Special Notice 13-SN-0016
Special Program Announcement for 2013 Office of Naval Research Research Opportunity:
Proactive Decision Support

I.   INTRODUCTION

This announcement describes a research thrust, entitled "Command Decision Making" 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 "Warfighter Performance (Code 34)" sub-section. The submission of proposals, their evaluation and the placement of research grants and contracts will be carried out as described in that Broad Agency Announcement.

The purpose of this announcement is to focus attention of the scientific community on current warfighter decision making needs for Proactive Decision Support (PDS) tools, and the development of theories and models that would enable a science of Context-Driven Decision Making (CDDM). The Command Decision Making program (CDM) will pursue basic and applied research to develop algorithms, methods, techniques and strategies for modeling missions, tasks and operational context in order to dynamically anticipate a warfighters information needs, and then present information to enable the decision maker to make better decisions, faster than they would without PDS.

II.   TOPIC DESCRIPTION

The Command Decision Making (CDM) program is seeking to invest in basic and applied research that aims to mitigate the challenges faced by today's decision makers. The purpose of this topic is to identify, understand, and resolve key issues, develop and mature algorithms and methods; determine and demonstrate performance of algorithms, methods, techniques, and strategies for automated computational methods and information systems that support decision making. At the center of this new research initiative is the idea that existing or newly developed algorithms applied to create a context awareness of decision makers' missions and tasks. Given dynamic algorithms of context that are sufficient to understand missions and tasks (i.e. goal driven behavior) it will then be possible to develop and demonstrate PDS tools that will anticipate the decision and information needs of decision makers. This will enable decision makers to effectively address operational complexity and make more optimal decisions, faster. The result of this effort will be algorithms, methods, techniques, and strategies that would be a basis for a Science of Context-Driven Decision Making (CDDM) and the development of practical Proactive Decision Support (PDS) tools.

Background:

Today's warfighters operate in a highly dynamic world with much uncertainty and multiple, competing, mission and task demands. Timely and effective decision making in this environment is increasingly challenging. The phrase "too much data – not enough information" is a common refrain in most combat and command centers and the modern pace of operations often means that warfighters find themselves engaging in tasks in ways, and in combinations, for which they hadn't planned, and for which they may not be prepared. Finding and integrating decision-relevant *information* (vice simply data) is hard. Mission and task context is often absent, or sparsely/poorly represented, in most information systems, thus requiring decision makers to reconstruct or infer it through laborious and error-prone internal processes as they attempt to comprehend and act on data. These factors force decision makers to multi-task amongst many competing and often conflicting mission objectives concurrently, further complicating the management of information and decision making. Clearly, there is a need for advanced mechanisms for the timely presentation of data that has value and relevance to decisions, (i.e. information).

Decision support has been defined as the presentation of data so that it "gets the decision maker in the ballpark" (Morrison, Kelly, Moore & Hutchins, 1998). When properly applied, it presents information around a decision such that the decision maker readily recognizes its significance and the implications of the information for the required decision. Decision support can make a difference for operational decision makers, however it has been typically designed to address a limited scope of tasks in a fairly narrow context. For modern warfighters operating in teams, with less bounded and dynamic task domains, decision support effectively remains in its infancy. What is needed are algorithms that can computationally model tasks in the context of operational environments so that the decision support can emulate the value added of a command's support staff by recognizing significant changes in the environment, and dynamically adapting the information presented.

PDS will build on cognitive science theory and modern information systems technologies to *"get the decision maker in the ballpark"*[1] by anticipating the decisions and data needs of a decision maker at key stages in their decision sequence. Developing techniques to automatically define and manage a decision maker's context is going to be critical for developing the next generation of decision support.

Our aim is to demonstrate paradigm shifting, scalable, techniques for dynamically detecting conditions for significant decision events based on mission and task context in order to structure and present information that would facilitate a decision maker(s) making more optimal decisions. Our expectation is that such research and development would specifically complement decision making in operational areas such as Command & Control, resource allocation, autonomy management, cyber security, and others.
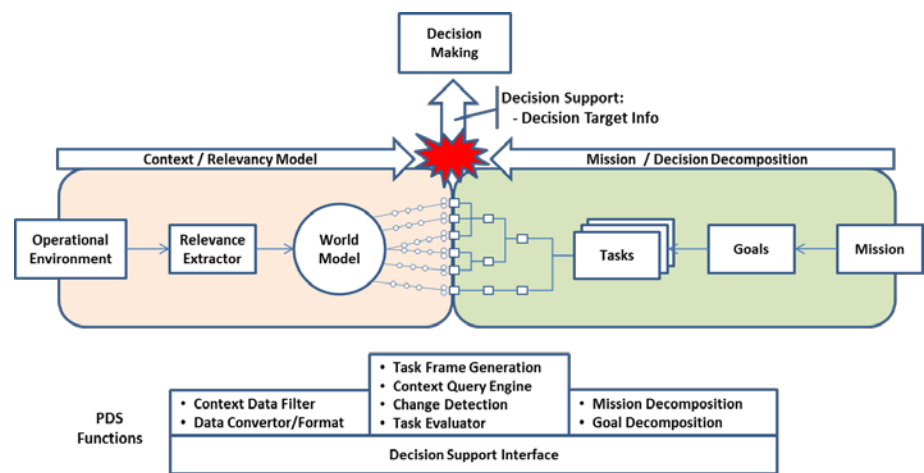
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[1] Morrison, J.G., Kelly, R. T., Moore, R. A., & Hutchins, S. G. (1998). Implications of Decision-Making Research for Decision Support and Displays. In: Salas, E. & Canon-Bowers, J., (Eds.), *Making Decisions Stress: Implications for Individual and Team Training*, (375-406).

Objective:

The Office of Naval Research (ONR) is interested in receiving proposals for the CDM program. Proposals should address the requirements for science that would address the mechanisms for Context Driven Decision Making, and technologies that would enable the development of Proactive Decision Support tools. The general interest is in innovative science and technology to model/infer the user's decision making behavior, to enable a *utility-based* exploitation of information needed to support those decisions, as well as the active modeling of "decision trajectories[2]" so as to provide time critical information supporting anticipated decisions. The active modeling of context related to tasks is expected to be a significant research problem that will contribute to the development of proactive decision support. It is expected that this research and development effort will demonstrate significant operational impact on the achievement of mission objectives and goals.

Proactive Decision Support will exploit Predictive Models that leverage from advances being made within the fields of decision theory, artificial intelligence, basic and applied mathematics, language reasoning, knowledge ontologies, graph analytics, practical reasoning from linguistics and meaning, as well as the application of pragmatics. Specific areas of interest from these fields expected to contribute to this research and development include: human behavior modeling and inference, team decision making, knowledge creation and transfer, and understanding the processes through which mental models for goal driven behavior are created and modified. New scientific breakthroughs will be necessary to dynamically model missions, tasks and workflow, and subsequently forecast the decisions in a given context. Models will need to maximize utility by supporting appropriate temporal reasoning; as well as algorithms to discover & exploit decision-relevant information; and enable the tracking and optimization of optimal decision trajectories.

The development of predictive models will be a key aspect of Proactive Decision Support. These models will infer context and decision processes based on, for example, user interaction with data and information. Such decision processes would support the overall mission or goal the user is interested in

Applying science at the intersection of DATA and TASKS

achieving. Techniques to model the utility of the data or information for the decision making task will, therefore, be of interest. The decision models, when coupled with the supporting data or information, would enable automated inference engines to reason about the types of decisions

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[2] Decision Trajectories are descriptive of patterns of behavior that may be used to infer goal-driven decisions.
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of interest to the decision-maker, as well as what information might be *pre-staged* to support those decisions. This Special Notice is interested in the following topics:

1. **Decision Models for goal-directed behavior:** **(a)** Techniques for inferring a users' decision context (mission, tasks, goals, etc.) based on, for example, information seeking/interaction/analysis patterns as well as identifying, computationally representing and monitoring such implicit changes to context. **(b)** Mathematical models of decision making behavior (state transitions) in a given decision context based on, for example, information seeking/interaction/analysis patterns. **(c)** Techniques for determining / measuring context and decision making behaviors based on other modes are also of interest. **(d)** The techniques for inferring decision context, and mathematical models that reflect decision making behaviors should enable appropriate information extraction and reasoning engines to be developed for assessing whether new information has high value for a given decision behavior in a given context. Also of interest are techniques that can broker across, generalize, or aggregate, individual mathematical models such that they can be applied in broader contexts. Similarity metrics that enable the selection of the appropriate model (mathematical or otherwise) for a given decision context, and intuitive visualizations to comprehend decision models are also of interest. Related topics include techniques to represent states of the world from which decision models may be developed.

2. **Information Extraction and Valuation:** **(a)** Locating, assessing, and enabling through *utility-based* exploitation, the integration of high-value information (HVI) for decision making is of interest. **(b)** Techniques that can extract and quantify the value of HVI (structured, semi-structured and unstructured) in a given decision context in relation to a decision-making model to enable the *pre-staging* of relevant data and information (while representing, reducing and/or conveying information uncertainty). **(c)** Of particular interest are technologies that are able to handle the volume, variety and veracity of data and information with specific time constraints to support operational decision making. **(d)** Specific challenges include how to define and value *substantively novel* information in relation to context and decision models, and approaches for understanding and assessing the *information accumulation* problem in revealing context or supporting the decision selection process (how much information is enough, and what is the point of *diminishing returns*).

3. **Decision Assessment:** Modeling decision "normalcy", in order to identify decision trajectories that might be considered outliers and detrimental to achieving successful outcomes in a given mission context are of interest, and techniques that proactively induce the correct decision trajectory to achieve mission success. Metrics for quantifying decision normalcy in a given context, which can be used to propose alternate sequences of decisions, or induce the exact sequence of decisions while *pre-staging* the appropriate information needed to support the evaluation of those decisions are of interest. Lastly, techniques to rapidly assess the outcome of the decisions are desired, and may include the use of simulations.

4. **Operator/Human Issues**: Understanding, modeling and integrating the human decision making component as an integral part of the aforementioned thrusts. The objective is to provide the underlying science and develop and demonstrate the process of incorporating human capabilities in proactive decision making in each of the three thrusts, respectively, by: **(a)** representing human decision-making behavior computationally (to include potentially the creative, intuitive, analytical, crosscutting and dynamic aspects of human intelligence); **(b)** to mathematically capture the human assessment of information value, risk, uncertainty, prioritization, projection and insight; and **(c)** computationally enabling the process of human foresight, intent and recognition of meaning.

IV.   WHITE PAPER SUBMISSION

Although not required, white papers are strongly encouraged for all offerors seeking funding. 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 "White Paper for ONR 2013 Research Opportunity: Command Decision Making" and include the following information: Title of the proposed effort, Technical point of contact, POC telephone number, fax numbers, 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: Jeffrey.g.morrison@navy.mil. Files exceeding 10MB in size should not be emailed, but instead transmitted 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 should be submitted **no later than May 30th, 2013**. White papers received after that date will be considered as time and availability of funding permit.

The planned date for completing the review of white papers is **June 30, 2013**.

V.   FULL PROPOSAL SUBMISSION AND AWARD INFORMATION

Full proposals should be submitted under **ONRBAA13-001** by **July 30, 2013**. Full Proposals received after that date will be considered as time and availability of funding permit.

ONR anticipates that both grants and contracts will be issued for this effort.

Full proposals for contracts should be submitted in accordance with the instructions at Section IV, Application and Submission Information, item 2.b, Full Proposals and item 6, Submission of Full Proposals for Contracts, Cooperative Agreements, and Other Transactions. The Technical Proposal/Content shall be single spaced and not exceed15 pages. The cover page, resumes, bibliographies, and table of contents are excluded in the page count. For contract proposal submission, 5 hardcopies and one (1) electronic submission on CD-ROM are requested.

Full proposals for grants should be submitted in accordance with the instructions at Section IV, Application and Submission Information, item 5, Submission of Grant Proposals through Grants.gov. All full proposals for grants must be submitted through www.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 341) and the Program Officer's name, last name first, in brackets (Morrison Jeffrey). All attachments to the application should also include this identifier to ensure the proposal and its attachments are received by the appropriate Program Office.

VI.   SIGNIFICANT DATES AND TIMES

Event	Date	Time
Recommended White Paper Submission	May 30, 2013	4:00 PM EST
Notification of White Paper Valuation*	June 30, 2013	None
Recommended Full Proposal Submission	July 30, 2013	4:00 PM EST
Notification of Selection: Full Proposals *	September 30, 2013	None
Awards *	February 01, 2014	None

Note: * These are approximate dates**.**

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VII.   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:
Dr. Jeffrey G. Morrison
ONR Code 341 – Warfighter Performance
Command Decision Making Division
Office of Naval Research
875 North Randolph Street, Room 1046
Arlington, VA 22203-1995
Email: Jeffrey.g.morrison@navy.mil

Business Point of Contact:
Ganesh Krish
Contract Specialist
Office of Naval Research
875 North Randolph Street, Room 1046
Arlington, VA 22203-1995
Email: Ganesh.Krish@navy.mil

VIII.   ADDRESS FOR THE SUBMISSION OF WHITE PAPERS AND FULL PROPOSALS FOR CONTRACTS

White Papers must be emailed to Dr. Jeffrey G. Morrison at the following email address: Jeffrey.g.morrison@navy.mil. The DVD or CD-ROM of the Full Proposal including all supporting documentation should be sent to the Office of Naval Research at the following address:

Primary Point of Contact
Office of Naval Research
Attn: Jeffrey Morrison
ONR Department Code 341
875 North Randolph Street – Room 1046
Arlington, VA 22203-1995

IX.   SUBMISSION OF QUESTIONS

Any questions regarding this announcement must be provided to the Technical Points of Contact and/or the 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) Webpage – https://www.fbo.gov/
- Grants.gov Webpage – http://www.grants.gov/
- ONR Special Notice Webpage - http://www.onr.navy.mil/Contracts-Grants/Funding-Opportunities/Special-Notices.aspx

Questions regarding **White Papers or Full Proposals** should be submitted NLT two weeks before the dates recommended for receipt of White Papers and/or Full Proposals. Questions after this date may not be answered.

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