



2020

Missile Defense Agency
Office of Small Business Programs
Virtual Conference



MDA

SB Conference

Mr. John Hawkins
Lead, Science and Technology

Dr. Yazmin Carroll
Director, Advanced Research



MDA Science & Technology Program Overview

Mr. John Hawkins



Missile Defense Evolving Threat Environment

Adversaries are fielding diverse and expansive ranges of modern offensive missile systems

- Developing new missiles & improving existing systems
 - Precision strike
 - Penetration aids (e.g. decoys, jamming devices)
- Capable of maneuvering in midcourse or terminal phase
 - Maneuvering Reentry Vehicle (MaRV)
 - Multiple Independent Reentry Vehicle (MIRV)
 - Hypersonic glide vehicles and cruise missiles



North Korea
Hwasong-15 ICBM



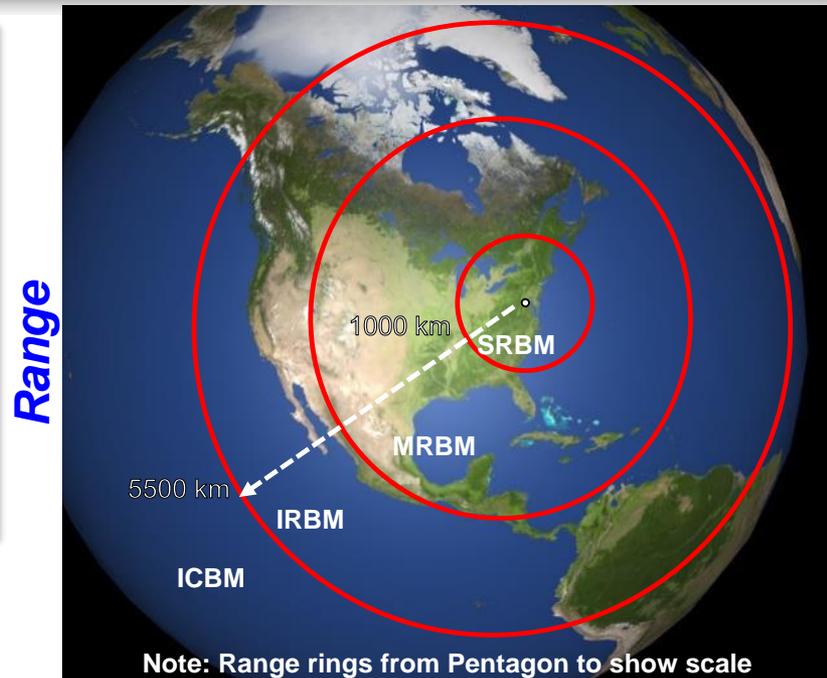
Iran
Emad-1 MRBM with MaRV



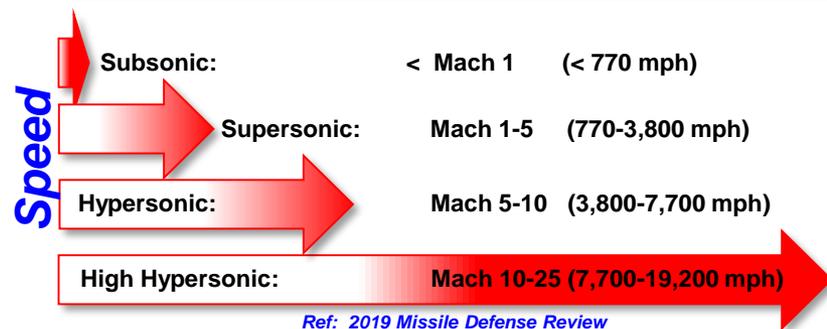
China
Dong Feng (DF-26) IRBM



Russia
Concept Hypersonic Glide Vehicle



SRBM: Short Range Ballistic Missile	(300-1000 km :: 621 mi)
MRBM: Medium Range Ballistic Missile	(1000-3000 km :: 1864 mi)
IRBM: Intermediate Range Ballistic Missile	(3000-5500 km :: 3418 mi)
ICBM: Intercontinental Ballistic Missile	(5500+ km :: 3418+ mi)





Missile Defense Agency Mission

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



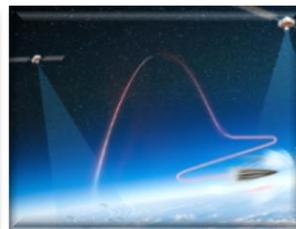
**Missile Defense Capability
Globally Deployed**



Missile Defense Agency Lines of Effort

In Support Of The National Defense Strategy

- Build **Warfighter confidence** through focus on **readiness and sustainment**
- Increase engagement **capability and capacity** to outpace emerging threats
- Increase **speed of delivery** of new capability to address the **evolving threat**



**Today's Missile Defense System Meets Today's Threat
but Requires Additional Capacity and Advanced Capability
to Outpace the Evolving Threat**

Missile Defense Agency Mission

C2BMC Command and Control, Battle Management and Communications

NMCC

USSTRATCOM

USNORTHCOM

USINDOPACOM

USEUCOM

USCENTCOM

BOOST
Defense Segment

ASCENT/MIDCOURSE
Defense Segment

TERMINAL
Defense Segment

**The System
Of Elements**

GBI
Ground-Based
Interceptor

SM-3 IIA
Standard
Missile

SM-3 IA/IB
Standard
Missile

THAAD
Terminal High
Altitude Area
Defense

SM-6
Standard
Missile

GMD
Ground-based
Midcourse
Defense

**Aegis
Ship & Ashore**
Ballistic Missile
Defense

**Aegis
Sea-Based
Terminal**

PAC-3
Patriot Advanced
Capability

Sensors



Satellite Surveillance
BMDS OPIR Architecture



Upgraded Early
Warning Radars



Forward-Based
Radars



AEGIS BMD
SPY Radars



Discriminating
Radars



MDA 2020 Industry Innovation Summit & Other Small Business Opportunities

- **MDA's Inaugural Industry Innovation Summit held on 5 February 2020!**
 - **Nearly 700 industry partners RSVP'd representing over 200 companies**
 - **Classified MDA presentations represented the whole of the Agency**
 - **Technology investments and gaps**
 - **Delivered MDA's first S&T Initiatives booklet**
 - **Our 2021 Summit will be announced on www.beta.SAM.gov**
- **Other MDA Small Business Opportunities**
 - **MDA will host a SBIR/STTR Conference in September 2020**
 - **Technical Interchange Meetings between Primes and Small Business will begin in May 2020 and occur throughout the year**



Approved for Public Release
20-MDA-10455 (13 Apr 20)



MDA Science & Technology Program Overview

- **MDA S&T Purpose:**

- Aligns technology development initiatives, S&T planning, programming, and execution with Agency-wide objectives and priorities
- Technology push and pull
- Provides platforms for communication between MDA , industry partners, universities, national laboratories, OUSD (Research & Engineering), OSD Communities of Interests, and other DoD components

National Defense Strategy



Nuclear Posture Review



Missile Defense Review



National Security Strategy



- **MDA S&T Roadmap**

- Identifies and prioritizes enabling technology needs to support long-term planning and alignment of S&T investments
- Provides updated MDA Strategic Vision to chart the path to deliver enabling technologies that support MDA's Future Architecture Roadmap

- **MDA Future Architecture Roadmap**

- The Future Architecture Roadmap (FAR) is responsive to DoD policy and OUSD(Research & Engineering) MDA focus areas to develop an updated Strategic Vision to chart the path to deliver capabilities to the Warfighter out to 2035

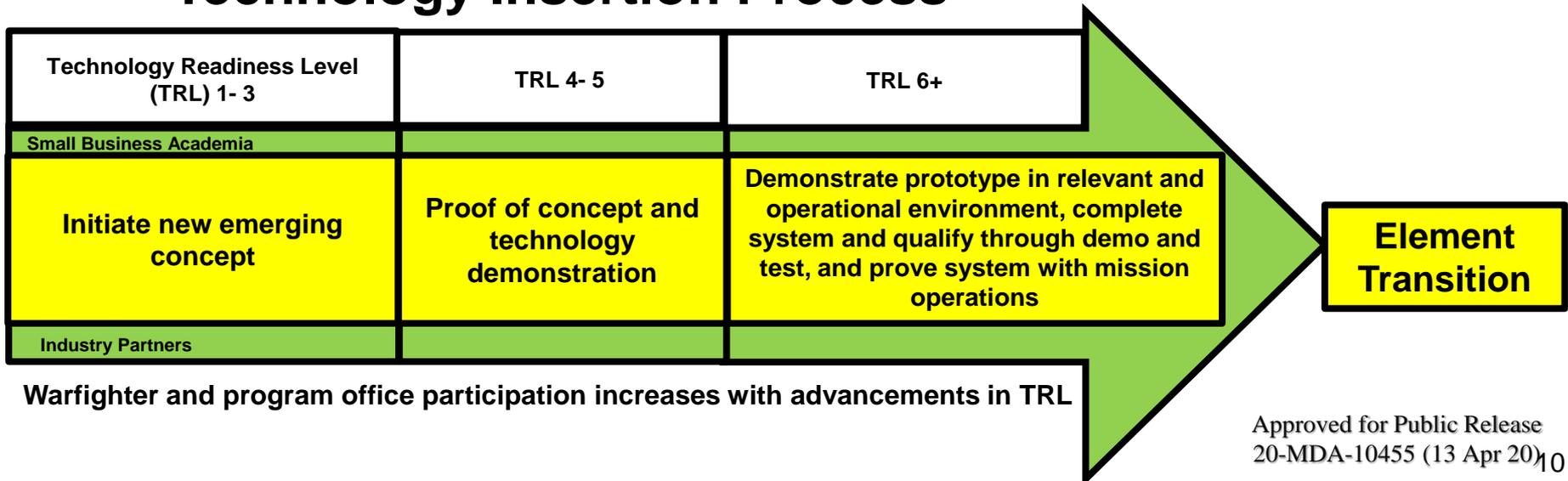


Technology Identification Maturation

Approach for Advancing Emerging Technologies for Insertion Into Missile Defense System across Kill Chain

- Warfighter identifies needs in the Prioritized Capabilities List
- MDS architect develops Future Architecture Roadmap
- Directorate of Engineering and Advanced Technology Program Executive Office jointly identify technology gaps
- Independently assesses other gaps and technology push opportunities
- Prioritizes technology development needs and documents in Science and Technology Roadmap
- Informs budget process

Technology Insertion Process





Today's Layered Missile Defense System

C2BMC Command and Control, Battle Management and Communications

NMCC USSTRATCOM USNORTHCOM USINDOPACOM USEUCOM USCENTCOM

BOOST
Defense Segment

ASCENT/MIDCOURSE
Defense Segment

TERMINAL
Defense Segment

**The System
Of Elements**

GBI
Ground-Based
Interceptor

SM-3 IIA
Standard
Missile

SM-3 IA/IB
Standard
Missile

THAAD
Terminal High
Altitude Area
Defense

SM-6
Standard
Missile

GMD
Ground-based
Midcourse
Defense

**Aegis
Ship & Ashore**
Ballistic Missile
Defense

**Aegis
Sea-Based
Terminal**

PAC-3
Patriot Advanced
Capability

Sensors



Satellite Surveillance
BMDS OPIR Architecture



Upgraded Early
Warning Radars



Forward-Based
Radars



AEGIS BMD
SPY Radars

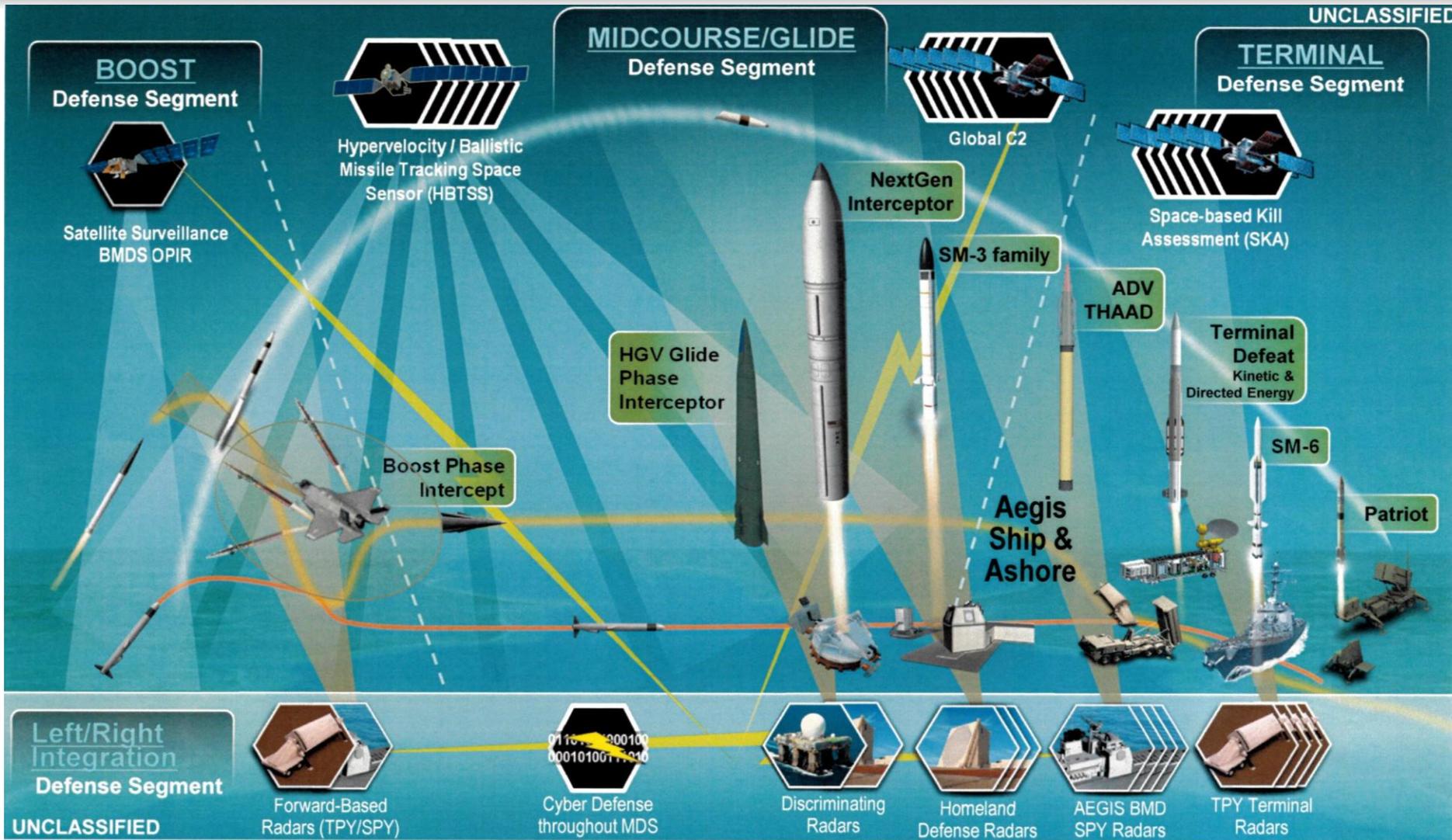


Discriminating
Radars



Tomorrow's Missile Defense System 2.0

UNCLASSIFIED



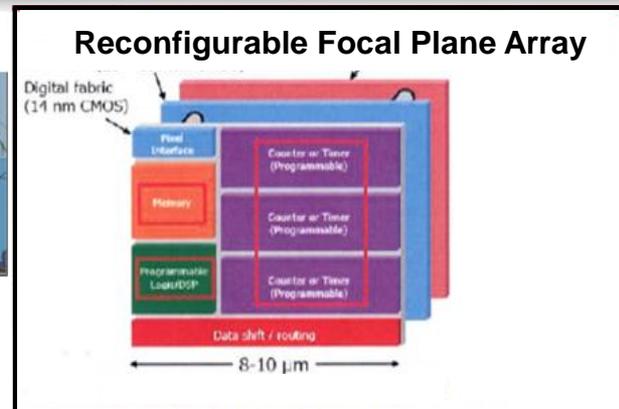


MDA's S&T Investment Strategy

1. Identify warfighter and future architecture needs
2. Review technology development program plans for viability and relevance
3. Identify gaps and disruptive technology opportunities
4. Build MDA Strategic S&T Roadmap
 - a. Prioritized and aligned with National Defense Strategy, Road to Dominance modernization and MDA lines of effort
5. Identify internal and external S&T investment opportunities
 - a. Leverage OSD programs (e.g. Rapid Innovation Fund, Communities of Interest, Applied Research for Advancement of Priorities)
 - b. Leverage collaboration with service communities and academia
6. Collaborate across warfighter community to advance MDA S&T Roadmap initiatives
7. Assign resources to support S&T initiatives
8. Develop rapid acquisition approaches
9. Accelerate technology transition to programs of record



Dynamic Battle Manager



Micro Electromagnetic Systems



Nanosat



Hypersonic
Glide Vehicles (Notional)



Threat
Reentry Vehicle (Notional)



Hypersonic Cruise
Missiles (Notional)



Technology Interest Areas

• **Interceptor Technology**

- Guidance, navigation, and control
- Batteries and power systems
- Advanced materials
 - High temperature
 - Lightweight
- Seeker technology
- Radiation hardened technology
- Deployment systems
- Low SWaP Inertial Measurement Units
- Lightweight composites
- Propulsion and control technologies
 - Improved specific impulse

• **Command and Control, Battle Management, and Communications (C2BMC)**

- Advanced tracking and discrimination algorithms
- Command and control algorithms
- Low latency and secure communications
- Battlespace management
- Data fusion
- Warfighter training
- Joint track management
- Combat identification
- Network management
- AI/MI

• **Modeling and Simulation**

- Lethality
- Battlespace environments
- Engagement
- Aerothermal environments
- Technology investment evaluation
- Test verification

• **MDS Testing**

- Affordable targets
- Scene generation
- HWIL
- Rapid analysis software toolkits
- Predictive analysis and modeling
- Range safety

• **Sensors**

- EO/IR and radar
 - Track and receive modules
 - FPAs
- Signal and data processing algorithms
- Radiation hardened technology
- Telescopes and antennas
- Windows and radomes



Approved for Public Release
20-MDA-10455 (13 Apr 20)



MISSILE DEFENSE AGENCY

Advanced Research Overview

Dr. Yazmin Carroll



DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

Approved for Public Release
20-MDA-10455 (13 Apr 20)



MDA Advanced Research

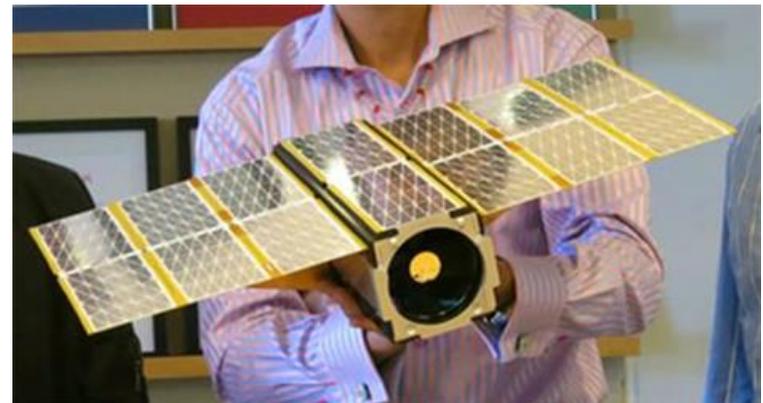
- Pursue a broad range of high-risk technologies
 - Capitalize on the innovation and creativity of the Nation's small businesses and universities
 - Develop and transform cutting edge technologies into actual applications for insertion into the MDS (Missile Defense System)
- Technology insertion into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





NanoSat Testbed Initiative

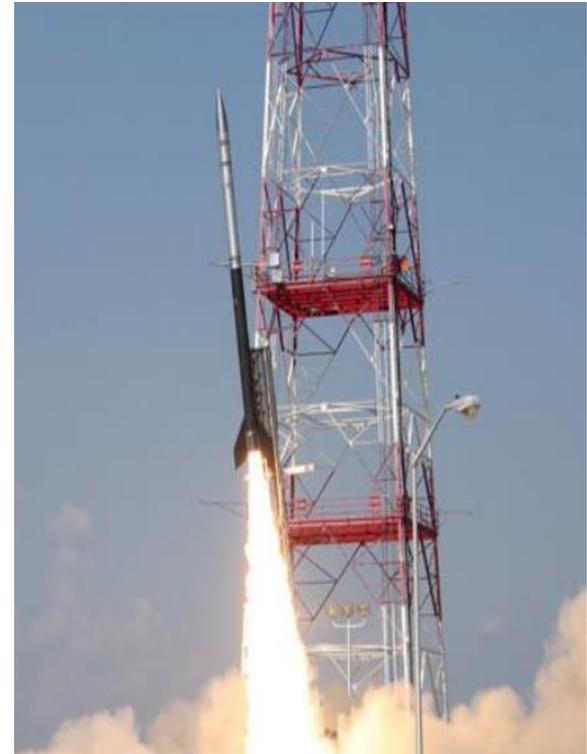
- ◆ The Nanosat Testbed Initiative uses small, low cost satellites to demonstrate MDS technology in a space environment.
 - Directly applicable to MDS kill vehicles, space sensors, and space weapons
 - Takes advantage of emerging small satellite technology, launch capacity, and automated operations for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





Sub-Orbital Flight Experiments

- ◆ **To demonstrate SBIR developed technologies in an operational environment**
 - **Raises Technology Readiness Level (TRL) of Demonstration technologies to TRL 6**
 - **Impartial demonstration**
 - **Can be used by small businesses as justification for insertion into programs of record**
 - **Provides risk mitigation activities for key components of MDA Architecture (Divert Attitude Control Systems, Batteries, Sensors, Inertial Measurement Units)**
 - **Can be iterated on regular basis**
 - **Allows experimentation at a lower quality level than a Flight Test**





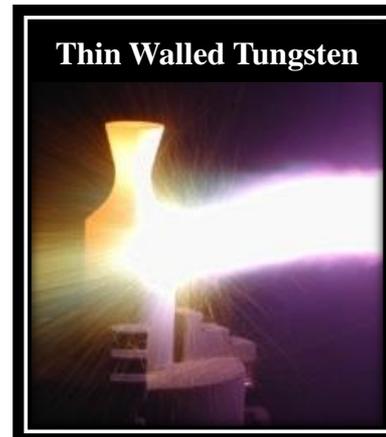
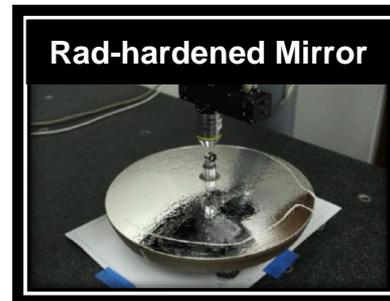
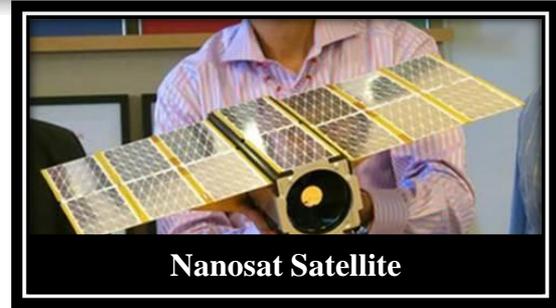
Hypersonic Defense Mission

- ◆ **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**
 - **Develop advanced seeker window materials and modeling techniques**



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 composites
- Near Net Shape Manufacturing Non-Eroding, Thin Walled, Tungsten
- Completed radiation testing on hardened mirrors
- Developed high-speed test instrumentation

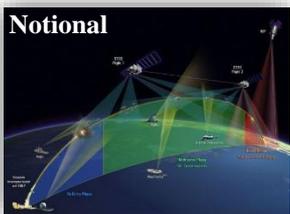


Approved for Public Release
20-MDA-10455 (13 Apr 20)

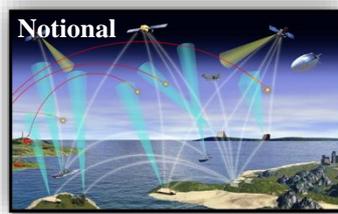


Solicitation Process

- **SBIR / STTR program is a four step process**
 - **Phase I: feasibility and concept development**
 - **Phase II: technology and prototype development**
 - **Technology may receive one sequential Phase II**
 - **Phase II Enhancement: Prototype testing and technology demonstrations and validation**
 - **Phase III: Commercialization and Transition**

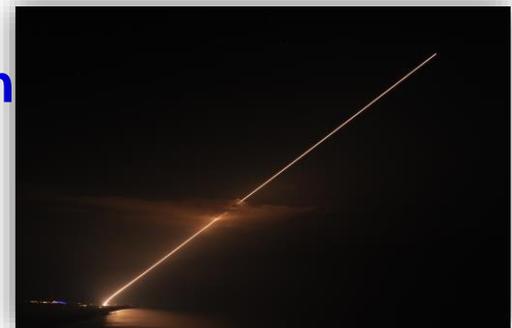


(SBIR/STTR Funded)

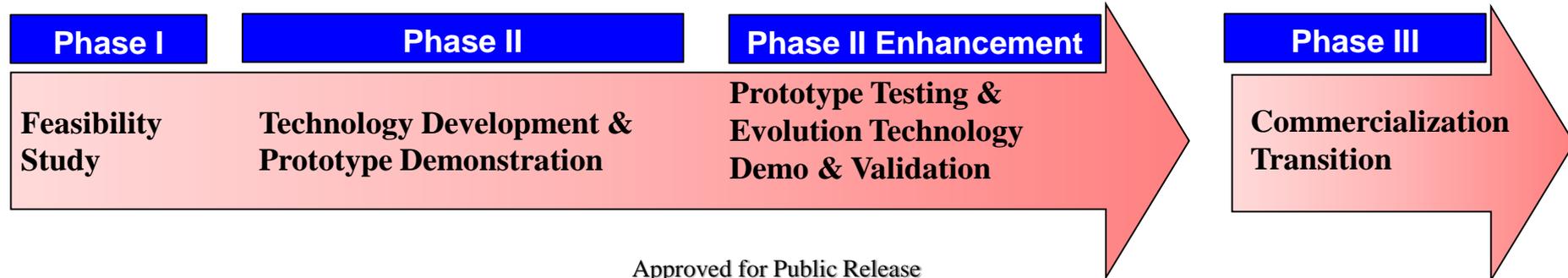


(SBIR/STTR Funded)

(SBIR/STTR Funded)



(Program Funded)





Technology Investment Awards

FY18 Awards

SBIR Phase I	94 Awards	\$9,452,855
SBIR Phase II	50 Awards	\$50,670,884
SBIR Phase III	3 Awards	\$13,969,647
BAA's	27 Awards	\$350,905,363

FY19 Awards

SBIR Phase I	62 Awards	\$6,253,241
SBIR Phase II	62 Awards	\$73,988,216
SBIR Phase III	4 Awards	\$17,340,888
BAA's	21 Awards	\$131,140,256



For More Information

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)
- 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
- University / BAA 256-450-3800 Advanced_Research@mda.mil
- Commercialization 256-450-5343 SBIR-PhaseIII@mda.mil



Questions

