NDIA
MDA SBIR Industry Day
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C2BMC

Stan Harmon
MDA / BC

Agenda

- **Research Area Scope & Objectives**
- **List of Technology Areas & Topics**
- **Topic Overview**
- **Questions**

C2BMC Scope & Objectives

The C2BMC research area funds hardware and software related innovations that enhance system performance through the integration of BMDS assets. Technology areas and their research topics include:

- **Automated Battle Management / Planning Aids**
  - **Topic: Resource Optimization for Battle Management**
- **Track Correlation / Sensor Netting**
  - **Topic: Track Correlation**
- **System Discrimination & Discrimination Fusion**
  - **Topic: Discrimination**
- **Communications**
  - **Topic: Scintillation Hardened End-to-End Communication Links**
- **Information Assurance**
  - **Topic: Information Assurance**
- **System Discrimination & Discrimination Fusion**
  - **Decision Making (STTR)**

Automated Battle Management / Planning Aids

Resource Optimization for Battle Management

Objective

With the addition of emerging weapon systems, to include multiple sensors and weapons, the Ballistic Missile Defense System (BMDS) will have the capability for layered defense. .

- Develop advanced, innovative, robust, real-time sensor/interceptor to target assignment algorithms and software that also support the warfighters' decision-making processes within a coordinated, layered missile defense environment.

Key Points

- This topic can be divided into two functional areas. While the basic techniques developed will likely have applicability to both areas, the areas have different constraints and requirements on processor capability and timeliness. Therefore, it is appropriate that proposals address one of the two areas explicitly.
  - First, the battle manager needs to allocate sensor and weapon systems to threat launch events.
  - Second, the fire control needs to optimally determine how best to employ the sensors and missiles allocated for negation of a threat launch, given that there might be multiple objects associated with each missile launch.
- Proposed solutions may address either sensors or weapons or both, should not address countermeasures or debris, and may consider techniques to optimize the solution over time or to measure confidence.

Development Plan

Phase I

Provide a proof of principle of the suggested approach for allocation methods that will enable robust engagement resource allocation for multiple sensors, weapon systems, battle managers, and fire controls with different capabilities.

Phase II

Develop/update the technology based on Phase 1 to provide a demonstration of the technology in a realistic environment using realistic data and operator interaction as needed, to include realistic processing speeds in complex scenarios

TPOC: Col Scott LeMay

Track Correlation/Sensor Netting

Track Correlation

Objective

The BMDS employs a variety of disparate sensors in the detection, tracking, and identification of ballistic missiles and their constituent parts. For the BMDS to engage tracks effectively, it is critical that tracks from disparate sources are correlated in an accurate and timely manner so the correct tracks are engaged, thereby minimizing interceptors wastage.

- Develop advanced, innovative, robust, real-time algorithms and software for the creation, handover and integration of sensor tracks originating from a variety of disparate sensors.

Key Points

- Proposed advances should provide robust, reliable capability to correctly correlate reports from multiple sources, or identify when the reports represent new tracks. The proposed approach should have the following properties:
  - Use metric data, features, or other data that provides for accurate and timely correlation.
  - Provide a measure of confidence with the correlation decision and manage ambiguities.
  - Promote track continuity and minimize the number of false tracks.
  - Provide for cluster tracks when absolutely necessary.
- The final product will need to operate in a distributed manner, with multiple interacting decision nodes; however, the algorithms could assume a centralized architecture as a first step.

Development Plan

Phase I

Develop the mathematical basis for and provide a proposed methodology write-up and a demonstration of track correlation/sensor netting concepts using simulated data.

Phase II

Develop/update the technology based on Phase 1 to provide a demonstration of the technology in a realistic environment using realistic data, to include realistic processing speeds in complex scenarios.

TPOC: Col Scott LeMay

System Discrimination & Discrimination Fusion

Discrimination

Objective

Ballistic Missile Defense System (BMDS) performance is heavily dependent on data from dispersed and disparate radars and other types of sensors. It has been shown that when a lethal object can be identified, the system is effective at negating the threat. The challenge today is developing the algorithms that will increase the accuracy in separating lethal objects from non-lethal objects in a complex and challenging environment.

- Apply innovative techniques to enable ballistic missile object discrimination through analysis of radar and/or optical sensor data.

Key Points

- Areas of exploration include algorithms, models, and system-level (multi-sensor) approaches, which can deal with ambiguity, and can be integrated with existing track correlation mechanisms.
- Solutions must be capable of accurately and reliably supporting acquisition, track, discrimination, and engagement of threatening objects across a spectrum of threat classes and environments.
- Technical issues that must be addressed include: sufficiently accounting for, or eliminating, uncertainty in both threat evolution and sensor feature measurements; reliance on a priori information; data throughput limitations between sensor platforms; processing speed and capacity; data latency and gap handling; target feature exploitation; and, countermeasure identification and negation.

Development Plan

Phase I

Develop and conduct proof-of-principle studies and/or demonstrations of discrimination concepts/algorithms that are easily adaptable to a wide range of sensors using simulated sensor data.

Phase II

Update/develop algorithm(s) based on Phase I results and demonstrate technology in a realistic environment using data from multiple sensor (as applicable) sources. Demonstrate ability of the algorithm(s) to work in real-time in a high clutter and/or countermeasure environment.

TPOC: Bob Morgan

Communications

Scintillation Hardened End-to-End Communication Links

Objective

A significant need exists for enhanced, highly reliable, high speed, in-flight communications between the BMDS Fire Control and Interceptor/Kill Vehicles such as the Ground Missile Defense – Exoatmospheric Kill Vehicle (GMD-EKV).

- Increase transmission rate of future Ballistic Missile Defense (BMDS) end-to-end interceptor communication links operating through adverse conditions.

Key Points

- A reconfigurable modem solution is sought, allowing a common communication system design suitable for cross-platform application. Channel impairments of interest include both signal fading caused by ionospheric scintillation, induced by high altitude nuclear weapons detonation, and electronic counter-measures (ECM).
- Specific emphasis should be placed on:
  - Channel waveform design, with emphasis on selection of an advanced modulation and FEC method.
  - Use of rapid prototyping for evaluation of candidate waveforms.
  - Modeling of HAENS & ECM environment with sufficient fidelity for use in conjunction with a prototype system.

Development Plan

Phase I

Contractors shall propose and analyze candidate communication link solutions for providing scintillation hardened connectivity to missiles and/or kill vehicles within the evolving MDA architecture. Candidate comparisons should emphasize preliminary link performance metrics and quantifiable measures of system complexity.

Phase II

The contractor shall implement each of the candidate waveforms from Phase I using the prototyping platform. testing will result in a full characterization of the performance of each candidate waveform in a joint nuclear and ECM environment. A final waveform design will be selected based on this evaluation.

TPOC: Aaron Corder

Information Assurance

Information Assurance

Objective

Product engineering has evolved into product and process engineering in which manufacturability, producibility, maintainability, usability - and other so-called "-ilities" - are considered during the design, acquisition and deployment of a product. MDA is seeking innovative approaches for maintaining the *protectibility* of hardware and software systems during the design, acquisition and deployment of a product. Protectibility includes the entire process during which the manufacture, production, maintenance, and use of a product must be protected against malware or exploitable code-based claws.

- Develop tools and technologies for discovering, monitoring, defending and/or remediating insider threats to software and firmware across the full system life cycle.

Key Points

- Improve the protectibility of a weapons system by developing technologies that can observe, identify, and guard systems against insider threats.
- Defend against threats posed in the production of that system or after deployment where replacement parts could also manifest malicious code.
- Provide a new level of rigor in the manufacturing process maintaining seamless production while ensuring that systems will be operating threat-free throughout the system lifecycle

Development Plan

Phase I

Develop a proof-of concept design, feasibility assessment, and demonstration for threat-free manufacturing tools and technologies.

Phase II

Based on the Phase I design and assessment, develop a prototype technology and demonstrate the efficacy of the Phase I results.

TPOC: Gary Mayes

System Discrimination & Discrimination Fusion

Decision Making (STTR)

Objective

Key functions of a missile defense system are to detect, track, discriminate, and engage threat objects. A missile defense system uses combinations of active and passive optical and microwave sensors to provide the required enabling information.

- Develop advanced, innovative, system discrimination and battle management techniques through the use of information fusion and decision logic. Proposed techniques should correlate real-time acquisition, tracking, and interceptor sensor views of the threat space coupled with interceptor inventory operational status, in order to facilitate accurate and efficient allocation of interceptor resources.

Key Points

- Sensors may be widely dispersed with respect to the missile threat and operate with widely varying phenomenology. This presents a significant information correlation challenge to the system battle manager.
- Interceptor assets will also be widely dispersed over the potential battle space. The battle manager must maintain accurate status, location, and capability of all interceptor assets.
- All information must be integrated unambiguously to facilitate robust system operation with a goal of 100% effectiveness against all threats, in all environments.
- Communications system requirements definition is an integral part of the overall battle management plan and must be addressed as part of the proposed system solution.

Development Plan

Phase I

Develop an innovative Battle Management/Communications structure which will provide real-time information fusion and analysis. Show by detailed analysis how the resulting information can be analyzed to support automated decisions for the optimal allocation and timing of interceptor resources.

Phase II

Develop and test a near-operational (demonstration) Battle Management/Communications structure to combine simulated data from at least 3 sensor sources and at least 3 interceptor systems including status reporting and interceptor kill assessment.

TPOC: Bob Morgan

Points of Contact

Government POC: Joey Wang, MDA/BC

Technical POC: Stan Harmon, MDA/BC

Technical POC: Alan Hickling, MDA/BC

<u>Automated Battle Management / Planning Aids</u>
Technical POC: Col Scott LeMay

<u>Track Correlation /Sensor Netting</u>
Technical POC: Col Scot LeMay

<u>System Discrimination & Discrimination Fusion</u>
Technical POC: Bob Morgan

<u>Communications</u>
Technical POC: Aaron Corder

<u>Information Vulnerability Defense</u>
Technical POC: Gary Mayes

Questions

- Questions after August 23, 2009 need to be submitted through the SBIR/STTR Interactive Topic Information System (SITIS) **http://www.dodsbir.net/sitis**
- For reasons of competitive fairness, direct communication between proposers and topic authors is not allowed starting August 24, when DoD begins accepting proposals for this solicitation.
- However, proposers may still submit written questions about solicitation topics in which the questioner and respondent remain anonymous and all questions and answers are posted electronically for general viewing until the solicitation closes.
- All proposers are advised to monitor SITIS (09.3 Q&A) during the solicitation period for questions and answers, and other significant information, relevant to the SBIR 09.3 topic under which they are proposing.