NDIA
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C2BMC

Joey Wang
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:

- **Communications**
  - **Topic: Radiation Hardened End-to-End Interceptor Communication Links**
- **Sensor Data Fusion**
  - **Topic: Sensor Data Fusion**
- **Integrated Sensor Mgmt./Systems Registration**
  - **Topic: Sensor Resource Management**
- **Information Assurance**
  - **GPS and Command Link Assured Operation**

Communications

End-to-End BMDS Interceptor / Gnd. Terminal Com. Links

Objective

MDA is seeking innovative approaches to hardening communications systems for current and future Interceptor/Kill Vehicle systems. All future MDA interceptor communication systems must employ effective means to mitigate link performance degradation associated with wartime environments.

- Develop innovative design/development/test concepts to enhance the reliability of communications between the Ballistic Missile Defense System (BMDS) Fire Control and Interceptor/Kill Vehicles under severe wartime conditions.

Key Points

- Specific issues that the successful bidder should consider include:
  - Representation and modeling of scitillation and fading channels and threat ECM techniques
  - Link Attributes (i.e., data rate, bandwidth, range, latency, error rates)
  - Channel waveform design
  - Communication system performance prediction methods
  - Receiver mitigation techniques for signal fading and Jam and Intelligence gathering resistance
  - Platform weight, size, and power constraints (especially on flight vehicles)
  - Cost trades of proposed communications solutions

Development Plan

Phase I

Propose and analyze candidate end-to-end communications solutions for providing robust connectivity to missiles and/or kill vehicles within the evolving MDA architecture, including strengths and weaknesses of different proposed solutions.

Phase II

Perform a detailed design of the system based upon Phase I work. Identify specific hardware components and demonstrate the capability for hardness, reliability and performance.

TPOC: Aaron Corder

Sensor Data Fusion

Sensor Data Fusion

Objective

This topic seeks to apply innovative concepts to creating a single integrated picture of the battlespace. The capability to collect, process, and fuse information from a variety of disparate sensors is critical in providing the warfighter with a clear picture of the evolving battlespace.

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Key Points

- sufficiently accounting for uncertainty in both threat genealogy and sensor feature measurements, over-reliance on a priori information, data throughput within and between sensor platforms, processing speed and capacity, data latency and gap handling, and target feature exploitation.
- Additional interests include methods for fusing multi-sensor data for 3-dimensional imaging for discrimination purposes. This includes multiple radar data, as well as on-board and off-board IR sensor data and active LADAR device data.

Development Plan

Phase I

Develop and conduct proof-of-principle demonstrations of advanced sensor data fusion concepts using simulated sensor data

Phase II

Update/develop technology (algorithms, software, hardware, or a combination thereof) based on Phase I results and demonstrate technology in a realistic environment using data from multiple Radar assets sources. Demonstrate ability of technology to work in real-time in a high clutter environment.

Integrated Sensor Mgmt./Systems Registration

Sensor Resource Management

Objective

As the BMDS evolves to incorporate new or enhanced sensors and weapon systems to contend with increasingly complex ballistic missile threats, the control and tasking of sensor systems will become increasingly difficult, requiring the operators to be supported by sophisticated planning and real time scheduling tools.

- Develop techniques for employment planning and real time tasking of diverse and distributed sensor resources to optimize the collection of threat data in a multi-target environment to meet competing requirements for accurate tracking and discrimination of critical threats in order to support weapons assignment.

Key Points

- Depending on the objective, required observations may differ in character from short single looks, through frequent revisits to sustained periods of continuous observation.
- Priorities for sensor tasking must reflect the need to provide fire control solutions for weapon systems appropriate to each layer in the BMDS architecture.
- The fidelity of track and discrimination information required will vary with time to match key decision points in an engagement.
- Sensor resources will be required post interceptor launch to support tracking, in flight target update of threat state vectors and discrimination state and to provide kill assessment.

Development Plan

Phase I

Develop a mathematical basis for the proposed approach, augmented as appropriate by coding or analysis sufficient to demonstrate it's computational and performance abilities.

Phase II

Implement the algorithm(s) and integrate with simulation framework to allow their testing and evaluation in realistic scenarios.

Information Assurance

GPS and Command Link Assured Operation

Objective

Simulation technologies are required to test guidance and navigation solutions under a variety of environmental conditions. These conditions may temporarily disrupt GPS reception, requiring weapon system recovery protocols and algorithmic contingencies. The ability to replicate global positioning constellation signals, jamming signals, and environmental effects in a hardware-in-the-loop environment is required.

- Develop a simulation environment for developing methods of overcoming guidance and command link drop-out during deliberate jamming or during and after exposure to a nuclear or EMP environment. Investigate techniques to mitigate impact of GPS disruption on BMDS sensor registration.

Key Points

- Ability to perform wavefront generation for up to 7 antennas on a vehicle moving at high-speed/acceleration in 6 degrees of freedom.
- The ability to replicate other navigation signals is also desired. In addition to GPS (L1, L2, L5, C/A, P, M codes), Galileo, Glonass, and signals from Asian navigation systems would provide additional test flexibility. Both digital and RF outputs are necessary for facility data collection and simulation.

Development Plan

Phase I

Research, quantitatively analyze, and develop a conceptual design and assess the feasibility of comprehensive GPS simulator. Hardware critical component demonstration to quantify limitations of existing systems and potential improvements state-of-the-art component technologies is desired.

Phase II

Design, develop, and characterize a prototype proof of concept of the GPS simulator and demonstrate its functionality. Investigate private sector applications along with military uses of key components developed in Phase II.

Points of Contact

Government POC: Joey Wang, MDA/BC (703) 697 – 6444 *Joey.Wang@mda.mil*

End-to-End BMDS Interceptor/Ground Terminal Communication Links		
Technical POC: Aaron Corder	**(256) 313-0436**	**aaron.corder@mda.mil**
Sensor Data Fusion		
Technical POC: Joey Wang	**(703) 697-6444**	**joey.wang@mda.mil**
Sensor Resource Management		
Technical POC: Joey Wang	**(703) 697-6444**	**joey.wang@mda.mil**
GPS and Command Link Assured Operation		
Technical POC: Tony Thompson	**(850) 883-0867**	**rhoe.thompson@eglin.af.mil**
Alternate POC: Aaron Corder	**(256) 313-0436**	**aaron.corder@mda.mil**