

Building Missile Defenses for the Future



August 14, 2014

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

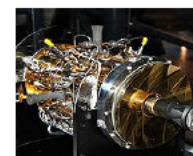
Mr. Richard Matlock
Program Executive for Advanced Technology



Technology Transitioned to the Field

Investments		Transitioned To
RF Radome (Nose Cone) Inertial Measurement Unit* Multi-Frequency RF Datalink	Advanced Master Frequency Generator Missile Round Pallet Canister* Batteries*	PAC-3
Manifold Alternate Aeroshell DACS Bulkhead Super Luminescent Diode 2-Color Focal Plane Array*	Missile Round Pallet Canister* Batteries* Mid-Body Structure	THAAD
All reflective Seeker 2-Color Focal Plane Array* Frame Summing Technique Advanced Solid Axial Stage Advanced Solid DACS Throttling DACS	Inertial Measurement Unit* Nose Cone Lightweight ExoAtmospheric Projectile Navy/BMDO Terrier LEAP Technology Flight Tests	SM-3 Aegis BMD
Mirrors Composite Sunshade Optics Electronic Housing Assembly	Auxiliary Sensor 2-Color Focal Plane Array* Composite Aft Flange Electrical Conversion Unit	GMD / EKV
Very Long Wave FPA Power Systems Gimbals Replacement	Mirror / Telescope Replacement Miniature Sensor Technology Integration Satellites -1, 2, 3	STSS
Advanced Optical Processor Discrimination Algorithms	High-Power Micro-electronics Thermal Management	Radar and RF
Composite Radome for David's Sling		Arrow 3

* Multiple Applications



Lightweight Exo-atmospheric Projectile



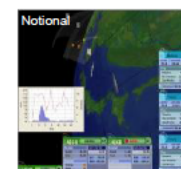
Throttling DACS



Nose Cone



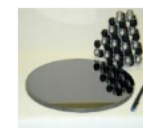
Inflatable Satellite Terminal



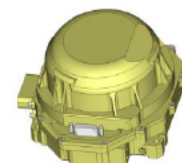
Advanced Algorithms



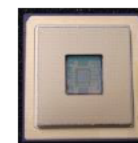
MSTI - 1



Silicon Carbide Mirrors



IMU



Focal Plane Array

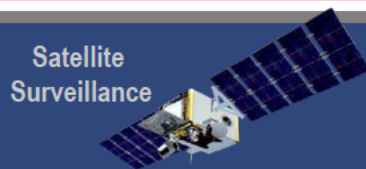


Terrier LEAP Interceptor



Today's Ballistic Missile Defense System

SENSORS



Satellite Surveillance

Forward-Based Radar



Sea-Based X-Band Radar



Aegis BMD SPY-1 Radar



Early Warning Radar

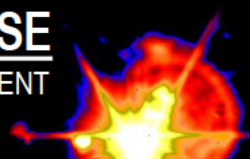


ASCENT

DEFENSE SEGMENT

MIDCOURSE

DEFENSE SEGMENT



TERMINAL

DEFENSE SEGMENT

Sea-Based Terminal



Patriot Advanced Capability-3



C2BMC

Command, Control, Battle Management and Communications

NMCC

USSTRATCOM

USNORTHCOM

USPACOM

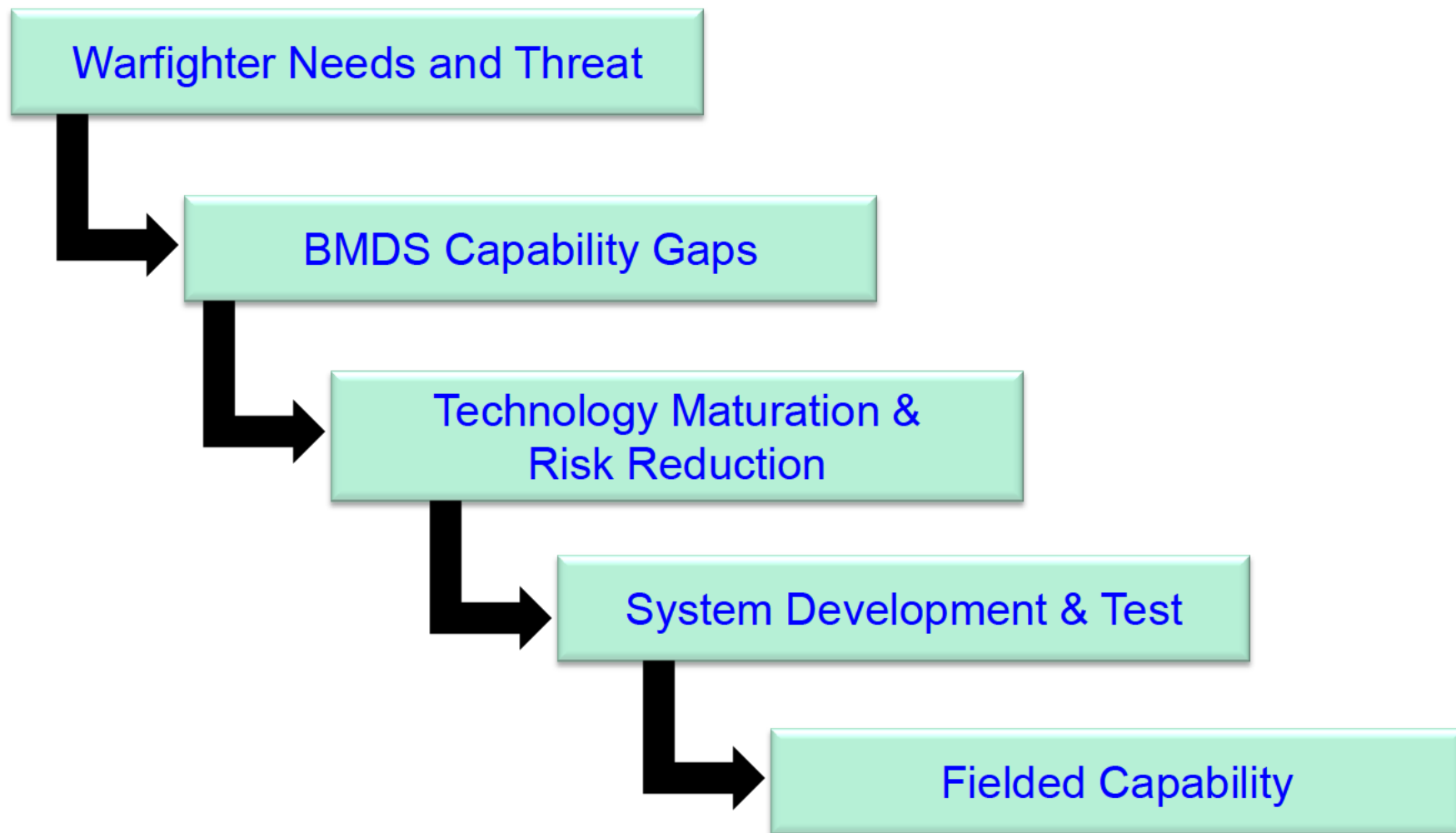
USEUCOM

USCENTCOM





Filling Gaps in the BMDS





The Increasing Ballistic Missile Threat

- Increasing SRBM/MRBM force levels, more accurate and capable
- North Korea
 - New IRBM in development
 - Commitment to long-range missile technology
 - Taepo Dong-2 launch in 2012 placed satellite on orbit
 - Unveiled the new road-mobile KN08 ICBM
 - Taken initial steps towards fielding



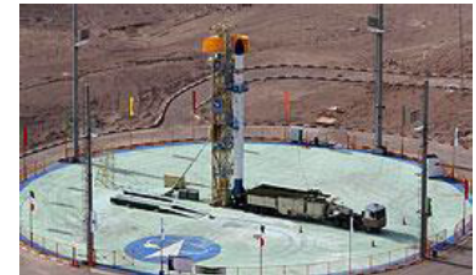
*North Korean Taepo Dong-2
SLV Launch, December 2012*



*North Korean Mobile IRBM
on Parade, April 2012*



*North Korean KN08 ICBM
Launcher on Parade, 2012*



Iranian Safir SLV on launch pad, 2011

- Iran
 - Could develop and flight test an ICBM capable of reaching U.S. by 2015
 - Safir multistage Space Launch Vehicle (SLV) could serve as a testbed for ICBM technologies



*Iranian Antiship Ballistic
Missile Test, 2011*

Sources: NASIC, Ballistic and Cruise Missile Threat, 2009, 2013; DIA, Iran's Military Power, Statement before the Senate Armed Services Committee, 14 APR 10; Annual Report on Military Power of Iran, April 2012, Full Update, DIA, Annual Threat Assessment 2008, 2012; DNI, Remarks, Worldwide Threat Assessment to the Senate Select Committee on Intelligence, 12 March 2013; DNI, Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, Covering 1 JAN to 31 DEC 2011; NSA-FCSS, e-mail, KN08 Classification, 20 Jan 2013; FARS News Agency, Korea Central News Agency, Yonhap News Agency

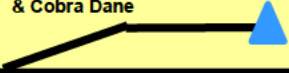
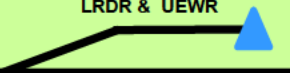




Investments and Products For The Future BMDS

Focus Area	Products		
	Near-Term (Now Thru 2016)	Mid-Term (2017-2020)	Far-Term (2021+)
Discrimination Improvements for Homeland Defense and Regional	<ul style="list-style-type: none"> Discrimination Upgrades EKV, AN/TPY-2, AN/SPY-1, SBX & Cobra Dane 	<ul style="list-style-type: none"> Discrimination Upgrades AN/TPY-2, AN/SPY-1, SBX, LRDR & UEWR SCOUT 	<ul style="list-style-type: none"> EO/IR Sensors Advanced Discrimination
Sensor Technology for Tracking and Discrimination	Precision Track 	<ul style="list-style-type: none"> Potential Contingency Operations 	<ul style="list-style-type: none"> Airborne or Space Advanced Sensor for Enhanced Discrimination
Weapons Technology High Power Lasers • DPALS • Fiber Combined Laser	Low 	High 	<ul style="list-style-type: none"> Boost Phase Defense
Kill Vehicle Common Technology	SRR 	<ul style="list-style-type: none"> Redesigned EKV Non-Intercept Test First Intercept Test 	<ul style="list-style-type: none"> Multi-Object Kill Vehicle GMD, SM-3 and THAAD
Space Layer	ROCKI RF/IR Fusion 	Space-based Kill Assessment Experiment 	Future Space Layer



Discrimination

Focus Area	Products		
	Near-Term (Now Thru 2016)	Mid-Term (2017-2020)	Far-Term (2021+)
Discrimination Improvements for Homeland Defense and Regional	<ul style="list-style-type: none"> Discrimination Upgrades <p>EKV, AN/TPY-2, AN/SPY-1, SBX & Cobra Dane</p> 	<ul style="list-style-type: none"> Discrimination Upgrades <p>AN/TPY-2, AN/SPY-1, SBX, LRDR & UEWR</p>  <p>SCOUT</p> 	<ul style="list-style-type: none"> EO/IR Sensors Advanced Discrimination 

- Upgrade threat definitions
- Develop and mature discrimination techniques
- Field advanced discrimination
- Increase discrimination reliability





Sensors

Focus Area	Products		
	Near-Term (Now Thru 2016)	Mid-Term (2017-2020)	Far-Term (2021+)
Sensor Technology for Tracking and Discrimination	<p>Precision Track</p>	<p>• Potential Contingency Operations</p>	<p>• Airborne or Space Advanced Sensor for Enhanced Discrimination</p>

- Demonstrate Aegis launch-on-remote with Airborne Sensor
- Demonstrate Aegis engage-on-remote with Advanced Sensor
- Develop next generation Sensor for UAVs or Space
- Transition capabilities to field

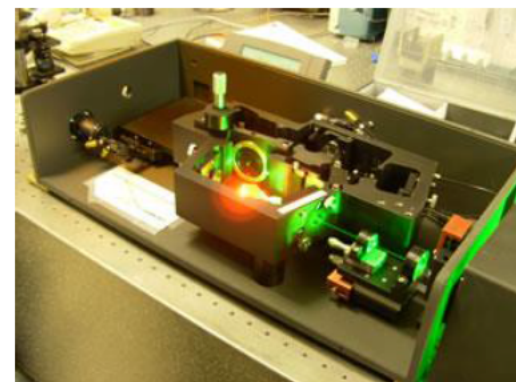




Weapons

Focus Area	Products		
	Near-Term (Now Thru 2016)	Mid-Term (2017-2020)	Far-Term (2021+)
Weapons Technology High Power Lasers • DPALS • Fiber Combined Laser • Other Industry	<p>Low Med</p> <p>← LASER Scaling →</p>	• UAV Flight Demonstrator	• Boost Phase Defense
		High	

- Develop a UAV-borne laser for Missile Defense
- Scale Lasers for Boost Phase Defense
- Develop UAV-borne laser for Boost Phase Defense





Kill Vehicle Common Technology

Focus Area	Products		
	Near-Term (Now Thru 2016)	Mid-Term (2017-2020)	Far-Term (2021+)
Kill Vehicle Common Technology	<p>SRR</p>	<p>• Redesigned EKV</p> <p>Non-Intercept Test First Intercept Test</p>	<p>• Multi-Object Kill Vehicle</p> <p>• GMD, SM-3 and THAAD</p>

- Develop modular, open architecture
- Demonstrate scalable, adaptable technology
- Develop multi-object kill vehicle
- Transition to interceptors





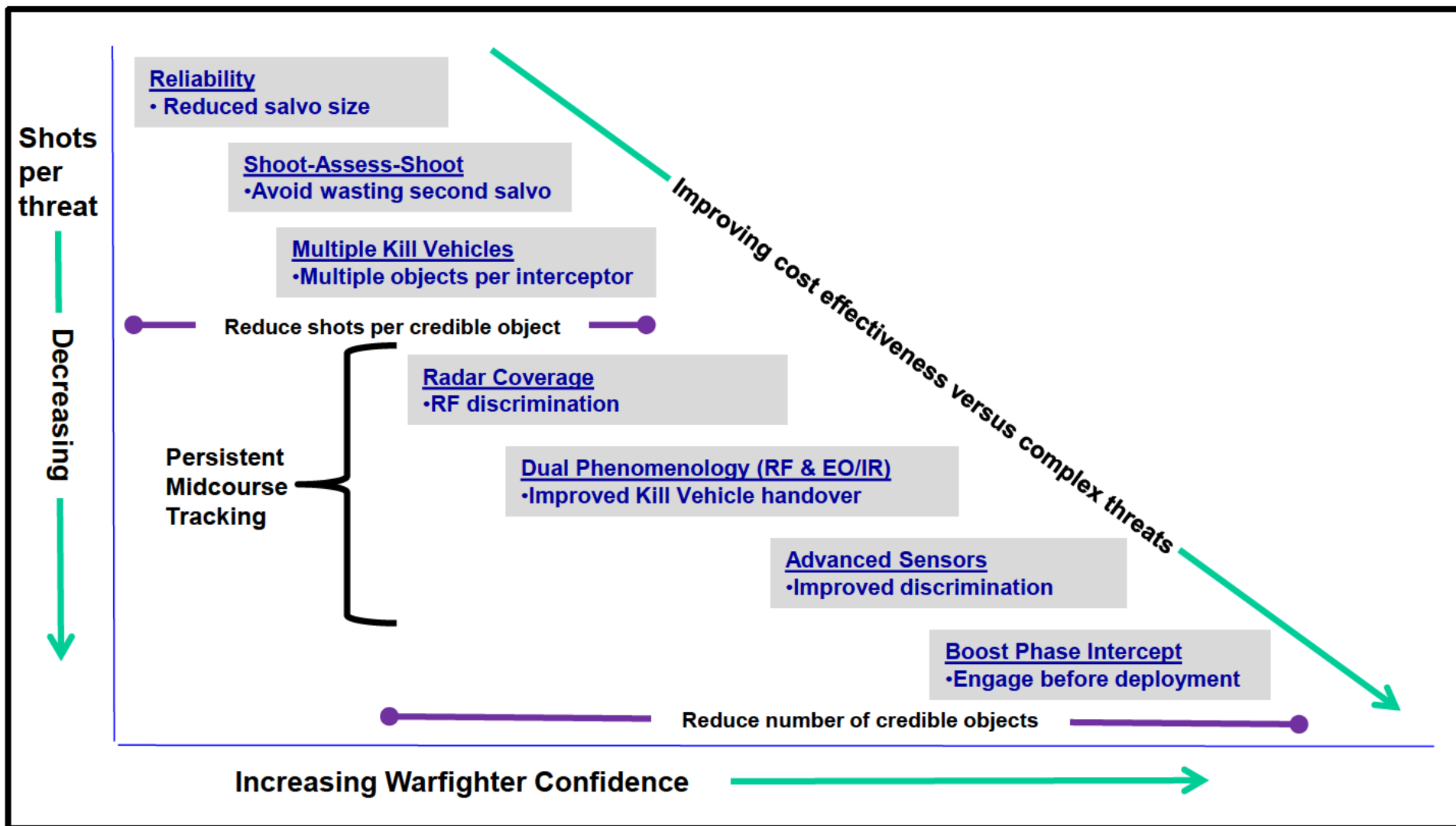
Space Layer

Focus Area	Products		
	Near-Term (Now Thru 2016)	Mid-Term (2017-2020)	Far-Term (2021+)
Space Layer	ROCKI RF/IR Fusion	Space-based Kill Assessment Experiment	Future Space Layer

- Incorporate Joint OPIR Ground
- Assess Space-based Kill Assessment
- Deploy sparse passive EO/IR space layer
- Develop future space layer for missile defense



Warfighter Confidence & Shot Doctrine





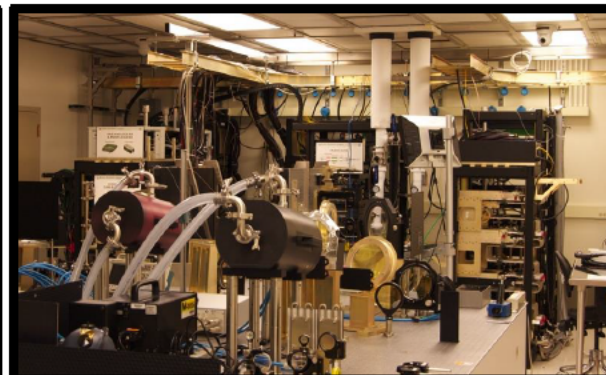
FY14 Accomplishments



Boeing Phantom Eye 7th Flight
~5Gb of Data at ~43,000 ft - June 2014



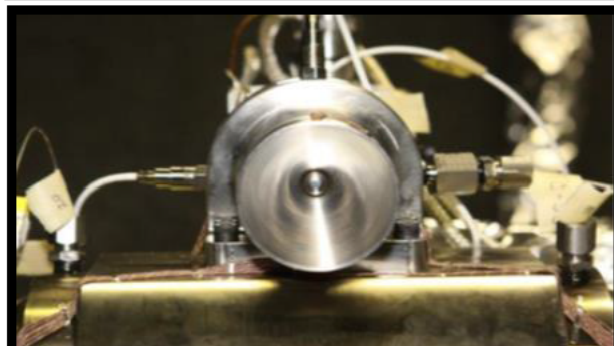
General Atomics Reaper
MTS-B Flight Test - Mar 2014



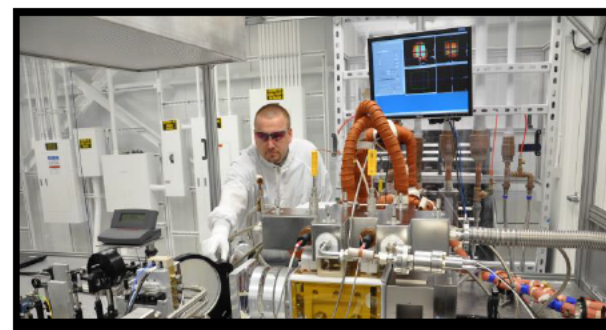
MIT/LL Fiber Combined Laser
Achieved 20 kW power – Jan 2014



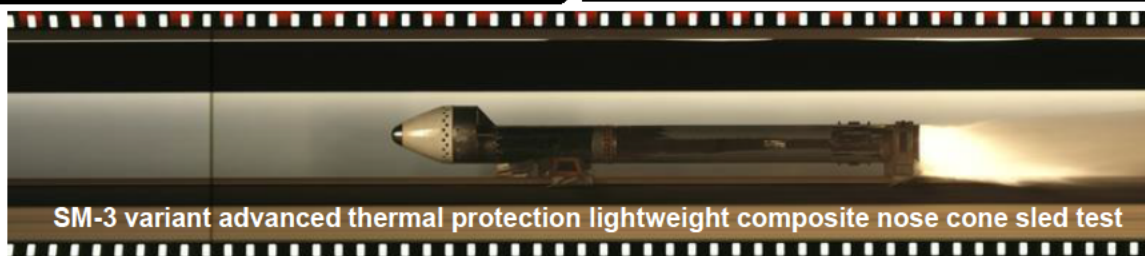
Multispectral Targeting System (MTS) – B & C
Tracked FTM 21 & 22 Missiles - Sep/Oct 2013



High fidelity component hardware firing test
of a Gas Generator valve



Lawrence Livermore National Lab
Diode Pumped Alkali Laser
Achieved 4 kW power - Oct 2013



SM-3 variant advanced thermal protection lightweight composite nose cone sled test



Composite Radome
Development



Summary

- **Objective: Target BMDS gaps and deliver offsetting technology**
 - Improve discrimination
 - Transition directed energy to Missile Defense
 - Develop next generation multi-object kill vehicle
 - Mature and transition emerging technology