Northrop Grumman Information Systems (NGIS)
Intelligence Systems Division (ISD)

2011 Research Challenge
Broad Area Announcement (BAA)
1. Overview Information

Sponsor – Northrop Grumman Information Systems, Intelligence Systems Division

Announcement Type – Collaborative Research Broad Area Announcement

Key Dates:

BAA Posted: **6 September, 2011**

Proposals Due:

Wave 1, Fall 2011/Winter 2012: **31 October, 2011**

Wave 2, Spring/Summer 2012: **5 March, 2012**

Award Selection: Proposal Deadline + 30 days (nominal)

**Anticipated Awards and Values** – Four to six awards, priced from $25k to $50k each are anticipated for this research cycle, subject to availability of funds.

**Technical POCs:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Region</th>
<th>Email Address</th>
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</thead>
<tbody>
<tr>
<td>Dr. Matthew Clarke</td>
<td>East Cost</td>
<td><a href="mailto:Matthew.Clarke@ngc.com">Matthew.Clarke@ngc.com</a></td>
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<tr>
<td>Dr. Anton Pfeiffer</td>
<td>West Cost</td>
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<tr>
<td>Daniel Reitz</td>
<td>Rocky Mountain</td>
<td><a href="mailto:Daniel.Reitz@ngc.com">Daniel.Reitz@ngc.com</a></td>
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**BAA Mailbox:** Please use the appropriate regional contact listed above for questions and electronic proposal submission.

1.1. **Collaborative Research Opportunity Description**

Northrop Grumman sponsors university research engagements to leverage the resources of our local university communities in addressing key challenges to global security. This BAA is a central component in this initiative as it provides a vehicle for university research groups to use novel techniques to solve problems related to integrated intelligence. This BAA targets research for potential award in 2011 and 2012. While this round of funding is geared toward research executed in 2011/2012, this engagement seeks to foster enduring relationships with research groups that will encompass future research, collaboration, and teaming.
2. Full Text of Announcement

2.1. Introduction

Northrop Grumman Intelligence Systems Division (ISD) focuses its research on approaches that assist the intelligence enterprise in observing, gaining awareness of, and addressing modern threats. Investment focuses on mission management, collection, information access, and analytic activities that support customers with the following missions:

- Counterterrorism
- Weapons of mass destruction (WMD) proliferation
- Clandestine technology
- Data exfiltration from unattended sensors
- Space vulnerabilities and survivability
- Cyber security/information operations

Northrop Grumman is increasingly solving hard problems in these domains through the use of multiple observable phenomenologies made available through multiple sources. This is the so-called multi-INT/multi-source environment, in which Northrop Grumman ISD aims to advance the state of the art. Though modern threats span multiple domains, the community’s ability to respond (reactively or proactively) universally depends upon three basic capabilities. The first critical capability is a processing architecture that enables collection and processing activities to occur efficiently and with maximum adaptability to changing requirements. The second is a coupled approach to resource allocation for collection and subsequent processing, such that intelligence gathering objectives are maximized within the available resources. The third and final critical capability is the ability to assimilate the information produced by modern intelligence collection and processing systems and facilitate the production of actionable intelligence from large quantities of disparate data. Northrop Grumman ISD’s 2011 research will focus on these three areas, as detailed in Section 2.2.
While submissions are encouraged for multiple areas of interest, a separate proposal must be submitted for each technical area addressed.

2.2. **Technical Areas of Interest**

Each research topic proposed against this Northrop Grumman ISD BAA should target one of the following three technical areas. In the descriptions that follow, each area is defined in paragraph form. A bulleted list of exemplary research topics is then provided for amplification. Note that the amplifying text is included to enlighten and stimulate creative thought, not constrain the spectrum of offerings.

2.2.1. **Dynamic Enterprise Ground Architectures**

Ground systems are routinely tasked with the collection, processing, storage, and dissemination of high volumes of intelligence data of various types, gathered from disparate sensor platforms. Modern trends in enterprise computing suggest that substantial efficiencies can be gained through the use of architectures that employ common infrastructure components and service-based application frameworks. Such configurations support rapid system reconfiguration, dynamic reallocation of critical resources, and interchange of data between disparate systems, while reducing hardware footprints and their attendant space, power, and cost concerns. This topic investigates such architectures, identifying the benefits and mitigating the challenges associated with processing 'big data' in a reconfigurable framework. Example areas of interest include, but are not limited to the following:

- Research into reusable, reconfigurable system integration frameworks, fabric, and service components for multi-source, multi-INT data processing
- Development of technologies to virtualize command and control systems, dynamically optimize resource configurations, and reduce operations and maintenance costs
- Novel strategies to analyze large volumes of data in motion, without the need to store or query the information
- Efficient methods to integrate embedded systems, legacy software and legacy hardware systems into modern real-time environments
• Cost effective strategies to enable enterprise modernization without requiring major changes to existing infrastructure, taking advantage of new technologies for searching, processing and sensing

• Cost effective approaches to significantly speed up computationally expensive processing, data query, and/or scheduling algorithms.

2.2.2. Coupled Dynamic Resource Management and Processing

The current mission environment is more dynamic and less certain than ever before. There is a need to adapt the capabilities of current systems to meet these demands, while at the same time designing future systems that are agile and responsive to a wide array of evolving threats. The dynamics and uncertainty of the current environment make efficient coordination of sensing, processing, communications and storage resources very challenging. Feedback loops between sensing and processing must be established to improve responsiveness and iteratively drive down uncertainty. This research topic involves creating agile, flexible, and scalable resource management approaches that dynamically adapt to change and optimally coordinate large-scale, heterogeneous systems in near real-time. Example areas of interest include, but are not limited to the following:

• Enterprise and System of Systems management solutions that enable data collection assets to quickly respond to emerging changes in intelligence targets by leveraging data collection capabilities from multiple different collection platforms

• Predictive, stochastic or online resource planning and scheduling methods to significantly shorten the planning and scheduling cycles of sensing and processing systems and provide improved resource allocation in dynamic, uncertain environments

• Development of resource allocation and scheduling approaches that maximize the mission-relevant information gained during an intelligence collection by adjusting future resource allocations based on the value of the information gathered and processed by the system

• Coordination and management of distributed or swarm systems to perform complex intelligence collection tasks.
2.2.3. Multi-Source ISR Enterprise Integration

The current intelligence analyst is not starving for data, in most cases, they are drowning in it. This research area focuses on algorithms, architectures and approaches for fusing, sense making, knowledge generation and decision making from multi-source data for users in multiple different domains. NGIS is interested in new ways of automatically merging different types of intelligence data. For example, extracting symbols from a UAV video feed and placing them onto another video feed from another video source (like a camera mounted on an infantry-mans helmet), or placing markers generated by individual soldiers onto UAV video feeds so that the pilot has an indicator of where trouble spots have been, or where US troops currently are. Also needed are ways of identifying information in other databases or streams that might be useful to the current analysis. Example areas of interest include, but are not limited to the following:

- Strategies for integrating voice, imagery, and motion video from multiple sensors, with different resolutions, frame rates, and formats
- Approaches to automatic query federation to unify diverse databases, stored in different locations, and represented in multiple formats
- Techniques for dynamically meta-tagging data to maintain maximum relevance. Methods to enable prior data collects to deliver fresh intelligence through application of novel algorithms or combination with recent data collects
- Development of perspective tagging mechanisms which recognize that each analyst examines data for different purposes. The brigade commander wants different information than the platoon leader. Both could be examining the same geographic area, with the same data sources, and be interested in completely different analysis products
- Research into automatic integration of dissimilar intelligence sources to include video from a UAV, reports in static or streaming textual formats, etc.
2.3. Notional Research Schedule

The following notional schedule outlines the major milestones and general progression of research. Each project will establish a schedule by the initial research kickoff meeting. Note that Northrop Grumman ISD is targeting the bulk of the work to be performed in 2011/2012.

<table>
<thead>
<tr>
<th>Months after award (notional)</th>
<th>Milestone</th>
<th>Activity Detail</th>
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<tr>
<td>1</td>
<td>Initial Research Kickoff Meeting</td>
<td>(a) Introductions with the technical team; (b) review of technical objectives; (c) review of proposed research approach and methodologies; (d) resolution of programmatic details needed to facilitate communication and project performance; and (e) selection of date or window for the Interim Research Review (IRR).</td>
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<tr>
<td>3-6</td>
<td>Interim Research Review (IRR)</td>
<td>Research review to encompass (a) progress on the fundamental technical issues under consideration; (b) identification of relevant data sets and testing methodologies to measure technical products; (c) overview of the final products to be delivered (see Section 2.4); and (d) selection of a date or window for the Final Research Review (FRR).</td>
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<tr>
<td>6-12</td>
<td>Final Research Review (FRR)</td>
<td>Final out-brief from the activity, to include (a) complete analysis of the research conducted; (b) delivery of specific products defined at the IRR; and (c) discussion of potential for future investigation and collaboration on the topics considered.</td>
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2.4. Deliverables

Three deliverables are requested from each project for delivery by the FRR milestone:
• An electronic copy of all software and technical data developed under this project. Northrop Grumman ISD makes no stipulation with respect to the language, platform, or condition of the software or with respect to any dependencies on commercial or proprietary software products.

• A final briefing covering the research, along with an electronic copy of the presentation materials.

• A white paper describing the topic, summarizing the results, and describing future opportunities. As Section 2.8 notes, a white-paper is the key component of any response to this BAA. Thus the deliverable white paper can simply be an update to the proposal white paper.

Northrop Grumman also respectfully requests a copy of publishable material generated by the research team during the course of this engagement.

2.5. Intellectual Property (IP) Rights

The Northrop Grumman ISD review team shall be provided, as relevant, with a copy of non-commercial software (including source code), software documentation, and technical data generated under this research proposal, with a minimum of Northrop Grumman unlimited right to use such in any manner without any claim on the part of offeror and without any duty to account to the offeror for such use. No strict-proprietary IP shall be used in the course of this research without prior consultation with, and consent of, the Northrop Grumman ISD review team. The Memorandum of Understanding (MOU) to be signed between Northrop Grumman ISD and the selected research teams will clarify this relationship prior to the initiation of research.

2.6. Award Information

Four to six awards are anticipated across any or all of the technical areas identified above. Review of competing proposals will occur in two waves per the schedule outlined on Page 2. The resources made available for award will depend on the quality of the proposals received and the availability of funds. Allocation of funds and project start dates may be staggered based on the availability of funds and the constraints of academic calendars. Northrop Grumman ISD reserves its rights to the following:
• to select for negotiation all, some, or none of the proposals received in response to this BAA,
• to make awards without discussion with offerors,
• to conduct discussions if it is later determined to be necessary,
• to accept proposals in their entirety or to select only portions of proposals for award,
• to fund proposals in phases with options for continued work at the end of one or more of the phases,
• to request any additional, necessary documentation once it makes the award determination, or
• to remove offerors from award consideration should the parties fail to reach agreement on award terms, conditions, and cost/price within a reasonable time or the offeror fails to provide requested information in a timely manner.

2.7. **Eligibility Information**

Eligible applications must meet all of the following minimum criteria for eligibility:

• be engaged in active research at a university within one of the designated focus regions (North Carolina Research Triangle, Rocky Mountains, Southern California),

• designate an academic faculty sponsor,

• include a US citizen in the proposed research team, as either the faculty advisor or a research assistant, and

• include no team-member who acts on behalf of a company that has a competitive relationship to Northrop Grumman.

If a prospective offeror has any questions on what constitutes a conflict of interest (whether organizational or otherwise), the offeror should promptly raise the issue with Northrop Grumman ISD by sending his/her contact information and a summary of the potential conflict to the BAA mailbox before time and effort are expended in preparing a proposal and mitigation plan. If, in the sole opinion of Northrop Grumman ISD after full consideration of the circumstances, any conflict situation cannot be effectively mitigated, the proposal may be rejected without
technical evaluation and withdrawn from further consideration for award under this BAA.

2.8. **Content and Form of Application Submission**

Northrop Grumman ISD will employ an electronic submission process for ideas submitted against this BAA. The proposal shall consist of three parts as follows:

1. A single page Quad-Chart in Microsoft PowerPoint or PDF format encompassing the following topics: Main Objective (upper left), Key Innovations (upper right), Expected Impact (lower left), and Budget/Staffing (lower right). A sample quad-chart is provided as an addendum to this BAA.

2. A two to five page white paper in Microsoft Word or PDF format.

3. The curriculum vitae (CV) of the faculty research sponsor and, optionally, the research assistant(s).

Sections 2.8.1 through 2.8.3 provide additional detail about each of these elements. Please note that failure to follow the guidelines presented in these sections may result in an incomplete assessment of the proposed research. Additional information may be included but will be considered by the review team for convenience only. The proposal’s merits must be completely captured within the aforementioned three elements.

NGIS considers all data contained in your proposal to be nonproprietary. If you submit proprietary data solely for evaluating your proposal, mark the bottom of each page of the data with a restricted rights legend. If you submit such data, you agree that NGIS will not be liable for disclosure of such data if the same is:

(a) In the public domain at the time of disclosure, or is subsequently made available to the general public without restriction by the disclosing party;

(b) Known to NGIS at the time of disclosure to be without restrictions on its use, or is/was independently developed by NGIS, and there is adequate documentation to demonstrate either condition;

(c) Used or disclosed by NGIS inadvertently despite the exercise of the same degree of care that NGIS takes to preserve or safeguard its own proprietary information;

(d) Used or disclosed with the prior written approval of the disclosing party;
2.8.1. Quad-Chart Instructions

The quad chart is summaries the key aspects of the research topic to the evaluation team. Prior to the award deadlines, Northrop Grumman’s technical POCs will accept draft quad-charts by email and offer comments as to the applicability of a proposed topic prior to creation of the full proposal. The quad-chart will consist of the following four sections, organized as noted below:

- Upper left: The main objective of the research and the technical area addressed indicated in bold.
- Upper right: Key innovations that discriminate the proposed approach from existing approaches in this field.
- Lower right: Requested budget allocation and a listing of team members, to include country of citizenship. The primary point of contact (POC) on the team should be indicated in bold, along with contact information (email/phone).
- Lower left: Expected impact of the proposed research, in terms of novel capabilities and/or levels of performance.

Graphics are encouraged as space allows. Quad-chart submissions are limited to one page in length and offerors are encouraged to employ the provided template when possible. Quad-charts should be named "quad_XXX.ppt " (or .pdf), where XXX is an abbreviated title for proposed research.

2.8.2. White Paper Instructions

Please employ the following headings to facilitate the review process: Problem Statement, Technical Approach, Expected Outcomes, and Schedule/Cost/IP Limitations. The content of white paper is left to the offeror, but an emphasis should be placed on clear and concise descriptions of the proposed research. The white paper is limited to five pages in length and should be named "wp_XXX.doc"
(or .pdf), where XXX an abbreviated title for the proposed research. Supplemental material may be submitted as long as it is clearly marked as a supplement.

2.8.3. **Curriculum Vitae (CV) Instructions**

The form and length of the CV is left to the offeror, but the naming convention of "cv_{XXX}.doc" (or .pdf) should be followed, where XXX is an abbreviated title for proposed research. If multiple topics are submitted under one researcher or assistant please include distinct copies of the CV, named for each activity, to simplify the review process.
3. Application Review Information

3.1. Evaluation Criteria

Evaluation of proposals will be accomplished through a scientific review of each proposal using the following criteria. The criteria are listed in descending order of importance:

1. Overall Scientific Technical Merit with Respect to the Technical Area of Interest (TAI)

The offeror's proposal will be evaluated on the long term effects of the proposed research; especially the technical payoff verses the TAI. Northrop Grumman ISD will evaluate whether the offeror demonstrates a thorough understanding of operational or technological problems, proposes a technically innovative approach that is reasonably likely to succeed, and includes a clear process to evaluate the efficacy of the proposed research.

2. Expertise and Experience of Proposed Technical Team

The proposed technical team will be evaluated upon the extent to which they have the experience to accomplish the proposed work.

3. Realism of Proposed Schedule

The articulated objectives will be assessed against the schedule and budgetary constraints. For this reason, a phased technical approach that notes technical objectives beyond this research cycle is encouraged.

4. IP Rights Limitations

The evaluation will consider the extent to which IP limitations constitute a barrier to technology reuse. Technology that is easily transitioned to government programs and is unencumbered by IP limitations are strongly preferred. Define and provide all IP limitations that apply.

5. Cost Competitiveness

The evaluation will assess the relative value of this research against other proposals to include the proposed cost. Value assessments will include consideration of the key staffers as detailed in the proposal.
3.2. **Review and Selection Process**

A selection board drawn from qualified Northrop Grumman professionals will perform the evaluation. As indicated in Section 2.8.1, the designated technical POCs will accept draft quad-charts by email and offer comments as to the applicability of a proposed topic. This allows proposing teams to vet ideas early and craft a more compelling proposal prior to submittal of the full proposal. For evaluation purposes, a proposal is the document in three parts as described in Section 2.8. Other supporting or background materials submitted with the proposal will be considered for the reviewer’s convenience only and not considered as part of the proposal. Proposals from all regions will be evaluated on the basis of their merit; geographic quotas will not govern awards.

3.3. **Award Notices**

As soon as the evaluation of a proposal is complete, the offeror will be notified that (1) the proposal has been selected for funding pending contract negotiations, or, (2) the proposal has not been selected. The primary POC identified on the quad-chart will receive notification.