

Request for Information (RFI)
DARPA-SN-11-36
Insight Focused Incubator

The Defense Advanced Research Projects Agency (DARPA) Information Innovation Office (I2O) is requesting information on innovative methodologies and approaches to enable revolutionary advances in Intelligence, Surveillance, and Reconnaissance (ISR) systems, in support of the Insight program.

BACKGROUND:

DARPA's Insight program is developing the next generation ISR exploitation and resource management system to enable detection of threat networks and irregular warfare operations, spanning rural to urban areas, through combination and analysis of information from imaging and non-imaging sensors and other sources. The technical approach is to:

- Build model-based correlation, behavioral modeling, and threat network analysis tools to automatically combine data across sources and manage uncertainty;
- Build resource management tools to identify collection opportunities, and enable efficient use of multi-intelligence (multi-INT) sensors and platforms across missions;
- Build a unified data management and processing environment to support data and processing normalization, and enable rapid integration of new data sources, exploitation algorithms, and analysis methodologies;
- Integrate human and machine processing, including visualization, hypothesis manipulation, and on-line learning.

Additional information on the Insight program can be found at:

http://www.darpa.mil/Our_Work/I2O/Programs/Insight.aspx.

The Insight platform will be designed as a vibrant ecosystem that supports open, modular ISR software and hardware components. A 'plug and play' modular architecture will enable the interoperability of the various system components, including the ability to easily add, remove, substitute, and modify software and hardware components. This will enable a flexible and agile ISR system in which different processing threads, workflows, algorithms, visualization approaches, and processors can be rapidly inserted to adapt to any combination of sensors, missions, and technologies.

As part of the Insight platform, the Insight program is developing a virtual environment (VE) capability to enable system evaluation using simulated sensor data, augmented with real-world collected data, within a simulated world of various threats, terrains, and terrain features. The VE will enable closed-loop system evaluation within multiple concepts of operation, alternative sensor mixes, and multiple exploitation algorithm solutions. A standalone VE with user interface capability will be available by mid-Phase 1 of the Insight program.

INFORMATION REQUESTED:

DARPA intends for the Insight Focused Incubator to: 1) demonstrate Insight's open, modular platform capability, and 2) incubate innovative methodologies and approaches to solving critical

technological challenges in ISR system development and evolution. To appropriately frame the Focused Incubator concept, DARPA is requesting information on innovative approaches and methodologies that can be applied in the following broad areas relating to ISR exploitation, resource management, visualization, and simulation:

- I. Multi-INT data integration, correlation, fusion, and exploitation:
 - a. Geo-registration. Given platform location estimations and sensor pointing accuracies, efficient algorithms to register various sensor (imaging and non-imaging) outputs to a high-resolution earth model with traceable high-precision accuracy.
 - b. Tracking. Video, ground moving target indicator (GMTI), signals intelligence (SIGINT):
 - i. Long term.
 - ii. With multiple conditional constraints.
 - iii. Feature-aided.
 - c. Threat network detection/estimation.
 - d. Behavioral (pattern-of-life) modeling including cultural, social, and insurgency dynamics.
 - e. Anomaly detection.
 - f. Algorithms for sensor data including: electro-optical color video (EO), infrared video (IR), synthetic aperture radar (SAR), GMTI, video moving target indicator (VMTI), SIGINT, wide area motion imagery (WAMI), multispectral imagery (MSI), hyperspectral imagery (HSI), Light Detection and Ranging (LIDAR), crowd- and open-source material, text chats, soldier information, human intelligence (HUMINT), electronic social media, as well as other emerging sensor modalities and sources.
 - g. Automated solutions which react to situational dynamics and contingencies in real-time. Includes concepts to accommodate varying degrees of autonomy and varying mechanisms for operator interaction. Includes advanced concepts of autonomy capable of executing complex missions with minimal human intervention.
 - h. Situation Understanding. Advanced representation and inferencing concepts that interpret contextual factors, associate situational features with *a priori* knowledge, and produce an understanding of the implications of particular phenomena and events within a “situation.”
 - i. Knowledge Discovery. Methods enabling the synthesis of new information which may include feature extraction/correlation, advanced inferencing techniques, and off-line/on-line learning.
 - j. Prediction. Target motion prediction and bounding as inferred from environmental factors (e.g., object class/type, terrain, road network, etc.) and tactical considerations (e.g., intent).
 - k. Data management including representation, indexing, and retrieval.
 - l. Data mining across all sources, both real-time and forensic.
 - m. Other (as suggested by respondents).
- II. Sensor and platform resource tasking and management, including cross-cueing:
 - a. Methods for low latency, scalable, dynamic re-planning.
 - b. Methods that successfully arbitrate across multiple information needs to support an *active sensing* process with multiple functions occurring simultaneously,

including opportunistic and serendipitous collections, to drive increased knowledge for exploitation.

- c. Robust to unanticipated contingencies including both weather and scenario-specific contingencies such as airspace de-confliction.
 - d. Decentralized and hierarchical methods which divide the computational re-planning load across platforms and/or their ground stations.
 - e. Methods for information needs generation to support exploitation functions.
 - f. Nimble (rapid, flexible) control of new, high complexity sensors with multiple modes, multiple waveforms, and rich sets of sensor parameters.
 - g. Control of teams and team decision-making paradigms, including human-in-the-loop and human-on-the-loop.
 - h. Other (as suggested by respondents).
- III. Human computer interface and mixed-initiative reasoning:
- a. Algorithms and data processing technologies to improve human-machine processing of multi-INT data streams.
 - b. Other (as suggested by respondents).
- IV. Other (as suggested by respondents).

RFI respondents are encouraged to submit ideas that address one or more of the areas identified above. DARPA invites participation from all those engaged in related research activities and appreciates responses from all capable and qualified sources including, but not limited to: universities, university-affiliated research centers, and private or public companies. Respondents from traditional defense/intelligence community organizations are encouraged to respond to this RFI, as are non-traditional academic and commercial organizations. Teams comprised of a mix of any of the aforementioned organizations and/or any other interested parties are also welcomed and encouraged to respond.

SUBMISSION FORMAT:

Format specifications for submissions include: 12 point Times New Roman font, single-spaced, single-sided, 8.5-inch by 11-inch paper, 1-inch margins in either Microsoft Word or Adobe Acrobat format. For charts, either Microsoft PowerPoint or Adobe Acrobat format will be accepted. Each submission will consist of:

- Cover Page (1 page):
 - a. Title.
 - b. Organization.
 - c. Technical point of contact (name, address, telephone number, facsimile number, and electronic mail address).
 - d. Administrative point of contact (name, address, telephone number, facsimile number, electronic mail address).
- Summary of the technical idea/concept for any of the broad areas specified above (1 page limit per idea submitted). Summarize technical ideas/concepts, associated technical challenges, as well as approaches to address the enumerated technical challenges.
- One quad chart and up to four additional charts summarizing the idea/concept and key aspects (5 page limit per idea submitted).
- Team biography consisting of a brief summary of each of the team members, including ongoing and/or prior work and background (1 page).
- Bibliography of relevant publications (1 page).

- If responding to “I.m.”, “II.h.”, “III.b.”, or “IV.”, the items marked “Other (as suggested by respondents)”, provide support for the proposed area and its perceived merits and potential contributions for advancing Insight’s capabilities (up to 5 pages).
- Opinion(s) and/or comment(s) on the following aspects of the anticipated Focused Incubator: structure and format, cost and schedule realism, software and data requirements, other support requirements, platform selection, etc. (1 page) (See TENTATIVE STRUCTURE below).

Respondents are encouraged to be as succinct as possible while providing sufficient detail to adequately convey the technical concepts, challenges, and approaches.

TENTATIVE STRUCTURE:

As presently conceived, the Insight Focused Incubator would be structured in three phases (a base phase and two option phases), each of six months in length. Offerors would propose against the full 18-month period of performance. Each phase would require progressively greater sophistication to achieve success, and performers would be down-selected prior to advancing to the next consecutive phase. Anticipated funding levels range from \$400K to \$800K per performer per phase.

DARPA is considering three prospective platforms for the Insight Focused Incubator:

1. Integrated Insight system. Performers would require a compute cluster with at least 240 cores.
2. Standalone Insight VE with programmatic control to allow control of all sensors, which provide first-level exploitation products (e.g., points of interest, vectors [tracks], or activities within an area of interest). Performers would require a high-end workstation.
3. Raw data from an existing high-fidelity, ground-truthed, coincident, multi-source data collection (i.e., the DARPA Global ISR Data Collection (GISR-DC1)). Performers would require a standard workstation.

For all three platforms, raw data collected under GISR-DC1 would be made available to performers and would require proof of eligibility to access U.S. Only/ International Traffic in Arms Regulations (ITAR) restricted data. For the first two platforms, the Insight VE in binary form would be available to performers. For the first platform, the complete Insight codebase in binary form would be made available to performers. Please note that performers may be required to provide their own equipment/hardware as DARPA does not intend to make available or fund the purchase of equipment for performer use.

DARPA may post a Broad Agency Announcement and/or other solicitation related to the Insight Focused Incubator at a later date, but DARPA is not obligated to do so, and this RFI does not signify any firm intention by DARPA to do so.

SUBMISSION INSTRUCTIONS:

Responses to this RFI must be submitted via email to InsightRFI@darpa.mil prior to 12:00 pm Eastern Time, June 30, 2011. Responses may be submitted any time between publication of this announcement and the due date. Please include "Insight Focused Incubator RFI" on the subject line of all correspondence.

DISCLAIMER:

This RFI is issued solely for information gathering and planning purposes; this RFI does not constitute a formal solicitation for proposals. In accordance with the Federal Acquisition Regulation (FAR) 15.201(e), responses to this RFI are not offers and cannot be accepted by the Government to form a binding contract. DARPA will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that DARPA is under no obligation to acknowledge receipt of any information received or provide feedback to respondents with respect to any information submitted under this RFI. Response to this RFI is strictly voluntary and is not required to propose to any subsequent solicitations related to this RFI, if any.

Submissions may be reviewed by DARPA and other Government personnel (e.g., the Air Force Research Laboratory) and DARPA support contractors (e.g., Scitor Corporation, CACI International, Inc.). All personnel with access to the submissions will be covered by a legally-binding non-disclosure agreement.

No classified information shall be included in the RFI response.

Submissions containing proprietary data/information should have the cover page, and each page containing proprietary data/information, clearly marked as containing “proprietary” data/information. It is the respondent’s responsibility to clearly define to the Government what is considered proprietary data/information.

POINT OF CONTACT:

Mr. Ben Cutler, Program Manager, DARPA/I2O. All inquiries on this RFI must be submitted to InsightRFI@darpa.mil. No telephone inquiries will be accepted.