



# MISSILE DEFENSE AGENCY

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*Dr. Jeff Keller*

*Director (Acting) Advanced Research for Advanced Technology*



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# Missile Defense Agency

## Missile Defense Agency Mission

**To develop and deploy a layered Ballistic Missile Defense System to defend the United States, its deployed forces, allies, and friends from ballistic missile attacks of all ranges and in all phases of flight**



**Missile Defense Capability  
Globally Deployed**



# Missile Defense Agency Priorities

- In Support Of The National Defense Strategy

- Continue focus on increasing system reliability to build warfighter confidence
- Increase engagement capability and capacity
- Address the Advanced Threat



**BMDs Meets Today's Threat but Requires Additional Capacity and Advanced Capability to Stay Ahead of the Evolving Threat**



# Today's Ballistic Missile Defense System

**C2BMC** Command and Control, Battle Management and Communications

NMCC

USSTRATCOM

USNORTHCOM

USINDOPACOM

USEUCOM

USCENTCOM

**BOOST / ASCENT**  
Defense Segment

**MIDCOURSE**  
Defense Segment

**TERMINAL**  
Defense Segment



**Aegis**  
Ballistic Missile Defense

**SM-3**  
Standard Missile-3



**GBI**  
Ground-Based Interceptor



**Aegis**  
Sea-Based Terminal

**The System  
Of Elements**

**Aegis Ashore**

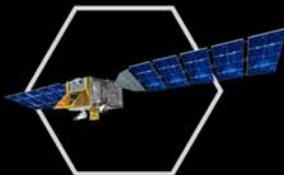


**THAAD**  
Terminal High  
Altitude Area Defense



**PAC-3**  
Patriot Advanced  
Capability-3

**Sensors**



Satellite Surveillance



Forward-Based Radar



Upgraded Early  
Warning Radar



AEGIS BMD  
SPY Radar



Sea-Based  
X-Band Radar



# Technology Transforming the Battlespace

- **Increased rate of investment in military R&D from near-peers**
- **Easy proliferation of knowledge and technology has eroded U.S. historic advantages**
  - **Increasing systems capabilities**
  - **Advanced production capabilities**
    - Driving lower costs
    - Decreasing the “time to market”
- **Increasingly Competitive National Security Technical Environment**
- **Speed and cycle time become the discriminator**





# USD(R&E) Top 10 Modernization Priorities

- **Missile Defense**
- **Hypersonics**
- **Directed Energy**
- **Fully Networked Command, Control, and Communication**
- **Space**
- **Cybersecurity – Offense and Defense**
- **Microelectronics**
- **Machine Learning (Artificial Intelligence)**
- **Quantum Science (Including Encryption and Computing)**
- **Autonomy**



# Transforming Missile Defense

Decrease **Emphasis**  
On:

**Fixed**

**Right of Launch**

**Centralized Location**

**Prolonged Acquisition**

**Costly**



Increase **Emphasis**  
On:

**Agile**

**Space**

**Directed Energy**

**Integrated Left & Right**

**Autonomy**

**Faster Refresh**

**More Affordable**

**Invest in technology to revolutionize the BMDS and prove technology readiness through demonstrations**



# MDA Advanced Technology Focus

**MISSION: Seek out, develop, and deliver innovative technologies and capabilities across missile defense to outpace the threat**

## BMDS Kill Chain

- Detect
- Track
- Discriminate
- Engage
- Assess

## Technology Focus

- All Source Information Integration
- Sensor Technology (Active/Passive)
- Robust Communications
- Kinetic Weapons
- Directed Energy
- Advanced Technology M&S Testbed

## Technology Investments

- MOKV
- Sensors
  - Ground
  - Airborne
  - Space
- Directed Energy – Power Scaling
- Hypersonic Glide Defense
- Advanced Research
- SBIR/STTR
- Right of Launch/Left of Launch

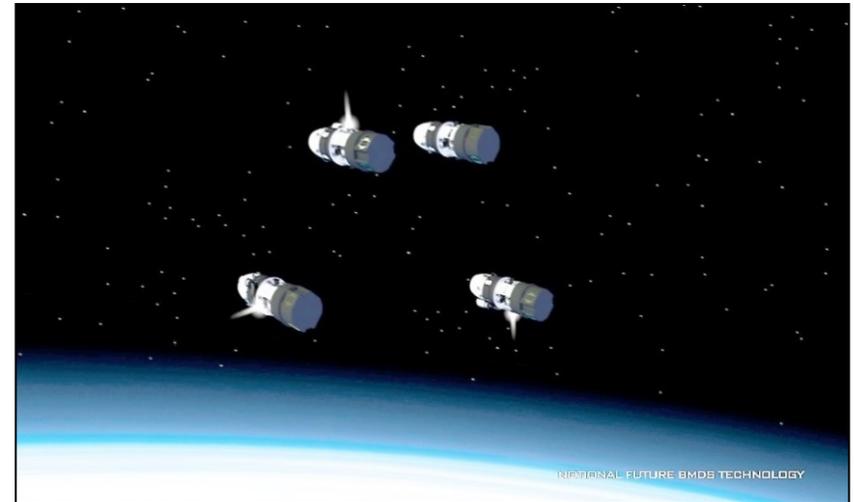
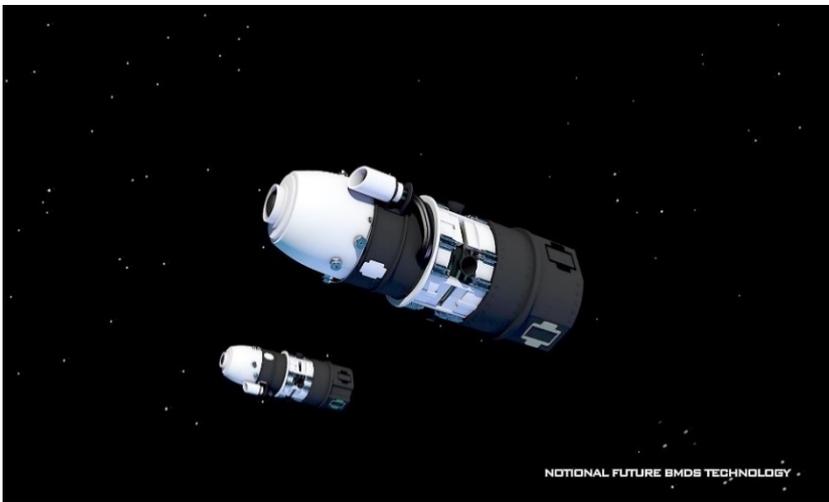
**Architecture Development**

**Continue to mature advanced technologies and evolve Missile Defense capabilities through research, experiments, and demonstrations for insertion into the BMDS**



# Multi-Object Kill Vehicle (MOKV)

- **Concept: kill multiple lethal objects from a single interceptor**
- **Address evolving threats**
- **Improve cost effectiveness, manufacturability, supportability, and testability**
- **Demonstrate technical maturity through integrated hardware HWIL testing**
- **Force multiplier by increasing BMD interceptor capacity**



Notional MOKV Concepts

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# Demonstrate Precision Tracking



- Two Reapers for stereo track
- Sensor with multiple cameras
- Unique airborne processor
- Forward chin mount to improve sensor field of view



- Extended Range Upgrades
  - Larger wings (more fuel and lift)
  - Ice protection (higher altitude)



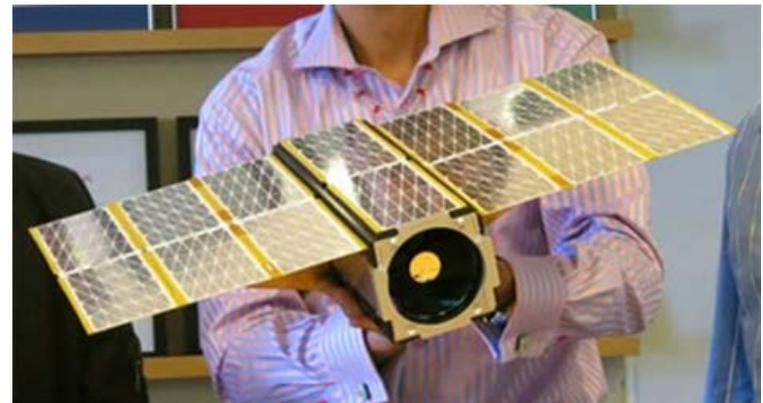
- Incorporate tracking laser
  - Single platform operations
  - Increased precision and range

**Demonstrate Acquisition & Tracking at Operational Ranges**



# NanoSat Testbed Initiative

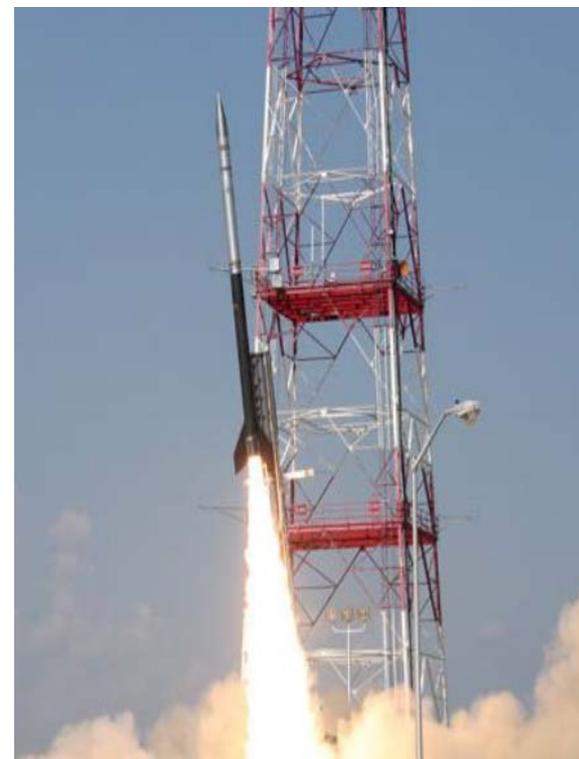
- **The Nanosat Testbed Initiative uses small, low cost satellites to demonstrate MDS technology in a space environment.**
  - Directly applicable to MDS kill vehicles, space sensors, and space weapons
  - Takes advantage of emerging small satellite technology, launch capacity, and automated operations for missile defense – many partnering opportunities available
  - Demonstrations integrate with existing MDA space operations center and EO/IR testbed





# Sub-Orbital Flight Experiments

- **To demonstrate SBIR developed technologies in an operational environment**
  - Raises TRL of Demonstration technologies to TRL=6
  - Impartial demonstration (Primes not in control)
  - Will provide verification of G6 Sim modeling
  - Can be used by small businesses as justification for insertion into programs of record
  - Provides risk mitigation activities for key components of MDA Architecture (DACs, Batteries, Sensors, IMUs)
  - Can be iterated on regular basis
  - Allows experimentation at a lower quality level than a Flight Test





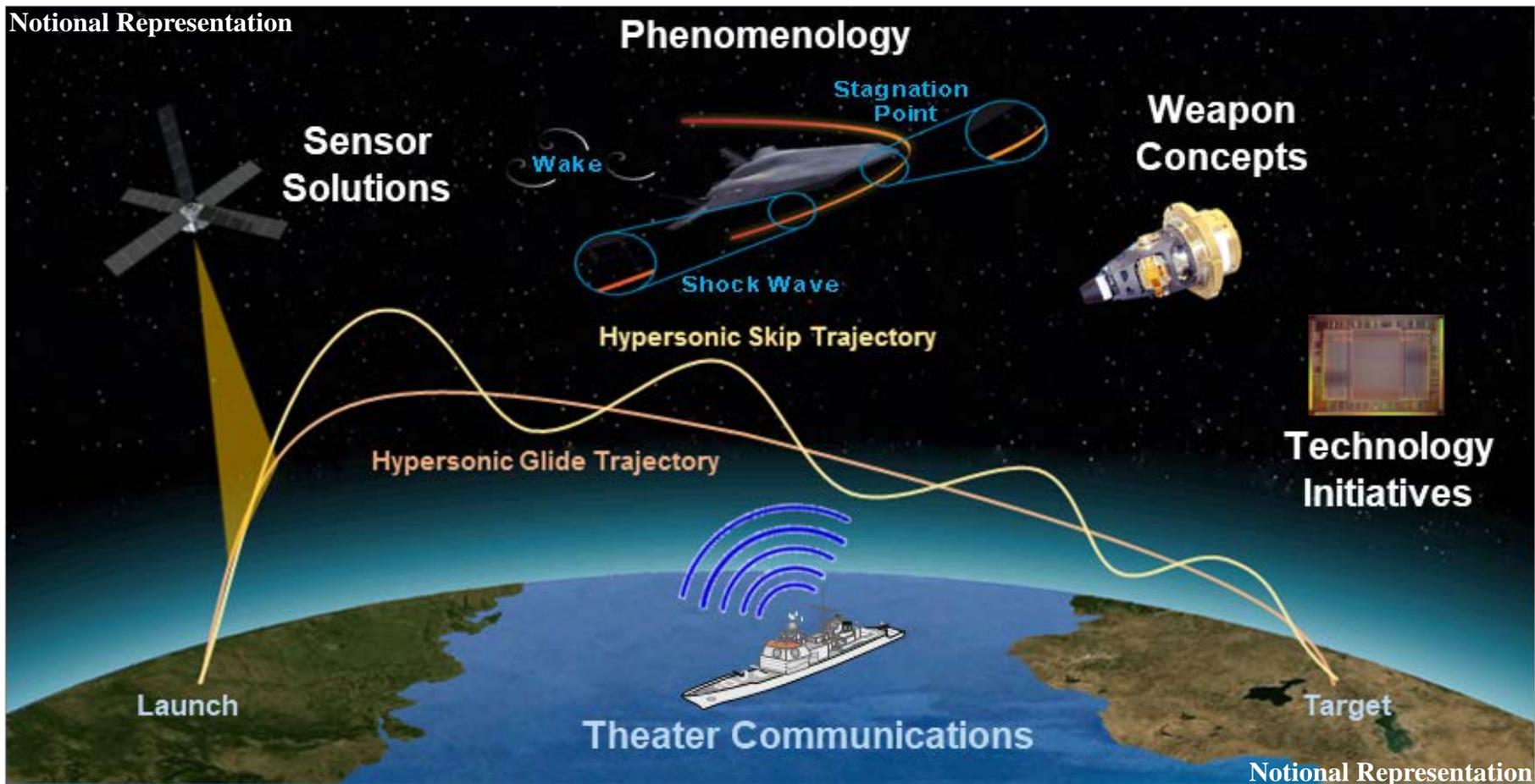
# Advanced Technology Hypersonic Defense Mission

- **Define weapon concepts and investments in key technology to enable a broad set of solutions including kinetic and non-kinetic means across left and right of launch**
  - Focus on development of weapon concepts through competitive development
  - Concepts and identified technology component risk reduction will formulate the trade space across cost, risk, and performance to inform the requirements development process
- **Develop technology to increase sensor capability**
  - Execute sensor technology demonstrations to inform the development strategy
  - Invest in larger focal plane arrays, clutter mitigation algorithms, low size, weight, and power, high speed processing



# Advanced Technology Hypersonic Defense Mission

Notional Representation





# Advanced Technology Hypersonic Defense Mission

- **Weapon Concept Definition:**
  - Complete joint government and industry concept definition for the hypersonic intercept weapons. The weapons concepts will aid the Agency in establishing the requirements foundation for hypersonic defense.
  - Deliver contractor concept(s) for hypersonic interceptor weapon components for future technology risk reduction
- **Hypersonic Threat Sensor Technology**
  - Identify and demonstrate sensor components for future hypersonic applications
  - Test and demonstrate sensor components for future hypersonic applications
  - Conduct EO/IR sensor-to-tactical network experiments to lower latency of sensor data to user
  - Ground test data processing and algorithms for wide field of view threat scenes



# MDA Advanced Research

- **Pursue a broad range of high-risk technologies**
  - Capitalize on the innovation and creativity of the Nation's small businesses and universities
  - Develop and transform cutting edge technologies into actual applications for insertion into the BMDS
- **Technology insertion into the BMDS is critical**
- **Advanced Research utilizes the following research vehicles:**
  - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program
    - 4<sup>th</sup> largest SBIR/STTR program in the Department of Defense
  - Rapid Innovation Funding
  - Broad Agency Announcements
    - Missile Defense Science & Technology Advanced Research
    - Advanced Technology Innovation





# Technology Interest Areas

- **Interceptor Technology**
  - Guidance, navigation, & control
  - Batteries & power systems
  - Advanced materials
    - High temperature
    - Light weight
  - Seeker technology
  - Rad-Hard technology
  - Deployment systems
  - Lightweight composites
  - Propulsion & control technologies
    - Improved specific impulse
- **C2BMC**
  - Advanced tracking & discrimination algorithms
  - Command & control algorithms
  - Low latency and secure communications
  - Battlespace management
  - Data fusion
  - Warfighter training
  - AI/ML
- **Modeling & Simulation**
  - Lethality
  - Battlespace environments
  - Engagement
  - Aerothermal environments
  - Technology investment evaluation
  - Test verification
- **BMDS Testing**
  - Affordable targets
  - Scene generation
  - HWIL
  - Rapid analysis SW toolkits
  - Predictive analysis & modeling
  - Range safety
- **Sensors**
  - EO/IR and radar
    - T/R modules
    - FPAs
  - Signal & data processing algorithms
  - Rad-Hard technology
  - Telescopes & antennas
  - Windows & radomes



# Heilmeier Framework

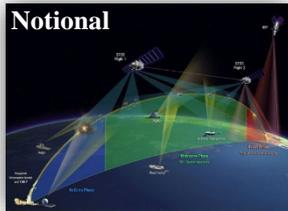
- 1. What are you trying to do?**
  - What problem are you trying to solve?
- 2. How does this get done at present? Who does it? What are the limitations of present approaches?**
- 3. What is new about your approach? Why do you think you can be successful at this time?**
  - Have you done a first-order analysis of your approach?
- 4. If you succeed, what difference will it make?**
- 5. How long will it take? How much will it cost? What are your mid-term and final exams?**
  - What does success look like and how will you demonstrate it?
  - What is your execution plan? How will you measure progress? What are your milestones/metrics? How will your results transition?



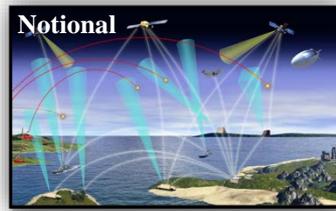
# Solicitation Process

- **SBIR / STTR program is a four step process**

- Phase I: feasibility and concept development (\$100,000)
- Phase II: technology and prototype development (\$1,000,000)
  - Technology may receive one sequential Phase II
- Phase II Enhancement: Prototype testing and technology demonstrations and validation (\$500,000)
- Phase III: Commercialization and Transition



(SBIR/STTR Funded)

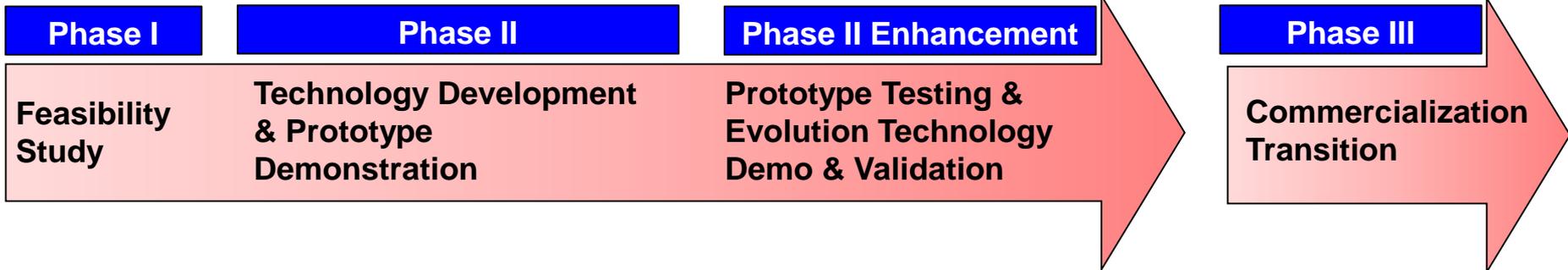


(SBIR/STTR Funded)

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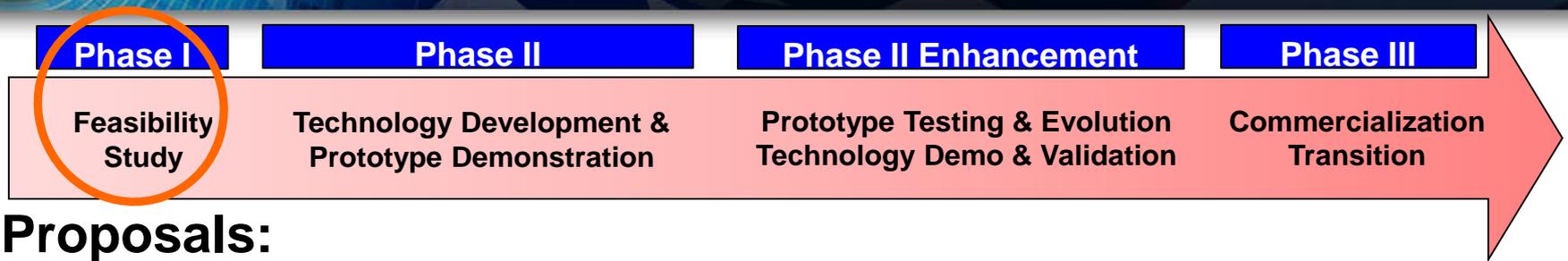


(Program Funded)





# SBIR / STTR Phase I Overview



- **Proposals:**

- Three criteria;
  - Technical merit, feasibility of the concept and approach
  - Qualifications of team
  - Commercialization/Transition potential and approach
- Must identify all foreign nationals and level of involvement
- Limited to twenty pages

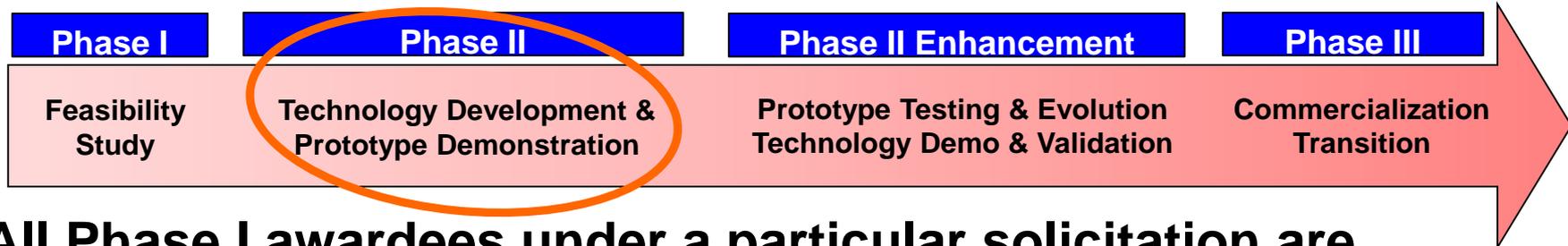
- **Contracts:**

- Topics typically Export Control restricted
- Unclassified
- Currently \$100,000; 6 Months
  - \$50,000 options are awarded to Companies selected for Phase II award (Bridge Funding)





# SBIR / STTR Phase II Overview

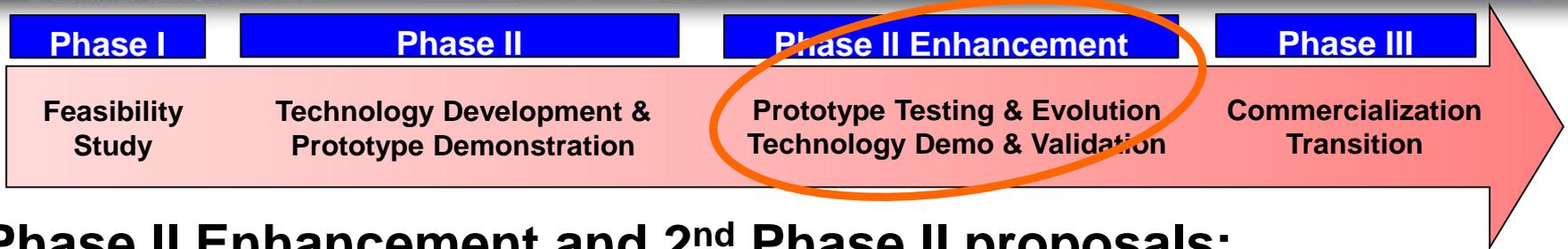


- **All Phase I awardees under a particular solicitation are allowed to submit a proposal for Phase II award**
- **Phase II proposals:**
  - Accepted only during announced open period
  - Announcement on web page with email notification to current Phase I awardees
  - Two-year award for further concept development to prototype stage
  - Submitted for an amount not to exceed \$1,000,000

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# SBIR / STTR Phase II Enhancement Overview



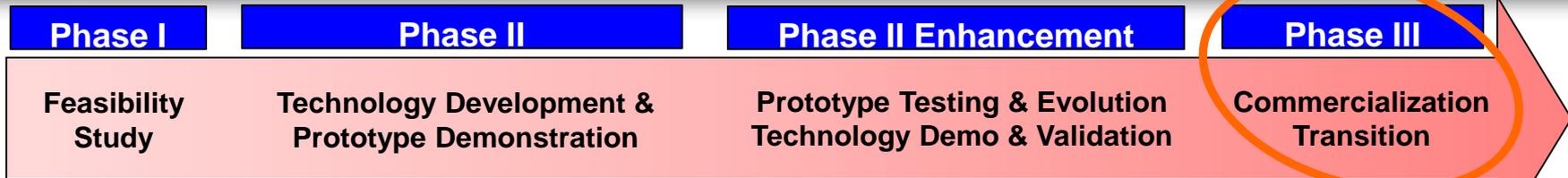
## • Phase II Enhancement and 2<sup>nd</sup> Phase II proposals:

- Technology must progress and innovate beyond the work you accomplished in your initial Phase II
- Must address why continued investment from the Government is needed
- Show a transition path for the technology beyond the SBIR/STTR Program.
- Up to \$500,000 award for Enhancements and up to \$1,000,000 award for 2<sup>nd</sup> Phase II





# SBIR / STTR Phase III Commercialization & Transition



- **Non-SBIR funded R&D or production of contracts for products developed under Phase I & Phase II activities**
- **Several means to pursue Phase III funding**
  - Phase III Contract with the Government
  - Sub to a Prime Contractor
  - Rapid Innovation Fund (RIF)
- **Benefits of SBIR developed technology**
  - Eligible for sole-source non-competitive contract
  - Help meet program small business goals
  - Source to generate cost savings to achieve life cycle cost goals
  - Extends SBIR data rights for five years from end of last SBIR award
- **Develop a diverse portfolio of cash flow for your technology**
  - SBIR technology often takes years to commercialize
- **Lay the framework for transition of SBIR technology early**
  - Program Office Requirements List
  - Prime Contractors have limited flexibility after contract negotiation
- **Look for opportunities outside of the Program/Agency that your SBIR/STTR technology was developed**
  - Phase I award qualifies your technology with any SBIR Program







# Broad Agency Announcement (BAA)

- **A competitive research and development contracting approach in the form of a general agency announcement:**
  - Identifies areas of research interest
  - Evaluates proposals based on peer or scientific reviews against individual merits rather than against each other
- **Meets full and open competition requirements of "The Competition in Contracting Act of 1984"**
- **The following slides give more information regarding specific BAA programs**



# Missile Defense Science & Technology Advanced Research (MSTAR) BAA Program

## • **Technical Objectives**

- Fund relevant, advanced research and development at domestic universities and academic institutions
- Build portfolio of revolutionary technology to support and enhance BMDS
- Develop holistic partnerships
- Educate future scientists and engineers

## • **Open continuously for proposals from universities**

- Broad Agency Announcement (<http://www.fbo.gov>)
- Research topics revised annually
- MDA is seeking strategic alliances with universities
- One year base period with two one year options
  - Base period up to \$200,000
  - Option years \$200,000 (each)



# Advanced Technology Innovation (ATI) BAA Program

- **Technical Objectives**

- Fund relevant cutting edge technology from industry, small business and universities
- Build portfolio of revolutionary technology to support and enhance BMDS

- **Advanced Technology Innovation Broad Agency Announcement**

- Open continuously to university and commercial vendors
- Contract value not limited





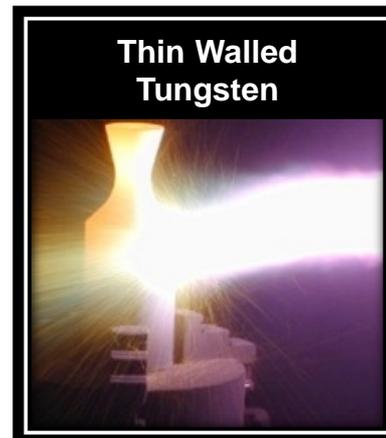
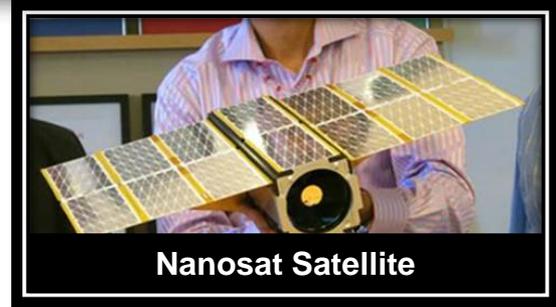
# Rapid Innovation Fund (RIF) Program

- **Established under FY11 Defense Authorization Act (Section 1073)**
  - A competitive, merit-based program
  - Accelerate fielding of innovative technologies into military systems
  - Typically, all MDA RIF projects are a SBIR Phase II follow-on
  - Prioritization is given to small business
- **Key Requirements:**
  - Satisfy an operational or national security need
  - Accelerate or enhance military capability
  - Reduce
    - Technical risk
    - Cost: Development, acquisition, sustainment, or lifecycle
  - Improve timeliness and quality of test and evaluation outcome
  - Provide approach for use by an acquisition program
  - Typical award length 24 months
  - Award values up to \$3,000,000



# Recent SBIR / RIF / BAA Sponsored Research Accomplishments

- Inaugurated a nanosat testbed program to demonstrate notional Kill Vehicle communication architecture
- Executed structural test series to validate SBIR developed lightweight unitary nosecone
- Near Net Shape Manufacturing Non-Eroding, Thin Walled, Tungsten
- Completed radiation testing on hardened mirrors
- Developed high-speed test instrumentation



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# For More Information

[www.mda.mil](http://www.mda.mil)

- Missile Defense News, Images, Videos, Fact Sheets
- BMDS Overview, BMD Basics
- MDA Business Opportunities  
([https://www.mda.mil/business/advanced\\_research.html](https://www.mda.mil/business/advanced_research.html))
- DoD SBIR/STTR website: <https://sbir.defensebusiness.org>
- SBA SBIR/STTR website: <https://www.sbir.gov>

## To Contact MDA

- SBIR / STTR            256-955-2020 [sbirsttr@mda.mil](mailto:sbirsttr@mda.mil)
- University / BAA      256-450-3800 [Advanced\\_Research@mda.mil](mailto:Advanced_Research@mda.mil)
- Commercialization   256-450-5343 [SBIR-PhaseIII@mda.mil](mailto:SBIR-PhaseIII@mda.mil)



# Questions

