Multi-Disciplinary Basic Research in the Science of Autonomy with Naval Relevance

INTRODUCTION:

This publication constitutes a Broad Agency Announcement (BAA) as contemplated in 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. The 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 the ONR to treat all proposals as sensitive competitive information and to disclose their contents only for the purposes of evaluation.

Special Notice 1: All Grant Applications submitted under this BAA shall be submitted via the Grants.Gov "APPLY" function. No other form of paper or electronic submission will be accepted unless the prospective grantee organization applies for and receives a waiver in accordance with Section IV.5 below.

Special Notice 2: All attachments to grant applications submitted through Grants.Gov must be in Adobe Portable Document Format. Proposals with attachments submitted in word processing, spreadsheet, or any format other than Adobe Portable Document Format will not be considered for award.

The grant Application Package Template to be used for submission of grant applications through Grants.Gov is based on the PureEdge Forms software.

I. GENERAL INFORMATION

1. Agency Name -

The Office of Naval Research

2. Research Opportunity Title -

Multi-Disciplinary Basic Research in the Science of Autonomy with Naval Relevance

3. Program Name –

Science of Autonomy

4. Research Opportunity Number -

09-008

5. Response Date –

White Papers: 21 November 2008
Full Proposals: 23 January 2009

6. Research Opportunity Description -

The ONR is seeking proposals that address basic science and engineering research in the science of autonomy at U.S. institutions of higher learning (hereafter referred to as "universities).   The focus is on problems of critical interest to the Navy and Marine Corps.   The research topics of interest are: (1) Human Collaboration and Interaction with Unmanned Systems, (2) Autonomous perception and intelligent decision making, (3) Scalable and robust distributed collaboration, and (4) Intelligent Architecture Enablers.   Detailed descriptions of the research topics can be found below. The detailed descriptions are intended to provide the proposer a frame of reference and are not meant to be restrictive to the possible approaches to achieving the goals of the topic and the program. Innovative ideas addressing these research topics are highly encouraged.

This BAA is focused on multi-disciplinary research efforts that intersect more than one traditional science and engineering discipline to address issues of critical interest to naval forces. Proposals from a team of university researchers may be warranted because the necessary expertise in addressing the multiple facets of the topics may reside in multiple universities. Proposals from a single university or a small team of researchers are within the scope of this BAA. One institution shall be the primary awardee for purposes of award execution.

Autonomous behavior and the systems that incorporate it will be seen in many future naval operating domains, used for many missions, and on multiple platforms. In the

future this may lead to a distributed system of heterogeneous unmanned systems relying on network-centric, decentralized control that is flexible in its level of autonomy, with the ability to get the right level of information to the right user at the right time. Features of such a system may include: (1) Operations as part of a hybrid force with manned systems and platforms, (2) Automated image/scene understanding, data gathering, purposeful sensing/seeking, information analysis and distributed information management, (3) Autonomous cooperation among a group of systems to perform a mission or task including automated distribution of tasks to elements within the automated system based on high-level plans, goals, and the commanders' intent, and (4) Autonomy to determine the best way to accomplish each task, with appropriate human guidance to shape and direct its performance.

Achieving such capabilities will require overcoming challenges of the operational environment of the Navy and Marine Corps including: (1) Operations in spatially and temporally variable and uncertain environments with limiting manning, communications, and other resources; (2) Users with a wide range of skills and experience including getting unmanned system services to support small tactical units; (3) Diverse environments encompassing air, sea surface, undersea and ground systems and hybrid concepts in between; (4) Platforms with highly limited and intermittent communications such as undersea vehicles including substantial latency in sharing data on the environment, targets of interest, and system state; (5) Complex missions with heterogeneous platforms and sensors including significant differences in physical and sensing capabilities (e.g., the shorter ranges of many sensors in the undersea environment); (6) Rapid and dynamic responses to user needs and changes in the operating space; and (7) The need for automation to explain its capabilities to the user and reliably execute the required tasks in the required time, which is particularly important for systems with limited communications bandwidth.

Offerors should note that the development of advanced sensors, communications hardware or hardware of any type is outside the scope of this effort with the exception of a limited amount of effort that may be used to design hardware needed as part of experiments. Also, specifically excluded is the development of new platforms, such as airframes, ground, or sea vehicles. In addition, the focus of this effort will not be on the development of general communications algorithms such as data compression algorithms. Proposed technologies should be applicable to multiple types of naval platforms. Technologies that are specific to only a single type of platform are outside the scope of this BAA. Finally, research in the science of autonomy shall emphasize principled approaches and/or mathematical rigor to the greatest extent possible and minimize the use of heuristics. Although, it is recognized that heuristics may sometimes be necessary in solutions to very complex problems.

The ONR is interested in receiving proposals for efforts that address the following focus areas. Proposals may address single or multiple focus areas. However, there are strong connections between the focus areas and proposals that address multi-disciplinary research topics, in general, are of most interest. This includes disciplines as diverse as artificial intelligence, control theory, mathematics, human factors, cognitive science,

biology, and the social sciences. In each case, the design of appropriate experiments to validate theoretical developments will be important. The ONR has funded related science and technology development under numerous programs. Proposals that build on current or previous Department of Defense (DoD) work are encouraged but not required. If offerors are enhancing work performed under other ONR 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.

6.1 Focus Area 1:   Human collaboration and interaction with unmanned systems

This research area focuses on the development of principles and methodologies to enable humans to interact with unmanned systems for (1) supervisory control of autonomous systems, (2) collaborative control between autonomous systems and humans or manned platforms, (3) disadvantaged users who request unmanned system services, and (4) peer-to-peer collaboration.   Approaches that focus on tele-operation of unmanned systems or traditional operator control of unmanned systems are outside the scope of this research. Instead, the focus should be on approaches that enable individual or teams of humans to shape and redirect the plans, behaviors, and capabilities of individual and groups of autonomous systems in real time to meet the ever changing requirements of users operating in a dynamic battlespace.   Of particular interest in this focus area are computational architectures that are cognitively compatible with those produced and understood most naturally by human teammates. Currently, there are few computational architectures that have the inherent ability to model the beliefs, desires, intentions and other mental states of teammates to foster more natural interactive behavior.

Of particular interest are proposals that address the following research areas relevant to naval problem domains: (1) Extending the common ground between human and/or robotic teammates where common ground refers to a set of shared beliefs about the world inferred through a history of interactivity between teammates and coupled with appropriate factors that define the context of their current interaction; (2) Integrating diectic (or indexical) modes of communication such as pointing, head/body movements, prosodic cueing and other forms of gesture into a framework supporting the modeling of teammates' mental states; (3) Forms of social cognition in relation to the learning and deployment of other cognitive skills such as reasoning, decision-making, planning, and recognizing intentions in both words and actions; (4) Using a-priori evaluation of the best available but uncertain prior information to calibrate and constrain the behavior set of the autonomous system to best achieve the decision maker's intent; (5) Concepts towards providing flexible tasking, guidance, and human-directed learning of appropriate behaviors and tactics; (6) Higher level abstractions of the capabilities, planning and execution of unmanned naval systems including trend and configural displays; and (7) New representations of the sensory and spatio-motor domains for the volume around naval autonomous vehicles that would both support human – autonomous system interaction and reflect both human cognitive spatial skills as well as the sensing limitations and maneuverability of the vehicles' sensing and control. Of particular interest are approaches that would be applicable to vehicles that may operate with limited sensing and communications capability, such as undersea vehicles. Also of interest is how this

spatial representation would be enhanced with new types of sensors, such as biosonar or electro-optics.

6.2 Focus Area 2: Autonomous perception and intelligent decision making.

This research area focuses on the development of principles and methodologies to learn the optimal tradeoff between exploration and exploitation in autonomous unmanned vehicle (AUV) sensing applications. For Naval problem domains, exploration involves high area coverage rate search for either static or mobile targets using multiple AUVs. Exploitation involves AUV maneuver for either high-resolution target interrogation or state manipulation (marking, target neutralization, etc). AUVs may be static (fixed camera nodes with pan, tilt, zoom), dynamic (unmanned underwater or air vehicles), or adrift (drifting sensor buoys), and they may possess multiple complimentary sensors enabling a single AUV to perform both exploration and exploitation. This research area also focuses on the development of principles and methodologies to first learn the context of the perception task and then apply the appropriate recognition or processing mechanism or to select or adapt the appropriate recognition or processing mechanisms based on autonomously gathered in situ information. For the autonomous systems of interest, context may refer to environment, surroundings, or situation, while in situ information may include object labels or semantic information.

Of particular interest are proposals that address the following research areas as relevant to naval problem domains: 1) placing sensory and computational resources on the most salient and relevant aspects of a given task while maintaining overall situational awareness of the entire task; 2) performing agile search within complex environments with particular emphasis on approaches learning the exploration / exploitation tradeoff directly from experience and not requiring a pre-learned world model as well as techniques capable of transfer to similar situations; 3) adaptation of algorithms for detection, feature extraction, feature selection, and classification based on context or in situ information; 4) characterizing or learning which contexts warrant slightly modified algorithms vice fundamentally different detection and feature extraction approaches; 5) performing adaptive recognition to the semantic level for actionable presentation to a human; and 6) performing robust multi-task learning across similar sensor types, environmental contexts, and target classes. For this last area, emphasis will be on approaches capable of appropriately sharing and leveraging information during the learning process as the substantial variability precludes the use of traditional globally trained machine learning classifiers.

6.3 Focus Area 3: Scalable and robust distributed collaboration.

This research area focuses on the development of principles and methodologies to provide an understanding of cooperation in large, distributed systems including factors such as role specialization, organizational structure, and hierarchy. This can include robust self-organization, adaptation, and collaboration among highly heterogeneous platforms and sensors in a dynamic environment that are tasked at a mission level only. Approaches inspired by both biology and the social sciences are relevant. Of particular

interest are concepts that can deal with large numbers of agents, provide rapid adaptation and responsiveness, and execute complex mission tasking. Concepts must also be able to provide some guarantees of performance including the ability to complete time-critical tasks within the required amount of time. For many naval applications, communication bandwidth constraints limit human interaction, and it is critical that autonomous sensor systems deliver performance consistent with the expectations of the user / decision-maker. Related to focus area 1, approaches must also provide ways to enable the user to shape and redirect the performance of these complex systems of systems.

Of particular interest are proposals that address the following research areas as relevant to naval problem domains: (1) Appropriate organizational structures or hierarchies as relevant to particular mission types or environmental situations including the impact of different airspace and waterspace limitations; (2) Task allocation/assignment, planning, coordination and control for heterogeneous systems in situations where the tasks have spatial/temporal dependencies with logical constraints on vehicles and tasks (this includes problems where there are limited resources and not all mission tasking may be feasible); (3) Structuring of the on-board autonomy to balance multiple competing and conflicting performance metrics as well as individual platform vs. larger team or group objectives at multiple levels; (4) Rigorous mathematical methods and tools for predicting behaviors of large numbers of unmanned systems under realistic assumptions (this includes looking at how to define traditional control properties such as stability, robustness, performance, and controllability, and also probabilistic models that connect behaviors to expectations for achievable performance); (5) Testing approaches for these very complex systems to determine potential problematic behaviors and ensure that performance can be predicted.

6.4 Focus Area 4. Intelligent C3 Architecture Enablers

The goal of this focus area is to develop principles, computational methods, and architectures for enhancing the intelligence needed for perception and decision-making by single agents and teams of agents to enable them to perform in uncontrolled environments without constant human supervision. The main characteristics of uncontrolled environments, that make them difficult for current approaches, are: (i) Information uncertainty, i.e., information may be imprecise, incomplete, contradictory, or irrelevant; (ii) Open world, i.e., the numbers and types of objects/agents/people are unrestricted, and the truth-value of statements cannot be determined; and (iii) Unpredictability, i.e., agents/people may be non-cooperative or hostile with unpredictable adversarial behaviors. Current approaches to developing basic elements of intelligence, such as reasoning, planning, and learning, generally become intractable for real world problems. A particular challenge is taking advantage of uncertainty to reduce computations through bundling cases, unlike current approaches that when applied to uncertain domains become more costly as they expand the search to examine every single possibility. Moreover, these methods should be analyzable and provide confidence estimates for performance of individual modules, agents, and teams of agents.

Of particular interest are proposals that address the following research areas as relevant to naval problem domains: (a) Qualitative or common-sense reasoning for robust and rapid reasoning with uncertain information. (b) Planning in the real world, where we have limited time, incomplete information about the environment, and multiple goals that are only approximately modeled. This also includes methods for plan/intention recognition to deal with adversarial situations; as well as methods for decentralized planning and coordination. (c) Methods for learning complex tasks and concepts, transfer learning, life-long learning, particularly learning from combining domain knowledge and examples. (d) Methods for acquiring and refining knowledge from many sources that may have partial or contradictory information, particularly methods that integrate logic-based and probability-based representations. (e) Architectures that allow efficient and seamless integration of perception, reasoning, planning, control, interaction, and other processes that enable building autonomous systems that operate in real-time.

7. Point(s) of Contact –

Questions of a technical nature should be submitted to:

Name: Marc Steinberg
Address: 875 North Randolph Street, Suite 1137
Code 351
Arlington, VA 22203-1995
Email: marc.steinberg@navy.mil

Questions of a business nature should be submitted to:

Name: Halyna Mudri
Address: 875 North Randolph Street, Suite W1263A
Code: BD253
Arlington, VA 22203-1995
Email: Halyna.Mudri@navy.mil

8. Instrument Type(s) -

It is anticipated that all awards resulting from this announcement will be grants (See Section II for award information).

9. Catalog of Federal Domestic Assistance (CFDA) Numbers -

12.300

10. Catalog of Federal Domestic Assistance (CFDA) Titles -

Basic Scientific Research

11. Other Information -

This announcement is restricted to basic research. Grants made under this BAA are for scientific study and experimentation directed towards advancing the state of the art and increasing knowledge or understanding. No data rights assertions will be issued as part of the grant awards.

II. AWARD INFORMATION

The amount and period of performance of each selected proposal will vary depending on the research area and the technical approach to be pursued by the selected offeror.

The estimated total value of awards is $20M of 6.1 basic research funding anticipated to be made available over a five year period. The ONR may award less than $20M under this BAA.

1. Estimated Total Amount of Funding Available ($K):

FY09	FY10	FY11	FY12	FY13	Total
4000	4000	4000	4000	4000	20M

2. Anticipated Number of Awards:

Multiple awards will be made under this BAA. Proposals may address single or multiple focus areas. Depending on the results of the proposal evaluation, there is no guarantee that any of the proposals submitted in response to a particular focus area will be recommended for funding. On the other hand, more than one proposal may be recommended for funding for a particular focus area.

3. Anticipated Range of Individual Award Amounts:

It is anticipated that the maximum award level for a single award will be $2M per year, contingent on availability of funds.   However, proposals for the maximum amount of $2M per year would need to show a very high degree of teaming across disciplines to justify that amount. Proposals at a much lower level of funding are also of interest.

4. Anticipated Period of Performance:

Each individual award shall have a base period with a maximum period of performance of three years. One or more options may be added to bring the total maximum term of the award to five years. The base and any option periods will be incrementally funded.

III. ELIGIBILITY INFORMATION

All responsible sources from academia may submit proposals under this BAA. Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs) are encouraged to submit proposals and join others in submitting proposals. However, no portion of this BAA will be set aside for HBCU and MI participation.

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 the 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.

Teams are encouraged to 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 Regulations (ITAR) - 22 CFR § 1201.1 et seq.

IV. APPLICATION AND SUBMISSION INFORMATION

1. Application and Submission Process -

The proposal submission process is in two stages. Prospective awardees are encouraged to submit white papers. White Papers and Full Proposals received after the published due dates will not be considered for funding under this BAA. As soon as the final proposal evaluation process is completed, the offeror will be notified via email and official letter of its selection or non-selection for an award. Proposals exceeding the page limit may not be evaluated.

1. White Papers: Refer to Section I.5 titled "Response Date" for due date of white papers. ONR's initial evaluation of the White Papers should give offerors some indication of whether a full proposal would likely result in an award. Selections from initial ONR evaluations of the White Papers will be issued via E-mail notification. Refer to Section IV.3 titled "Significant Dates and Times" for approximate date of notification. Detailed

technical and cost proposals will be subsequently encouraged from those offerors whose proposed technologies have been identified through the above-referenced E-mail as being of "particular value" to the ONR. However, any such encouragement does not assure a subsequent award. Any offeror may submit a full proposal even if its White Paper was not identified as being of "particular value".

2. <u>Full Proposals</u>: Refer to Section I.5 titled "Response Date" for due date of full proposals.

2. Content and Format of White Papers/Full Proposals –

White Papers and Full Proposals submitted under the BAA shall be unclassified.

White papers shall be submitted directly to the Technical Point of Contract (TPOC) identified in Section I.7.

Full Proposals shall be submitted through Grants.gov (See Section IV.5). Full 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. The proposal shall include a severable, self-standing Statement of Work (SOW), which does not include any proprietary restrictions.

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.

The proposal format and content identified below are applicable to the submission of proposals for grants. As noted in Section IV.5 below, proposals seeking grant awards are to be formatted as required by Standard Form 424 (R&R), which is available via the internet at http://www.grants.gov/.

<u>2.1 WHITE PAPERS</u>

<u>2.1.1 White Paper Format</u>

• 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 - no more than four (4) single-sided pages (excluding cover letter, and curriculum vitae). White papers exceeding the page limit may not be evaluated.
• Copies –in Microsoft® Word or Excel 97 compatible or .PDF format is acceptable.

• White papers are required to be submitted electronically via e-mail to the TPOC. Hard copies of the white paper and separate attachments, such as individual brochures or reprints, will not be accepted.

2.1.2 White Paper Content

• Identification of the research and issues
• Proposed technical approaches
• Naval Relevance and Potential impact on naval capabilities
• Potential team and management plan
• Summary of estimated costs
• Curriculum vitae of key investigators
The white paper should provide sufficient information on the research being proposed
(e.g., hypothesis, theories, concepts, approaches, data measurements and analysis) to
allow for an assessment by a technical expert. It is not necessary for white papers to carry
official institutional signatures.

2.2 FULL PROPOSALS

2.2.1 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 - no more than twenty-five (25) single-sided pages. The cover, table
of contents, list of references, letters of support, and curriculum vitae are excluded from
the page limitations. Full proposals exceeding the page limit may not be evaluated.
• The full proposal shall be submitted electronically at http://www.grants.gov/ as
  delineated in Section IV.5 below.

**Note: The instructions below for the Cover page and for other portions of the
Technical and Cost proposals may be at variance with the format of SF424 (R&R)
found at grant.gov. in that case, a proposer should provide all the information
requested here but in a manner consistent with the SF424 (R&R).**

2.2.2 Full Proposal Content

2.2.2.1 Volume 1: Technical Proposal

Cover Page This should include the words "Technical Proposal" and the following:

1) BAA number;
2) Title of Proposal;
3) Identity of prime Offeror and complete list of subcontractors and collaborating
institutions, 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) Duration of effort (differentiate basic effort and any proposed options)

Project Summary/Abstract

The project summary should be a single page that identifies the research problem, technical approaches, anticipated outcome of the research, if successful, and impact on naval capabilities. It should identify the Principal Investigator, the university and other universities involved in the team if any, the proposal title, and the total funds requested from DoD for the base period, any options, and the total performance period. The project summary must not exceed 1 page.

Project Narrative

The first page of your narrative must include the following information:
• Principal Investigator name
• Phone number, fax number and e-mail address
• Institution, Department, Division
• Institution address
• Other universities involved in the team
• Current DoD Contractor or Grantee? If yes, provide Agency, point of contact; phone number
• Proposal title
• Institution proposal number
• Agency to which proposal is submitted
• Topic number and topic title

Table of Contents: List proposal sections below and corresponding page numbers.

Statement of Work: A SOW should clearly detail the scope and objectives of the effort and the specific research to be performed. The proposed SOW will be incorporated by reference into any resultant award instrument. To this end, the SOW must be without any proprietary restrictions.

Technical Approach: 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 programs elsewhere. Include appropriate literature citations/references. Discuss the nature of expected results and their relevance to the Navy's research interests as explained in Section I.6 of this BAA. Describe 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 other students, if any. Include a summary of the schedule of events and research milestones and provide a detailed description of the results and products to be delivered.

Management Approach: A discussion of the overall approach to the management of this effort, including brief discussions of: required facilities; relationships with any

subawardees and with other organizations; availability of personnel; and planning, scheduling and control procedures.

(a) Describe the facilities available for the accomplishment of the proposed research and related education objectives. Describe any capital equipment planned for acquisition under this program and its application to the proposed research. If possible, any 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.

(b) 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. If subawards to other universities are proposed, make clear the division of research activities, to be supported in the Cost proposal by detailed budgets for the proposed subawards.

(c) Designate the Principal Investigator. Briefly summarize the qualifications of the Principal Investigator and other key investigators to conduct the proposed research.

(d) Describe the research activities of the Principal Investigator and co-investigators in on-going and pending research projects, whether or not acting as Principal Investigator in these other projects, the time charged to each of these projects, and their relationship to the proposed effort. Describe your plans to manage the interactions among members of the proposed research team.

(e) Identify other funding sources, if any, to whom the proposal has been, or will be sent, including agency contact information.

List of References: List publications cited in above sections.

Curriculum Vitae: Include curriculum vitae of the Principal Investigator and key co-investigators.

2.2.2.2 VOLUME 2: Cost Proposal

The Cost Proposal shall consist of two parts, Part 1 will provide a detailed cost breakdown of all costs by cost category by calendar or Government fiscal year, and Part 2 will provide a cost breakdown by task/sub-task corresponding to the task numbers in the proposed SOW. Options must be separately priced.

> **Part 1 –Grant Recipient :** The offeror must use the Grants.Gov forms from the application package template associated with the BAA on the Grants.Gov web site located at http://www.grants.gov/ . Elements of the budget should include:

- Direct Labor – Individual labor categories or persons, with associated labor hours and unburdened direct labor rates or percentage of effort or total man-years. Provide escalation rates for out years. Justify in Field K
- Indirect Costs – Fringe Benefits, Overhead, F&A, G&A etc. and their applicable allocation bases. If composite rates are used, provide the calculations used in deriving the composite rates. Justify in Field K
- Travel – Provide a breakout of travel costs including the purpose and number of trips, origin and destinations(s), duration, travelers per trip, and the airfare, hotel, per diem, car rental costs, etc. for each trip. Or a basis for estimate, i.e., based on previous efforts, based on past experience, etc. Justify in Field K.
- Subawards - Cost proposal as detailed as the recipient's cost proposal will be required to be submitted by the subreceipient. The subawardee's or subrecipient's cost proposal can be provided in a sealed envelope with the recipient's cost proposal or may be sent directly to the Government. Subawardee proposals must be received and reviewed prior to award.
- Consultants – Provide a breakdown of the consultant's hours, the hourly rate proposed, any other proposed consultant costs and a copy of the consultant's proposed statement of work if it is not already separately identified in the prime recipient's proposal. Strong justification must be provided, and consultants are to be used only under exceptional circumstances where no equivalent expertise can be found at a participating university. Justify in Field K.
- Materials & Supplies – Provide an itemized list of all proposed materials and supplies including quantities, unit prices, proposed vendors (if known), and the basis for the estimate (e.g., quotes, prior purchases, catalog price lists). Justify in Field K.
- 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). For computer/laptop purchases include a statement indicating the computer/laptop will be integrated into the program or used as an integral part of the research effort. Justify in Field K.
- 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 estimates (e.g., quotes, prior purchases, catalog price lists). Justify in Field K.

NOTE: If the grant proposal is for a conference, workshop, or symposium, the proposal should include the following statement: "The funds provided by ONR will not be used for food or beverages."

- Options – The Base Period of Performance and Option Periods must be priced at the submission of the proposal. Any proposal containing unpriced options will not be included in the award.
- Fee/Profit - Fee/profit is unallowable.

Part 2: Cost breakdown by task/sub-task corresponding to the same task breakdown in the proposed SOW. When options are contemplated, options must be separately identified and priced by task/subtask.

3. Significant Dates and Times –

Schedule of Events

EVENT	DATE	TIME (EDT)
Submission of Questions – White Papers	14 November 2008	2:00 pm
White Papers Due Date	21 November 2008	2:00 pm
Notification of Initial Navy Evaluations of White Papers	11 December 2008*	
Submission of Questions – Full Proposal	16 January 2009	2:00 pm
Full Proposal Due Date	23 January 2009	2:00 pm
Notification of Selection for Award	20 February 2009*	
Issued Awards	22 May 2009*	

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

4. Submission of Late 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:

> • 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
> • 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
> • 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.

5. Submission of Grant Proposals to Grants.gov

Grant Proposals shall be submitted through Grants.gov using 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 of the TPOC (Code 351) in Block 4 entitled 'Federal Identifier' of the Standard Form (SF) 424 R&R.

However, White Papers should NOT be submitted through the Grants.gov process but rather be sent electroncially to the TPOC (See Section IV.2.1.1 above).

For electronic submission of grant full proposals, 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/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. Any 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

Process to Obtain a Waiver from the Use of Grants.Gov for Submission of Full Grant Proposals: If a prospective grantee is unable to comply with the requirement to use Grants.Gov "APPLY" for submission of a grant application under this BAA or finds it would be an excessive burden to comply with this requirement, a waiver request may be submitted not less than 30 calendar days prior to the closing date for receipt of Full Proposals. Such request should be submitted by the Electronic Business Point of Contact listed in the CCR for the organization and should contain the Organization/Individual's Name, Address, Telephone number, and email address. The request should state the reason for the request in sufficient detail so a decision can be made. The Waiver Request should be submitted to the ONR Acquisition Department business point of contact listed in the BAA. Such request can be sent by registered mail or email. The "postmark" stamp on the envelope or the time annotated on the email will be used to determine timeliness of the request. A decision and response will be issued within 14 calendar days of receipt of the request by ONR. Foreign proposers who are not registered in CCR may request a waiver on that basis since CCR registration is integral to the Grants.Gov application process.

V. EVALUATION INFORMATION

1. Evaluation Criteria –

White papers will be evaluated to assess whether the proposed research is likely to meet the objectives of the relevant focus area(s), and thus whether to encourage the submission of a full proposal. The assessment will focus on scientific and technical merit (criterion 1, below) and relevance and potential contribution to the Navy and Marine Corps (criterion 2, below), although the other criteria may also be used in making the assessment.

Award decisions will be based on a competitive selection of proposals resulting from a scientific and cost review. Evaluations will be conducted using the following evaluation criteria:

(1) Scientific and technical merits of the proposed basic science and/or engineering research

(2) Relevance and potential contributions of the proposed research to the research areas and to naval missions

(3) Potential impact on the institution's ability to perform naval-relevant research and to train, through the proposed research, students in science and/or engineering

(4) The qualifications and availability of the Principal Investigator and key co-investigators.

(5) The adequacy of current or planned facilities and equipment to accomplish the research objectives;

(6) The realism and reasonableness of cost (cost sharing is not a factor in the evaluation).

Technical factors (1 – 5) are more important than the cost factor. Technical factors 1 – 4 are of equal importance, and factor 5 is of less importance. The degree of importance of cost will increase with the degree of equality of the proposals in relation to the other factors on which selection is to be based, or when the cost is so significantly high as to diminish the value of the proposal's technical superiority to the Government.

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 grant performance.

2. Evaluation Panel -

Technical and cost proposals submitted under this BAA will be protected from unauthorized disclosure. The cognizant Program Officer and other Government scientific experts will perform the evaluation of technical proposals. Cost proposals will be evaluated by Government business professionals. Restrictive notices notwithstanding, one or more support contractors may be utilized as subject-matter-expert technical consultants. Similarly, support contractors may be utilized to evaluate cost proposals. 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. <u>AWARD ADMINISTRATION INFORMATION</u>

1. Administrative Requirements –

• Central Contractor Registry (CCR) - Successful Offerors not already registered in the 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 http://www.onr.navy.mil/02/ccr.htm.

• Grant awards greater than $100,000 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 (complete Blocks 18 and 19); The following certification applies to each applicant seeking federal assistance funds exceeding $100,000:

CERTIFICATION REGARDING LOBBYING ACTIVITIES

(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.

2. Reporting -

The following are samples of data deliverables that are typically required under a research effort:

> *Technical and Financial Progress Reports
> *Experimentation plans and reports
> *Presentation Materials
> *Interim Reports
> *Final Report

Additional data deliverables may be proposed and finalized during negotiations.

VII. OTHER INFORMATION

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

Each proposer 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 that it proposes to purchase for this effort. 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.

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 explain as part of their proposals which of these facilities are critical for the project's success.

2. 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 AALAC 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/Human Use Administrator at (703) 696-4046.

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 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 Federalwide Assurance (FWA) or the Offeror's DoD Navy Addendum number. 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. Information about assurance applications and forms can be obtained by contacting 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. [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. Additional supporting documentation may be requested. For additional information on this topic, email ONR_343_contact@navy.mil.] For assistance with submission of human subject research related documentation, contact the ONR Animal/Human Use Administrator at (703) 696-4046.

3. 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 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. Protection of Proprietary and Sensitive Information

The parties acknowledge that, during performance of the contract or grant agreement resulting from this BAA, the recipient may require access to certain proprietary and confidential information (whether in its original or derived form) submitted to or produced by the Government. Such information includes, but is not limited to, business practices, proposals, designs, mission or operation concepts, sketches, management policies, cost and operating expense, technical data and trade secrets, proposed Navy budgetary information, and acquisition planning or acquisition actions, obtained either directly or indirectly as a result of the effort performed on behalf of ONR. The recipient shall take appropriate steps not only to safeguard such information, but also to prevent disclosure of such information to any party other than the Government. The recipient agrees to indoctrinate company personnel who will have access to or custody of the information concerning the nature of the confidential terms under which the Government received such information and shall stress that the information shall not be disclosed to any other party or to recipient personnel who do not need to know the contents thereof for the performance of the contract/agreement. Recipient personnel shall also be informed that they shall not engage in any other action, venture, or employment wherein this information will be used for any purpose by any other party.

5. Project Meetings and Reviews

Individual program reviews between the ONR sponsor and the performer will 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.

6. Submission of 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 shall be submitted in writing by electronic mail.

Questions regarding **white papers** must be submitted by 2:00 P.M. Eastern Time on **14 November 2008.** Questions after this date and time may not be answered, and the due date for submission of the white papers will not be extended.

Questions regarding **full proposals** must be submitted by 2:00 P.M. Eastern Time on **16 January 2008.** Questions after this date and time may not be answered, and the due date for submission of the proposals will not be extended