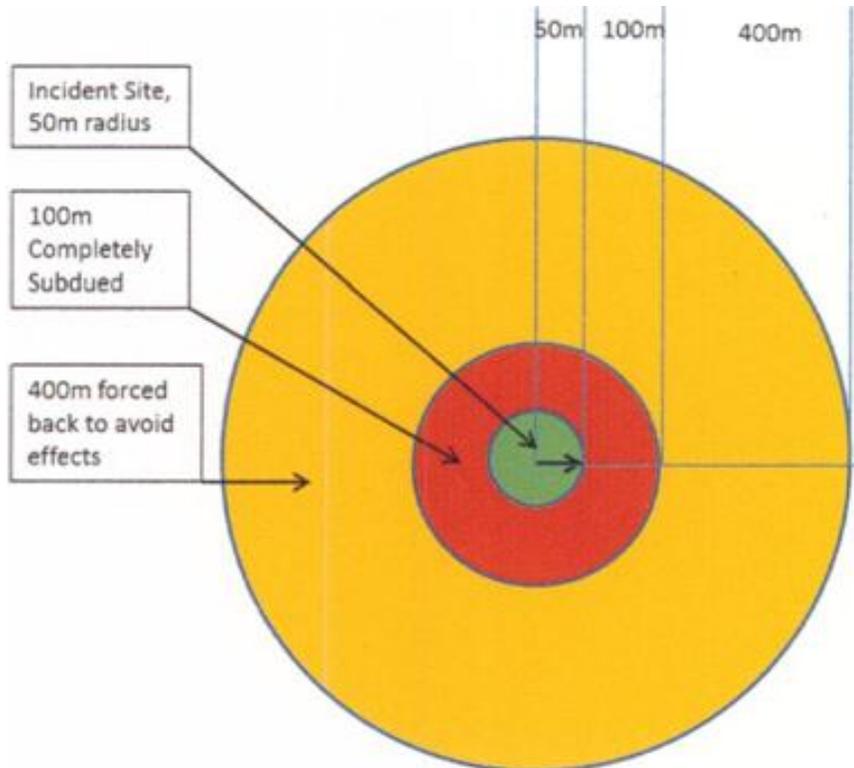


Figure 3

The weapons system solution can be one non-lethal device, weapon, or munition or up to 3 to 4 devices, weapons, or munitions. This weapon system could also employ one or more non-lethal stimuli in a combined effects manner or employed individually.

Some further amplifying design assumptions related to the weapon concept would be:

1) A single device would utilize either: a subset area emitting beam that could be swept or scanned across the full 360 degree of azimuth coverage and still produce the required suppression and/or disable effects on all human targets in the target area; or a full 360 degree (or omni-directional) area of influence. If the solution is an area emitting device, then the system must also include a protective safe-zone so as to make the operators and innocent civilians immune to its effects.

- The goal of these non-lethal weapon(s) is/are to protect a sensitive site; however, it should be noted that all weapon systems must conform to the Law of War, of which distinction/discrimination is a fundamental principle. A weapon must be able to be directed at a military objective. Those weapons that are likely to hit/affect civilians must be considered indiscriminate and as such this type of weapon system must undergo a preliminary legal review early on in the technology development schedule. This type of device is similar to a “fence,” which is indiscriminate, in that it keeps everyone out. Here, the same result is wanted, but because it causes a disabling affect it must conform to the Law of War. Now, the intended use of the device may render it lawful and the principle of discrimination will have to be addressed at the time of employment. This means that any incidental injury caused to the innocent civilians in the area must not be excessive in relation to the military

advantage sought to be achieved by the weapon's use.

2) Multiple devices could be designed to be utilized and/or focused in a given direction at or outside of the incident site. For example each device could emit protection (i.e., waves/rays) 120 degrees out from each device. Cross coverage is desired between devices to ensure 360 degree coverage.

3) Device(s) may be employed with lightweight telescoping tripod(s) and/or be hand held.

Thus the non-lethal weapons or devices that are designed to shoot and suppress/disable one person at a time will not meet the intent of this requirement. The device(s) must be capable of providing continuous coverage/protection/security to the incident site for 1 to 4 hours without resupply or recharge.

Primarily the device(s) should be lightweight and small in size (hand held). If this is not possible then secondary the combined max weight of device(s) should be limited to 100 lbs. Required device(s) shall be lightweight and man transportable so there is no degradation to urban/overland tactical movement or immediate action drills. If device(s) cannot meet these lightweight/man-transportable parameters then the device(s) must meet the 2 following requirements:

1) For the US Air Force (USAF), this form-factor must fall within the floor space, cube and weight restrictions for the USAF's Pavehawk (HH-60G) helicopter. The device(s) also must not hinder Guardian Angel (GA) Personnel Recovery operations related to floor space, cube and weight restrictions (considering standard combat search and recovery (CSAR) and Casualty Evacuation (CASEVAC) load out of GA equipment and 3 operators) in the HH-60G and must be capable of being belayed from the HH-60G. Similar form-factors, cube, and weight restrictions follow for the rest of the Services. Recommend the use of the above USAF restrictions as a first order solution for systems that support the other Services.

2) Must be capable of being delivered to the incident site by one high mobility multiple-wheeled vehicle (HMMWV) or by one Guardian Angel Air Rescue Vehicle (GAARV).

The device(s)/system should only take 1 to 3 personnel a maximum of five (5) minutes to establish and maintain the 360 degree protection of the incident site with a radius of 50 meters. The deploying group cannot afford to lose more than three (3) personnel to set up and/or operate this device(s)/system.

Possible solutions could include: microwave and/or millimeter wave emitters, ocular interruption/impairment, auditory impairment (disabling sound waves), or supplementary intelligible audible tones that can suppress human targets, and/or devices through any means other than those prohibited by international law. Specifically the Geneva Conventions does not address specific weapons, but rather only addresses the treatment of specific persons on the battlefield. The solution could also be a device(s) or system that utilized multiple different subduing effects at once.

This BAA topic shall analyze and develop any possible legal, treaty, and policy issue early on in this technology development and it shall identify any possible special Rules of Engagement that would be necessary to employ this type of 360 degree "protection" area weapon. This analysis shall also develop associated Tactics Techniques & Procedures for this type of non-lethal weapon system and include weapon employment planning considerations for this type of device(s) or systems.

### **13. Human Effects and NLW Weapon Effectiveness Studies, Risk Assessments, and Evaluations**

The objective of this BAA topic is to support the required JNLWP S&T research as required to support existing and new JNLWP human effects (HE) and weapon effectiveness research. This BAA topic supports the full HE research, the associated HE risk characterization, and the prediction of the risk of possible injuries to the breadth of possible human targets and our possible conditions: to include age, motivation, gender, and all other relevant physiological and behavioral differences. Predicting and quantifying risk of significant injury is a key attribute associated with the non-lethal weapons human effects characterization process. It should be noted that the degree of rigor associated with this human effects characterization research must withstand several boards of independent review both within and outside the U.S. Government by senior subject matter experts. Thus this BAA topic must include human effects and weapon effectiveness research on all the new non-lethal weapons under development by the Services and the U.S. Government but it must also include weapons and non-lethal stimuli being produced under this BAA under Sections 1-12 above. All animal and human subject research shall be conducted in compliance with federal and DoD regulations. The performer shall comply with the requirements of DoD Instruction 3216.01 and Secretary of the Navy Instruction (SECNAVINST) 3900.38C, regarding the use of animals in DoD-sponsored research, and with those of DoD Instruction 3216.02, regarding human subjects in DoD-sponsored research.

One of the primary goals of this BAA is to perform human effects S&T research to gain a high confidence in the associated predicted injury assessments database for the following non-lethal stimuli: kinetic energy, optical, acoustic, and thermal (e.g., 95 GHz, lasers). A near-term goal for this S&T research is to gather human effects risk data supporting near-term development of NLW to include gathering appropriate data on: physiological assessments of all human targets and possible users; NLW that are guided by an effects-based NLW design concept, and risk assessments and risk of significant injury (RSI) predictions.

To complete this human effects S&T research will encompass several different S&T challenge areas such as:

- Identifying exposure limits and risks to enable testing of emerging NLW, such as new Active Denial Technologies, RF waveforms, nanosecond electrical pulses, and blast overpressure
- Determining the biochemical and biomechanical mechanisms of various physiological effects to enable Human Effects Readiness Level (HERL) maturation
- Correlating physiological data to testable performance parameters
- Determining quantifiable physiological metrics to evaluate RSI
- Developing methodologies to enable an independent validation of RSI predictions
- Understanding the chronic effects from exposure to established NLW technologies
- Identifying the effects of next-generation non-lethal stimuli

- Understanding the chronic effects from exposure to emerging NLW technologies

The S&T solution to these many challenges are within realm of the possible with today's technologies and the current state-of-the-art. Much of this research continues to follow the human effect research process that the JNLWP developed at the start of this DoD Program. The solutions now primarily are achievable based on conducting more focused human effects research which is based on specific dose-response curves, effects-based design, and finite element injury prediction models as well as validation from cellular/tissue experimentation and small animal testing, followed by specific validation research using large animal testing and human testing under institutional review board protocols. As such some of these S&T solutions can be achieved by:

- Conducting appropriate human subject and animal testing
- Developing and refining human effects models for Human Effects Modeling Analysis Program (HE-MAP)
- Assessing exposure limits and risks via modeling and simulation
- Analyzing changes in physiological markers (e.g., intracellular concentrations and other small molecules); Determine the extent of tissue damage
- Developing appropriate test targets or surrogates to allow for live fire test and evaluation of predicted RSI metrics for NLWs
- Testing with a human/surrogate (including test targets)/animal/cellular studies with injury prediction/validation supported via the JNLWP's Human Effects Modeling Analysis Program (HE-MAP).

The desired end-state for this HE S&T research is to achieve a high state of confidence in this gathered human effects knowledge which supports: NLW development and fielding; HERL maturation; RSI assessments; validated and verified models to predict human effects from any non-lethal stimuli.

Another goal of this BAA Topic is to perform S&T research to determine quantitatively non-lethal weapon effectiveness through the extrapolation of operational outcomes based on: (1) known physiological effects (to include the full range of human behaviors); (2) limited after action reports; and/or (3) human subject experiments (under IRB protocols) but at simulated user and target evaluations. To-date the assessment of non-lethal weapons effectiveness to include behavioral analyses and human target behaviors has been very limited. These behavioral analyses and weapon effectiveness experiments have not been able to simulate real operational outcomes and gauge quantitatively real military utility.

The near-term desired capability for non-lethal weapon effectiveness assessment is to perform S&T research to determine and quantify the ability to assess the effectiveness of fielded and near term non-lethal weapons (NLW) with respect to operational outcomes in individual and groups of individuals assuming various escalation-of-force (EoF) scenarios. This S&T research should be extended to include any emerging non-lethal technologies as developed by the JNLWP, other US government agencies, and any new innovative NLW technologies as developed under these focus areas 1 through 12.

The specific S&T research challenges associated with this type of non-lethal weapon effectiveness analyses should include but not be limited to:

- Determining elements of crowd (few, many) and individual behavior that are influenced by NLW
- Quantifying the degree to which some existing NLW and non-lethal stimuli are more effective than others
- Quantifying/qualifying the degree to which variables, such as motivation and cultural influence, affect behavioral responses to fielded NLW
- Formulating standard metrics that link non-lethal stimuli (blunt impact, optical, acoustic, overpressure, active denial technology (ADT)) to predictable behavioral responses
- Formulating standard metrics that link behavioral response to operational outcomes in EoF scenarios
- Quantifying the effectiveness of emerging NL capabilities/stimuli against existing capabilities
- Quantifying/qualifying the degree to which variables, such as motivation and cultural influence, affect behavioral responses to emerging NLW capabilities/stimuli (e.g., nanosecond electrical pulses and combined effects)
- Formulating standard metrics that link emerging non-lethal stimuli to predictable behavioral responses

The corresponding S&T solutions to these challenges shall include but not be limited to the:

- evaluation of various NLW stimuli (blunt impact, optical, acoustic, overpressure, millimeter wave) against animal models and human subjects in controlled experiments to quantify/qualify behavioral response tendencies and link to operational outcomes relevant to EoF scenarios
- analysis of historical crowd interactions to determine elements and variables that affect crowd behavior
- evaluation of additional (emerging) NLW stimuli (e.g., nanosecond electrical pulses and any combined effects) against animal models and human subjects in controlled experiments to quantify/qualify behavioral response tendencies and link to operational outcomes relevant to EoF scenarios
- research of various emerging NLW stimuli against animal models and human subjects in controlled experiments to quantify/qualify behavioral response tendencies and link to operational outcomes relevant to emerging/revised military needs.

The desired end-state for this S&T non-lethal weapon effectiveness research is to produce a sufficient body of knowledge to assess NLW effectiveness relevant to JNLE capability needs in emerging NL/EoF scenarios.

#### A. RF Bio-Effects – Active Denial Technologies

The Active Denial (95 GHz) “Repel effect” has undergone 15 plus years of human effects risk analysis and characterization. The current large spot size produced by the ADS systems (System 1 and System 2) have an effective spot-size of greater than 1 m, and thus produces a nominal repel time of less than 2 seconds at 2.3 Watts/cm<sup>2</sup> at

ranges from 10 meters to approximately 1 km from a 100 kW Gyrotron source operating at approximately 95 GHz. As such, these more compact mm-wave sources should operate at similarly safe operational wavelength as ADS, with commensurate effective “repel” power densities and with a large (enough) effective (i.e., person-size) spot-size of 15 to 24 inches or greater. The goal is to reproduce the ADS “Repel Effects” at range but in a much more compact and lower cost ADT system. As such this BAA should look to develop and test other mm-wave source technologies, beam configurations (to include small yet effective spot sizes), and operational frequencies so as to achieve the same ADS “repel effects” but to do so in a more compact configuration.

The bulk of the ADS-related human effects data exists at the ADS operating frequencies of 94 – 95 GHz. The development of new compact ADT sources should include this known effective ADT operating frequency but it should also include other frequencies that produce this same “ADS Repel” effect in humans.

The current ADS systems operate at a single (narrowband) frequency of approximately 95 GHz (plus or minus 0.5 GHz). This is the frequency where most of the human effect data lies, i.e., good atmospheric propagation and effective universal shallow human skin penetration depths of < 1/64th of an inch (approximately 396 microns). This “95 GHz” atmospheric window does represent a minimum in atmospheric attenuation but this minimum attenuation extends from approximately 92.5 GHz to 105 GHz. A second atmospheric window exists at approximately 135 GHz to 150 GHz and a third atmospheric window exists at approximately 210 GHz to 225 GHz. Thus the 95 GHz band represents the lowest atmospheric attenuation of these three bands, but the 146 GHz and 220 GHz window bands, over a kilometer range, would also have a low atmospheric transmission loss and would thus be acceptable overall.

The 95 GHz waveform penetrates the skin to a depth of roughly 396 microns. The majority of temperature sensing nociceptors (A delta and C nociceptors) lie approximately 100 microns beneath the top layer of the human skin. The higher the millimeter wave frequency, the lower the penetration in the skin. 220 GHz penetrates to approximately 100 microns. As such we are also interested in ADT sources that operate at 220 GHz and would have the same safe “repel” effects that we see at 95 GHz. There is currently no human effects data related to 220 GHz, thus S&T on the development of an effective ADT source should also include performing validation and verification tasks to ensure commensurate and effective “ADS repel effects” can be achieved at this higher ADT frequency.

Another possible advantage of a 220 GHz ADT source over a 95 GHz source is the accepted frequency of the transmitter to the transmitter’s aperture size law. Nominally the mm-wave source size goes as 1 over the square of the frequency of the source’s operation so if one can double the frequency of the source (i.e., from 95 GHz to 220 GHz) then one can approximately 1/4 the size of the resulting source system antenna.

#### 14. Other Non-Lethal Weapon Technologies

##### A. Additional Non-Lethal Weapon Technologies

Several other non-lethal technologies exist that were not captured in Focus Areas 1 through 13 above. One objective of this BAA was to focus on the many known S&T challenges that we have associated with many of the current JNLWP projects. Hence the detail in Focus Areas 1 through 13. But Focus Area 14 is included to include several non-lethal technologies that the JNLWP have worked in the recent past. The following list covers some of these additional non-lethal weapon

technologies:

- a. Vehicle / Vessel Stoppers/Barriers deployed from moving launching platforms
- b. Bright White Light Increased Intensity & Duration with & Size & Weight Reduction
- c. Marking Capability improvements
- d. .556 & .762 NL Ammunition
- e. Anti-Swimmer Grenades
- f. Riot Control Agents
- g. Smoke / Illumination Payloads
- h. Voice Translation Devices

This BAA should also include these non-lethal weapon technologies to include development enhanced system prototype with greater range, longer duration of effects, greater volumes of fire, and lower risk of significant injury.

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For each of the 14 non-lethal Focus Areas (and corresponding non-lethal technology challenge areas) described above in Focus Areas 1 through 12 there will be a requirement to develop and test advanced prototypes and/or system breadboards. The offeror shall include a plan for vetting their conceptual design and projected system performance specifications, system framework and system standards to the appropriate industry, academic, and government community for feedback and provide independent 3<sup>rd</sup> party senior subject matter expert critical review to increase probability for greater acceptance to the DoD community to include the Services and the Combatant Commands.

The offeror shall also include an assessment of the non-lethal weapon effectiveness of their own breadboard/prototype NL weapon system, device, or munition to include battle damage assessment (BDA) of the non-lethal weapon on counter-material targets and a human effects risk assessments for non-lethal counter-personnel weapons, devices, and munitions. These NLW effectiveness studies shall include effects/results on intended and unintended targets, i.e., include estimates of collateral damage/effects.

Offerors must include a realistic testing and validation plan for their proposed technology, breadboard, and/or system prototype and directly describe how their approach compares to the current state-of-the-art. Proposed technologies whose effects can only be postulated via modeling and simulation must provide reasonable independent verification, validation and/or accreditation of the model employed to assess weapon effectiveness and human effects risk characterization and/or prediction of injuries.

Technologies for Next-Generation Non-Lethal Weapon Prototyping and Military Assessment:

The end-state objective of this BAA is to: (1) develop next-generation non-lethal breadboard and early prototype weapon systems using BA-3 S&T funds as well as; (2) assess these lower TRL/HERL next-generation weapon system along with more mature (higher TRL/HERL) next-generation non-lethal weapons systems in formal military users assessments (MUA)s and/or limited users experiments (LUEs). These MUAs and LUEs would be funded using BA-4 funding **If efforts using BA-4 funds are awarded, they will be incorporated into an existing**

**contract via contract modification subject to Section 819 of the Defense Authorization Act for Fiscal Year 2010.**

An additional part of this BAA is to fund any necessary enabling non-lethal technology that would address any of our current non-lethal technology challenge areas. These technology challenge areas were discussed in Focus Areas 1 through 14 above, but put simply they most often involve solving current enabling systems, subsystems, and components sub-technologies to address and reduce the current size, weight and cost of our current system prototype. Thus our technology challenges often involve reducing the size weight and cost of several specialize system components all the while by also increasing their performance parameters by 2 to 20 times the current state-of-the-art. These are the true JNLWP S&T technology challenges.

Technologies of interest include but are not limited to the non-lethal stimuli described in each of Focus Areas 1 through 14. Offerors must directly describe how their approach compares to the current state-of-the-art.

**G. Point(s) of Contact -**

Comments or questions submitted should be concise and to the point, eliminating any unnecessary verbiage. In addition, the relevant part and paragraph of the Broad Agency Announcement (BAA) should be referenced.

Questions of a technical nature should be submitted to the following with a copy to the business point of contact:

Technical Primary Point of Contact:

Mr. David B. Law  
Joint Non-Lethal Weapons Directorate (JNLWD)  
Technology Division Chief  
3097 Range Road  
Quantico, VA 22134  
Email: [David.b.law1@usmc.mil](mailto:David.b.law1@usmc.mil)

Technical Secondary Point of Contact:

Ms. Alicia Owsiak  
Joint Non-Lethal Weapons Directorate (JNLWD)  
Deputy, Technology Division Chief  
3097 Range Road  
Quantico, VA 22134  
Email: [Alicia.owsiak@usmc.mil](mailto:Alicia.owsiak@usmc.mil)

Questions of a business nature should be submitted to:

Business Primary Point of Contact:

Lynn Christian  
Office of Naval Research  
ONR Code BD 252  
875 North Randolph Street Suite 1252A  
Arlington, VA 22203-1995  
Email: Lynn.Christian@navy.mil

Business Secondary Point of Contact:

Susan M. Paolini  
Office of Naval Research  
ONR Code BD 252  
875 North Randolph Street Suite 1279  
Arlington, VA 22203-1995  
Email: Susan.Paolini@Navy.mil

Questions of a security nature should be submitted to:

Security Point of Contact

JNLWD Security Point of Contact:  
Mr. Brad Whitfield  
Joint Non-Lethal Weapons Directorate  
Security Manager  
3097 Range Road  
Quantico, VA 22134  
Email: bardley.whitfield@usmc.mil

Note: All UNCLASSIFIED communications shall be submitted via e-mail to the Technical Points of Contact (POCs) with a copy to the designated Business POCs. Any questions regarding this solicitation must be provided to the Technical Point of Contact (TPOC) and Business Points of Contact. All questions shall be submitted in writing by electronic mail.

CLASSIFIED questions shall be handled through the JNLWD Security POC. Specifically, any entity wanting to ask a CLASSIFIED question shall send an email to the JNLWD Security POC with a copy to both the TPOC and the Business POC stating that the entity would like to ask a CLASSIFIED question. DO NOT EMAIL ANY CLASSIFIED QUESTIONS. The Security POC will contact the entity and arrange for the CLASSIFIED question to be asked through a secure method of communication

Questions submitted within 2 weeks prior to a deadline may not be answered, and the due date for submission of the white paper and/or full proposal will not be extended.

Answers to questions will be issued as amendments to this BAA and will be posted to one or more of the following webpages:

- Federal Business Opportunities (FEDBIZOPPS) Webpage - <https://www.fbo.gov/>
- Grants.gov Webpage – <http://www.grants.gov/>
- ONR Broad Agency Announcement (BAA) Webpage – <http://www.onr.navy.mil/en/Contracts-Grants/Funding-Opportunities/Broad-Agency-Announcements.aspx>
- JNLWP Webpage - <http://jnlwp.defense.gov>

#### **H. Instrument Type(s) - Contracts and Grants**

Awards may take the form of contracts and grants as appropriate. The Office of Naval Research (ONR) reserves the right to award a different instrument type if deemed to be in the best interest of the Government.

Any contract awards resulting from this BAA will incorporate the most current FAR, DFARs, NMCARS and ONR clauses.

Examples of model contracts can be found on the ONR website at the following link: <http://www.onr.navy.mil/en/Contracts-Grants/submit-proposal/contracts-proposal/contract-model-awards.aspx>. ONR Contract specific representations and certifications can be assessed on the following page of the ONR website: <http://www.onr.navy.mil/en/Contracts-Grants/submit-proposal/contracts-proposal.aspx>.

Examples of model grants can be found on the ONR website at the following link: <http://www.onr.navy.mil/en/Contracts-Grants/submit-proposal/grants-proposal/model-grant.aspx>

#### **I. Catalog of Federal Domestic Assistance (CFDA) Numbers -**

12.300

#### **J. Catalog of Federal Domestic Assistance (CFDA) Titles -**

ONR - Department of Defense (DoD) Basic and Applied Scientific Research

#### **K. Other Information -**

Work funded under a BAA may include basic research, applied research and some advanced research. With regard to any restrictions on the conduct or outcome of work funded under this BAA, ONR will follow the guidance on and definition of “contracted fundamental research” as provided in the Under Secretary of Defense (Acquisition, Technology and Logistics) Memorandum of 24 May 2010.

As defined therein the definition of “contracted fundamental research,” in a DoD contractual context, includes [research performed under] grants and contracts that are (a) funded by Research, Development, Test and Evaluation Budget Activity 1 (Basic Research), whether performed by universities or industry or (b) funded by Budget Activity 2 (Applied Research) and performed on campus at a university. The research shall not be considered fundamental in those rare and exceptional circumstances where the applied research effort presents a high likelihood of disclosing performance characteristics of military systems or manufacturing

technologies that are unique and critical to defense, and where agreement on restrictions have been recorded in the contract or grant.

Pursuant to DoD policy, research performed under grants and contracts that are a) funded by Budget Activity 2 (Applied Research) and NOT performed on-campus at a university or b) funded by Budget Activity 3 (Advanced Research) does not meet the definition of “contracted fundamental research.” In conformance with the USD (AT&L) guidance and National Security Decision Direction 189, ONR will place no restriction on the conduct or reporting of unclassified “contracted fundamental research,” except as otherwise required by statute, regulation or Executive Order. For certain research projects, it may be possible that although the research being performed by the prime contractor is restricted research, a subcontractor may be conducting “contracted fundamental research.” In those cases, it is the **prime contractor’s responsibility** in the proposal to identify and describe the subcontracted unclassified research and include a statement confirming that the work has been scoped, negotiated, and determined to be fundamental research according to the prime contractor and research performer.

Normally, fundamental research is awarded under grants with universities and under contracts with industry. Non-fundamental research is normally awarded under contracts and may require restrictions during the conduct of the research and DoD pre-publication review of such research results due to subject matter sensitivity. Potential Offerors should consult with the appropriate ONR Technical POCs to determine whether the proposed effort would constitute basic research, applied research or advanced research.

FAR Part 35 restricts the use of Broad Agency Announcements (BAAs), such as this, to the acquisition of basic and applied research and that portion of advanced technology development not related to the development of a specific system or hardware procurement. Contracts and grants and other assistance agreements made under BAAs are for scientific study and experimentation directed towards advancing the state of the art and increasing knowledge or understanding.

**THIS ANNOUNCEMENT IS NOT FOR THE ACQUISITION OF TECHNICAL, ENGINEERING AND OTHER TYPES OF SUPPORT SERVICES.**

As regards to the present BAA, the Research and Development efforts to be funded will consist of applied research, advanced technology development, and early-on advanced component development and prototypes necessary to evaluate capability-gap mitigation. The funds available to support awards are Budget Activities 2-3.

**II. AWARD INFORMATION**

**A. Amount and Period of Performance -**

The period of performance of the awards will range from six (6) months to thirty six (36) months. In conjunction with ONR, the JNLWP plans to fund individual awards of \$500,000.00 to \$1,500,000.00 per year using some combination of Budget Activity BA--2, and Budget Activity BA-3. However, lower and higher cost efforts will be considered. The period of performance for projects may be from six (6) months to three (3) years with an estimated start date of 1 January 2015, 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.

## **B. Peer Reviews**

In the case of proposals funded as basic research, ONR may utilize peer reviewers from academia, industry, and Government agencies to assist in the periodic appraisal of performance under these awards, as outlined in ONR Instruction 3966.1. Such periodic program reviews monitor the cost, schedule and technical performance of funded basic research efforts. The reviews are used in part to determine which basic research projects will receive continued ONR funding. Peer reviewers who are not U.S. Government employees must sign nondisclosure agreements before receiving full or partial copies of proposals and reports submitted by the basic research performers. Offerors may include travel costs for the Principal Investigator (PI) to attend the peer review.

## **C. Production and Testing of Prototypes -**

In the case of funded proposals which result in contracts for the production and testing of prototypes, ONR may, during the contract period add a contract line item or contract option for the provision of advanced component development or for the delivery of additional prototype units. However, such a contract addition shall be subject to the limitations contained in Section 819 of the National Defense Authorization Act for Fiscal Year 2010.

## **III. ELIGIBILITY INFORMATION**

All responsible sources from academia and industry may submit proposals under this BAA. Inclusive of Small Business Concerns, Historically Underutilized Business Zone (HUBZone) Concerns, Service-Disabled Veteran-Owned Small Business (SDVOSB) Concerns, Small Disadvantaged Business (SDB) Concerns, Women-Owned Small Business (WOSB) Concerns, Veteran-Owned Small Business (VOSB) Concerns, and Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs) are all highly encouraged to submit proposals as prime contractors and as well as join others (e.g., subcontractors) in submitting proposals. However, no portion of this BAA will be set-aside for Small Businesses, HUBZones, SDVOSBs, SDBs, WOSBs, VOSBs or HBCU and MI participation, due to the desire to seek research ideas from all entities.

Federally Funded Research & Development Centers (FFRDCs), including Department of Energy National Laboratories, are not eligible to receive awards under this BAA. However, teaming arrangements between FFRDCs and eligible principal bidders are allowed so long as they are permitted under the sponsoring agreement between the Government and the specific FFRDC.

Navy laboratories and warfare centers as well as other Department of Defense and civilian agency laboratories are also not eligible to receive awards under this BAA and should not directly submit either white papers or full proposals in response to this BAA. If any such organization is interested in one or more of the programs described herein, the organization should contact an appropriate ONR POC to discuss its area of interest. The various scientific divisions of ONR are identified at <http://www.onr.navy.mil/>. As with FFRDCs, these types of federal organizations may team with other responsible sources from academia and industry that are submitting 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.

Teams are also encouraged and may submit proposals in any and all areas. However, Offerors must be willing to cooperate and exchange software, data and other information in an integrated program with other contractors, as well as with system integrators, selected by ONR.

Some topics cover export controlled technologies. Research in these areas is limited to "U.S. persons" as defined in the International Traffic in Arms Regulation (ITAR) – 22 CFR § 1201.1 et seq.

#### **A. Cost Sharing**

There is no requirement for cost sharing.

### **IV. APPLICATION AND SUBMISSION INFORMATION**

#### **A. Application and Submission Process - White Papers and Full Proposals**

White Papers: The due date for white papers is no later than 3:00 PM Eastern Local Time on Tuesday 15 July 2014. White papers are to be submitted as a PDF file via electronic mail (email) only to [Alicia.owsiak@usmc.mil](mailto:Alicia.owsiak@usmc.mil). If an Offeror does not submit a white paper before the specified due date and time, it is not eligible to participate in the remaining Full Proposal submission process and is not eligible for funding. (In order to provide traceability and evidence of submission, Offerors may wish to use the "Delivery Receipt" option available from Microsoft Outlook and other email programs that will automatically generate a response when the subject email is delivered to the recipient's email system. Consult the User's Manual for your email software for further details on this feature.) Each white paper should state that it is submitted in response to ONRBAA14-008 and cite the particular sub-section of the Research Opportunity Description that the white paper is primarily addressing.

White Paper Evaluation/Notification: Evaluation of the white papers will be issued via email notification on or about 15 August 2014. Any Offeror whose white paper technology was not identified as being of "particular value" to ONR and the JNLWP is ineligible to submit a full proposal under this BAA.

A full proposal will be subsequently encouraged from those Offerors whose proposed technologies have been identified through the aforementioned email as still being of "particular value" to ONR/JNLWP. Any Offeror whose white paper was not identified as being of "particular value" to the ONR/JNLWP is ineligible to submit a full proposal under this BAA.

Full Proposals: The due date for receipt of Full Proposals is 3:00 PM (EDT) on Friday 26 September 2014. It is anticipated that final selections will be made within approximately four (4) weeks after full proposal submission. As soon as the final full proposal evaluation process is completed, PI's will be notified via email of their project's selection or non-selection for FY15 funding. Full proposals received after the published due date and time will not be considered for funding in FY15.

#### **B. Content and Format of White Papers/Full Proposals -**

White Papers and Full Proposals submitted under the BAA are expected to be unclassified; however, confidential/classified responses are permitted. If a classified proposal is submitted,

the resultant contract or other vehicle will be unclassified.

Unclassified Proposal Instructions:

Unclassified proposals shall be submitted in accordance with Section IV. Entitled, "Application and Submission Information".

Classified Proposal Instructions:

Classified White Papers and Full Proposals shall be submitted directly to the attention of JNLWD's Security Point of Contact at the following address:

OUTSIDE ENVELOPE (no classification marking):

Mr. Brad Whitfield  
Joint Non-Lethal Weapons Directorate  
3097 Range Road  
Quantico, VA 22134  
Email: bardley.whitfield@usmc.mil

The inner wrapper of the classified White Paper and/or Full Proposal should be addressed to the attention of Mr. David B. Law (David.b.law1@usmc.mil), JNLWD Technology Division Chief and marked in the following manner:

INNER ENVELOPE (stamped with the overall classification of the material)

"Program: 2015 BAA Joint Non-Lethal Weapons Directorate  
Office of Naval Research  
ATTN: Mr. David Law  
ONR Code: ONR Program Officer Code  
875 North Randolph Street  
Arlington, VA 22203-1995"

All proposal submissions will be protected from unauthorized disclosure in accordance with FAR Subpart 15.207, applicable law, and DoD/DoN regulations. Offerors are expected to appropriately mark each page of their submission that contains proprietary information.

STATEMENT OF WORK (SOW)

An 'unclassified' Statement of Work (SOW) must accompany any classified proposal.

For both classified and unclassified proposals, a non-proprietary version of the SOW must also be submitted.

IMPORTANT NOTE: Titles given to the White Papers/Full Proposals should be descriptive of the work they cover and not be merely a copy of the title of this solicitation.

## a. 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
- Page limit: Maximum Number of Pages permitted: ten (1) pages (excluding cover page, resumes, bibliographies, and table of contents)

### White Paper Submission

Electronic (email) submissions should be sent to the attention of [alicia.owskiak@usmc.mil](mailto:alicia.owskiak@usmc.mil). The subject line of the email shall read "ONR BAA 14-008 White Paper - Submission". The white paper must be a Microsoft Word 2007 compatible, or PDF format attachment to the email. There is an email size limit of 5MB per email.

**NOTE: Do not send 1) hardcopies of White Papers (including Facsimiles) as only electronic submissions will be accepted and reviewed; 2) .ZIP files; and 3) password protected files.**

In order to provide traceability and evidence of submission, Offerors may wish to use the "Delivery Receipt" option available from Microsoft Outlook and other email programs that will automatically generate a response when the subject email is delivered to the recipient's email system. Consult the User's Manual for your email software for further details on this feature.

### White Paper Content

- **Cover Page:** The Cover Page shall be labeled "WHITE PAPER", and shall include the BAA Number 14-008, technical point of contact, telephone number, facsimile number, and e-mail addresses and signed by an authorized officer.
- **Technical Concept:** A description of the technology innovation and technical risk areas.
  1. Project Manager and/or Principal Investigator;
  2. Standard programmatic QUAD Chart (1 page)
  3. Relevance to BAA Research Opportunity Description and specific sub-section(s) being addressed; Specifically outline how the corresponding technology challenges will be mitigated
  4. Technical objective;
  5. Technical approach;
  6. Deliverables;
  7. Recent technical breakthroughs that will reduce risk; and
  8. Funding plan or POA&M showing requested funding per fiscal year, as well as the total funding request.

For Basic Research

- Future Naval Relevance (where applicable) – A description of potential Naval Relevance and contributions of the effort to the agency's specific mission.

For Applied Research and Advanced Technology Development

- **Operational Concept – (where applicable) Military Needs Addressed:** A description of the project objectives, the concept of operation for the new capabilities to be delivered, and the expected operational performance improvements.
- **Operational Utility Assessment Plan (where applicable):** A plan for demonstrating and evaluating the operational effectiveness of the Offeror's proposed products or processes in field experiments and/or tests in a simulated environment.
- **Programmatic Section:** A programmatic section that includes milestones and a timetable.
- **Resumes:** A single page (each) summary resume (including previous relevant experience and pertinent publications) for Project Manager and/or Principal Investigator.
- Rough Order of Magnitude (ROM) (where applicable).

**b. FULL PROPOSALS**

**i. INSTRUCTIONS FOR CONTRACTS, (Does not include Grants)**

*NOTE: Submission instructions for BAAs issued after FY 2010 have changed significantly from previous requirements. Potential Offerors are advised to carefully read and follow the instructions below. The new format and requirements have been developed to streamline and ease both the submission and the review of proposals.*

*Proposal Package: The following four documents with attachments comprise a complete proposal package:*

- (1) Technical Proposal Template (pdf)
- (2) Technical Content (word)
- (3) Cost Proposal Spreadsheet (excel)
- (4) Adequacy Checklist for Pre Award Audit (SF 1408 (as applicablez))

*These documents can be found at: <http://www.onr.navy.mil/Contracts-Grants/submit-proposal/contracts-proposal> All have instructions imbedded into them that will assist in completing the documents. Also, both the Technical Proposal Template and the Cost Proposal Spreadsheet require completion of cost-related information. Please note that attachments can be incorporated into the Technical Proposal Template for submission.*

Offerors responding to this BAA must submit a separate list of all technical data or computer

software that will be furnished to the Government with other than unlimited rights. The Government will assume unlimited rights if offerors fail to identify any intellectual property restrictions in their proposals. Include in this section all proprietary claims to results, prototypes, and/or deliverables. If no restrictions are intended, then the offeror should state "NONE."

For proposals below the simplified acquisition threshold (less than or equal to \$150K), the Technical Proposal Template and Technical Content documents, and the Cost Proposal Spreadsheet are required. In addition, if a purchase order will be awarded, the effort will be firm fixed price. Purchase orders can also contain options, if authorized under the BAA, as long as the total amount of the base and all options does not exceed \$150k.

(Required as Applicable) Intellectual Property: Offerors responding to this BAA must submit a separate list of all technical data or computer software that will be furnished to the Government with other than unlimited rights. The Government will assume unlimited rights if offerors fail to identify any intellectual property restrictions in their proposals. Include in this section all proprietary claims to results, prototypes, and/or deliverables. If no restrictions are intended, then the offeror should state "NONE."

The format requirements for any attachments are as follows:

- Paper Size- 8.5 x 11 inch paper
- Margins – 1 inch
- Spacing- single or double spaced
- Font- Times New Roman, 12 point

For proposed subcontracts or inter-organizational transfers over \$150,000, Offerors must provide a separate fully completed Cost Proposal Spreadsheet in support of the proposed costs. This spreadsheet, along with supporting documentation, must be provided either in a sealed envelope with the prime's proposal or via e-mail directly to both the Program Officer and the Business Point of Contact at the same time the prime proposal is submitted. The e-mail should identify the proposal title, the prime Offeror and that the attached proposal is a subcontract, and should include a description of the effort to be performed by the subcontractor.

Offerors should submit an appropriate number of hard copies as discussed with the cognizant Program Officer, of their proposal package. The electronic copy should be submitted in a secure, pdf-compatible format, except for the electronic file for the Cost Proposal Spreadsheet which should be submitted in a Microsoft Excel 2007 compatible format. All attachments should be submitted in a secure, pdf-compatible format.

The secure pdf-compatible format is intended to prevent unauthorized editing of the proposal prior to any award. A password should not be required for opening the proposal document, but the Government must have the ability to print and copy text, images, and other content. Offerors may also submit their Technical Proposal Template and Content in an electronic file that allows for revision (preferably in Microsoft Word) to facilitate the communication of potential revisions. Should an Offeror amend its proposal, the amended proposal should be submitted following the same hard and electronic copy guidance applicable to the original proposal.

Any proposed options that are identified in the Technical Proposal Template or Technical Content documents, but are not fully priced out in the Cost Proposal Spreadsheet, will not be included in any resulting contract, cooperative agreement, or other transaction. If proposing

options, they **must** be separately priced and separate spreadsheets should be provided for the base period and each option. In addition to providing summary by period of performance (base and any options), the Contractor is also responsible for providing a breakdown of cost for each task identified in the Statement of Work. The sum of all costs by task worksheets **MUST** equal the total cost summary.

The electronic submission of the Excel spreadsheet should be in a “useable condition” to aid the Government with its evaluation. The term “useable condition” indicates that the spreadsheet should visibly include and separately identify within each appropriate cell any and all inputs, formulas, calculations, etc. The Offeror should not provide “value only spreadsheets” similar to a hard copy.

Fixed Fees on ONR Contracts: The Government Objective is set in accordance with the DFARS 215.404-71. See the below table for range and normal values:

Contract Risk Factor	Contract Type	Assigned Value (Normal range)	Normal Value
Technical (1)		3% - 7% (2)	5%
Management/Cost Control (1)		3% - 7% (2)	5%
Contract Type Risk	Firm Fixed Price	2% - 6% (3)	3% - 5% (4)
Contract Type Risk	Cost Plus Fixed Fee	0% - 1% (2)	0.5%

- (1) Assign a weight (percentage) to each element according to its input to the total performance risk. The total of the two weights equal 100 percent.
- (2) Assign a weighting score relative to the Risk Factor.
- (3) Depends on the specific Contract Type (With/without financing, performance-based payments, and/or progress payments).
- (4) Depends on the specific Contract Type.

Technology Incentive (TI) is rarely utilized at ONR, because the contracts issued by ONR typically are not eligible for TI (See DFARS 215.404-71-2(c)(2)). Any consideration of TI requires strong and convincing justification in the proposal, which are then subject to negotiation and determination of a fair and reasonable fee, within the context of the specific award. Typically the range of fee is 5% to 7.5% on an ONR awarded contract.

For submission instructions, see sub-section F. Submission of White Papers and Full Proposals for Contracts

**ii. INSTRUCTIONS FOR GRANTS (Does not include contracts)**

The following information must be completed as follows in the SF 424 located on [www.grants.gov](http://www.grants.gov) to ensure that the application is directed to the correct individual for review: Block 4a, Federal Identifier: Enter the previous ONR award number, or N00014 if the application is not a renewal or expansion of an existing award; Block 4b, Agency Routing Number: Enter the three (3) digit Program Office Code and the Program Officer’s name, last name first, in brackets (i.e., [Shifler, David]). Applicants who fail to provide a Program Officer code identifier may receive a notice that their proposal is rejected.

To attach the technical proposal in Grants.gov, download the application package  
Click on "Research and Related Other Project Information"  
Click on "Move form to Submission List"  
Click on "Open Form"

You will see a new PDF document titled "Research & Related Other Project Information"  
Block 7 is the Project Summary/Abstract -> click on "Add attachment" and attach the project summary/abstract. (You will not be able to type in the box, therefore, save the file you want to attach as Project Summary or Abstract).

Block 8 is the Project Narrative -> click on Add attachment and attach the technical proposal. (Save the file as Volume I- Technical Proposal since you will not be able to type in the box).

### **Full Proposal Format – Volume 1 - Technical Proposal and Volume 2 - Cost Proposal**

- Paper Size – 8.5 x 11 inch paper
- Margins – 1 inch
- Spacing – single-spaced
- Font – Times New Roman, 12 point
- Discuss the limit on the number of pages for Volume I with the cognizant Program Officer. There are no page limitations to the Cost Proposal, Volume 2.
- The full proposal should be submitted electronically at <http://www.grants.gov/> as delineated in paragraph E below entitled, "Submission of Grant Proposals through Grants.gov"

### **Volume 1: Technical Proposal**

- **Cover Page:** This should include the words "Technical Proposal" and the following:
  - 1) BAA Number ONRBAA14-008
  - 2) Title of Proposal;
  - 3) Identity of prime Offeror and complete list of subawards, if applicable;
  - 4) Technical contact (name, address, phone/fax, electronic mail address);
  - 5) Administrative/business contact (name, address, phone/fax, electronic mail address) and;
  - 6) Proposed period of performance (identify both the base period and any options, if included).
- **Table of Contents:** An alphabetical/numerical listing of the sections within the proposal, including corresponding page numbers.
- **Technical Approach and Justification:** The major portion of the proposal should consist of a clear description of the technical approach being proposed. This discussion should provide the technical foundation/justification for pursuing this particular approach/direction and why one would expect it to enable the objectives of the proposal to be met.

***Include for Basic Research, if it applies.***

- **Future Naval Relevance (where applicable):** A description of potential Naval relevance and contributions of the effort to the agency's specific mission.

***For Applied Research and Advanced Technology Development, if it applies.***

- **Operational Naval Concept (where applicable):** A description of the project objectives, the concept of operation for the new capabilities to be delivered, and the expected operational performance improvements.
- **Operational Utility Assessment Plan (where applicable):** A plan for demonstrating and evaluating the operational effectiveness of the Offeror's proposed products or processes in field experiments and/or tests in a simulated environment.
- **Project Schedule and Milestones:** A summary of the schedule of events and milestones:
- **Reports:**

The following are sample reports that are typically required under a research effort:

- Technical and Financial Progress Reports
- Final Report

Grants do not include the delivery of software, prototypes, and other hardware deliverables.

- **Management Approach:** Identify which personnel and subcontractors/subrecipients (if any) will be involved. Include a description of the facilities that are required for the proposed effort, along with a description of any Government Furnished Equipment/Hardware/Software/Information required, by version and/or configuration.
- **Current and Pending Project and Proposal Submissions:** Offerors are required to provide information on all current and pending support for ongoing projects and proposals, including subsequent funding in the case of continuing contracts, grants, and other assistance agreements. Offerors shall provide the following information of any related or complementary proposal submissions from whatever sources (e.g., ONR, Federal, State, local or foreign government agencies, public or private foundations, industrial or other commercial organizations).

The information must be provided for all proposals already submitted or submitted concurrently to other possible sponsors, including ONR. Concurrent submission of a proposal to other organizations will not prejudice its review by ONR:

- 1) Title of Proposal and Summary;
- 2) Source and amount of funding (annual direct costs; provide contract and/or grant numbers for current contracts/grants);
- 3) Percentage effort devoted to each project;
- 4) Identity of prime Offeror and complete list of subawards, if applicable;
- 5) Technical contact (name, address, phone/fax, electronic mail address)
- 6) Administrative/business contact (name, address, phone/fax, electronic mail address);
- 7) Period of performance (differentiate basic effort);
- 8) The proposed project and all other projects or activities requiring a portion of time of the Principal Investigator and other senior personnel must be included, even if they receive no

- salary support from the project(s);
- 9) The total award amount for the entire award period covered (including indirect costs) must be shown as well as the number of person-months or labor hours per year to be devoted to the project, regardless of source of support; and
  - 10) State how projects are related to the proposed effort and indicate degree of overlap.

• **Qualifications:** A discussion of the qualifications of the proposed Principal Investigator and any other key personnel. Include resumes or curricula vitae for the Principal Investigator, other key personnel and consultants. The resumes/curricula vitae shall be attached to the proposal.

## **Volume 2: Cost Proposal**

The offeror must use the Grants.gov forms (including the Standard Form (SF) Research and Related (R&R) Budget Form) from the application package template associated with the BAA on the Grants.gov web site located at <http://www.grants.gov/>. If options are proposed, the cost proposal must provide the pricing information for the option periods; failure to include the proposed costs for the option periods will result in the options not being included in the award. Assume that performance will start no earlier than three (3) months after the date the cost proposal is submitted. A separate Adobe .pdf document should be included in the application that provides appropriate justification and/or supporting documentation for each element of cost proposed.

### **Part 1:** The itemized budget must include the following

- **Direct Labor** – Individual labor categories or persons, with associated labor hours and unburdened direct labor rates. Provide escalation rates for out years.

**Administrative and clerical labor** – Salaries of administrative and clerical staff are normally indirect costs (and included in an indirect cost rate). Direct charging of these costs may be appropriate when a major project requires an extensive amount of administrative or clerical support significantly greater than normal and routine levels of support. Budgets proposing direct charging of administrative or clerical salaries must be supported with a budget justification which adequately describes the major project and the administrative and/or clerical work to be performed.

- **Fringe Benefits and Indirect Costs** (i.e., F&A, Overhead, G&A, etc) – The proposal should show the rates and calculation of the costs for each rate category. If the rates have been approved/negotiated by a Government agency, provide a copy of the memorandum/agreement. If the rates have not been approved/negotiated, provide sufficient detail to enable a determination of allowability, allocability and reasonableness of the allocation bases, and how the rates are calculated. Additional information may be requested, if needed. If composite rates are used, provide the calculations used in deriving the composite rates.
- **Travel** – The proposed travel cost should include the following for each trip: the purpose of the trip, origin and destination if known, approximate duration, the number of travelers, and the estimated cost per trip must be justified based on the organizations historical average cost per trip or other reasonable basis for

estimation. Such estimates and the resultant costs claimed must conform to the applicable Federal cost principals. Offerors may include travel costs for the Principal Investigator to attend the peer reviews described in Section II of this BAA.

- Subawards/subcontracts – Provide a description of the work to be performed by the subrecipient/subcontractor. For each subaward, a detailed cost proposal is required to be submitted by the subrecipient(s). A proposal and supporting documentation must be received and reviewed before the Government can complete its cost analysis of the proposal and enter negotiations. ONR's preferred method of receiving subcontract information is for this information to be included with the Prime's proposal. However, a subcontractor's cost proposal can be provided in a sealed envelope with the recipient's cost proposal or via e-mail directly to the Program Officer at the same time the prime proposal is submitted. The e-mail should identify the proposal title, the prime Offeror and that the attached proposal is a subcontract. Fee/profit guidance for subawards/subcontracts may be found below in the bullet entitled. "Fee/Profit".
- Consultants – Provide a breakdown of the consultant's hours, the hourly rate proposed, any other proposed consultant costs, a copy of the signed Consulting Agreement or other documentation supporting the proposed consultant rate/cost, and a copy of the consultant's proposed statement of work if it is not already separately identified in the prime contractor's proposal.
- Materials & Supplies – Provide an itemized list of all proposed materials and supplies including quantities, unit prices, and the basis for the estimate (e.g., quotes, prior purchases, catalog price lists).
- Recipient Acquired Equipment or Facilities – Equipment and/or facilities are normally furnished by the Recipient. If acquisition of equipment and/or facilities is proposed, a justification for the purchase of the items must be provided. Provide an itemized list of all equipment and/or facilities costs and the basis for the estimate (e.g., quotes, prior purchases, catalog price lists). Allowable items normally are limited to research equipment not already available for the project. General purpose equipment (i.e., equipment not used exclusively for research, scientific or other technical activities, such as personal computers, laptops, office equipment) should not be requested unless they will be used primarily or exclusively for the project. For computer/laptop purchases and other general purpose equipment, if proposed, include a statement indicating how each item of equipment will be integrated into the program or used as an integral part of the research effort.
- Other Direct Costs – Provide an itemized list of all other proposed other direct costs such as Graduate Assistant tuition, laboratory fees, report and publication costs, and the basis for the estimate (e.g., quotes, prior purchases, catalog price lists).
- Fee/Profit – Fee/profit is unallowable under assistance agreements at either the prime or subaward level but may be permitted on subcontracts issued by the prime awardee.

**Part 2:** Cost breakdown by Government fiscal year and task/sub-task corresponding to the same task breakdown in the proposed Statement of Work. When options are contemplated, options must be separately identified and priced by task/subtask.

For submission instructions, see paragraph E entitled, "Submission of Grant Proposals through Grants.gov"

**C. Significant Dates and Times -**

<b>Anticipated Schedule of Events *</b>		
<b>Event</b>	<b>Date (MM/DD/YEAR)</b>	<b>Time (Local Eastern Time)</b>
White Papers Due Date	15 July 2014	3:00 PM Eastern Local Time
Notification of Navy Evaluations of White Papers*	15 August 2014	
Full Proposals Due Date	26 September 2014	3:00PM Eastern Local Time
Notification of Selection for Award *	31 October 2014	
Contract Awards*	End of May 2015	

**\*These dates are estimates as of the date of this announcement.**

**NOTE:** Due to changes in security procedures since September 11, 2001, the time required for hard copy written materials to be received at the Office of Naval Research has increased. Materials submitted through the U.S. Postal Service, for example, may take seven days or more to be received, even when sent by Express Mail. Thus any hard-copy proposal should be submitted long enough before the deadline established in the solicitation so that it will not be received late and thus be ineligible for award consideration.

**D. Submission of Late Proposals (Applicable to White Papers and Full Proposals)**

Any proposal, modification, or revision, that is received at the designated Government office after the exact time specified for receipt of proposals is "late" and will not be considered unless it is received before award is made, the contracting officer determines that accepting the late proposal would not unduly delay the acquisition and

- (a) If it was transmitted through an electronic commerce method authorized by the announcement, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or
- (b) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of proposals and was under the Government's control prior to the time set for receipt of proposals; or
- (c) It was the only proposal received.

However, a late modification of an otherwise timely and successful proposal that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.

Acceptable evidence to establish the time or receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the Government office designated for receipt of proposals by the exact time specified in the announcement, and urgent Government requirements preclude amendment of the announcement closing date, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the announcement on the first work day on which normal Government processes resume.

The contracting officer must promptly notify any offeror if its proposal, modifications, or revision was received late and must inform the offeror whether its proposal will be considered.

#### **E. Submission of Grant Proposals through Grants.gov**

Detailed instructions entitled "Grants.gov Electronic Application and Submission Information" on how to submit a grant proposal through Grants.gov may be found at the ONR website listed under the 'Acquisition Department – Contracts & Grants Submitting a Proposal' link at: <http://www.onr.navy.mil/Contracts-Grants/submit-proposal/grants-proposal/grants-gov.aspx>.

White Papers should not be submitted through the Grants.gov application process, but rather should be e-mailed directly to [Alicia.owsiak@usmc.mil](mailto:Alicia.owsiak@usmc.mil). White Paper format requirements are found in Section IV entitled, "Application and Submission Information" paragraph entitled, "Application and Submission Process" paragraph entitled, "White Papers".

For electronic submission of grant full proposals, several one-time actions must be completed in order to submit an application through Grants.gov. These include obtaining a Dun and Bradstreet Data Universal Numbering System (DUNS) number, registering with the System for Award Management (SAM), registering with the credential provider, and registering with Grants.gov. See <http://www.grants.gov>,

Use the Grants.gov organization Registration Checklist at <http://www.grants.gov/documents/19/18243/OrganizationRegChecklist.pdf/fc7e7c18-2497-4b08-8d9b-bfac399947a3> which will provide guidance through the process. Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called "MPIN" are important steps in the SAM registration process. Applicants who are not registered with SAM.gov and Grants.gov should allow at least 21 days to complete these requirements. The process should be started as soon as possible. Any questions relating to the registration process, system requirement, how an application form works, or the submittal process **must** be directed to Grants.gov at 1-800-518-4726 (1-606-545-5035 for foreign applicants) or [support@grants.gov](mailto:support@grants.gov).

## **Special Notices Relative to Grant Applications to be Submitted Through Grants.gov**

All attachments to grant applications submitted through [Grants.gov](https://www.grants.gov) must be in Adobe Portable Document Format (i.e., .pdf files). Proposals with attachments submitted in word processing, spreadsheet, or any format other than Adobe Portable Document Format will not be considered for award.

For Program-specific Announcements: Applicants who have registered with Grants.gov are urged to submit their proposals electronically *at least* three days before the date and time that proposals are due so that they will not be received late and be ineligible for award consideration.

### Proposal Receipt Notices:

After a full proposal is submitted through Grants.gov, the Authorized Organization Representative (AOR) will receive a series of three e-mails. It is extremely important that the AOR watch for and save each of the e-mails. You will know that your proposal has reached ONR when the AOR receives e-mail Number 3. You will need the Submission Receipt Number (e-mail Number 1) to track a submission. The three e-mails are:

Number 1 – The applicant will receive a confirmation page upon completing the submission to Grants.gov. This confirmation page is a record of the time and date stamp that is used to determine whether the proposal was submitted.

Number 2 – The applicant will receive an e-mail indicating that the proposal has been validated by Grants.gov within two days of submission (this means that all of the required fields have been completed). After an institution submits an application, Grants.gov generates a submission receipt via email and also sets the application status to "Received." This receipt verifies the Application has been successfully delivered to the Grants.gov system. Next, Grants.gov verifies the submission is valid by ensuring it does not contain viruses, the opportunity is still open, and the applicant login and applicant DUNS number match. If the submission is valid, Grants.gov generates a submission validation receipt via email and sets the application status to "Validated." If the application is not validated, the application status is set to "Rejected." The system sends a rejection email notification to the institution, and the institution must resubmit the application package. Applicants can track the status of their application by logging in to Grants.gov.

Number 3 – The third notice is an acknowledgement of receipt in e-mail form from ONR within ten days from the proposal due date, if applicable. The e-mail is sent to the authorized representative for the institution. The e-mail for proposals notes that the proposal has been received and provides the assigned tracking number.

### **F. Address for the Submission of White Papers and Full Proposals for Contracts,**

Full Proposals for Contracts shall be sent to the following address:

Joint Non-Lethal Weapons Directorate  
Attn: Mr. David Law  
3097 Range Road  
Quantico, VA 22134

Electronic submissions of White Papers for Contracts and Grants shall be submitted via email directly to [Alicia.owskiak@usmc.mil](mailto:Alicia.owskiak@usmc.mil). There is an email size limit of 5MB per email.

## **V. EVALUATION INFORMATION**

### **A. Evaluation Criteria –**

Awards under this BAA will be made to proposers on the basis of the evaluation criteria listed below, and program balance to provide overall value to the Government. The Government reserves the right to request any additional, necessary documentation once it makes the award instrument determination. The Government reserves the right to remove proposers from award consideration should the parties fail to reach agreement on award terms, conditions, and cost/price within a reasonable time, or the proposer fails to timely provide requested additional information. Evaluations will be conducted using the following evaluation criteria. Criteria 1 through 4 are significantly more important than Criterion 5, and Criteria 1 through 4 are of equal value. The primary basis for selecting proposals for acceptance shall be technical, importance to agency programs, and fund availability. Cost realism and reasonableness shall also be considered to the extent appropriate.

The items in subparagraphs under each factor are not subfactors; rather, they provide insight into the areas that evaluators consider when assessing proposals under each factor."

- 1) Overall scientific and technical merits of the proposal
  - a. Degree of innovation, to the extent that the proposed technology mitigates high priority military needs and associated technology challenges;
  - 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 JNLWP critical need,
  - b. JNLWP program or initiative depends on the technology,
  - c. Potential transition effort identified, and
  - d. Part of a joint service technology effort.
  
- 3) Program structure and execution plan
  - a. Level of technical risk appropriate for level of research (e.g. applied and advanced),
  - 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 Project Manager (PM)/Principal (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 costs and availability of funds.

The ultimate recommendation for award of proposals is made by the JNLWP scientific/technical community. Recommended proposals will be forwarded to the ONR contracts department. Any notification received from JNLWP that indicates that the Offeror's full proposal has been recommended, does not ultimately guarantee an award will be made. This notice indicates that the proposal has been selected in accordance with the evaluation criteria above and has been sent to the contracting department to conduct cost analysis, determine the offeror's responsibility, and take other relevant steps necessary prior to commencing negotiations with the offeror.

## **B. Commitment to Small Business- (For Contract Awards Only)**

The Office of Naval Research/JNLWP is strongly committed to providing meaningful subcontracting opportunities for small businesses, small disadvantaged businesses (SDBs), woman-owned small businesses (WOSBs), historically underutilized business zone (HUBZone) small businesses, veteran-owned small business (VOSBs), service disabled veteran-owned small businesses (SDVOSBs), historically black colleges and universities, and minority institutions, and other concerns subject to socioeconomic considerations through its awards.

For businesses unfamiliar with doing business with the government and require assistance may contact the state-specific Department of Defense (DoD) Procurement Technical Assistance Center (PTAC). DoD PTACs serve as a resource for businesses pursuing and performing under contracts with DoD, other federal agencies, state and local governments and with government prime contractors. Assistance provided by the PTACs is usually free of charge. PTAC support includes registration in systems such as SAM, identification of contract opportunities, understanding requirements and preparing and submitting proposals. The PTACs have a presence in each state, Puerto and Guam. To locate a local PTAC visit: <http://www.dla.mil/SmallBusiness/Pages/ptac.aspx> or <http://www.aptac-us.org/new/> .

1.) Subcontracting Plan - For proposed awards to be made as contracts that exceed \$650,000, large businesses and non-profits (including educational institutions) shall provide a Subcontracting Plan (hereafter known as the 'Plan') that contains all elements required by FAR Subpart 19.704, FAR 52.219-9 and as supplemented by DFARS 252.219-7003.

NOTE: Small businesses are exempt from this requirement.

The Plan should be submitted as an attachment to the "Technical Proposal Template" and will not be included in the page count. If a company has a Master Subcontracting Plan, as described in FAR 19.701 or a Comprehensive Subcontracting Plan, as described in DFARS 219.702, a copy of the Plan shall also be submitted as an attachment to the "Technical

Proposal Template”.

Plans will be reviewed for adequacy, ensuring that the required information, goals, and assurances are included. FAR 19.702 require the apparently successful offeror to submit an acceptable Plan. If the apparently successful offeror fails to negotiate a Plan acceptable to the contracting officer within the time limit prescribed by the contracting officer, the offeror will be ineligible for award.

Offerors shall propose a plan that ensures small businesses (inclusive of SDBs, WOSBs, HUBZone, VOSBs and SDVOSBs, etc...) will have the maximum practicable opportunity to participate in contract performance consistent with its efficient performance.

As a baseline, offerors shall to the best extent possible propose realistic goals to ensure small business participation in accordance with the current or most recent fiscal year subcontracting goals found on the DoD Office of Small Business Program website at: <http://www.acq.osd.mil/osbp/>. If proposed goals are below the statutory requirements, then the offeror shall include in the Plan a viable written explanation as to why small businesses are unable to be utilized and what attempts were taken to ensure that small business were given the opportunity to participate in the effort to the maximum extent practicable.

## 2.) Small Business Participation Statement –

If subcontracting opportunities exist, all prime Offerors shall submit a Small Business Participation Statement regardless of size in accordance with DFARS 215.304 when receiving a contract for more than the simplified acquisition threshold (i.e., \$150,000). All offerors shall provide a statement of the extent of the offeror’s commitment in providing meaningful subcontracting opportunities for small businesses and other concerns subject to socioeconomic considerations through its awards and must agree that small businesses, VOSBs, SDVOSBs, HUBZones, SDBs, and WOSBs concerns will have to the maximum practicable opportunity to participate in contract performance consistent with its efficient performance.

This assertion will be reviewed to ensure that it supports this policy by providing meaningful subcontracting opportunities. The statement should be submitted as a part of the proposal package and will not be included in the page count.

## 3.) Subcontracting Resources -

Subcontracting to a prime contractor can be a good way to participate in the contracting process. The following is a list of potential resources that may assist in locating potential subcontracting partners/opportunities:

- \*Companies Participating in DoD Subcontracting Program Report
- \*DAU Small Business Community of Practice (SB COP)
- \*DefenseLink ≥ \$6.5M Award Notices
- \*DoD OSBP Prime Contractors and Subcontractors with Subcontracting Plans
- \*Dynamic Small Business Search
- \*Electronic Subcontracting Reporting System (eSRS)
- \*Federal Business Opportunities (FEDBIZOPPS)
- \*Navy SBIR/STTR Search – Website or Brochure

- \*DoD Procurement Technical Assistance Centers (PTAC)
- \*Small Business Administration (SBA) Subcontracting Opportunities Directory
- \*SBA Subnet

For a description and associated websites visit the ONR Office of Small Business webpage at: <http://www.onr.navy.mil/Contracts-Grants/small-business.aspx>.

For example, in accordance with FAR Subpart 5.206, entities may transmit a notice to a Government Point of Entry (GPE) to seek competition for subcontracts and to increase participation by qualified HUBZone small business, small, small disadvantaged business, women-owned small business, veteran-owned small business and service-disabled veteran-owned small business concerns is encouraged, and to meet established subcontracting plan goal as follows:

- (a) A contractor awarded a contract exceeding \$150,000 that is likely to result in the award of any subcontracts;
- (b) A subcontractor or supplier, at any tier, under a contract exceeding \$150,000, that has a subcontracting opportunity exceeding \$15,000.

The notices must describe—

- (a) The business opportunity;
- (b) Any prequalification requirements; and
- (c) Where to obtain technical data needed to respond to the requirement.

An example of a GPE is the SBA SUB-Net which is a place in which prime contractors may post solicitations or sources sought notices for small business. The SUB-Net database provides a listing of subcontracting solicitations and opportunities posted by large prime contractors and other non-federal agencies.

### **C. Options -**

The Government will evaluate options for award purposes by adding the total cost for all options to the total cost for the basic requirement. Evaluation of options will not obligate the Government to exercise the options during contract performance.

### **D. Evaluation Panel -**

Technical and cost proposals submitted under this BAA will be protected from unauthorized disclosure in accordance with FAR 3.104-4 and 15.207. The cognizant Program Officer and other Government scientific experts will perform the evaluation of technical proposals. Restrictive notices notwithstanding, one or more support contractors may be utilized as subject-matter-expert technical consultants. However, proposal selection and award decisions are solely the responsibility of Government personnel. Each support contractor's employee having access to technical and cost proposals submitted in response to this BAA will be required to sign a non-disclosure statement prior to receipt of any proposal submissions

## VI. AWARD ADMINISTRATION INFORMATION

### 1. Administrative Requirements –

- North American Industry Classification System (NAICS) code – The NAICS code for this announcement is 541712 with a small business size standard of “500 employees”
- System for Award Management (SAM): All Offerors submitting proposals or applications must:
  - a) be registered in the SAM prior to submission;
  - b) maintain an active SAM registration with current information at all times during which it has an active Federal award or an application under consideration by any agency;  
and
  - c) provide its DUNS number in each application or proposal it submits to the agency.

The System for Award Management (SAM) is a FREE WEBSITE that consolidates the capabilities you used to find in CCR/FedReg, ORCA, and EPLS. Future phases of SAM will add the capabilities of other systems used in Federal procurement and awards processes.

SAM may be accessed at <https://www.sam.gov/portal/public/SAM/>

- Access to your Grant, Cooperative Agreement, Other Transaction and Contract Award

Effective 01 October 2011, hard copies of award/modification documents are no longer mailed to Offerors. All Office of Naval Research (ONR) award/modification documents will be available via the Department of Defense (DoD) Electronic Document Access System (EDA).

EDA is a web-based system that provides secure online access, storage, and retrieval of awards and modifications to DoD employees and vendors.

If you do not currently have access to EDA, complete a self-registration request as a “Vendor” via <http://eda.ogden.disa.mil> following the steps below:

Click "New User Registration" (from the left Menu)  
Click "Begin VENDOR User Registration Process"  
Click "EDA Registration Form" under Username/Password (enter the appropriate data)  
Complete & Submit Registration form

Allow five (5) business days for your registration to be processed. EDA will notify you by email when your account is approved.

Registration questions may be directed to the EDA help desk toll free at 1-866-618-5988, Commercial at 801-605-7095, or via email at [cscassig@csd.disa.mil](mailto:cscassig@csd.disa.mil) (Subject: EDA Assistance).

## VII. OTHER INFORMATION

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#### **A. Applies to Grant applications only:**

- i. Federal Funding Accountability and Transparency Act of 2006:

The Federal Funding Accountability and Transparency Act of 2006 (Public Law 109-282), as amended by Section 6202 of Public Law 110-252, requires that all agencies establish requirements for recipients reporting information on subawards and executive total compensation as codified in 2 CFR 33.110. Any company, non-profit agency or university that applies for financial assistance (either grants, cooperative agreements or other transaction agreements) as either a prime or sub-recipient under this BAA must provide information in its proposal that describes the necessary processes and systems in place to comply with the reporting requirements identified in 2 CFR 33.220. An entity is **exempt** from this requirement **UNLESS** in the preceding fiscal year it received: a) 80 percent or more of its annual gross revenue in Federal contracts (and subcontracts), loans, grants (and subgrants), and cooperative agreements; b) \$25 million or more in annual gross revenue from Federal contracts (and subcontracts), loans, grants (and subgrants), and cooperative agreements; and c) the public does not have access to information about the compensation of the senior executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 or section 6104 of the Internal Revenue Code of 1986.

ii. Military Recruiting on Campus (DoDGARS Part 22.520):

This applies to domestic U. S. colleges and universities. Appropriate language from 32CFR22.520 Campus access for military recruiting and Reserve Officer Training Corps (ROTC) will be incorporated in all university grant awards.

iii. Certification regarding Restrictions on Lobbying:

Grant and Cooperative Agreement awards greater than \$100,000, as well as OTAs not under Section 845, require a certification of compliance with a national policy mandate concerning lobbying. Grant, applicants shall provide this certification by electronic submission of SF424 (R&R) as a part of the electronic proposal submitted via [Grants.gov](https://www.grants.gov) (complete Block 17). The following certification applies likewise to each cooperating agreement and normal OTA applicant seeking federal assistance funds exceeding \$100,000:

- 1) No Federal appropriated funds have been paid or will be paid by or on behalf of the applicant, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- 2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the applicant shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- 3) The applicant shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S.C. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

iv. Representation Regarding an Unpaid Delinquent Tax Liability or a Felony Conviction Under any Federal Law - DOD Appropriations:

All grant applicants are required to complete the "Representation on Tax Delinquency

and Felony Conviction" found at <http://www.onr.navy.mil/Contracts-Grants/submit-proposal/grants-proposal.aspx> by checking the "I agree" box in block 17 and attaching the representation to block 18. of the SF424 (R&R) as part of the electronic proposal submitted via Grants.gov. The representation reads as follows:

(1) The applicant represents that it is \_\_\_ is not\_\_\_ a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in timely manner pursuant to an agreement with the authority responsible for collecting the tax liability

(2) The applicant represents that it is\_\_\_ is not \_\_a corporation that was convicted of a felony criminal violation under any Federal law within the preceding 24 months.

NOTE: If an applicant responds in the affirmative to either of the above representations, the applicant is ineligible to receive an award unless the agency suspension and debarment official (SDO) has considered suspension or debarment and determined that further action is not required to protect the Government's interests. The applicant therefore should provide information about its tax liability or conviction to the agency's SDO as soon as it can do so, to facilitate completion of the required consideration before award decisions are made.

## **B. Applies to Contracts only:**

### **i. Government Property/Government Furnished Equipment (GFE) and Facilities:**

Government research facilities and operational military units are available and should be considered as potential government-furnished equipment/facilities. These facilities and resources are of high value and some are in constant demand by multiple programs. It is unlikely that all facilities would be used for any one specific program. The use of these facilities and resources will be negotiated as the program unfolds. Offerors should indicate in the Technical Proposal Template, Section II, Blocks 8 and 9, which of these facilities are critical for the project's success.

### **ii. Use of Arms, Ammunition and Explosives:**

#### **Safety**

The Offeror is required to be in compliance with DoD manual 4145.26-M, *DoD Contractor's Safety Manual for Ammunition and Explosives* if ammunitions and/or explosives are to be utilized under the proposed research effort. (See DFARS 223.370-5 and DFARS 252.223-7002)

If ammunitions and/or explosives (A&E) are to be utilized under the proposed research effort, the Government requires a preaward safety survey in accordance with DFARS PGI 223.370-4(C)(iv) entitled *Preaward survey*. The Offeror is solely responsible for contacting the cognizant DCMA office and obtaining a required preaward safety survey before proposal submission. The Offeror should include required preaward safety surveys with proposal submissions.

If the Offeror proposes that the Government provide Government-furnished A&E containing any nitrocellulose-based propellants and/or nitrate ester-based materials

(such as nitroglycerin,) or other similar A&E with a tendency to become chemically unstable over time, then NMCARS 5252.223-9000 will also apply to a resulting contract award. (See NMCARS 5223.370-5)

Security

If arms, ammunition and explosives (AA&E) are to be utilized under the proposed research effort, the Government requires a preaward security survey. The Offeror is solely responsible for contacting the cognizant DCMA office and obtaining a required preaward security survey before proposal submission. The Offeror should include a required preaward security survey with proposal submission. (See DoD manual 5100.76-M, *Physical Security of Sensitive Conventional Arms, Ammunition and Explosives*, paragraph C1.3.1.4)

If AA&E are to be utilized under the proposed research effort, the Government may require the Contractor to have perimeter fencing around the place of performance in accordance with DoD 5100.76-M, Appendix 2.

If AA&E are to be utilized under the research effort, the Offeror is required to provide a written copy of the Offeror’s AA&E accountability procedures in accordance with DoD 5100.76-M. If the Offeror is required to provide written AA&E accountability procedures, the Offeror should provide the respective procedures with its proposal submission. See DoD 5100.76-M Appendix 2.12.

iii. System for Award Management (SAM):

FAR 52.204-7 System for Award Management and FAR 52.204-13 System for Award Management Maintenance are incorporated into this BAA, and FAR 52.204-13 will be incorporated in all awards.

iv. Employment Eligibility Verification:

As per FAR 22.1802, recipients of FAR-based procurement contracts must enroll as Federal Contractors in E-verify and use E-verify to verify employment eligibility of all employees assigned to the award. All resultant contracts from this solicitation will include FAR 52.222-54, “Employment Eligibility Verification.”

v. FAR / DFARS Clauses:

The following are examples of clauses that may be incorporated into an ONR contract:

#	Clause
52.204-7	System for Award Management
52.215-16	Facilities Capital Cost of Money
52.215-22	Limitations on Pass Through Charges - Identification of Subcontract Effort
52.216-1	Type of Contract
52.216-27	Single or Multiple Awards
52.217-4	Evaluation of Options Exercised at time of Contract Award

52.217-5	Evaluation of Options
52.222-24	Preaward On-Site Equal Opportunity Compliance Evaluation (Applies if exceeds \$10M)
25.226-2	Historically Black College or University and Minority Institution Representation
52.230-7	Proposal Disclosure - Cost Accounting Practice Changes
52.232-15	Progress Payments not included
52.233-2	Service of Protest
52.252-1	Solicitation Provisions Incorporated by Reference
52.252-3	Alterations in Solicitation
52.252-5	Authorized Deviations in Provisions
252.203-7005	Representation Relating to Compensation of Former DoD Officials
252.204-7004	Alternate A, System for Award Management
252.215-7003	Requirements for Submission of Data Other than Certified Cost or Pricing Data - Canadian Commercial Corporation

vi. Combating Trafficking in Persons:

Appropriate language from FAR Clause 52.222-50 will be incorporated in all awards.

vii. Updates of Information regarding Responsibility Matters:

FAR clause 52.209-9, Updates of Publicly Available Information Regarding Responsibility Matter, will be included in all contracts valued at \$500,000 where the contractor has current active Federal contracts and grants with total value greater than \$10,000,000.

**C. Applies to Contracts, and Grants**

i. Security Classification:

In order to facilitate intra-program collaboration and technology transfer, the Government will attempt to enable technology developers to work at the unclassified level to the maximum extent possible. If access to classified material will be required at any point during performance, the Offeror must clearly identify such need in Section II, Block 11 of the Technical Proposal Template.

If it is determined that access to classified information will be required during the performance of an award, a Department of Defense (DD) Form 254 will be attached to the contract, and FAR 52.204-2 - Security Requirements will be incorporated into the contract.

**ONR does not provide access to classified material under grants.**

ii. Use of Animals and Human Subjects in Research:

If animals are to be utilized in the research effort proposed, the Offeror must complete a DoD Animal Use Protocol with supporting documentation (copies of AAALAC accreditation and/or NIH assurance, IACUC approval, research literature database searches, and the two most recent USDA inspection reports) prior to award. For assistance with submission of animal research related documentation, contact the ONR Animal Use Administrator at (703) 696-4046.

Similarly, for any proposal for research involving human subjects, the Offeror must submit or indicate an intention to submit prior to award: documentation of approval from an Institutional Review Board (IRB); IRB-approved research protocol; IRB-approved informed consent form; proof of completed human research training (e.g., training certificate or institutional verification of training); an application for a DoD-Navy Addendum to the Offeror's DHHS-issued Federal wide Assurance (FWA) or the Offeror's DoD-Navy Addendum. In the event that an exemption criterion under 32 CFR.219.101 (b) is claimed, provide documentation of the determination by the Institutional Review Board (IRB) Chair, IRB vice Chair, designated IRB administrator or official of the human research protection program including the category of exemption and short rationale statement. This documentation must be submitted to the ONR Human Research Protection Official (HRPO), by way of the ONR Program Officer. Information about assurance applications and forms can be obtained by contacting [ONR\\_343\\_contact@navy.mil](mailto:ONR_343_contact@navy.mil). If the research is determined by the IRB to be greater than minimal risk, the Offeror also must provide the name and contact information for the independent medical monitor. For assistance with submission of human subject research related documentation, contact the ONR Human Research Protection Official at (703) 696-4046.

For contracts and orders, the award and execution of the contract, order, or modification to an existing contract or order serves as notification from the Contracting Officer to the Contractor that the HRPO has approved the assurance as appropriate for the research under the Statement of Work and also that the HRPO has reviewed the protocol and accepted the IRB approval or exemption determination for compliance with the DoD Component policies. See, DFARS 252.235-7004.

iii. Recombinant DNA:

Proposal which call for experiments using recombinant DNA must include documentation of compliance with Department of Human and Health Services (DHHS) recombinant DNA regulations, approval of the Institutional Biosafety Committee (IBC), and copies of the DHHS Approval of the IBC letter.

iv. Department of Defense High Performance Computing Program:

The DoD High Performance Computing Program (HPCMP) furnishes the DoD S & T and RDT & E communities with use-access to very powerful high performance computing systems. Awardees of ONR contracts, grants, and other assistance instruments may be eligible to use HPCMP assets in support of their funded activities if ONR Program Officer approval is obtained and if security/screening requirements are favorably completed. Additional information and an application may be found at <http://www.hpcmo.hpc.mil/>.

v. Organizational Conflicts of Interest:

All Offerors and proposed subcontractors must affirm whether they are providing scientific, engineering, and technical assistance (SETA) or similar support to any ONR technical office(s) through an active contract or subcontract. All affirmations must state which office(s) the offeror supports and identify the prime contract numbers. Affirmations shall be furnished at the time of proposal submission. All facts relevant to the existence or potential existence of organizational conflicts of interest (FAR 9.5) must be disclosed. The disclosure shall include a description of the action the offeror has taken or proposes to take to avoid, neutralize, or mitigate such conflict. In accordance with FAR 9.503 and without prior approval, a contractor cannot simultaneously be a SETA and a research and development performer. Proposals that fail to fully disclose potential conflicts of interests will be rejected without technical evaluation and withdrawn from further consideration for award. Additional ONR OCI guidance can be found at <http://www.onr.navy.mil/About-ONR/compliance-protections/Organizational-Conflicts-Interest.aspx>. If a prospective offeror believes that any conflict of interest exists or may exist (whether organizational or otherwise), the offeror should promptly raise the issue with ONR by sending his/her contact information and a summary of the potential conflict by e-mail to the Business Point of Contact in Section I, item G above, before time and effort are expended in preparing a proposal and mitigation plan. If, in the sole opinion of the Contracting Officer after full consideration of the circumstances, any conflict situation cannot be effectively avoided, the proposal may be rejected without technical evaluation and withdrawn from further consideration for award under this BAA.

vi. Project Meetings and Reviews:

Individual program reviews between the ONR sponsor and the performer may be held as necessary. Program status reviews may also be held to provide a forum for reviews of the latest results from experiments and any other incremental progress towards the major demonstrations. These meetings will be held at various sites throughout the country. For costing purposes, offerors should assume that 40% of these meetings will be at or near ONR, Arlington VA and 60% at other contractor or government facilities. Interim meetings are likely, but these will be accomplished via video telephone conferences, telephone conferences, or via web-based collaboration tools.

vii. Reporting Executive Compensation and First-Tier Subcontract Awards:

The FAR clause 52.204-10, "Reporting Executive Compensation and First-Tier Subcontract Awards," will be used in all procurement contracts valued at \$25,000 or more. **A similar award term will be used in all grants and cooperative agreements.**

<b>DEPARTMENT OF DEFENSE CONTRACT SECURITY CLASSIFICATION SPECIFICATION</b> <i>(The requirements of the DoD Industrial Security Manual apply to all security aspects of this effort.)</i>				<b>1. CLEARANCE AND SAFEGUARDING</b> SER:059-14 a. FACILITY CLEARANCE REQUIRED <div style="text-align: center;">SECRET</div> b. LEVEL OF SAFEGUARDING REQUIRED <div style="text-align: center;">SECRET</div>	
<b>2. THIS SPECIFICATION IS FOR:</b> <i>(X and complete as applicable)</i>			<b>3. THIS SPECIFICATION IS:</b> <i>(X and complete as applicable)</i>		
	a. PRIME CONTRACT NUMBER	X	a. ORIGINAL <i>(Complete date in all cases)</i>		DATE (YYYYMMDD) 20140422
	b. SUBCONTRACT NUMBER		b. REVISED <i>(Supersedes all previous specs)</i>	REVISION NO.	DATE (YYYYMMDD)
X	c. SOLICITATION OR OTHER NUMBER ONRBAA14-008	DUE DATE (YYYYMMDD)	c. FINAL <i>(Complete Item 5 in all cases)</i>		DATE (YYYYMMDD)
<b>4. IS THIS A FOLLOW-ON CONTRACT?</b> <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO. If Yes, complete the following: Classified material received or generated under _____ <i>(Preceding Contract Number)</i> is transferred to this follow-on contract.					
<b>5. IS THIS A FINAL DD FORM 254?</b> <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO. If Yes, complete the following: In response to the contractor's request dated _____, retention of the classified material is authorized for the period of _____.					
<b>6. CONTRACTOR</b> <i>(Include Commercial and Government Entity (CAGE) Code)</i>					
a. NAME, ADDRESS, AND ZIP CODE For Solicitation Purposes Only		b. CAGE CODE	c. COGNIZANT SECURITY OFFICE <i>(Name, Address, and Zip Code)</i>		
<b>7. SUBCONTRACTOR</b>					
a. NAME, ADDRESS, AND ZIP CODE		b. CAGE CODE	c. COGNIZANT SECURITY OFFICE <i>(Name, Address, and Zip Code)</i>		
<b>8. ACTUAL PERFORMANCE</b>					
a. LOCATION		b. CAGE CODE	c. COGNIZANT SECURITY OFFICE <i>(Name, Address, and Zip Code)</i>		
<b>9. GENERAL IDENTIFICATION OF THIS PROCUREMENT</b> The objective of this BAA is to stimulate applied research, advanced technology development (ATD), and advanced component development and prototypes (ACD&P) to include rapid-prototyping, testing and evaluation of NLW technologies in an attempt to address known military needs.					
<b>10. CONTRACTOR WILL REQUIRE ACCESS TO:</b>		YES	NO	<b>11. IN PERFORMING THIS CONTRACT, THE CONTRACTOR WILL:</b>	
a. COMMUNICATIONS SECURITY (COMSEC) INFORMATION			X	a. HAVE ACCESS TO CLASSIFIED INFORMATION ONLY AT ANOTHER CONTRACTOR'S FACILITY OR A GOVERNMENT ACTIVITY	X
b. RESTRICTED DATA			X	b. RECEIVE CLASSIFIED DOCUMENTS ONLY	X
c. CRITICAL NUCLEAR WEAPON DESIGN INFORMATION			X	c. RECEIVE AND GENERATE CLASSIFIED MATERIAL	X
d. FORMERLY RESTRICTED DATA			X	d. FABRICATE, MODIFY, OR STORE CLASSIFIED HARDWARE	X
e. INTELLIGENCE INFORMATION			X	e. PERFORM SERVICES ONLY	X
(1) Sensitive Compartmented Information (SCI)			X	f. HAVE ACCESS TO U.S. CLASSIFIED INFORMATION OUTSIDE THE U.S., PUERTO RICO, U.S. POSSESSIONS AND TRUST TERRITORIES	X
(2) Non-SCI			X	g. BE AUTHORIZED TO USE THE SERVICES OF DEFENSE TECHNICAL INFORMATION CENTER (DTIC) OR OTHER SECONDARY DISTRIBUTION CENTER	X
f. SPECIAL ACCESS INFORMATION			X	h. REQUIRE A COMSEC ACCOUNT	X
g. NATO INFORMATION			X	i. HAVE TEMPEST REQUIREMENTS	X
h. FOREIGN GOVERNMENT INFORMATION			X	j. HAVE OPERATIONS SECURITY (OPSEC) REQUIREMENTS	X
i. LIMITED DISSEMINATION INFORMATION			X	k. BE AUTHORIZED TO USE THE DEFENSE COURIER SERVICE	X
j. FOR OFFICIAL USE ONLY INFORMATION	X			l. OTHER <i>(Specify)</i>	X
k. OTHER <i>(Specify)</i>			X		

**12. PUBLIC RELEASE.** Any information (*classified or unclassified*) pertaining to this contract shall not be released for public dissemination except as provided by the Industrial Security Manual or unless it has been approved for public release by appropriate U.S. Government authority. Proposed public releases shall be submitted for approval prior to release  Direct  Through (*Specify*)

The Joint Non-Lethal Weapons Directorate (JNLWD) Mr. David B. Law 3097 Range Road, Quantico, VA 22134

to the Directorate for Freedom of Information and Security Review, Office of the Assistant Secretary of Defense (Public Affairs)\* for review.  
\*In the case of non-DoD User Agencies, requests for disclosure shall be submitted to that agency.

**13. SECURITY GUIDANCE.** The security classification guidance needed for this classified effort is identified below. If any difficulty is encountered in applying this guidance or if any other contributing factor indicates a need for changes in this guidance, the contractor is authorized and encouraged to provide recommended changes; to challenge the guidance or the classification assigned to any information or material furnished or generated under this contract; and to submit any questions for interpretation of this guidance to the official identified below. Pending final decision, the information involved shall be handled and protected at the highest level of classification assigned or recommended. (*Fill in as appropriate for the classified effort. Attach, or forward under separate correspondence, any documents/guides/extracts referenced herein. Add additional pages as needed to provide complete guidance.*)

The contractor will be responsible to adhere to established OPSEC requirements at government, cleared contractor locations, and any home office. Contractor personnel may be required to attend annual OPSEC briefings to be conducted at actual work performance locations.

Access to classified information is not required for the purpose of submitting a bid/proposal for this statement(s) of work. However, the successful contractor shall be eligible to receive a Secret facility clearance (FCL) with Secret Safeguarding. Contractor personnel supporting positions that require access to classified information/material shall be U.S. citizens and eligible to receive a DoD Personnel Security Clearance (PCL) at the Secret level.

A DD254 will be issued with each individual Award and or Task Order with a requirement to access classified information.

Marking, Safeguarding and Distribution guidance will be provided as necessary after contract award(s) and under separate cover.

TPOC:

The Joint Non-Lethal Weapons Directorate (JNLWD)  
Mr. David B. Law, 3097 Range Road, Quantico, VA 22134  
david.b.law1@usmc.mil

**14. ADDITIONAL SECURITY REQUIREMENTS.** Requirements, in addition to ISM requirements, are established for this contract.  Yes  No  
(*If Yes, identify the pertinent contractual clauses in the contract document itself, or provide an appropriate statement which identifies the additional requirements. Provide a copy of the requirements to the cognizant security office. Use Item 13 if additional space is needed.*)

**15. INSPECTIONS.** Elements of this contract are outside the inspection responsibility of the cognizant security office.  Yes  No  
(*If Yes, explain and identify specific areas or elements carved out and the activity responsible for inspections. Use Item 13 if additional space is needed.*)

**16. CERTIFICATION AND SIGNATURE.** Security requirements stated herein are complete and adequate for safeguarding the classified information to be released or generated under this classified effort. All questions shall be referred to the official named below.

a. TYPED NAME OF CERTIFYING OFFICIAL	b. TITLE	c. TELEPHONE ( <i>Include Area Code</i> )
Diana Pacheco (diana.pacheco@navy.mil)	Contracting Officer for Security Matters	(703) 696-8177

d. ADDRESS (*Include Zip Code*)  
Office of naval Research  
One Liberty Center, 875 N. Randolph Street  
Arlington, VA 22203-1995

e. SIGNATURE  


**17. REQUIRED DISTRIBUTION**

- a. CONTRACTOR
- b. SUBCONTRACTOR
- c. COGNIZANT SECURITY OFFICE FOR PRIME AND SUBCONTRACTOR
- d. U.S. ACTIVITY RESPONSIBLE FOR OVERSEAS SECURITY ADMINISTRATION
- e. ADMINISTRATIVE CONTRACTING OFFICER
- f. OTHERS AS NECESSARY JNLWD, ONR 43, 25