



NDIA MDA SBIR Industry Day

August 7, 2008



Interceptor Technology Research Area

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Agenda

- Research Area Objectives
- Research Area Approach
- List of Topics
- Topic Overviews
- Questions



Interceptor Research Area Scope and Objectives

- **Scope:** Develop innovative technologies for spiral upgrades to current Ballistic Missile Defense (BMD) interceptor systems and enable advanced interceptor concepts
- **Objectives**
 - Improve capabilities in BMD interceptor elements against future threats
 - Intercept various threats in all phases of flight
 - Help discriminate lethal targets from countermeasures
 - Defeat asymmetric threats



Interceptor Research Area Approach

- **Management Commitment:**

- Standardized Program Reviews: Use a system of regularly scheduled reviews to ensure research is being exposed to an MDA wide audience
- Industrial Partnership Days: Regular events that match SBIR projects with interested Prime Contractors
- Transition: Work beyond formal process to encourage and maximize transition opportunities



Interceptor Research Area 2008.3 SBIR Solicitation

TOPIC	Topic Team Lead	Co-lead
GNC Algorithms	Dimitrios Lianos	
Advanced Synergistic Structures	Joe Ratliffe	
Interceptor Avionics	Doug Engle	Dimitrios Lianos
Interceptor seekers	Mei Mei Tidrow	Dimtrios Lianos
Advanced Divert and Attitude Control Systems	Pashang Esfandiari	
Test Methodology and Equipment for Radiation Hardened Interceptors	Tom Turflinger	
Target Instrumentation Technology	Dimitrios Lianos	
Cabling Architecture and Mechanisms	Christopher Olmedo	Russ Medley
Innovative Axial Propulsion Technology	Jason Calvert	Paul Zuttarelli



Topic: Interceptor Guidance, Navigation, and Control (GNC) Algorithms

- Develop
 - Algorithms for multiple kill vehicle weapon-target assignment, collision avoidance, multiple apertures, formation flying, and maximizing probability of hit
 - Algorithms for improved interceptor operations in a hostile environment
 - Algorithms supporting kill vehicle participation in discrimination
 - Algorithms that process interceptor signals and data
 - Use of algorithms as integral in the designs of interceptors
- Performance goals include the minimization of miss distance with minimum interceptor control energy and freedom from reliance on a priori data with emphasis on engaging maneuvering targets during boost, midcourse, or terminal phase of their flight



Topic: Advanced Synergistic Structures for Interceptor Kill Vehicles

- **Synergistic structures**
 - Structures with multiple functions (e.g., fuel tanks or batteries that function as load-bearing KV structure and/or protect against hostile environment)
 - Structures with embedded components (electrical, optical, power, propulsion, sub-structures, isolation, etc)
- The synergy must not compromise the integrity of the interceptor and must significantly improve key interceptor performance parameters (speed, volume, mass, accuracy, agility, survivability, etc.)
- Structures must be designed to meet the operational environment (temperature variations, high acoustic levels, maneuvering loads, high shock loads, >300krad, and severe vibration loads)



Topic: Interceptor Avionics

- Develop and demonstrate innovative, high performance avionics components and systems to enhance interceptor capabilities with emphasis on operating in a hostile environment
 - Gyros
 - Accelerometers
 - Associated electronics
 - Integrated units (Inertial Reference Unit, Inertial Measurement Units)
 - Global Positioning System augmentation
 - Processors
 - Flight computers
 - Power sources/power conditioning
 - Secure communications
- Focus on agile interceptors to defeat various types of threats



Topic: Interceptor Seekers

- Design, develop and demonstrate innovative highly integrated, compact, lightweight interceptor seeker technologies
 - Seeker components, for RF and EO/IR seekers
 - Advanced active, passive and multi-mode seekers
- These technologies will support integrated seeker suites to enable advanced, agile interceptors that
 - Counter maneuvering targets
 - Facilitate discrimination
 - Defeat the asymmetric threats
 - Improve current BMD interceptor capabilities to defeat threat in all phases of flight
- A primary objective is long range detection, tracking and intercept of all Ballistic Missile Defense (BMD) endo- and exo- atmospheric targets



Topic: Advanced Divert & Attitude Control Systems

- Develop and demonstrate novel concepts for advanced solid and liquid DACS components and systems for interceptors that operate in endo- and exo-atmospheric regimes
 - Lightweight DACS with high delta velocity (> 1000 m/sec) and high thrust (> 5 gs) that enable high system mass fraction ($> 40\%$) are of special interest
 - Advanced propellants and components (thrusters, tanks, valves, etc) for high thrust, high delta V, fast reaction performance
 - Novel propulsion systems that are light weight and result in a highly agile KV
 - Criteria include low cost, light weight, high performance, fast reaction, and resistance to high temperature and high pressure



Topic: Target Instrumentation Technology

- Design, develop and demonstrate highly integrated instrumentation both on and off-board targets that can be used to determine position of hit and attributes of hit and misses for kinetic and/or directed energy weapons
 - Miniaturized digital sensor systems for shock, vibration, temperature, and pressure
 - Miniaturized hit grid package (encoder and grid interface) that will reduce the overall footprint, interconnect cabling and weight required for the system
- The primary objective is to lower the complexity and cost of instrumentation systems used on target missiles while increasing their capability and reducing the impact to off board and other on-board systems



Topic: Test Methodology and Equipment for Radiation Hardened Interceptors

- Design, evaluate, and validate
 - Innovative test systems and test approaches that will support insertion of improved radiation-hardened technology (e.g. active or passive optical seeker subsystems) within the MDA systems with radiation hardening requirements
 - Test methods and hardware, concepts that enable system operability while controlling degradation, and production concepts that reduce net costs of hardening efforts
 - Concepts to create simulated nuclear environments to validate radiation performance not possible in real flight experiments
- Topic focuses on innovations that can be used in improving confidence in performance of missile defense interceptors



Topic: Cabling Architecture and Mechanisms

- Develop and design reliable/robust modular interconnection of interceptor components, including electrical, radio-frequency, heat, light, and accommodating special needs
 - Adaptive wiring
 - Integrated self-test/diagnostic
 - Enhanced test/debug support
 - Advanced optical/RF approaches
 - Reliable separation
- Emphasis is on mass/volume overhead of cabling, mechanical robustness, resilience to aero heating, and lightning protection



Topic: Innovative Axial Propulsion Technology

- Develop innovative booster component designs and test capabilities that are high performance, capable of Thrust Vector Control (TVC) and variable thrust, and compliant with DoD insensitive munitions (IM) objectives compliant
- Technologies of Interest
 - Propellant chemistry
 - Motor case technology/ Ceramic Matrix Composite (CMC) technology
 - Vehicle health monitoring
 - Ignition Safety
 - TVC technologies
- The primary objectives are to increase kill mechanism velocity, accuracy, efficiency, battle space, and to address advanced threats.



QUESTIONS?