Broad Agency Announcement (BAA)
ONR BAA Announcement Number
07-004

"High Energy Laser Multidisciplinary Research Initiative (HEL MRI)"

INTRODUCTION:

This publication constitutes a Broad Agency Announcement (BAA) as contemplated in the Department of Defense Grant and Agreement Regulation (DODGARS) 22.315. A formal Request for Proposals (RFP), solicitation, and/or additional information regarding this announcement will not be issued.

The Office of Naval Research (ONR) will not issue paper copies of this announcement. The ONR and Department of Defense (DoD) agencies involved in this program reserve the right to select for award all, some or none of the proposals submitted in response to 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

1. Agency Name

Office of Naval Research
One Liberty Center
875 North Randolph Street, Suite 1425
Arlington, VA 22203-1995

2. Research Opportunity Title

Multidisciplinary Research Initiative

3. Program Name

Fiscal Year 2007 Directed Energy High Energy Laser Multidisciplinary Research Initiative (HEL MRI) Program of the University Research Initiative

4. Research Opportunity Number

BAA 07-004

5. Response Date

Full Proposals are due by 3:00 PM (Eastern Standard Time (EST)) on 16 February 2007.

6. Research Opportunity Description

This BAA MRI will be executed by the Office of Naval Research (ONR) on behalf of the HEL-JTO (High Energy Laser – Joint Technology Office. Industrial partners are allowed, but the funding to be provided to industry partners shall not exceed forty-nine percent of the total cost of the proposed effort. No proposals will be accepted unless submitted directly by academia.

The DoD announces the Fiscal Year 2007 competition for the HEL MRI. The HEL MRI is sponsored by the HEL-JTO and the Office of the Deputy Under Secretary of Defense for Science and Technology (DUSD (S&T)) to enhance the capabilities of the US institutions of higher education (hereafter referred to as universities) to perform basic science and engineering research and related education in lasers, optics, and other areas critical to national defense applications of HELs.

The HEL MRI will support university-led multidisciplinary teams whose research efforts intersect more than one traditional science and engineering discipline within the general area of HELs. Multidisciplinary team effort can accelerate research progress in areas particularly suited to this approach by cross-fertilization of ideas and also can help to hasten the transition of basic research findings to practical application. DoD plans to complement this initiative with HEL-related single-investigator awards.

The JTO FY07 HEL MRI BAA solicits proposals from U. S. Universities (Service Academies and Postgraduate Schools are included) to conduct basic research in five thrust areas of High Energy Laser (HEL) technologies: Solid State Laser (SSL), Free Electron Laser (FEL), Gas Laser (GL), Advanced Laser (AL), and Beam Control (BC). These MRIs programs are up to five years duration (3 years basic contract, plus 2 options).

Through this competition, the DoD expects to make awards addressing the five previously identified research thurst areas of strategic importance to DoD, subject to the availability of appropriations. All awards will be based on merit competition.

The awards will be made on behalf of the DUSD (S&T) Basic Research Office and the HEL JTO, under the supervision of the Office of Naval Research.

The specific research thrust area descriptions follow on the subsequent pages:

Thrust Area #1 - Solid State Laser (SSL) - Scalable, efficient, high power eyesafer laser technology

The objective of this research is to explore all aspects of eyesafer laser technology that can be scalable to high energy output, >100kW, with good beam quality, <2 x DL, in a format that is highly efficient, > 20% wall plug. CW operation is assumed but pulsed operation is acceptable. Eyesafer wavelengths of interest are defined as those wavelengths that do not reach the eye retina and have a high transmission through the atmosphere. Optimal wavelengths to reduce eye damage are preferred, as are wavelengths that transmit through the atmosphere with minimal absorption, scatter and diffraction loss. For instance see; “Laser Eye Safety Research at APL,” R. L. McCally *et al* in John Hopkins APL Technical Digest, Vol. 26, #1, Jan-March 2005, page 46 for information on the eyes susceptibility to damage from lasers operating at different wavelengths and http://www.jach.hawaii.edu/UKIRT/astronomy/utils/ for atmospheric transmission.

All solid state approaches such as direct coupled diodes; or diode pumped fiber lasers, disk lasers and slab laser designs, will all be considered as well as more efficient diode pump sources for this spectral region. Single aperture as well as multiple apertures will be considered. However, multiple apertures need to consider a means of efficient beam combining. Passive beam combining/mode control is strongly preferred over active beam combining. Passive methods may include, but are not be limited to, spatial filters, grating couplers, phase conjugators, liquid crystals, wavelength couplers, and other transform systems. The combined beam format should be approximately circular; hexagons and squares are acceptable approximations to a circle; a 1x2 rectangle is not. Performance optimization via modeling is encouraged.

Thermal management is expected and must be considered in the scaled models. Gain media engineering and novel materials development will be considered. Overall laser costs are desired to be low enough, and component lifetimes and runtimes long enough, for a practical device, but are not primary considerations. However, projections of these parameters should show possible paths to a practical device.

Thrust Area #2 - Free Electron Laser (FEL)

The free electron laser (FEL) was first demonstrated in 1977 in the infrared wavelength by Madey et. al. producing a few hundred milliwatts of power in the 3.4 μm wavelength region. Recently, Jefferson National Laboratory has demonstrated the scaling of the FEL to a cw power level of about 15 kW at 1.6 μm. This remarkable progress in the power scaling by about five orders of magnitude in ~30 years (doubling in power every 2 years on an average) proves the viability of further increase in power by 1 to 2 orders of magnitude for use as a defensive weapon against missiles and other threats. Further scaling in the output power requires significant technology developments in several areas. Key developments are needed in the field of optical coatings with very low absorption, ability of the optical coatings to withstand harmonic loading in the UV, cooling of optical components, high peak and average current injector technology, superconducting energy recovery linac (ERL) structures that can stably accelerate electron beams and recover energy from electrons back into RF after FEL interaction. Fielding of these lasers in Navy ships in a maritime environment would necessitate technology developments in areas such as cryogenic engineering, high temperature superconducting accelerator technology, active and passive vibration isolation of the beam transport components, optical components, etc. In this multi-disciplinary university research initiative, proposals are sought that address the fundamental physics and engineering issues related to scaling the output power of the FEL up to and beyond the nominal megawatt range. JTO understands that many universities would not be able to conduct most of the experiments at the beam parameters required for these efforts, but collaborative research with national laboratories may be needed to complete the proposed efforts.

Proposals are sought in three categories:

1. Topic # 1 – High average current injector technology

The objective of this effort is to develop injector technology to deliver average currents of approximately 1 amp with high bunch charge (≥ 1 nC) and low emittance. Different groups have pursued several injector technologies over the last couple of decades. The most promising technologies involve a photocathode with the emitted electrons being accelerated either in a dc field, an RF field at room temperature or an RF field in a superconducting cavity. No one has so far demonstrated the fabrication of robust photocathodes that are capable of operating at high average current at reasonable quantum efficiency using realistic drive laser power and that have reasonably long life (measured in weeks rather than hours). Photocathodes also require drive lasers with the proper pulse format, power stability to better than 1% and spatial profile that is consistently reproducible. Other gun technologies such as thermionic cathodes, field-emission cathodes, cathodes with diamond amplification have all been proposed and need to be investigated. It is important to have a close coupling between

theory, simulation and experiment. Coupled with the development of the injector technology, modeling of electron beam injectors including cathode emission, space charge and RF effects is needed. Any codes developed should be anchored to definitive experiments.

2. Topic # 2 – Investigation of methods to improve the electron beam stability at high average current levels, investigation and mitigation of beam halo, and investigation of Coherent Synchrotron Radiation and mitigation of its effects in increasing the beam emittance

To improve the overall electrical efficiency of the FEL, it has been recognized for some time that the best approach is to recirculate the electron beam in the accelerator about 180 degrees out of phase with the accelerating bunches in order to recover energy not converted to photons. The stability of the electron beam in such an energy recovery linac is an important question that has not yet been investigated at average currents approaching one ampere that would be required for scaling the FEL to megawatt power levels. Both cumulative and regenerative beam break-up instabilities need to be investigated. Another serious issue is the part of the electron beam that strays off-course from the axis of the beam line forming a halo. The high average current linacs cannot tolerate even one part in a million of the beam being lost hitting the walls of the beam pipe. At best, induced radioactivity in regions of the accelerator might make servicing difficult and require additional shielding. At worst, the accelerator/FEL might be seriously damaged or even destroyed. Mechanisms of halo generation need to be identified, understood and controlled. Shipboard FELs may contain transport sections that have tight bends. At high bunch charge and peak currents, coherent synchrotron radiation (CSR) would be emitted. The CSR is thought to increase the beam emittance and possibly to contribute to the formation of beam halo. At present this subject is not well understood. Both theoretical and experimental work is needed. All the above-mentioned areas require well-anchored modeling codes as well as theoretical analyses that are supported by definitive experiments. Research in the area of RF drive power that would be required for the injector and the main accelerator and the coupling of the power to the RF cavities may also be addressed. Issues connected with the outcoupling of higher-modes generated in the cavities due to instabilities rightly belongs in this topic area.

3. Topic # 3 – Optical coatings, substrate cooling technology

The objective of this effort is to develop optical coatings that have very low absorption in the fundamental wavelength as well as in the harmonics that are concomitantly produced in any high power FEL, and the cooling technology to preserve the curvature of the mirrors within specified limits. The above-cited success at the JLAB of achieving an average FEL power of 10 kW was possible only after improved optical coatings were available, the radius of curvature of the mirrors was closely controlled, and heat removal from the substrate was enhanced. The absorption of the harmonics in the UV can lead to color center formations in the coatings. These are known to change the absorption characteristics at the fundamental wavelength. Since the FEL is expected to run for several minutes and possibly for several hours, the accumulated dosage of the optical flux due to the harmonics can become significant. For any operational weapon class FEL system, the optical components would have to withstand the high cavity fluxes at several wavelengths for hundreds of hours. Even if the architecture employed for the high power FEL is an amplifier configuration, the first mirror that is exposed to the laser flux will also be subjected to harmonic radiation. The amplifier configurations may lower the flux loading on the mirror but not completely solve the potential problem of coating damage due to fundamental and harmonic loading. Another concern is the ability for the coatings and mirror to work over at least a narrow range of wavelength. A tunable FEL has certain advantages over a laser that operates at a fixed wavelength. The tunability of an FEL is seriously limited by the cavity optics in the case of oscillators and by the tunability of the seed laser in the case of an amplifier. The coatings and substrate technology developed under this proposal call should be generally applicable in the 1.0 to 2.4 micron range.

Thurst Area #3 - Gas Laser (GL) - High-Power Gas-Phase Hybrid Laser Systems

Background: A gas-phase lasing medium offers a number of potential advantages for high-power laser systems. Primary considerations are the high-power, high-duty-cycle operation that can be achieved with good beam quality and without material damage due to the advantageous thermal management capability of the gas-phase medium. In addition, the narrow spectral band and desirable lasing wavelengths available from gas-phase systems make them attractive candidates for high power lasers. Recent advances in gas-phase hybrid laser systems in which several traditional pumping mechanisms (electrical, chemical, optical) are combined have created considerable interest in the high-power laser community for potential strategic and tactical applications. These hybrid approaches attempt to retain the strengths of each pumping method while eliminating their weaknesses. Examples of progress in this area include the demonstration of the electric oxygen-iodine laser and diode pumped alkali metal lasers. Advances in our understanding of the fundamental physical and chemical processes involved are required to develop and scale these hybrid devices into robust and reliable high-power systems.

Objective: To develop the fundamental understanding of the processes necessary for the realization of scalable, lightweight, high power, gas-phase hybrid laser systems. To foster interest into basic research on related fundamental physical processes and parameters such as excitation schemes, chemical reaction rate constants, product branching fractions, energy distributions, and quenching. To stimulate development of new concepts for high-power, hybrid, gas-phase laser systems.

Research Concentration Areas: Areas of interest include, but are not limited to: (1) developing the understanding and methods necessary to use electrical discharges to selectively and efficiently produce an excited atomic or molecular lasing species, particularly $O_2(a^1\Delta)$, in electrically-pumped hybrid systems; (2) developing the understanding and methods necessary to match linewidths of pump sources and absorbing medium for efficient use of excitation energy in optically-pumped hybrid systems; (3) developing the understanding and methods necessary to scale hybrid laser systems to the pressures and concentrations necessary to achieve high power operation and to demonstrate such operation.

Impact: The development of a new high-power, gas-phase hybrid laser systems could revolutionize current warfighter architectures, as well as enable new missions and/or significantly reduce the risks associated with current missions.

Thrust Area #4 - Advanced Laser (AL) - ADVANCED LASERS: Novel Laser Materials and Processing Techniques for High Average Power Applications

Background: There is currently a need for novel laser materials and processing techniques for high average power applications. For example, in solid state lasers, it has been recently shown that Nd-doped YAG polycrystalline laser hosts can be fabricated to a quality that is equivalent or better than single crystals. As another example, Yb-doped, polycrystalline Y_2O_3 has been demonstrated to have potential as a novel diode pumped laser host. Some of the significant advantages of polycrystalline laser host materials compared to single-crystal materials are higher intensities as a result of higher dopant concentrations, cheaper fabrication, larger devices and the possibility of new gain materials. Millimeter-wave processing has been shown to be an effective method of pressure-free sintering of low-loss oxide ceramic materials. New laser materials with unique thermal, wavelength and gain characteristics together with processing techniques suitable for high average power applications are required.

Objective: The JTO is seeking proposals for advanced laser materials and processing methods for high average power applications. Proposals should address high power lasing characteristics such as grain size control, trapped pore elimination, grain boundary effects, as well as transmittance, absorption and emission spectra, and thermal conductivity of the processed material. Advanced processing techniques using, for example, high-power

microwaves/millimeter-waves or hybrid methods are of interest. The JTO is also seeking proposals for characterization and operation of polycrystalline ceramics for CW, pulsed and ultra-short pulse applications.

Thurst Area # 5 - Beam Control (BC)

Topic #1: Tactical HEL weapon alignment system architecture efficiencies.

The objective of this topic is to design alternatives for tracking/pointing architectures of tactical HEL weapons to be compact, light weight and transmission-efficient, especially in the high energy path.

Emerging laser systems for tactical use, such as JHPSSL and HELLADS, are expected to be sufficiently compact and lightweight to allow transportability. The aim of this effort is to develop technologies to improve the fieldability of beam control systems to support tactical uses in ground, maritime, and airborne environments. To do so, the system's functions must remain (slew, acquire, fine track, wavefront-correct, and hold the target for the laser dwell), but the size, weight and complexity are to be minimized.

Requirements for the beam control system performance include 2 microradian or better rms jitter (one axis one sigma), target spot size 10 cm at 10 km, clear aperture 30 cm. Acquisition sensors and target illuminators should be included in the trades, as well as modification to the laser resonator… all should be considered contributors to beam control system efficiency. Possible approaches might include but would not be limited to:

1. Reducing the number of optical elements in the high energy path.
2. Packaging more functionality into the turret assembly.
3. Use control elements that combine functions (e.g. tilt and aberration/focus control).
4. Eliminate the traditional split between laser and tracker line of sight stabilization. Combining both into one controller (i.e. one fast steering mirror).
5. Pushing functionality from the high power path into the low power path where smaller/lighter optics can be used.
6. Using adaptive techniques to estimate jitter, atmospheric aberrations and sensor noise and driving reduced bandwidth optical feedback loops with these feed forward estimates.
7. Trading off control and optical bench structural stiffness and isolation.

The required innovation is to define an architecture that is amenable to weight, volume and complexity reductions needed to enable tactical beam control.

Topic #2: Aero-Optics Characterization and Mitigation.

Aero-optic disturbances in the near field of airborne laser weapon systems present a debilitating distortion to projected laser performance, especially at look-back angles. Multiple interservice research projects are ongoing that explore this effect, and its alleviation, through numerical computation and wind-tunnel experimentation. The gap in this research is a concerted effort to anchor these investigations with a carefully instrumented in-flight test of the aero optics effect.

The aim of this topic is to formulate and validate methods by which aero-optical disturbances can be predicted, measured, and overcome, so that this understanding can enhance engineering solutions in prospective laser weapons. JTO is particularly interested in proposals that provide an evolution of aero-optics studies from fundamental physics based codes, through controlled wind tunnel experimentation, and progressing to an affordable aero-optics flight demonstration. Proposals in this area should present a clear path of graduated research fidelity to demonstrate the progressive improvement in understanding of the phenomenon.

The initial phase of research may concentrate on a generic turret configuration. A successful proposal must include a clear capability to expand its scope to varying turret geometries, flow-

control studies and adaptive-optic studies/flight demonstrations. While the initial studies may study aero-optic issues at fully subsonic flight Mach numbers, a successful proposal must include a clear path to eventual flight-test regimes that produce transonic flow over the turret. The proposed hardware should be capable of being used in both laboratory and flight tests to assure consistency between these regimes.

Topic #3: Passive Imaging System for Measuring Atmospheric Scattering and CFLOS

Transmission losses due to atmospheric scattering and clouds can be a limiting factor in HEL engagements, limiting practical engagement distances and/or driving laser power requirements. The goal of this topic is to investigate the feasibility and demonstrate the use of passive imaging devices for making single-ended measurements of scattering losses and/or cloud-free-line-of-sight (CFLOS) over an extended path, for use in test and evaluation and in operational scenarios. The work shall include analysis, experimental measurements, proof-of-concept demonstrations, as well as the design and construction and delivery of prototype systems.

a. Single-Ended Scattering Imager. (i) Years 1 – 3. Provide studies leading to the design of a passive imaging sensor for measuring the extended path losses due to scattering by atmospheric components including dust and aerosols for near-horizontal and slant paths. This includes the evaluation of the radiometric characteristics of available targets of opportunity and their use in deriving and/or estimating attenuation losses from these measurements. Build prototype systems to test the concepts, including evaluation of calibration impacts and final estimated system uncertainties. (ii) Years 4 – 5: Finalize the design and build prototype robust imagers that can provide this information for shipboard and/or battlefield environments.

b. CFLOS Imager. (i) Years 1 – 3. Conduct studies leading to the design of a single-ended passive sensor for measuring lower hemisphere radiances in a horizontal path as well as all downward-looking directions simultaneously from a tactical aircraft, in order to determine cloud free line of sight. Build and test prototype systems and prototype cloud algorithms appropriate for determining cloud free line of sight statistics. (ii) Years 4 - 5: Modify the prototype design, build and demonstrate on shipboard or mount on an aircraft platform (to be determined), acquire appropriate cloud imagery, and derive CFLOS probabilities as a function of altitude and look angle for use in Air Force tactical system performance analyses.

7. Points of Contact:

Questions of a technical nature shall be directed to both Technical Points of Contact as specified below:

Technical Points of Contact

Dr. Lewis DeSandre, Program Officer
Office of Naval Research, Code 351
875 North Randolph Street, Suite 1132
Arlington, VA 22203-1995
Tel: (703) 696-0330
Fax: (703) 696-4274
Email: Lewis_DeSandre@onr.navy.mil

LCDR Rich T. Nguyen
HEL-JTO Navy Rep
901 University Blvd. SE, Suite 100
Albuquerque, NM 87106
Tel (505) 248-8215
Fax (505) 245-2195
Email: rich.nguyen@jto.hpc.mil

Questions of a business nature shall be directed to the cognizant Contract Specialist, as specified below:

Business Point of Contact

Ms. Iris Green, Contract Specialist
Office of Naval Research, Code 0253
875 North Randolph Street, Suite 1425
Arlington, VA 22203-1995
Tel: (703) 696-0554
Fax: (703) 696-4430
Email: iris_green@onr.navy.mil

**** Important Notices Regarding Questions ****

Any questions regarding this solicitation must be provided to the Science and Technology Point of Contact and/or Business Point of Contact listed in this solicitation. All questions (of a general, technical, programmatic, or business nature) shall be submitted in writing by electronic mail. Questions and responses will be posted under the ONR BAA web page (http://www.onr.navy.mil/02/baa). No e-mail responses will be provided. Questions must be submitted by 3:00 p.m. EST on February 9, 2007. Questions submitted after this date and time may not be answered and the due date for submission of proposals will not be extended.

Questions presented by telephone call, fax message, or other means will not be responded to. There will be no meetings between potential offerors and ONR personnel.

8. Instrument Type(s)

Awards resulting from this solicitation will be in the form of grants.

9. Catalog of Federal Domestic Assistance (CFDA) Numbers

CFDA No.: 12.300

10. Catalog of Federal Domestic Assistance (CFDA) Titles

CDFA Title: Basic and Applied Scientific Research - ONR

11. Other Information

None

II. AWARD INFORMATION

The Government anticipates making several grant awards as a result of this announcement. The awards will be made at funding levels commensurate with the proposed research and in response to agency missions.

Depending on the results of the proposed evaluation, there is no guarantee that any of the proposals submitted in response to a particular thrust area will be recommended for funding. On the other hand, more than one proposal may be recommended for funding for a particular thrust area.

The Department of Defense expects that typically each award will be:

For the base period of three years (funded incrementally) with two additional years possible as options to bring the total award to five years, subject to the availability of appropriations; and

At a funding level commensurate with the fields and breadth of research included in the details of each specific proposal. For the FY2007 HEL MRI competition, the total contract value for each thrust area (SSL,FEL,GL,AL,and BC) is listed below. Total number of projects per thrust area selected shall be at the discretion of the government:

1. SSL: $1.6M (up to 3 projects)
2. FEL: $1.5M (up to 3 projects)
3. GL: $1.1M (up to 2 projects)
4. AL: $0.5M (one project)
5. BC: $2.5M (up to 3 projects)

III. ELIGIBILITY INFORMATION

Proposals may be submitted only by U.S. institutions of higher education ("universities") with degree-granting programs in science and/or engineering. Ineligible organizations (e.g., industry, DoD laboratories, Federally Funded Research and Development Centers (FFRDCs), and foreign universities) may collaborate on the research. Eligible universities may submit proposals either individually or collectively, as consortia. Proposing universities may establish research collaborations with industry or Federally Funded Research and Development Centers (FFRDCs). This measure allows universities the ability to access relevant experience outside of academia. Costs for industry and/or FFRDC participation can be covered by sub-award of HEL MRI funds and/or by funds otherwise available to them. The main purpose of this initiative is to support university research; hence it is expected that award funds will remain vested substantially with the university, at least fifty-one percent (51%). DoD laboratories can team with the universities to conduct the research but cannot receive HEL MRI funds awarded via this broad agency announcement. Proposals involving multiple organizations must name one principal investigator at a university as the responsible technical point-of-contact. This university will be the primary awardee for purposes of award execution. The relationship among the research team members and their respective roles, as well as the apportionment (i.e., subaward by the primary awardee) of funds must be described in both the proposal text and budget.

Historically Black Colleges and Universities (as determined by the Secretary of Education to meet the requirements of 34 CFR Section 608.2) and Minority Institutions (as defined by 10 U.S.C. 2323 (a) (1) (c)) are encouraged to submit proposals either individually or as members of consortia. However, no funds are specifically allocated for HBCU/MI participation.

Government activities (Federal, State, and Local) and Federally Funded Research Centers (FFRDCs) are not eligible for direct award under this solicitation.

IV. APPLICATION AND SUBMISSION PROCESS

1. Full Proposals

The due date for receipt of Full Proposals is 3:00 p.m. (Local Eastern Time) on 2/16/2007. It is anticipated that final selections will be made by 4/20/2007. Proposals received after the published due dates may not be considered for funding in Fiscal Year 07, but may be considered for funding at a later time, if funding is available. As soon as the final proposal evaluation process is completed, the Offeror will be notified via email of its selection or non-selection for an award. Proposals exceeding the page limit may not be evaluated.

2. Content and Format of Proposals:

The Proposals submitted under this BAA are expected to be unclassified. However, confidential/classified proposals are permitted. All proposal submissions will be protected from unauthorized disclosure. Upon receipt, all grant proposals shall be safeguarded from unauthorized disclosure throughout the review and selection process. The reviewer will not knowingly disclose the grantee's proposal information or source selection information prior to the placement of the Federal grant to which the information relates. Proposers are expected to appropriately mark each page of their submission that contains proprietary information.

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

- Paper Size – 8.5 x 11 inch paper
- Margins – 1" inch
- Spacing – single or double-spaced
- Font – Times New Roman, 12 point
- Number of Pages – Volume 1 is limited to no more than 25 pages. Volume 2 has no page limitations. Limitations within sections of the Technical Proposal are indicated in the individual descriptions shown below. The cover page, table of contents, and resumes are excluded from the page limitations. Full Proposals exceeding the page limit may not be evaluated.

  The full proposal must be submitted electronically at http://www.grants.gov/ as delineated below.

The proposal must be signed, complete, self-contained and marked "Original" to qualify for review. **Full Proposal Content – Total page count should be twenty-five (25) excluding personnel**

Volume 1: Technical Proposal

- **Cover Page**: This should include the words "Technical Proposal" and the following:
  (1) Broad Agency Announcement (BAA) Number
  (2) Title of Proposal
  (3) Thrust Number and Title and Topic Number and Title, if applicable
  (4) Identity of prime Offeror and complete list of subcontractors, if applicable
  (5) Administrative/business contact (name, address, phone/fax, e-mail address) and
  (6) Duration of effort
  (7) Annual funding requirements

- **Abstract:** (1 page) Provide an abstract.

- **Table of Contents :** (1 page) List project narrative sections and corresponding page numbers.

- **Statement of Work**: (3 pages) A Statement of Work (SOW) clearly detailing the scope and objectives of the effort and the technical approach. It is anticipated that the proposed SOW will be referenced in the resultant award instrument.

- **Technical Approach :** (10 pages) Describe in detail the basic science and/or engineering research to be undertaken. State the objective and approach, including how data will be analyzed and interpreted. Discuss the relationship of the proposed research to the state-of-the-art knowledge in the field and to related efforts in the nature of expected results. Discuss potential applications to defense missions and requirements. Describe the plans for the research training of students. Include the number of full time equivalent graduate students and

undergraduates, if any, to be supported each year. Discuss the involvement of students, if any.

- **Project Schedule and Milestones**: (2 pages) A master schedule of events and milestones shall be provided for the base year (s) and each option year for the contract period of performance.

- **Assertions of Data Rights**: (1 page) Include here a summary of any proprietary rights to pre-existing results, prototypes, or systems supporting and/or necessary for the use of the research, results, and/or prototype. Any data rights asserted in other parts of the proposal that would impact the rights in this section must be cross-referenced. If there are proprietary rights, the Recipient must explain how these affect its ability to deliver research results and final data. Additionally, Recipient must explain how the program goals are achievable in light of these proprietary limitations. If there are no claims of proprietary rights in pre-existing data, this section shall consist of a statement to that effect.

- **Management Approach**: (4 pages)

  A discussion of the overall approach to the management of this effort, including: brief discussions of the total organization; use of personnel; project/function/subcontractor relationships; government research interfaces; and planning, scheduling and control practice. Identify which personnel and subcontractors (if any) will be involved. Include a description of any Government Furnished Equipment/Hardware/Software/Information required by version and/or configuration. Please include the following:

  (a) Describe in detail proposed subawards to other eligible universities or relevant collaborations (planned or in place) with government organizations, industry, or other appropriate institutions. Particularly describe how collaborations are expected to facilitate the transition of research results to applications. Descriptions of industrial collaborations should explain how the proposed research will impact the company's research and/or product development activities. If subawards to other universities are proposed, make clear the division of research activities, to be supported by detailed budgets for the proposed subawards.

  (b) Designate one individual as the Principal Investigator for the award, for the purpose of technical responsibility and to serve as the primary point-of-contact with the agency's Program Topic Chief. Describe in detail the qualifications and availability of the Principal Investigator to conduct the proposed research and other key researchers involved in the project. Include curriculum vitae. For a consortium, one individual shall be designated Principal Investigator for purposes of technical responsibility and contact. Briefly summarize the qualifications of the Principal Investigator in these other projects, the time charged to each of these projects, and their relationship to the proposed effort.

  (c) Describe plans to manage the interactions among members of the proposed research team.

- **Deliverables**: (1 page) A detailed description of the offeror's proposed results shall be delivered. The deliverables should include a final technical report. Interim reports and briefings will be required on a monthly, quarterly, and annual basis.

- **Facilities**: (2 pages)

  Describe the facilities available for the accomplishment of research and related education objectives. Describe the equipment planned for acquisition under this program and its application to objectives (When possible, equipment should be

purchased very early in the research award period). If possible, budget for capital equipment should be allocated to the first budget period of the grant. Include a description of any government furnished equipment/hardware/software/information, by version and/or configuration that are required for the proposed effort.

Volume 2: Cost Proposal

The Cost Proposal shall consist of a detailed breakdown of all costs for each year of the support requested for both the Recipient and all proposed Subrecipients. Options must be separately priced.

Subrecipients must also provide a detailed breakdown of their proposed costs, which may be submitted either in a sealed envelop in conjunction with the Recipients proposal, or may be submitted directly to the cognizant Government Grant Specialist, or may be requested at a later date.

- **Cover Page:** The words "Cost Proposal" should appear on the cover page in addition to the following information:
  (1) Broad Agency Announcement (BAA) Number
  (2) Title of Proposal
  (3) Identity of prime Offeror and complete list of subcontractors, if applicable
  (4) Administrative/business contact (name, address, phone/fax, e-mail address) and
  (5) Duration of effort

- **Part 1**: Detailed breakdown of all costs by cost category by Government fiscal year, award through 30 September for the base year and 1 October through 30 September for follow on years.
  (a) Direct Labor - Individual labor categories or person with associated labor hours and unburdened direct labor rates.
  (b) Indirect Costs – Fringe Benefits, Overhead, G&A, COM, etc. (Must show base amount and rate)
  (c) Travel – Number of trips, destination, duration, etc.
  (d) Subcontract – A cost proposal as detailed as the Offeror's cost proposal will be required to be submitted by the subcontractor. The subcontractor's cost proposal can be provided in a sealed envelope with the Offeror's proposal or will be obtained from the subcontractor prior to award.
  (e) Consultant – Provide consultant agreements or other documentation which verifies the proposed loaded daily/hourly rate
  (f) Materials should be specifically itemized with costs or estimated costs. An explanation of any estimating factors, including their derivation and application shall be provided. Include a brief description of the Offerors procurement method to be used (Competition, engineering estimate, market survey, etc.)
  (g) Other Direct Costs, particularly any proposed items of equipment or facilities. Equipment and facilities generally must be furnished by the contractor/recipient. (Justification must be provided when Government funding for such items is sought.) Include a brief description of the Offerors procurement method to be used (Competition, engineering estimate, market survey, etc.)
  (h) Fee/Profit will not be allowed.

3. Significant Dates and Times

Anticipated Schedule of Events		
Event	**Date (MM/DD/YEAR)**	**Time (Eastern Standard Time)**
Full Proposals Due Date	02/16/2007	3:00 PM
Notification of Selection for Award *	04/20/2007	N/A
Grant Awards *	07/20/2007	N/A

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

4. Submission of Late Proposals

Any proposal submitted through 'Grants.gov' where the time and date for submission is after the deadline for the proposal submission, will be late and will not be evaluated unless the 'Grants.gov' website was not operational on the due date and was unable to receive the proposal submission. If this occurs, the time specified for the receipt of the proposals through Grants.gov will be extended to the same time of day specified in this BAA on the first workday on which the 'Grants.gov' website is operational.

*** Proposals sent by fax, postal mail (hardcopy), or email will NOT be considered. ***

5. Submission of Grant Proposals to Grants.gov

Grant proposals must be submitted through Grants.gov. The offeror must use the Grants.gov forms from the application package template associated with the BAA on the Grants.gov website. To be considered for award, applicants must include the ONR Department Code in Block 4 entitled 'Federal Identifier' of the Standard Form (SF) 424 R&R (ONR Code 351 for this BAA). **Please be sure to enter the Department Code that best relates to your proposal in Block 4 (Federal Identifier) of the SF 424 R&R to ensure that it is properly routed to the correct Program Office. Only one Department Code may be selected.** Please choose at the sub-Department level wherever possible (i.e., for parent ONR Code 30, you should select at the 301, 302 or 303 level if possible). A list of the Department Codes can be found at http://www.onr.navy.mil/ on the right side of the screen. Applicants who fail to provide a Department Code identifier will receive notification that their proposal submission has been rejected.

For electronic submission, there are several one-time actions that must be completed in order to submit an application through Grants.gov (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contract Registry (CCR), register with the credential provider, and register with Grants.gov). See www.grants.gov, specifically www.grants.gov/GetStarted.

Use the Grants.gov Organization Registration Checklist at
http://www.grants.gov/applicants/get_registered.jsp
http://www.grants.gov/applicants/register_your_organization.jsp 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 CCR registration process. Applicants who are not registered with CCR and Grants.gov, should allow at least 21 days to complete these requirements. It is suggested that the process be started as soon as possible. Additionally, in order to download the application package, applicants will need to install PureEdgeViewer. This small, free program will allow applicants to access, complete and submit applications electronically and securely. For a free version of the software, visit the following website: www.grants.gov/DownloadViewer. Questions that may arise relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@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/02/how_to.asp

V. EVALUATION CRITERIA

1. Evaluation Criteria

The DoD expects that the HEL MRI will focus on basic science and engineering research that will eventually lead to applications for defense purposes primarily and also for commercial purposes and further education at the institution.

Award decisions will be based on a scientific, technical review of the proposals received. Evaluations will be conducted using the following evaluation criteria:

Evaluation criteria weighting – 60% equally distributed to criteria (a)–(c).

a) Overall scientific and technical merit of the proposed research
b) Innovativeness of research
c) Potential of basic research transitioning to applied research. This includes the quality of the proposer's plan for establishing linkages with research and development organizations that transition research findings to application, particularly U.S. industrial organizations, DoD laboratories, and other DoD organizations that perform research and development for defense applications. Examples of approaches that can be proposed are collaboration in the performance of the proposed research (with or without a subaward of HEL MRI funds), exchange of scientific and engineering personnel, and exchange of technical information.

Other evaluation criteria of lesser importance than (a), (b) and (c) will have an evaluation criteria weighting of 40% equally distributed to criteria (d)-(g).

d) Risk.
e) Qualifications, capabilities, and experience of the proposed principal investigator, team leader or other key personnel who are critical in achieving proposed objectives
f) Offeror's record of past projects to include assessment of duplication with already completed or ongoing work
g) Realism and reasonableness of the proposed cost.

Proposals will undergo a multi-stage review. First, the technical evaluation teams will review proposals using the criteria in this Section. Then, senior DoD managers will review the findings of the evaluation teams.

If options are applicable to the requirement, the Government may evaluate options utilizing any one of the following methodologies:

(1) Evaluation Exclusive of Options – The Government may evaluate offerors for award purposes by including only the cost for the basic requirement, i.e., options may not be included in the evaluation for award purposes; or

(2) Evaluation of Options Exercised at Time of Award – Except when determined not be in the Government's best interests, the Government may evaluate the total cost for the basic requirement together with any option(s) to be exercised at the time of award; or

(3) Evaluation of Options – Except when it is determined not to be in the Government's best interests, the Government will evaluate 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 option(s) at anytime during the period of performance.

2. Evaluation Panel

Proposals will be evaluated by Government personnel. All government personnel participating in evaluation will protect proprietary and source-selection information.

The Government may use selected support personnel to assist in providing both technical expertise and administrative support regarding any proposals ensuing from this announcement. These support contractors are bound by appropriate non-disclosure agreements to protect proprietary and source-selection information.

3. Selection Process

Full proposals will undergo a multi-stage evaluation procedure. The respective evaluation panels will review proposals first. Findings of the evaluation panels will be forwarded to senior DoD officials who will make funding recommendations to the awarding officials.

VI. AWARD ADMINISTRATION INFORMATION

1. Administration Requirements

- CCR – Successful Offerors not already registered in the Central Contractor Registry (CCR) will be required to register in CCR prior to award of any grant, contract, cooperative agreement or other transaction agreement. Information on CCR registration is available at www.ccr.gov.

- Certification – Proposals should be accompanied by a completed certification package which can be accessed on the ONR home page at Contracts and Grants. For grant proposals and proposals for cooperative agreements or other transaction agreements (other than for prototypes), the certification package is entitled, "Certifications for Grants and Agreements."

2. Reporting

A comprehensive final report will be required. Interim reports and briefings will be required on a monthly, quarterly and annual basis.

VII. OTHER INFORMATION

1. Government Property/Government Furnished Equipment (GFE) and Facilities

Each Offeror must provide a very specific description of any equipment/hardware that it needs to acquire to perform the work. This description should indicate whether or not each particular piece of equipment/hardware will be included as part of a deliverable item under the resulting award. Also, this description should identify the component, nomenclature, and configuration of the equipment/ hardware proposed to be purchased for this effort. It is the Government's desire to have the contractor purchase the equipment/hardware for deliverable items under their contract. The purchase on a direct reimbursement basis of special test equipment or other equipment that is not included in a deliverable item will be evaluated for allowability on a case-by-case basis. Maximum use of Government integration, test, and experiment facilities is encouraged in each of the Offeror's proposals.

Offerors are expected to provide all facilities (equipment and/or real property) necessary for the performance of the proposed effort. Any direct charge of facilities, not including deliverable items, must be included in the offeror's proposal and approved in advance by the cognizant Government official. After contract award, requests to use integration, test, and experiment

facilities will be considered on a case by case basis based on availability and justification of need.

2. Security Classification

ONR will accept only unclassified proposals. The proposal shall include a severable, self-standing Statement of Work, which contains only unclassified information and does not include any propriety restrictions as described in Section IV, paragraph 2. In order to facilitate intra-program collaboration and technology transfer, the Government will attempt to enable awardees to work at the unclassified level to the maximum extent possible. However, access to and storage of some classified information will be required under this program. Awardees must be specific as to max level of classification and location of work.

If awardees use unclassified data in their deliveries and experimentation regarding a potential classified project, they should use methods and conventions consistent with those used in classified environments. Such conventions will permit the various subsystems and the final system to be more adaptable in accommodating classified data in the transition system.

3. Department of Defense High Performance Computing Program

The DoD High Performance Computing Program (HPCMP) furnishes the DoD S&T and DT & E communities with use-access to very powerful high performance computing systems. Awardees of ONR contracts, grants, and 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/.

4. 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 OLAW Animal Welfare Assurance approval letter , IACUC approval, research literature database searches, and the two most recent USDA inspection reports) prior to award. Similarly, for any proposal for research involving human subjects the Offeror must submit prior to award: documentation of approval from an Institutional Review Board (IRB); IRB-approved informed consent form; IRB-approved research protocol; an executive summary of planned research (one-half to one page in length); proof of completed human research training (e.g., training certificate, institutional verification of training, etc.); an application for a DoD Navy Addendum to the Offeror's DHHS-issued Federalwide Assurance (FWA) or the Offeror's DoD Navy Addendum number. The forms for assurance applications can be found at http://www.onr.navy.mil/sci_tech/34/343/ . 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. [Note: for research involving human subjects that is greater than minimal risk, administrative procedures to protect human subjects from medical expenses (not otherwise provided or reimbursed) that are the direct result of participation in a research project must be addressed. Documentation describing those procedures may be requested. For additional information on this topic please email 343_contact@onr.navy.mil.] For assistance with submission of animal and human subject research related documentation, contact the ONR Animal/Human Use Administrator at (703) 696-4046.