

Space & Missile Defense Symposium



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BMDs

THE BALLISTIC MISSILE DEFENSE SYSTEM

SENSORS

An effective layered defense incorporates a wide-range of sensors to detect and track threat missiles through all phases of their trajectory. Satellites and a family of land- and sea-based radars provide worldwide sensor coverage.



SATELLITE SURVEILLANCE



FORWARD-BASED RADAR



EARLY WARNING RADAR



AEGIS BMD SPY-1 RADAR

BOOST/ASCENT DEFENSE SEGMENT

POTENTIAL NEW TECHNOLOGIES

SM-3
STANDARD MISSILE-3



AEGIS
BALLISTIC MISSILE DEFENSE

A SYSTEM OF ELEMENTS

MIDCOURSE DEFENSE SEGMENT

EKV
EXOATMOSPHERIC
KILL VEHICLE

GBI
GROUND-BASED
INTERCEPTOR

GROUND-BASED
MIDCOURSE
DEFENSE

TERMINAL DEFENSE SEGMENT

AEGIS
SEA-BASED TERMINAL

THAAD
TERMINAL HIGH
ALTITUDE AREA
DEFENSE

PAC-3
PATRIOT
ADVANCED
CAPABILITY-3

COMMAND, CONTROL, BATTLE MANAGEMENT AND COMMUNICATIONS

C2BMC

The Command, Control, Battle Management and Communications (C2BMC) program is the hub of the Ballistic Missile Defense System (BMDs). It is a vital operational system that enables the U.S. president, secretary of defense and combatant commanders at strategic, regional and operational levels to systematically plan ballistic missile defense operations, to collectively see the battle develop, and to dynamically manage designated networked sensors and weapons systems to achieve global and regional mission objectives.

NMCC

USSTRATCOM

USNORTHCOM

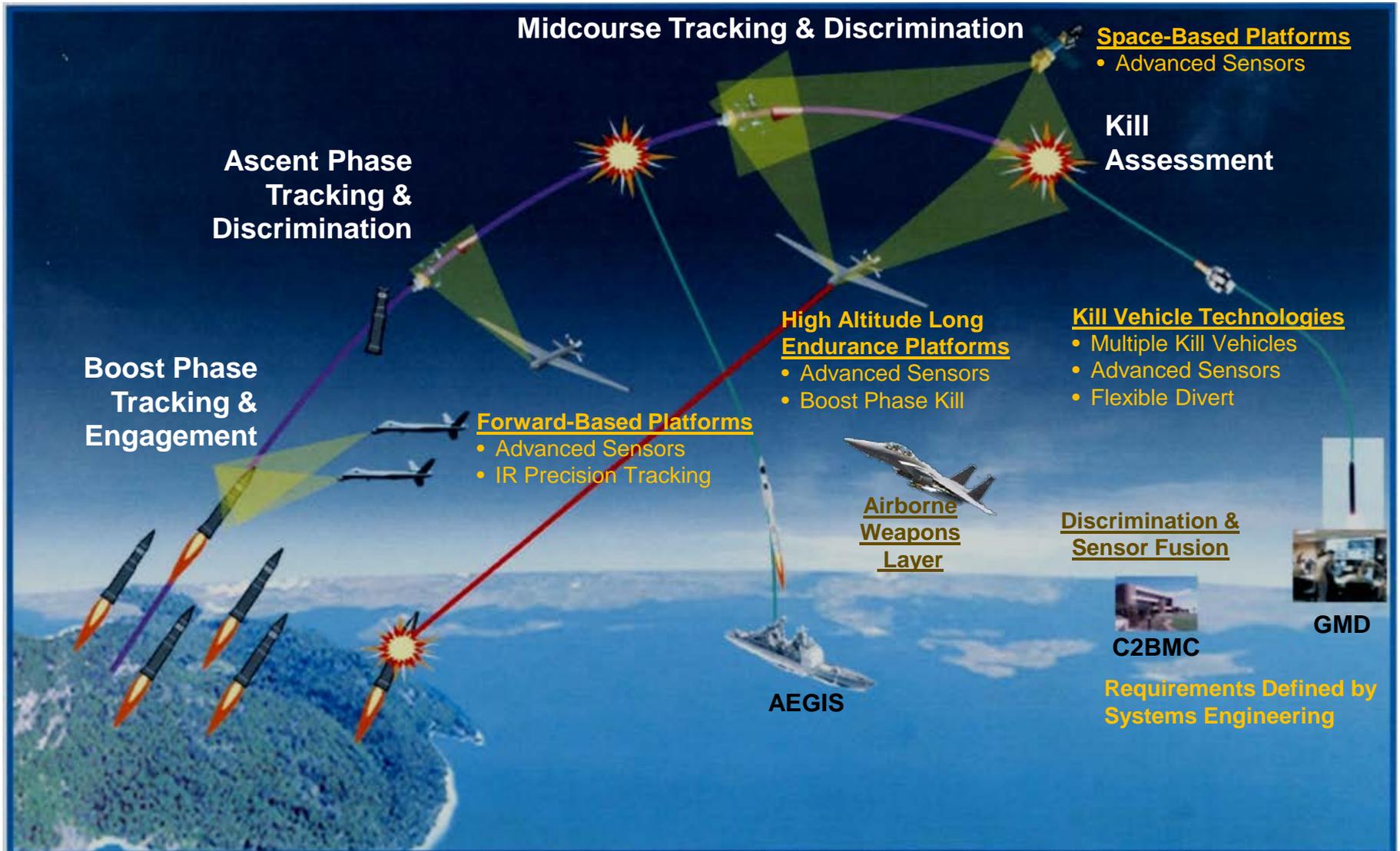
USPACOM

EUCOM

CENTCOM

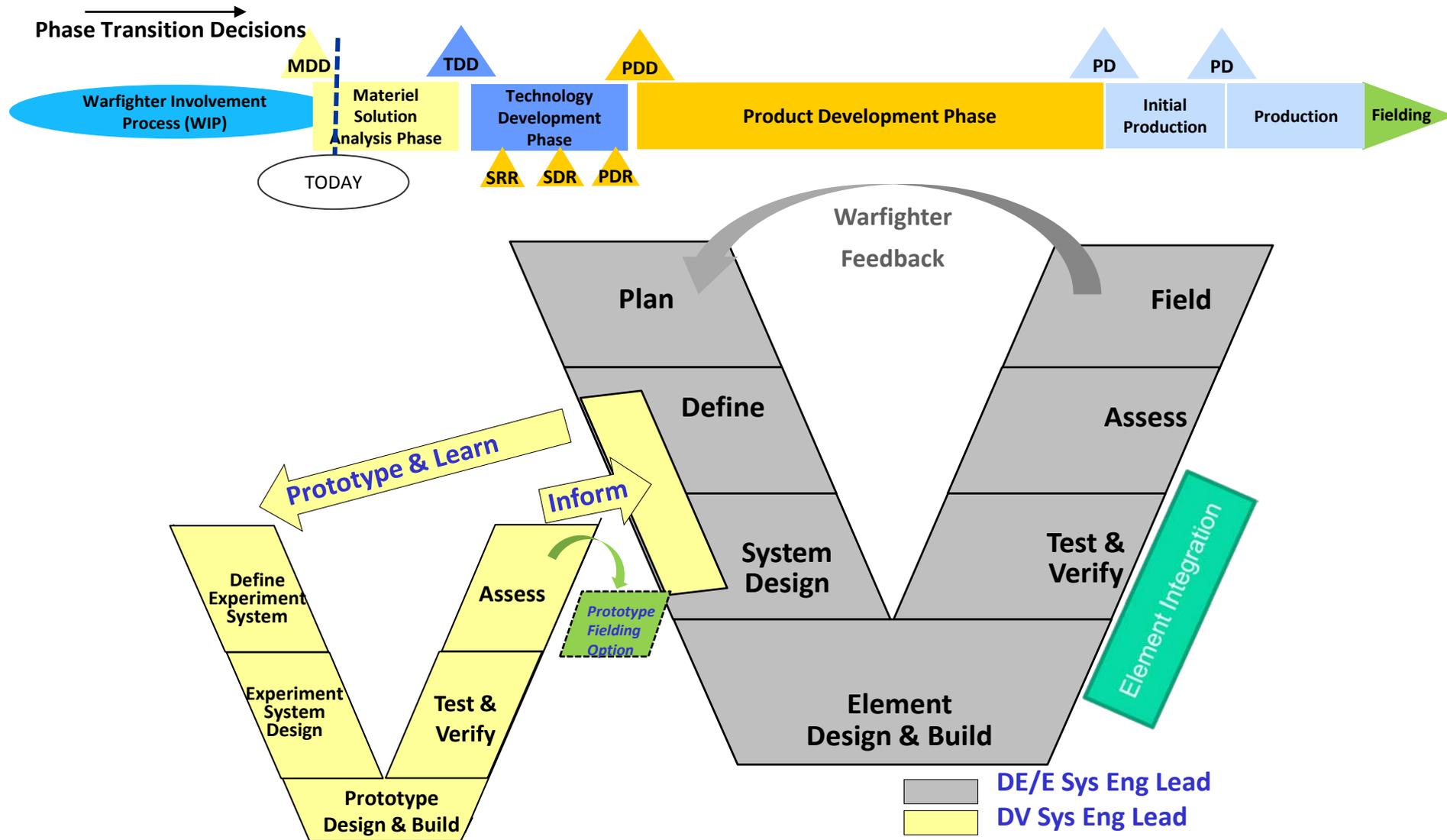


Technology Contributions to the BMDS



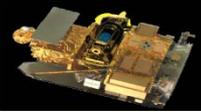
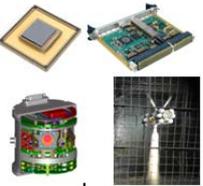


DV Engineering Context





Planned Technology Investments

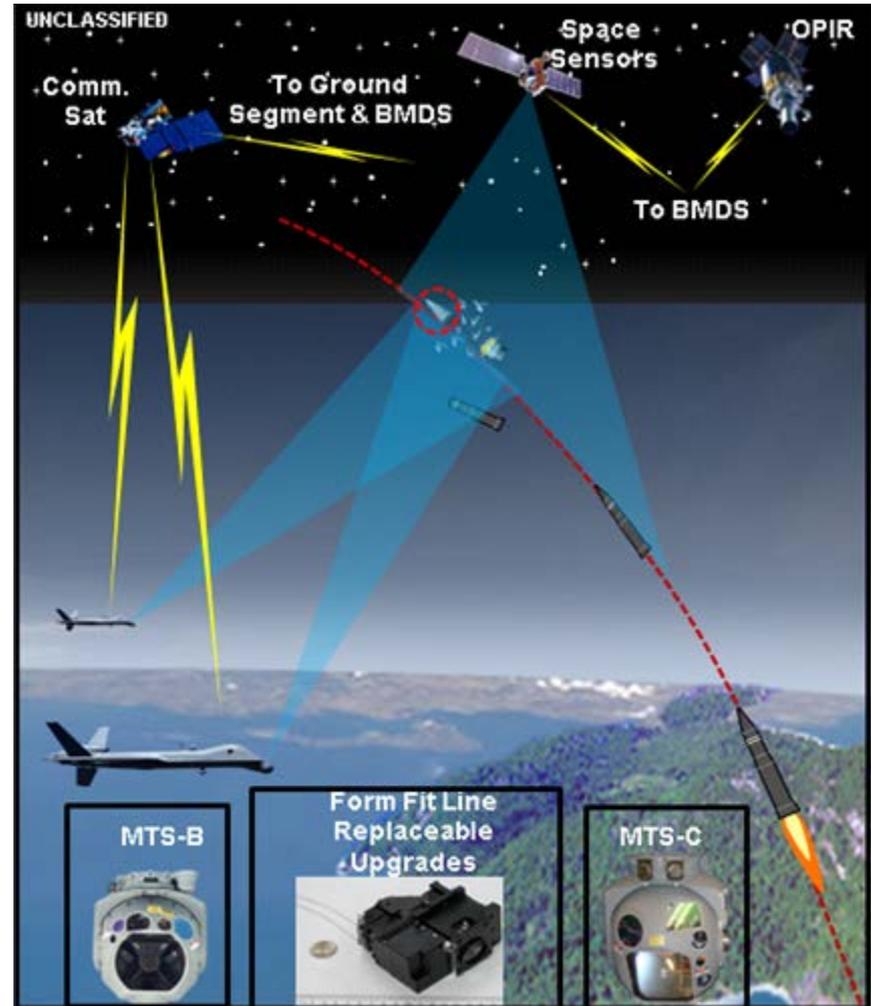
Investment Area	Vision	Investment Roadmap
<p>Persistent Discrimination</p> 	<p>Capitalize on persistent, multi-phenomenology sensors to maximize the discrimination capability of our BMDS architecture</p> 	<ul style="list-style-type: none"> Precision tracking demonstrations Discrimination demonstrations Deploy Airborne or Space-based Prototypes
<p>High Power Lasers</p> 	<p>Integrate high power lasers into the BMDS architecture for a broad range of missile defense missions</p> 	<ul style="list-style-type: none"> Lab experiments UAV-borne Laser Flight tests
<p>Common Kill Vehicle Technology</p> 	<p>Develop common kill vehicle technology for insertion into GBI and SM-3 programs that addresses the future threat</p> 	<ul style="list-style-type: none"> Component R & D Demonstrate prototypes Develop and Deploy Discriminating and Multi-object kill vehicles
<p>Advanced Research</p> 	<p>Pursue high-risk and high pay-off technologies for the next Ballistic Missile Defense System</p> 	<ul style="list-style-type: none"> Exploit emerging technologies Partner with our Nation's small businesses and universities Transform new technologies into applications for insertion into the BMDS





Discrimination Sensor Technology

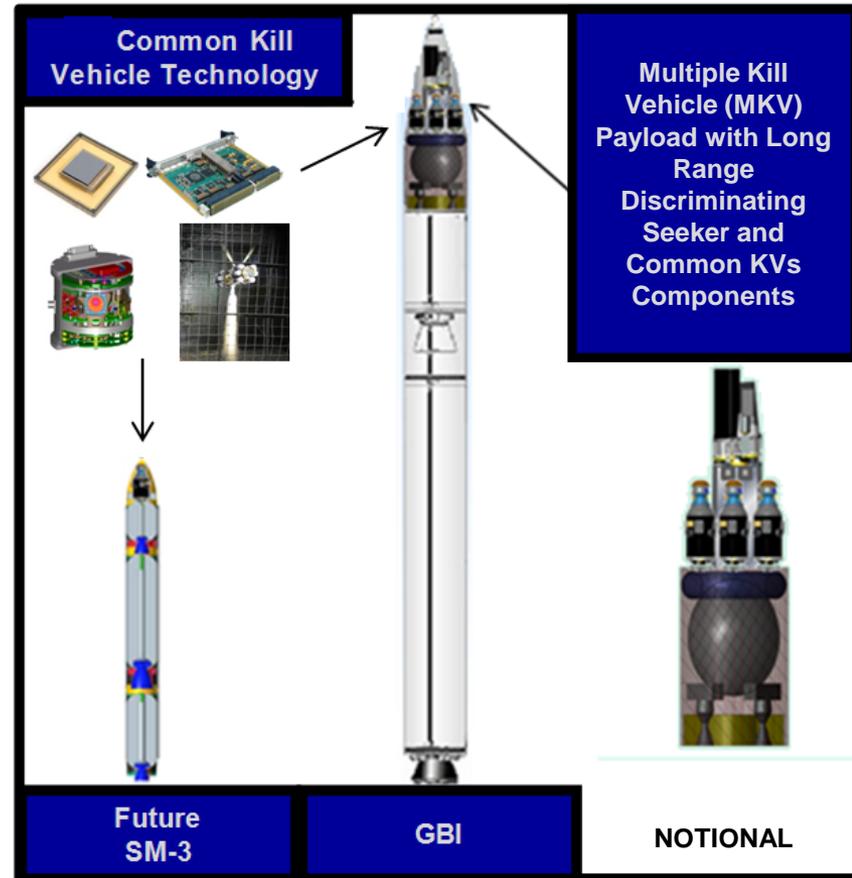
- Develop and demonstrate discriminating technology through robust tests
- Demonstrate engage-on-remote using Multispectral Targeting System sensors
- Design, build, and integrate advanced sensor upgrades to the sensors
- Evaluate the performance of advanced discrimination algorithms
- Mature sensor technology for multiple applications





Common Kill Vehicle Technology

- Develop modular, open kill vehicle architecture
- Capitalize on the innovation of our industrial base
- Develop scalable technology at the component level in phases
- Integrate and test kill vehicle component technology on a prototype
- Phased transition of discriminating kill vehicle technology to Ground Based Interceptor (GBI) and Standard Missile-3 (SM-3)
- Evolve to a multiple kill vehicle payload for GBI





“Smart Buyer” Approach to Acquisition

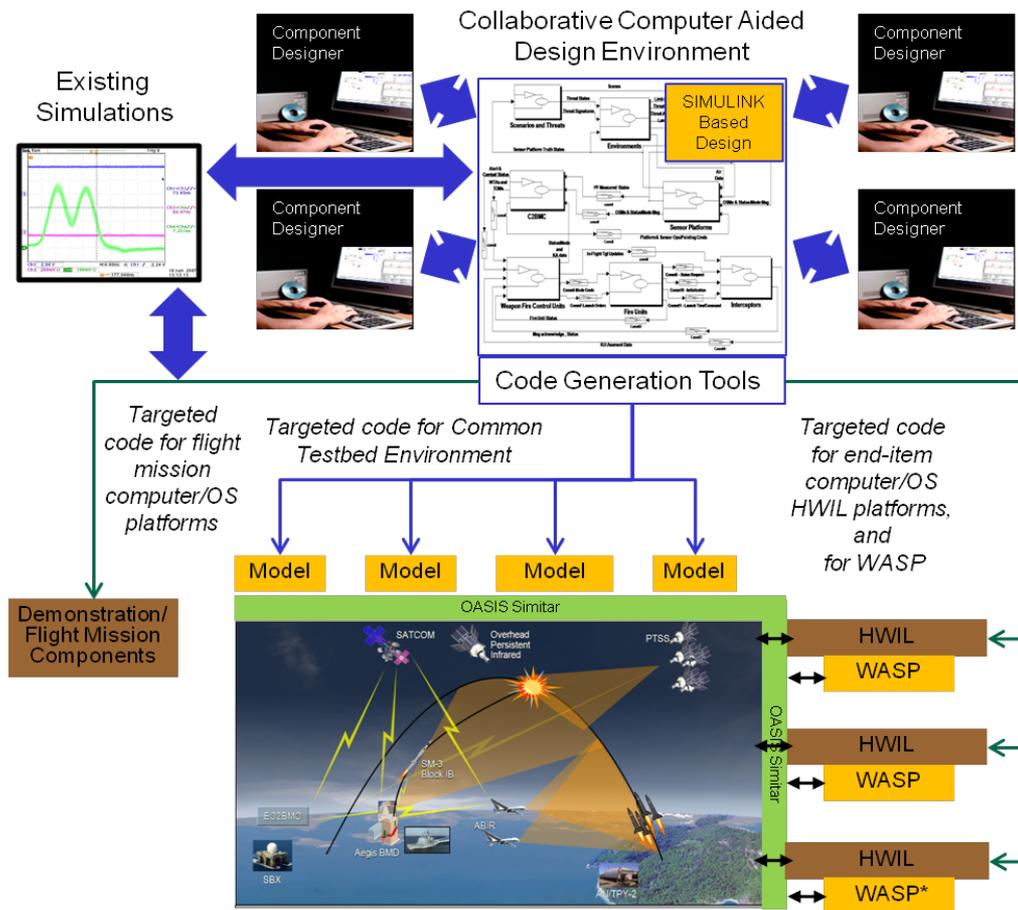
Advanced Technology Concept Assessment and Model-Based Engineering Approach Exploiting Simulation-Based Tools

- Leverages expertise gained developing government-owned, non-proprietary tools
- Provides leadership with independent assessment of industry-provided concept performance
- Provides options for conducting trade studies to support requirements and concept development, assessment of alternatives, design decisions, and performance assessments
- Provides the foundation for successful development, demonstration, and implementation of emerging BMDS technology



Integrated Approach Single Source Multiple Uses

Model-Based Engineering Tools Provide Code Generation for Simulation through Concept Demonstration and Flight



Matlab/Simulink

OASIS Simitar

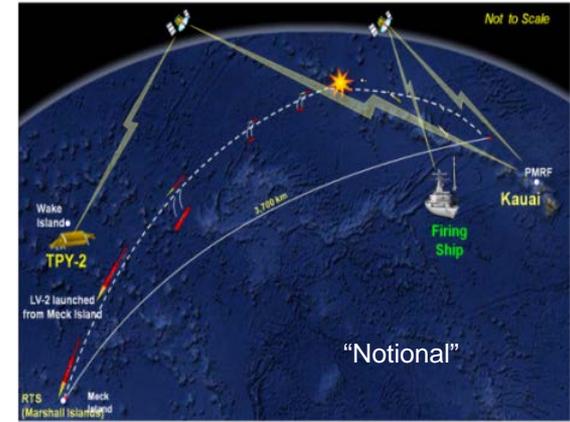
- Flexible platform
- Requirements
- Design architecture
- Simulation
- Algorithm test bed
- Dynamic visualization and data reduction



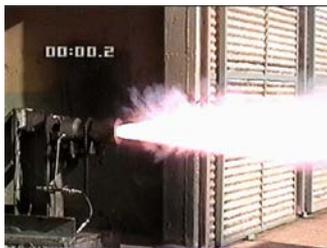
University Engagement / Domestic

Technical Objectives

- Fund relevant, advanced Research and Development (R&D) at domestic universities and academic institutions
- Exploit breakthroughs in science to offer robust technical improvements to BMDS
- Build portfolio of revolutionary technology to support and enhance BMDS
- Develop holistic partnerships
- Educate future scientists and engineers



Data Fusion and Tracking Algorithms



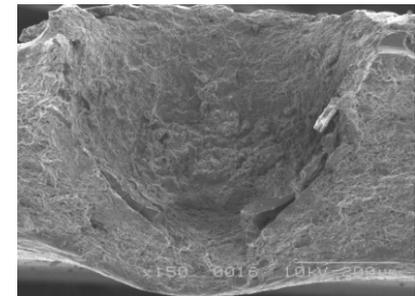
Solid Divert & ACS



High Energy Lasers



Plume Signature Modeling



High Velocity Impact Studies



University Research To Satisfy Missile Defense Needs

- **Missile Defense** requires cutting edge technology
 - Over \$50M/year available for university research
- **Small Business Research**
 - **Small Business Technology Transfer (STTR) program**
 - Universities partner with small business
 - Annual call for proposals from 26 Jul – 25 Sep 2013
 - Efforts could provide up to \$1.9M per project for Universities
 - **Small Business Innovation Research (SBIR) program**
 - Universities subcontract with small business
 - Annual call for proposals from 24 Apr – 26 Jun 2013
 - Efforts could provide up to \$1.5M per project for Universities
 - Link: <http://www.dodsbir.com> <http://www.mdasbir.com>
- **Missile Defense Science & Tech Adv Research (MSTAR)**
 - Annual call for proposals begins in Jun and closes Sep 2013
 - \$0.6M/year is available
 - Link: http://www.mda.mil/business/research_opportunities.html
- **Advanced Technology Innovation Broad Area Announcement (ATI BAA)**
 - Continuously open call for new ideas
 - Funding available as required
 - Link: http://www.mda.mil/business/research_opportunities.html

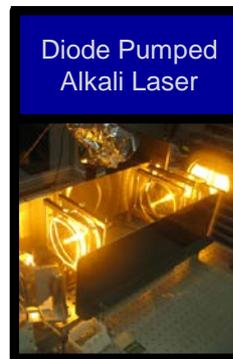
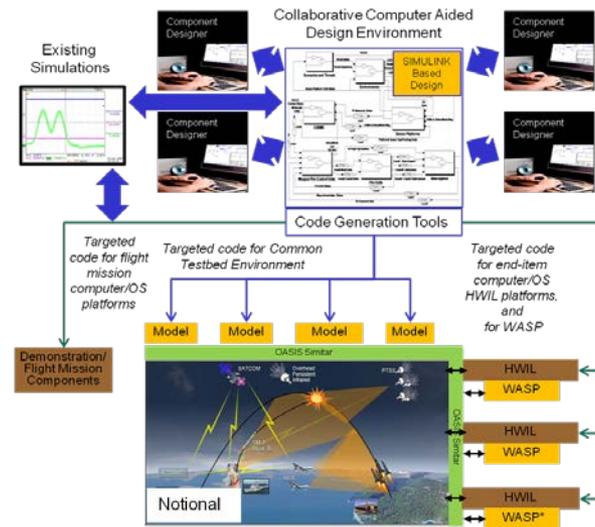




Technology Contributions To The Missile Defense Architecture

BMD Technology Contribution to the BMDS:

- Assess performance
 - ... of advanced concepts through models and simulations prior to and throughout development
- Bridge warfighter capability gaps
 - ... through the development and demonstration of discriminating technology
- Hedge future threats
 - ... through exploration and development of advanced technology for homeland and regional defense





Program Mission Summary

- **Develop game changing technology that is:**
 - **Tangible, Feasible, Fieldable, Deployable, Upgradeable**
- **Develop through innovative technical and programmatic approaches**
- **Investments based on warfighter needs, architecture, and threat evaluation**
 - **Technical drivers** → **Investment Area** → **Capability**

Past technology investments shape the BMDS of today and tomorrow

- **Lightweight Exo-Atmospheric Projectile (LEAP) – Standard Missile**
- **STSS – launch-on-remote**