SBA 13-SN-0005 Amendment 0001

Special Notice 13-SN-0005

Special Program Announcement for 2013 Office of Naval Research

Research Opportunity:

Basic Research Challenges in the Science of Autonomy

Amendment 0001

8 March 2013

The purpose of this Amendment is to update Section VII of the Special Notice, "Significant Dates and Times." The date for Full Proposal Submission is changed to 25 March 2013. The date for Notification of Selection: Full Proposals is changed to 15 April 2013. The approximate date for awards in place is changed to 10 Jun 2013.

There are no other changes to the Special Notice.

For reference, the updated Special Notice is attached.

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Research Opportunity:

Basic Research Challenges in the Science of Autonomy

I. INTRODUCTION:

This announcement describes a research thrust entitled "Basic Research Challenges in the Science of Autonomy" to be launched under the ONRBAA13-001, Long Range Broad Agency Announcement for Navy and Marine Corps Science and Technology which can be found at http://www.onr.navy.mil/Contracts-Grants/Funding-Opportunities/Broad-Agency-Announcements.aspx. The research opportunity described in this announcement specifically falls under numbered paragraph 1 of the "Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (Code 31)" sub-section, numbered paragraph 1 of the "Ocean Battlespace Sensing (Code 32)" sub-section, numbered paragraph 1 of the "Warfighter Performance (Code 34)" subsection, and numbered paragraph 1 of the "Naval Air Warfare and Weapons (Code 35)" sub-section. The submission of proposals, their evaluation and the placement of research grants will be carried out as described in that Broad Agency Announcement.

The purpose of this announcement is to focus attention of the scientific and engineering community on (1) the areas to be studied, and (2) the planned timetable for the submission of white papers and proposals.

II. TOPIC DESCRIPTION: BASIC RESEARCH CHALLENGES IN THE SCIENCE OF AUTONOMY

Background:

ONR basic research programs in autonomy address critical multi-disciplinary fundamental challenges that cut across different scientific and engineering disciplines and system domains (air, sea, undersea, and ground systems) with a focus on problems with particular naval relevance. Five new basic research focus areas have been identified and are "Understanding Satisficing in Human, Animal, and Engineered Autonomous Systems for Fast Decision-making with Limited Data," "Cognitively Compatible Semantic and Visual Representation of Autonomous System Perceptual Data for Effective Human/Machine Collaboration," "Mental Simulation as a Unifying Framework for Perception, Cognition and Control in Autonomous Systems and Dexterous Robots," "Structured Machine Learning for Scene Understanding," and

"Integrated Autonomy for Long Duration Operations." ONR seeks to initiate 6.1 Basic Research efforts in these five thrusts beginning Government Fiscal Year 2013.

Objective:

The Office of Naval Research (ONR) is interested in receiving initially white papers and

eventually proposals from selected Offerors for five new thrusts for Basic Research Challenges in the Science of Autonomy. Each individual white paper and proposal should address only a single one of the five research thrusts listed below. This program supports basic science and/or engineering research within academia and industry. The program focuses on stimulating new, high-risk basic research projects. ONR will consider awards to single investigators, but the preference is for collaborative groups that have a history of innovative research across multiple scientific and engineering disciplines.

The five research thrust areas are:

Thrust 1: Understanding Satisficing in Human, Animal, and Engineered Autonomous Systems for Fast Decision-making with Limited Data

Background:

Current autonomous systems technologies have severe limitations in terms of their abilities to operate robustly in hazardous environments, support the tempo of rapid operations, or operate around and interact with humans, manned platforms, and other autonomous systems in highly constrained and chaotic environments. There are several emerging opportunities that exist to address these types of problems by modeling the fast satisficing processing seen in human and animal cognitive, neural, behavioral, and perceptual processing which reduce response times in challenging environments. The scope of satisficing under this topic includes (1) skilled, expert human reasoning in which decision and action sequences may be automatically triggered by the task context and patterns of environmental cues with little or no conscious thought, (2) fast behavioral heuristics that exploit the structure of information in the environment and are simple enough to be used when time, information, and processing power are limited, and (3) affect/motivational systems in humans and other animals to process and react to information and events and modulate behaviors in ways that can support the system's survival and ability to achieve goals. However, before such opportunities can be realized, there is a great need to develop models of the underlying processes that are appropriate for incorporation within engineering mathematical frameworks. Dominant models in psychology, biology, and cognitive and cognitive neuroscience research have many limitations in this regard. Existing theoretical models are highly diverse and have significant differences in how they conceptualize the similar phenomena. Moreover, many models are qualitative or descriptive rather than quantitative or predictive and there has not always been a sound mathematical basis for how such theoretical models have been turned into computational ones. As well, there are also significant limitations in understanding the basic underlying phenomena that can be concurrently addressed with engineering experiments/theory in a synergistic way.

Objective:

The objective of this effort will be to develop a unified framework for fast satisficing with limited information including: (1) Exploit multidisciplinary strategies to access the cognitive and perceptual operations that underlie satisficing in humans and animals, (2) Develop computational models of cognitive processes, fast heuristics, and affective/motivation processes that are suitable for engineering frameworks, (3) Develop new frameworks and methods for autonomy that exploit comparable mechanisms, (4) Examine how these models can impact the control of an autonomous system including mathematical representation of satisficing solutions, approaches for prioritizing, removing, and varying constraints, and understanding limitations, bounds, and risks that satisficing solutions will not be appropriate, and (5) Understanding of implications of satisficing methods for human trust and performance, the differences between satisficing in human and engineered systems, and how they can be made complementary for future hybrid human/autonomous system teams. Note that the focus of this effort is not on the development of new platforms, sensors, computational hardware, or hardware of any kind.

Research Areas:

This topic is expected to motivate new collaborations between fields such as control theory, nonlinear dynamics, computational intelligence/robotics, machine learning, human factors, mathematics, cognitive/social/affective neuroscience, cognitive science, psychology, and biology. This topic is open to different sized teams with appropriate expertise across multiple of these disciplines, but does not require a single team to incorporate researchers from all of these areas. Cognitive Science can offer conceptual tools, such as computational cognitive models to provide principled frameworks. Cognitive Neuroscience can provide novel brain imaging techniques that can be used in conjunction with behavioral analysis to help identify both conscious and unconscious cues, decisions and decision points. Experimental Psychology can provide research methodologies and analytic techniques that combine the constraints of multiple behavioral and neuroscientific methodologies to infer and validate unconscious determinants of performance. Human factors can provide insight into the crucial experiential factors and conditions that promote the transition from conscious, controlled processing to unconscious, automated processing. Autonomous systems, control computational intelligence, and machine learning can provide modeling, testbeds, new automated methods for data collection in experiments, and rigorous mathematical methods and models as well as raising new research questions that support an engineering agenda

Thrust 2: Semantic and Visual Representation of Autonomous System Perceptual Data for Effective Human/Machine Collaboration

Background:

The past decade has seen substantial progress in moving from direct operator control to supervisory control of autonomous systems. A primary goal of these past efforts has often been to reduce the number of humans and/or the level of skill and training required to effectively manage a certain number of autonomous systems in a particular mission and environmental context. While this goal will remain important, future research will need to focus increasingly on enabling a mixed human/robotic team to operate as (or more) capably than a fully human one.

Objective:

Realizing the aforementioned requirements will require greatly improved understanding of how to achieve cognitively compatible and shared semantic and visual representations of data, knowledge, and information collected by the autonomous system. Additionally, attaining our goals requires that we close the gap in understanding myriad of types of raw perceptual data and autonomous system world model information. We must translate this into actionable information for warfighters that can be utilized in time-critical and communications limited environments.

We must focus on the relationship between how the task must be performed (and why it must be performed that way) and the capabilities and limitations of the human and automated team members. Advances in this area will require a generalized understanding of the relationships between characteristics of tasks (both how and why) and the impacts on the complementariness of human and autonomous system capabilities and limitations. This may apply to either supervisory control in which a warfighter has responsibility for a particular autonomous system or a teaming framework in which the autonomous system needs to share information with the human so that the team can complete its mission.

Research Areas:

Perceptual data in autonomous systems currently involves a host of sensors employed in various stages of research that allow an autonomous system the ability to perceive its surroundings. These include Light Detection And Ranging (LIDAR), LAser raDAR (LADAR, which is interchangeable with LIDAR). Millimeter Wave Radar (MMWR), stereovision, Electro-Optical (EO) /Infrared (IR), Sonar, and any combination of these. Moreover, there are new variants of these systems that will likely become commercially available, such as the use of flash LIDAR to replace more conventional scanning LIDARs. Perception of the environment is critical for both humans and machines as possible actions cannot be formulated until the world is perceived in some fashion. The attainment of our goals includes correcting the inverse relationship in the development of decision support technologies, shared representations, data fusion techniques, and novel visualization techniques that allow operators to make sense of such data, particularly in real time, such that reliable, actionable decisions can be quickly made. Examples of this may occur in a wide range of applications from a Marine using a UAV or UGV as a "wingman" to scout ahead to a diver working with an AUV for hull inspection to even manned vehicle problems such as brown out in helicopters.

While the focus of these previous programs has been the development of the actual sensor and underlying platform technology, there has not yet been any principled development or experimentation with decision support visualization or semantic ways of conveying information to this end, which includes issues such as how to convey uncertainty and how to achieve an appropriate match between human and autonomous understandings of the world. How to take autonomous system perception data and quickly turn it into actionable information for an operator under time pressure, in near-real time, is still an open, basic research question. As well, there are significant challenges in developing useful models of human behavior in these circumstances that are not narrow in scope and incorporate knowledge of how human performance can degrade.

Thrust 3: Mental Simulation as a Unifying Framework for Perception, Cognition and Control in Autonomous Systems and Dexterous Robots

Background:

Extending the capabilities of autonomous systems toward robust human-robot teams will involve making them trainable. A natural way to accomplish this would be to allowing them to learn new skills from mixtures of verbal instruction and physical demonstrations by human teachers. Many of the challenges involved require tremendous amounts of integration between the ongoing perception of human action, active understanding of verbal commands and determining how to reproduce the intended effects using the system's own sensorimotor resources. State-of-the-art computational techniques for each component of this problem are substantially different from one another and pose challenges for developing any sort of unified system. The goal of this effort is to produce a computational treatment of perception, high-level cognition and motor control for autonomous systems inspired by recent findings across the cognitive and neural sciences. The core idea defining the approach is the notion of a mental simulation. Simulations allow us to consider hypothetical, counterfactual, past, and future situations: all of which differ from reality in important ways. It has been suggested that mental simulation lies at the heart of perception, cognition and action. Even the simplest motor movements are thought to be accompanied by motor simulations that predict expected consequences and compare those predictions against actual outcomes. This simulate-and-predict scheme has also been implicated in the ongoing construction and organization of episodic knowledge and in planning. Simulation has also played a prominent role in more abstract cognitive capabilities such as understanding natural language, with evidence suggesting that hearing action-verbs produces action-appropriate neural activity in the motor cortex. Finally, mental simulation has been thought to play a substantial role in how we understand the perspective of others, including their beliefs, desires, and intentions. It has been suggested that perspective-taking of this type involves mentally simulating oneself as the other person, making adjustments where needed. In the case of student-teacher interaction, this latter type of mental simulation is critical. The teacher must accurately ascertain what the student knows, while deciding on how to demonstrate a particular skill or convey a piece of knowledge. The student must interpret these demonstrations and correctly decode the teacher's intention in order to successfully and robustly learn highly generalizable skills. Additionally, students engage in active learning, asking the teacher to elaborate or further demonstrate ill-understood or poorly learned skills. Mental simulation may then be used as a metacognitive device to diagnose their own lack of ability and to facilitate planning to ask follow-up questions of the instructor. In summary, mental simulation appears to be a unifying construct in the design of computational architectures for use onboard autonomous systems; especially those that need to socially interact with human teammates while engaged in tasks involving coordinated manipulation, mobility and on-the-fly learning. Critical Naval missions such as dexterous manipulation for EOD and room clearing are paradigmatic cases of situations in which a simulation-driven architecture would constitute a leap-ahead past current tele-operated systems.

Objective:

Develop and demonstrate socially-guided learning capabilities for autonomous systems that exploit mental simulation for the seamless integration of sensation, perception, cognition, active learning and control.

Research areas:

The goals associated with this topic are especially ambitious, and in no way are expected to be completely fulfilled in the short-term. The research questions that are central to a solution span multiple scales; from the architectural to issues at the level of integrating two or more modules, down to representational and inferential details. Proposals that address one or more of the following are welcome:

Exploration of architectures and learning mechanisms inspired that implement simulation-based perception, cognition and control. These may involve interlingua between the various perceptual, motor and cognitive modules; or they may involve casting algorithms for the latter in a uniform representational framework.

Using mental simulations explicitly as part of an overall strategy for deliberative on-line control. Having high-level inference expressed in simulative terms allows for top-down influences upon on-line action execution.

Learning generalizable action primitives by combining surface imitation, linguistic labeling and gesture. Using these to further learn complex skills via goal-based imitation.

Achieving goal-based imitation by combining high-level inference about the intentions associated with observed actions. Using inferred intentions along with planning and sensorimotor resources to robustly engage in goal-based imitation.

Learning new skills via natural language dialogue with a teacher.

Utilizing facial expression and gesture to speed learning. Modeling affect-transmission as a reinforcement signal during episodes of learning from social partners and teammates.

Exploration of active learning under a variety of circumstances. Principled mixed-initiative tele-operation and autonomous control of dexterous robotic manipulators.

Development of these computational techniques within the context of bimanual dexterous manipulation is of particular interest.

Thrust 4: Structured Machine Learning for Scene Understanding

Background:

The Navy is interested in developing the science base for building versatile autonomous agents/systems that are capable of learning complex concepts and reasoning about them so that they can function in open, uncertain environments. Much of the impressive advances in theory and practice of machine learning in recent years has been on classification-like approaches, where annotated exemplars are mapped into scalar outputs (e.g. nonlinear regression) or into simple symbols without internal structures (e.g. object classification). However, most concepts (tasks, entities, events, activities) have various levels of complexity with potentially deep internal structures that may include spatial layouts, temporal sequences, contextual relations, interactions, causal relations, etc. Automatic learning of such concepts from examples presents challenging problems that go well beyond current methods, which require the user to specify the input representation and provide a precise model for the concept structure. While current methods learn only the parameters of the model, we want to develop methods that can also learn the structure of the model. Another shortcoming of most machine learning approaches is that their focus is primarily on knowledge acquisition, rather than on representing and organizing the learned knowledge for optimizing methods for inference, prediction, planning, problem solving, etc. We need foundational research in machine learning and new computational approaches to be able to tackle the open problems mentioned above. Machine learning is a broad research area with potential impact on many domains; thus to bound the research in this effort, we focus on scene understanding from imagery and other information sources.

Objective:

The goal of this topic is to develop the mathematics and computational methods that make structured machine learning possible and tractable, methods that (a) do not require prescribed precise structure models and can discover new rules and update the model, and (b) are optimized for joint learning and reasoning.

Research Areas:

Users often have significant knowledge about the domain; however it is inefficient and expensive to code such knowledge in a precise and comprehensive model. Rather, it may be feasible to sketch an approximate and imperfect model and let the learning method correct and complete the partial model from examples.

The primary focus of this BRC topic is to develop efficient, robust computational methods for structured machine learning that can integrate domain knowledge. The focus should be such that, given an approximate, incomplete structure model, the learning method can discover new rules and update the model. We are also interested in learning generative models that adapt and provide models consistent with the task and the level of available information and are optimized for joint learning and reasoning. We also expect to develop a principled framework that unifies different approaches to structured learning and elucidates their relative strengths.

The focus also includes machine learning approaches which must also be addressed. Good input features are critical to learning good models, however it is often challenging to hand-craft good features. Therefore, we want to develop methods that can learn optimal input feature. Additionally, preparing well-annotated training datasets are expensive and often impossible. Hence, we want to develop learning approaches that can effectively and reliably exploit partially annotated, imperfect training data. Finally, learning methods typically become computationally intractable when faced with high-dimensional models and large training datasets. Thus, we want to develop learning methods that are scalable.

Thrust 5: Integrated Autonomy for Long Duration Operations

Background:

Unmanned Vehicles (whether ground, air, sea-surface or underwater – hereafter UXVs) typically operate for short episodes and encounter little stress on their machine self-saving mechanism or on the adaptation of the autonomy to complete missions. By short episodes we refer to timeframes of hours or a few days and with the human not far from the loop for mission re-interpretation, interpretation of engineering data that indicates a malfunction and or hostile environment and handling a particularly complex situation or environment. Extensive manning is necessary because many of today's state of-the-art autonomy methods are not robust and fundamentally not scalable to longer duration missions in larger scale and more complex environments with characteristics typical of many naval missions of interest. Methods break down at longer temporal and spatial scales in everything from lower-level localization and mapping approaches to knowledge representation and higher-level planning and learning. In some cases, these are limitations that can be proven theoretically. The situation becomes even more difficult with multiple systems and in contested environments. The practical application of autonomy shows all three areas – theory, algorithm/software, and hardware- limit the ability of UXVs to carry out long-duration missions.

Objective:

The objective of this program is to capitalize on recent basic sciences advances in the fields of computational sciences, mathematics, computational hardware, and autonomy sciences to make the leap ahead to long duration autonomy via multi-disciplinary advances in interrelated research problems. These research areas include: (1) Long-term learning, planning and exploration strategies including mission tradeoffs involving resource management over very long time periods (2) Meta-cognition/introspection to identify unexpected situations/states and determine policies to robustly deal with them, (3) Persistent estimation in dynamic environments and dealing with dynamic changes in the environment on a wide range of time scales, (4) limited types of human/system interaction in enabling long-term operations and utilizing these systems, (5) rigorous validation of system reliability for very long periods of time, and (6) strategies for autonomous adaptation / compensation for mission durations that exceed subcomponent reliability.

Particular focus will be on research that addresses the environmental adaptation and learned behavior feedback to vehicle control and over the duration of weeks and months focusing on the meshing of the algorithms, computational architecture, and computational hardware to deal with problems such as accumulated drift of non-global signals, interrupted/unreliable sensor feeds (e.g. GPS), and the system self-calibration during long missions. For autonomous sea surface vehicles, solutions that deal with a highly dynamic and degraded environment, such as high density traffic, high vehicle speeds, obstacles, and degraded sensor performance/perception because of weather or sea state would be of interest; we anticipate that the reaction speed of the computations becomes an additional challenge for this application. These are just examples of research challenges in areas (1) and (2).

Research Areas:

Research that uses machine learning, reasoning, and meta-cognition needs to provide the vehicle with self-awareness, diagnosis and self-healing software that is beyond hierarchical or interval programming is of interest. Additionally, new methods are sought to help vehicles sense, diagnose, and compensate or fix their engineering crisis (that is to become self-healing). This topic requires fundamental understanding of how to mesh complex concepts of machine self-awareness and through-the-sensor fed machine learning routines. Proposals on this topic should incorporate consistent computational methods and computational hardware that can provide for both basic housekeeping and survival and utilization of the environment for mission completion. These are examples of research challenges in areas (2) through (6).

The expected outcome(s) of this program are integrated approaches for investigating non-brittle algorithms that work on cutting edge processors that are low power but computational advanced. By meshing the hardware software, sensor integration we wish to move the field forward for long duration autonomy.

III. WHITE PAPER SUBMISSION

White papers are strongly encouraged for all offerors seeking funding. Individual white papers should address one of the 5 thrusts listed in Section II only. White papers should be submitted according to the format requirements found in Section IV, item 2a or ONRBAA13-001.

Each white paper will be evaluated by the Government to determine whether the technology advancement proposed appears to be of particular value to the Department of the Navy. Initial Government evaluations and feedback will be issued via e-mail notification from the Technical Point of Contact. The initial white paper appraisal is intended to give entities a sense of whether their concepts are likely to be funded.

Detailed Full Proposal (Technical and Cost volumes) 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 Government. However, any such encouragement does not assure a subsequent award. Full Proposals may also be submitted by any offeror whose white paper was not identified as being of particular value to the Government or any offeror who did not submit a white paper.

For white papers that propose efforts that are considered of particular value to the Navy but either exceed available budgets or contain certain tasks or applications that are not desired by the Navy, ONR may suggest a full proposal with reduced effort to fit within expected available budgets or an effort that refocuses the tasks or application of the technology to maximize the benefit to the Navy.

White papers should not exceed 4 single-sided pages, exclusive of cover page and resume of principal investigator, and should be in 12-point Times New Roman font with margins not less than one inch.

The cover page should be labeled "2013 Office of Naval Research (ONR) Research Opportunity: Basic Research Challenges in the Science of Autonomy:[name of the single thrust area that the white paper addresses] " and include the following information: title of the proposed effort, technical point of contact, telephone number, fax number, and e-mail address.

The 4-page body of the white paper should include the following information:

(1) Principal Investigator;

(2) Relevance of the proposed effort to the research areas described in Section II;

(3) Technical objective of the proposed effort;

(4) Technical approach that will be pursued to meet the objective;

(5) A summary of recent relevant technical breakthroughs; and

(6) A funding plan showing requested funding per fiscal year.

A resume of the principal investigator, not to exceed 1 page, should also be included after the 4-page body of the white paper.

White papers should be submitted electronically to the program technical points of contact listed below. Files exceeding 10MB in size should not be emailed, but instead transitted via a file transfer service, for example AMRDEC Safesite, https://safe.amrde.army.mil, or mailed on DCROM or DVD. White papers shall be in Adobe PDF format (preferred) or in Microsoft Word format compatible with MS Office 2007

To ensure full, timely consideration for funding, white papers are encouraged by the date specified below in Section VI, Significant Dates and Times. White papers received after that date will be considered as time and availability of funding permit.

IV. FULL PROPOSAL SUBMISSION AND AWARD INFORMATION

Full proposals should be submitted under ONRBAA13-001 by the date identified below in Section VI, "Significant Dates and Times." Full Proposals received after that date will be considered as time and availability of funding permit. ONR anticipates that only grants will be issued for this effort. All full proposals must be submitted through www.grants.gov in accordance with accordance with the instructions in BAA 13-001, Section IV, Application and Submission Information, item 5, Submission of Grant Proposals through Grants.gov. The following information must be completed as follows in the SF 424 to ensure that the application is directed to the correct individual for review: Block 4a, Federal Identifier: Enter N00014; Block 4b, Agency Routing Number, Enter the three (3) digit Program Office Code (e.g., "311") and the Program Officer's name, last name first, in brackets ("[lastname, firstname]") for the individual identified below for the single thrust the proposal is addressing. All attachments to the application should also include this identifier to ensure the proposal and its attachments are received by the appropriate Program Office.

ONR plans to fund multiple awards using Basic Research funds with a value of $100,000 to $150,000 per investigator per year. However, lower and higher cost proposals will be considered. The period of performance for projects may be from one to four years. Total available funding for this research effort is expected to be $5.2M. The expected funding is divided per each individual thrust as follows: 1) FY13 $1M, 2) FY14 $1.2M, 3) FY15 $1.5M, and 4) FY16 $1.5M.

Although ONR expects the above described program plan to be executed, ONR reserves the right to make changes including the right to make no awards.

Anticipated dates for funding decisions and award dates are identified below in Section VII, "Significant Dates and Times."

V. POINTS OF CONTACT

In addition to the points of contact listed in ONRBAA13-001, the specific points of contact for this announcement are listed below:

Technical Points of Contact:

Thrust 1

Understanding Satisficing in Human, Animal, and Engineered Autonomous Systems for Fast Decision-making with Limited Data:

Marc Steinberg, marc.steinberg@navy.mil Program Office Code 351

Julie Marble, julie.marble@navy.mil

Harold Hawkins, harold.hawkins@navy.mil

Thrust 2

Semantic and Visual Representation of Autonomous System Perceptual Data for Effective Human/Machine Collaboration

Mary Cummings, mary.cummings@navy.mil Program Office Code 352

Marc Steinberg, marc.steinberg@navy.mil

Julie Marble, julie.marble@navy.mil

Thrust 3

Mental Simulation as a Unifying Framework for Perception, Cognition and Control in Autonomous Systems and Dexterous Robots

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Paul Bello, paul.bello@navy.mil

Thrust 4

Structured Machine Learning for Scene Understanding

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Paul Bello, Paul.Bello@navy.mil

Jason Stack, Jason.Stack@navy.mil

Thrust 5

Integrated Autonomy for Long Duration Operations

Terri Paluszkiewicz, terri.paluszkiewicz@navy.mil Program Office Code 32

Jason Stack, Jason.Stack@navy.mil

Marc Steinberg, marc.steinberg@navy.mil

Business Point of Contact:

Lynnette Desorcie, Contracting Officer, lynnette.desorcie@navy.mil

VI. SIGNIFICANT DATES and TIMES

Event	Date
Recommended White Paper Submission Date	1 Feb 2013
Notification of White Paper Evaluation	16 Feb 2013
Recommended Full Proposal Submission Date	25 Mar 2013
Notification of Selection: Full Proposals	15 Apr 2013
Awards*	10 Jun 2013

Note: * These are approximate dates.

VIII. Submission of Questions

Any questions regarding this announcement must be provided to the Technical Points of Contact and/or Business Point of Contact listed above. All questions shall be submitted in writing by electronic mail.

Answers to questions submitted in response to this Special Notice will be addressed in the form of an Amendment and will be posted to the following web pages:

- Federal Business Opportunities (FEDBIZOPPS): https://www.fbo.gov/
- Grants.gov: http://www.grants.gov
- ONR Broad Agency Announcement (BAA) Webpage: http://www.onr.navy.mil/Contracts/Funding-Opportunities/Special-Notices.aspx

Questions regarding White Papers should be submitted no later than two weeks before the recommended date for receipt of White Papers. Questions regarding Full Proposals should be submitted after submission of White Papers and no later than two weeks before the recommended due date for receipt of Full Proposals. Questions received after the dates indicated will not be acknowledged and will be answered only as time permits.