Ballistic Missile Defense Program Overview
For
The National Defense Industrial Association

8 MAY 08

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Director
Missile Defense Agency

Approved for Public Release
08-MDA-3495 (7 MAY 08)

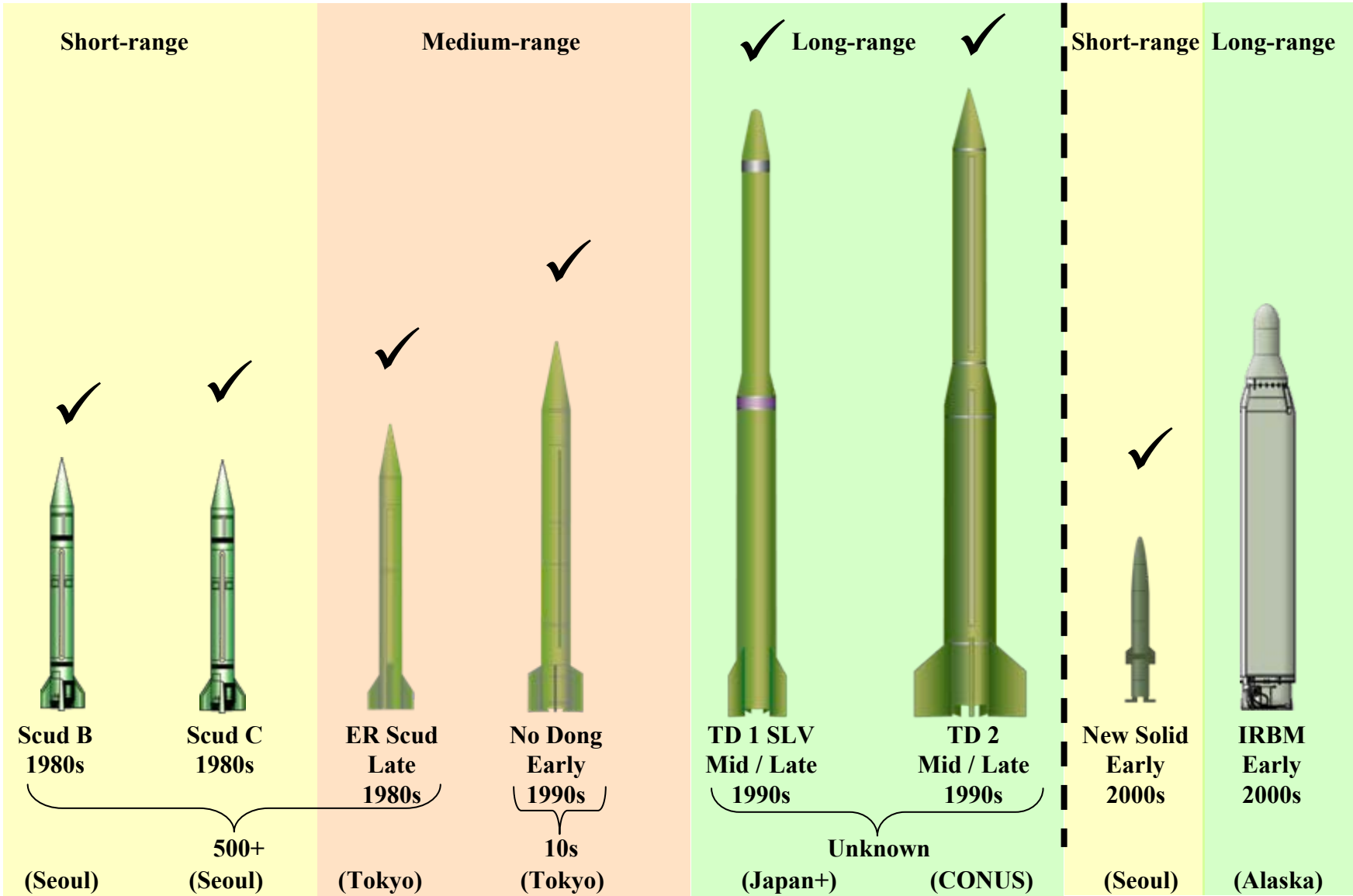
Strategic Overview – May 2008

- **Fielded an initial capability to defend the U.S. and our allies against ballistic missile attacks which we will expand to meet warfighter needs and future uncertainties, addressing the threat from North Korea**
- **On the heels of April 2008 NATO Summit in Bucharest, we are on track to field missile defense to Europe, addressing the forecasted threat from Iran**
- **Successfully tested the system in operationally realistic conditions which we will make even more challenging as we mature**
- **Countering more complex future threats will require focused effort, a flexible approach and dedicated resources**
  - **Building an integrated capability maximizes system potential**

Missile Defense Is Now A Proven Capability For The Nation

North Korean Ballistic Missiles

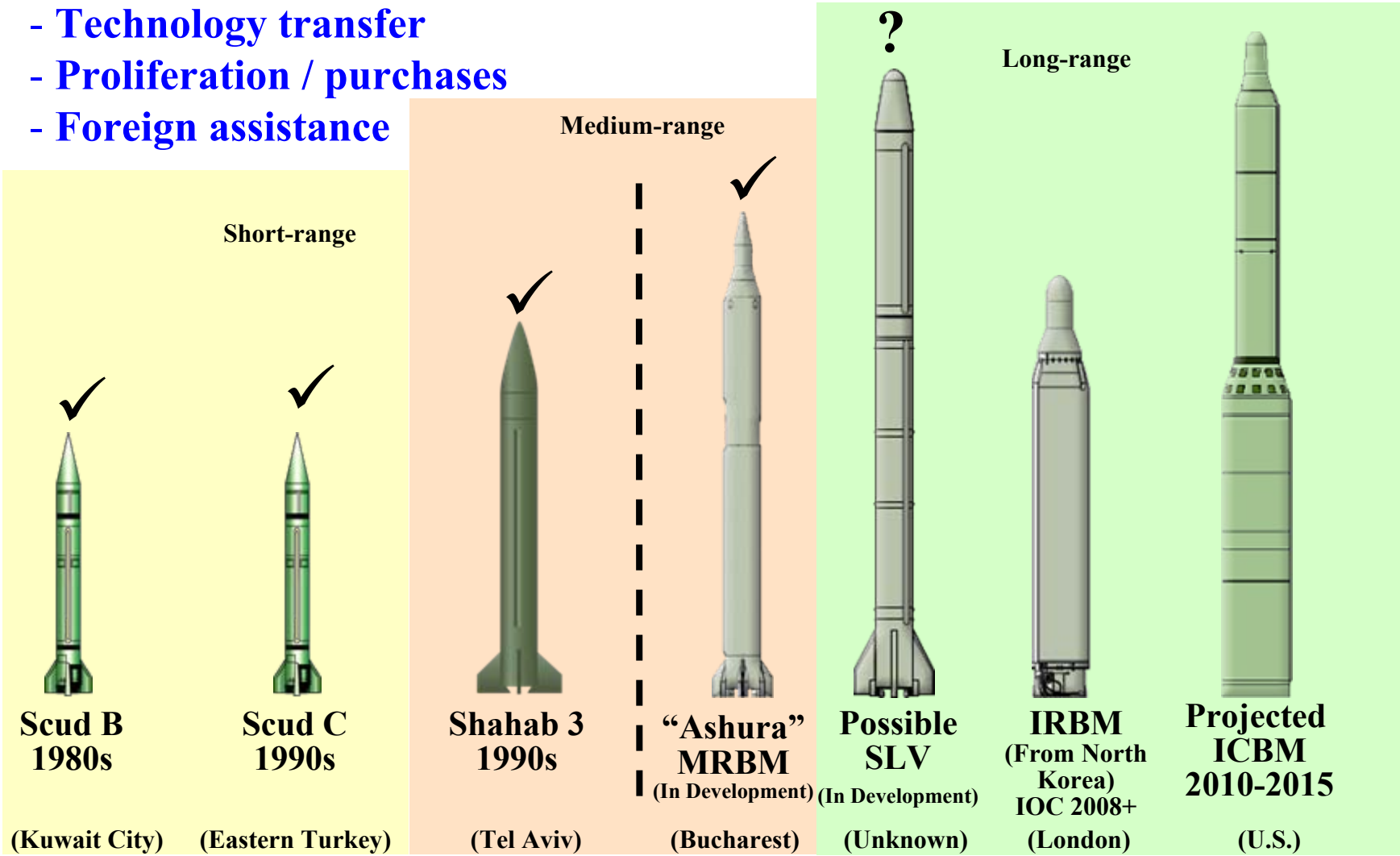
✓ *Flown*



Iranian Ballistic Missiles

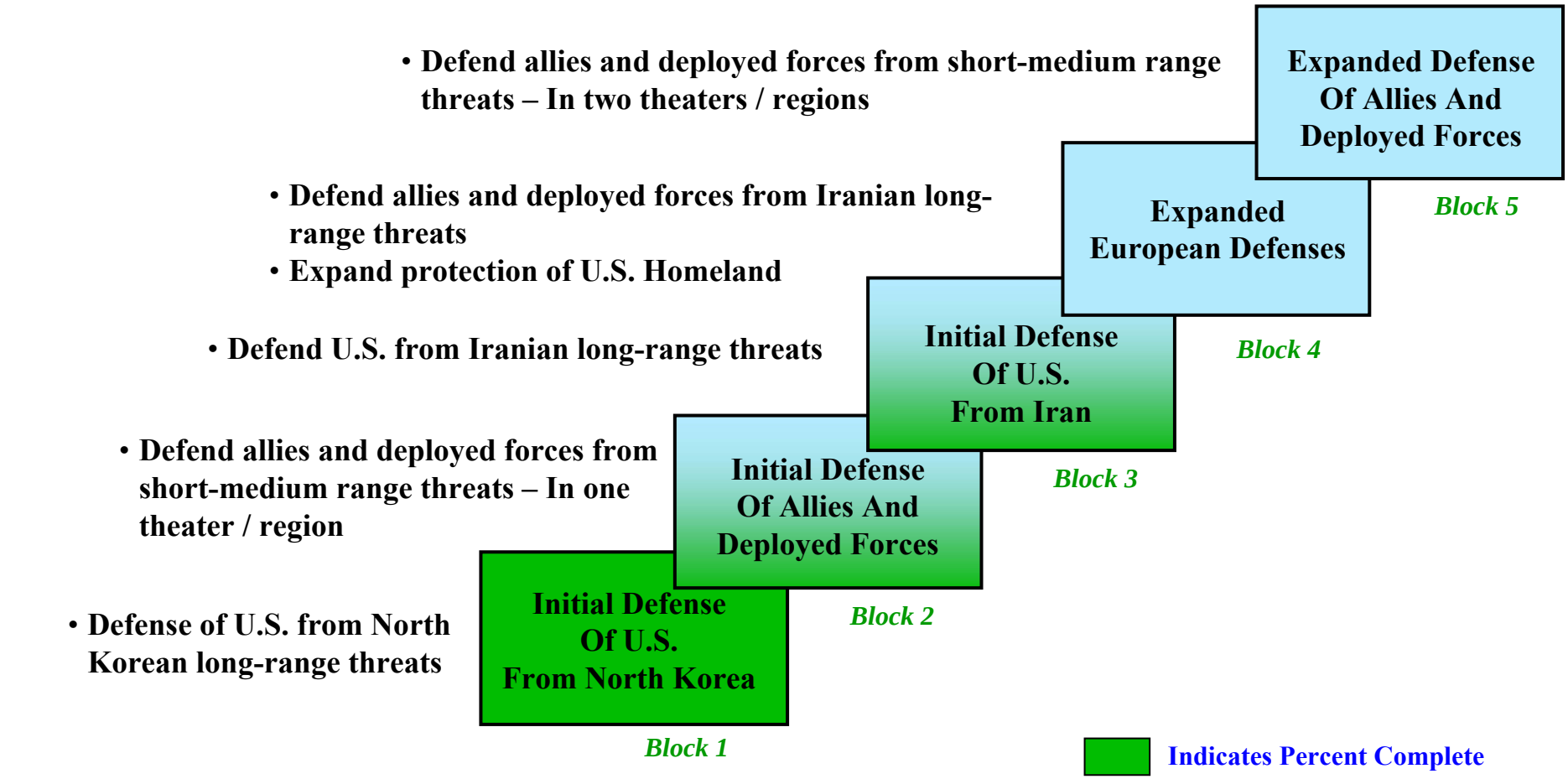
✓ *Flown*

- **Iranian missile capability likely to accelerate due to**
  - **Technology transfer**
  - **Proliferation / purchases**
  - **Foreign assistance**



Sources: NASIC B&CM Threat 2006; Jacoby Testimony March 2005; Maples Testimony January 2007

Capability-Based Block Structure



Delivering Ballistic Missile Defense Capabilities By Block

Integrated Ballistic Missile Defense System

Sensors

Defense Support Program

Space Tracking and Surveillance System

Sea-Based Radars

Forward-Based Radar With Adjunct Sensor

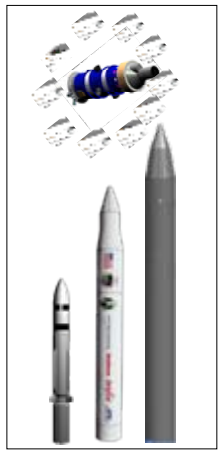
Midcourse X-Band Radar

Early Warning Radar

Airborne Laser

Kinetic Energy Interceptor

Aegis Ballistic Missile Defense / Standard Missile-3



Multiple Kill Vehicle

Ground-Based Midcourse Defense

Terminal High Altitude Area Defense

Sea-Based Terminal

Patriot Advanced Capability-3

Command, Control, Battle Management & Communications

NMCC USSTRATCOM USNORTHCOM USPACOM USEUCOM USCENTCOM

Designated Lead Service: Army | Navy | Air Force | TBD

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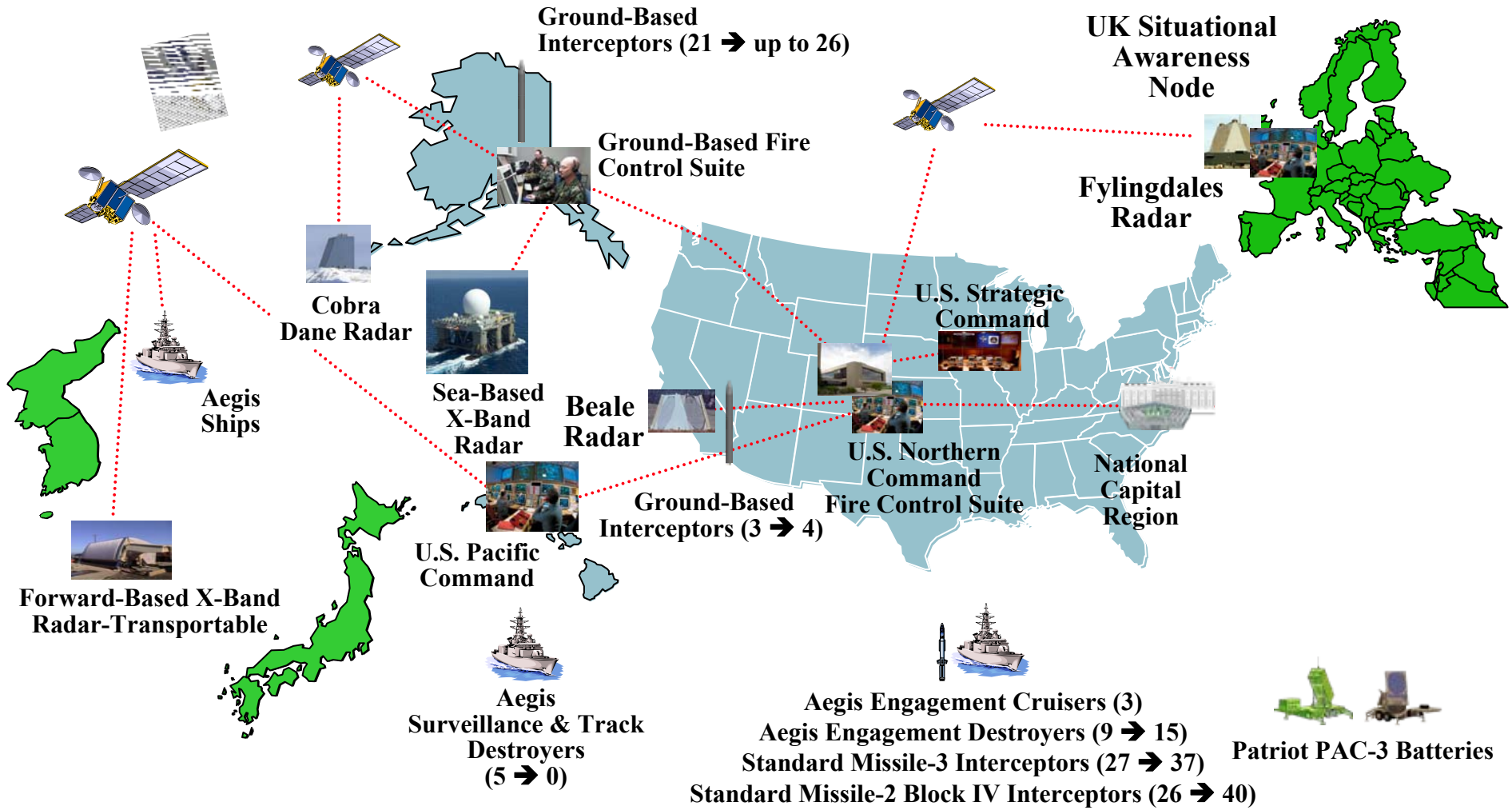
System Configuration
May 2008 ➔ December 2008

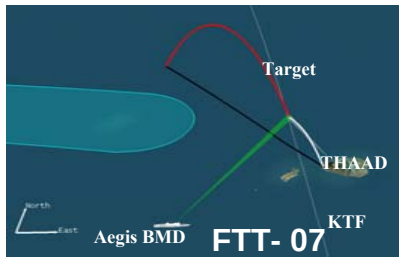
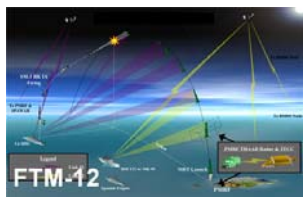


None Of This BMD Capability Existed In June 2004

Flight Tests

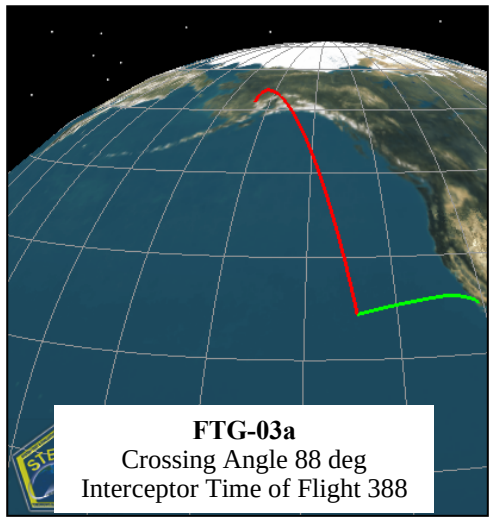
34 Of 42 Terminal And Midcourse Hit-To-Kill Intercepts In The Atmosphere And Space Since 2001

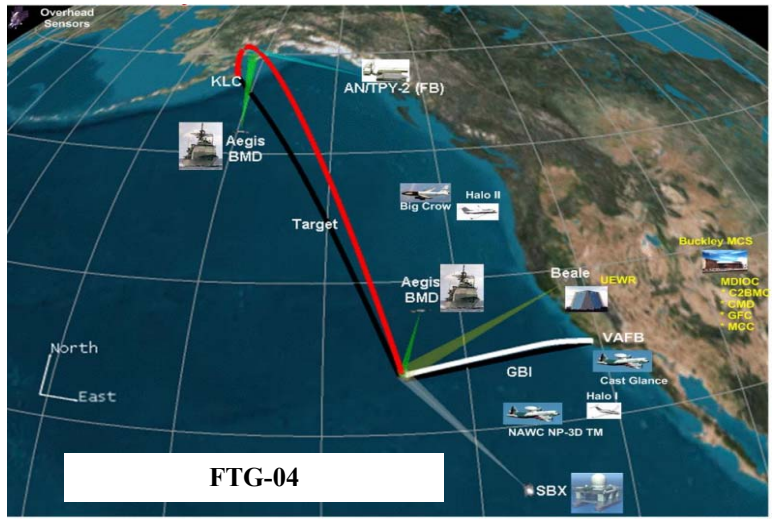
MDA Achieved 26 Test Successes In Last 27 Flight Tests Since September 2005

Hit-To-Kill Since 2001		Since September 2005	
Terminal High Altitude Area Defense (4 of 4)		✓	**July 12, 2006**
		✓	**January 26, 2007**
		✓	**April 5, 2007** VM313
		✓	**October 27, 2007**
Aegis Ballistic Missile Defense (12 of 14)		✓	**November 11, 2005**
		X	**December 7, 2006**
		✓	**June 22, 2006**
		✓	**April 26, 2007**
		✓	**June 22, 2007**
		✓	**August 31, 2007** VM-339C
		✓ ✓	**November 6, 2007** VM-355
		✓	**December 17, 2007**

Note: Patriot PAC-3 (12 of 15)

Long-Range Flight Tests





Ground-based Midcourse Defense (6 of 9)

- **Operational infrastructure**
- **Threat-representative target**
- **Operational fire control software**
- **Operational radars**
- **Operational crews**

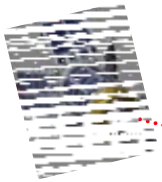
✓ **September 1, 2006**

✓ **September 28, 2007 Russian officials observed this test from Washington, DC**

- **Later this year – FTG-04**

- **Operational infrastructure**
- **Threat-representative target**
- **Operational fire control software**
- **Operational radars**
- **Operational crews**
- **More complex target scenario**

System Configuration – 2013



Ground-Based Interceptors (40)

Ground-Based Fire Control

Cobra Dane Radar

Sea-Based X-Band Radar

Ground-Based Interceptors (4)

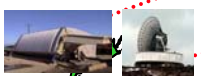
Beale Radar

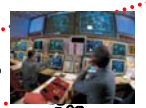
STRATCOM C2BMC

NORTHCOM C2BMC

National Capital Region

Japan Forward Based Transportable Radar





PACOM C2BMC

Terminal High Altitude Area Defense Fire Units (4)
Interceptors (96)

Additional Forward Based Transportable Radars (3)

Thule Radar Greenland

Fylingdales, UK Radar

Europe, Interceptors (10), Midcourse Radar

Patriot PAC-3 Fire Units (60)
Interceptors (798)

Aegis Engagement Cruisers / Destroyers (18)
Standard Missile-3 Interceptors (133)

Sea-based Standard Missile-2 Terminal Interceptors (100)

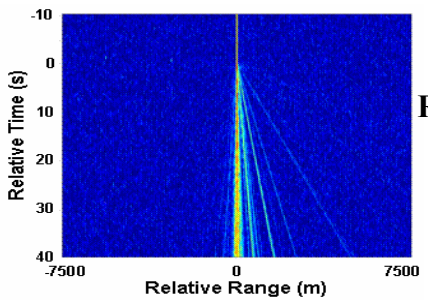
Full NATO Endorsement of Missile Defense
"Bucharest Summit Communiqué"

On 3 APR 08, the *Heads of State* of all 26 NATO nations

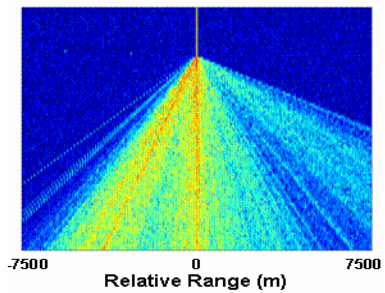
- **Stated that "ballistic missile proliferation poses an increasing threat to Allies' forces, territory and population"**
- **Recognized "the substantial contribution to the protection of Allies from long-range missile threats to be provide by the planned deployment of European based United States missile defence assets"**
- **Pledged to explore ways to "link this capability with current NATO missile defence efforts" as part of "any future NATO wide missile defense architecture"**
  - **Options to extend coverage to all Allied populations to be reviewed at the 2009 NATO Summit**
  - **North Atlantic Council to develop options**
- **Are committed to working with Russia to develop "maximum transparency and reciprocal confidence building measures"**

Satellite Intercept – 20 FEB 08

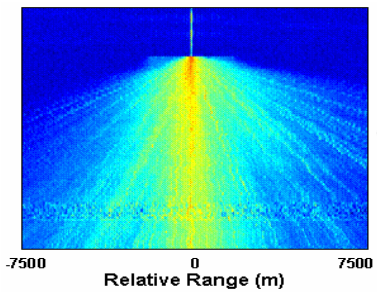
- **Background – NRO Director called MDA Director one week before Christmas**
  - **Could we destroy inbound, uncontrolled ~ 5,400 lb satellite with ~ 1,000 lbs highly toxic hydrazine fuel onboard which presented loss of life risk?**
- **Preparation – MDA analysis showed capability with GMD, THAAD and Aegis**
  - **Aegis selected due to flexibility, modification needs and reduced program impact**
  - **3 Standard Missiles-3 (SM-3), radars and system software extensively modified to enable intercept – however, ship could not perform mission autonomously**
  - **Intercept required integration of off-board tracking data from sensor network**
- **Engagement – One SM-3 launched by USS Lake Erie northwest of Hawaii**
  - **Successful destruction of satellite and fuel tank occurred ~153 miles (250 km) above the earth verified by different phenomenology**



Predicted Radar Image Non-Lethal Intercept



Predicted Radar Image Of Lethal Intercept

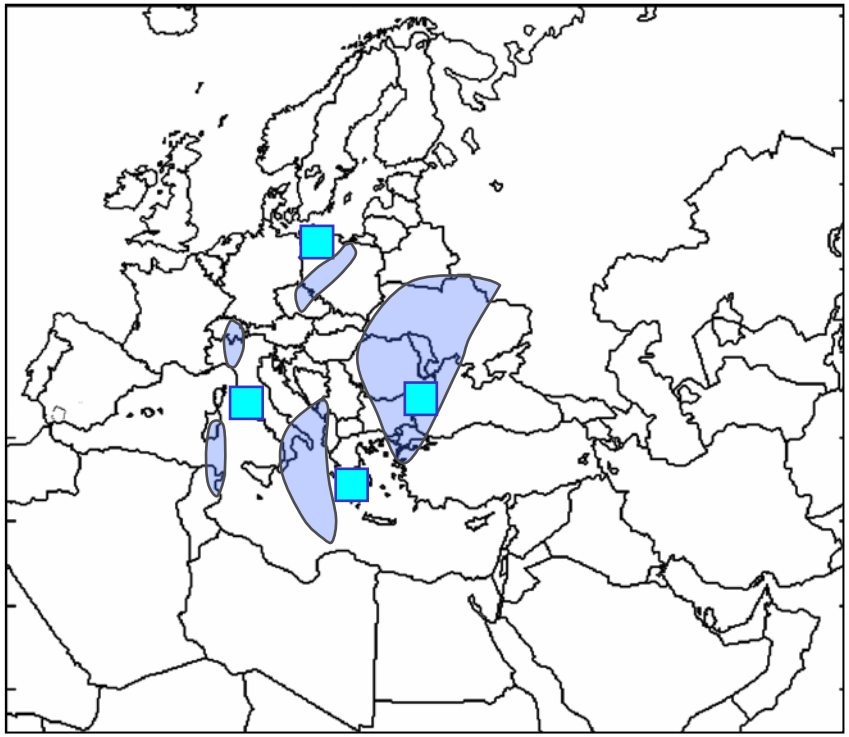


Screen Capture Of Actual Intercept

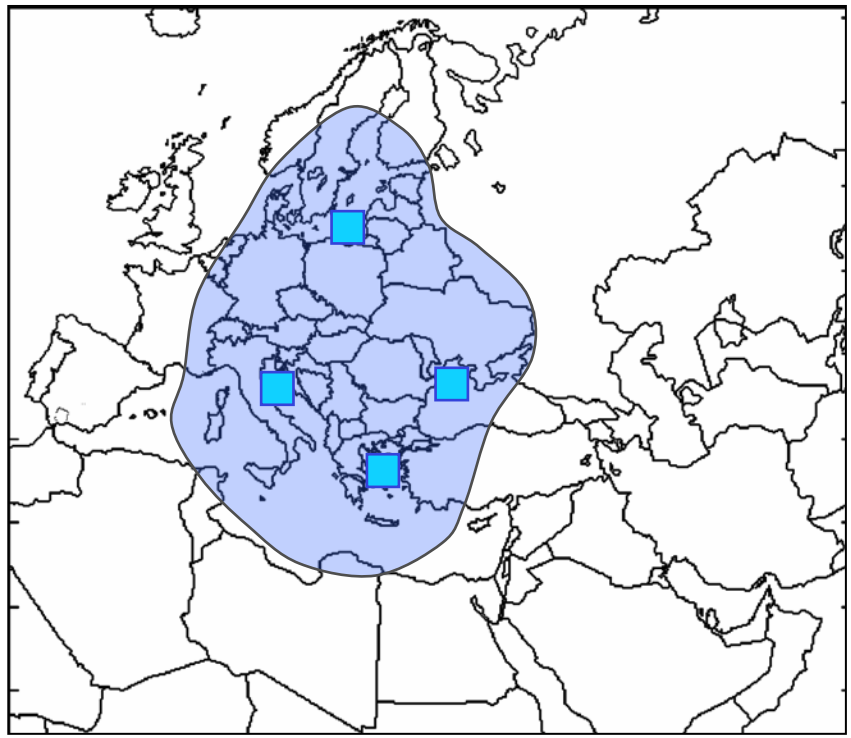
Aegis BMD Defense Of Europe

– Autonomous Versus Launch On Forward-Based Radar –

Autonomous



LoR / EoR AN/TPY-2 at Caucasus



Adversary

- MRBM / IRBM
- Simple threat

Architecture

- Four Aegis Ships
- Forward-based radar in Caucasus region

Addressing Key Capabilities Needed
MDA's Strategy For Countering Complex Threats

Boost Phase

Airborne Laser

VM373

- Over 70 successful laser firings
- Atmospheric compensation and tracking test against target, July, August 2007
- Lethal shootdown 2009

Air Launched Concepts

- Successfully tested the Net-Centric Airborne Defense Element (NCADE), marking first intercept of a ballistic missile from an air platform and the first boost-phased intercept of a ballistic missile

Kinetic Energy Interceptor

- Completed 2 1st stage static firings (FY07)
- Conduct 2 2nd stage static firings (FY08)
- Booster flight test in 2009
- Partial full-scale flight test in FY11

VM343

Pervasive Sensors

Advanced Infrared

Space Tracking and Surveillance System

- Launch 2 demonstration satellites in 2008
- First launch of operational satellite 2016-2018

Advanced Discrimination

Sea-Based X-band Radar

- Deployed in the Pacific Ocean (mobile)

Forward-based X-band Radar (AN/TPY-2)

- Deployed to Japan (transportable)

Improve object tracking and discrimination

Technologies

- Advanced Processors
- Scaleable panels
- Algorithms for clutter mitigation

Addressing Key Capabilities Needed
MDA's Strategy For Countering Complex Threats

Maneuverable Interceptors

Advanced Technology Kill Vehicle

- High Divert
- Flexible Energy Management

SM-3 Block IB Interceptor

- Delaying burn of 2nd pulse of 3rd stage provides enhanced maneuverability

Kinetic Energy Interceptor

- Improving 3rd stage to increase maneuverability

- Software mods and advanced sensors

Multiple / Volume Kill

Multiple Kill Vehicle

- Land- and sea-based volume kill capability
- Flight test in 2015
- Initial capability in 2017

Destroy multiple threat objects and decoys

Technologies

- Structures
- Propellants
- Advanced processors
- Advanced communications
- Divert Attitude Control System

Inventory

THAAD

- 96 total missiles by 2013
- 200 missiles by 2016

Sea-Based Terminal

SM-3 Block IB Interceptor

- 133 interceptors by 2013
- 249 interceptors by 2016

SM-3 Block IIA 21" Interceptor

- Intercept flight test 2014
- Operational avail 2015

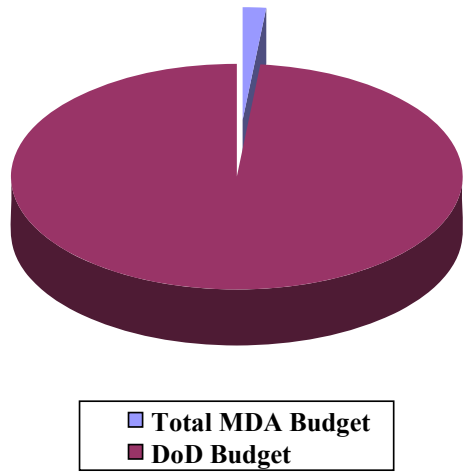
Addressing An Increasingly Sophisticated Threat By Expeditiously Providing Critical Technologies To The Warfighter

MDA PB09 Budget Overview

- **PB09 continues to field the same capabilities programmed in PB08**
  - **Delivery of some capabilities delayed as necessary to address both Congressional marks and program adjustments**
- **Overall budgetary flexibility is limited by fielding and sustainment commitments and increasing test program complexity**
  - **Fielding and sustainment is $2.5B in FY09 and $3.1B in FY10**
  - **Test and test related activities account for ≈ $2.0B a year**
- **Focus is on near-term development and fielding ($7.0B of $9.3B in FY09 or 75%)**
- **Responds to identified warfighter requirements and to the Department of Defense Transformation Priorities**

Total FY09 DoD Budget – $515.4B

MDA, $9.3B, 1.8%



Myths And Facts

- **Threat**
- **Testing**
- **Countermeasures**
- **Operational Effectiveness**
- **Funding**

Threat

Myth

The threat from ballistic missile attacks has gone down since 2001, not up

Fact

- **Today, there are 26 countries with ballistic missile capabilities, compared to 9 in 1972**
- **Roughly 120 ballistic missile launches occurred in 2007 alone**
- **The technology is spreading – Why?**
- **Just the threat of a catastrophic attack could cause serious disruption to U.S. foreign and defense policies**
- **While numbers of long-range missiles in U.S. and Russian inventories were reduced with START, ACCESS to missiles and their technology has grown**

Threat

Myth

Adversaries are far more likely to smuggle a suitcase nuke into the country than to use a ballistic missile

Fact

- **We need to be prepared to address all threats, particularly those threats that match up well against our vulnerabilities**
- **We have defenses in place that address smuggling a nuclear weapon into the United States**
- **Ballistic missiles have been used against us – our adversaries are investing in ballistic missile because of the coercion and military advantages offered**

Testing

Myth

MDA has not realistically tested the BMDS

Fact

- MDA works with DOT&E and the warfighter to develop criteria for operational realism for all elements
- Aegis BMD has passed OT&E testing
- GMD has defined criteria
  - Operationally representative GBI, sensors and fire control software
  - Representative threat and complex countermeasures
  - Warfighter participation and tactics, techniques and procedures
  - Unannounced target launch
  - End-to-end test
- We achieved all of these except complex countermeasures in FTG-02 and FTG-03a

Testing

Myth

MDA has not practiced its shoot-look-shoot CONOPs during its flight tests. The agency also has not launched multiple interceptors at multiple targets

Fact

- **We have conducted multiple engagements by Aegis BMD when the ship engaged two SRBMs**
- **THAAD will engage multiple targets in FTT-12 (2009)**
- **GMD has no plans to conduct a flight test with multiple targets because of cost and because vast majority are independent engagements**
- **We conduct multiple GMD ground tests and use models and simulation to test the performance of the interceptor in salvo-like engagements**

Testing

Myth

In the entire missile defense testing program, only the flight intercept tests matter (therefore the 26 of 27 string of test successes since September 2005 is "misleading")

Fact

- **14 of 15 successful intercepts since September 2005**
- **We learn significant information from our ground-tests and modeling and simulation, which we "anchor" using data from our intercept and non-intercept flight tests**
- **Ground tests and high accuracy modeling and simulation allow us to run scenarios that would either be impossible to conduct, too inefficient to conduct, or too costly to conduct in our flight intercept tests**

Countermeasures

Myth

MDA has not included countermeasures or decoys in its tests over the last five years

Fact

- **We were successful against countermeasures of increasing complexity in tests conducted from 2000-2002 (IFT-3, IFT-6, IFT-7, IFT-8, IFT-9)**
- **As the BMDS matures, MDA pushes the limits of system performance in modeling and simulation and increasingly complex flight tests – crawl, walk, run approach to testing**
- **The next long-range flight intercept (FTG-04) will include countermeasures**

Countermeasures

Myth

MDA has not taken into account the 1999 National Intelligence Estimate that assessed that Iran or North Korea could have effective countermeasures by the time of their first ICBM

Fact

- **The BMDS can defeat simple countermeasures, as demonstrated in our earlier test program**
- **Today, MDA has a robust approach to countermeasures**
  - **Advanced discrimination (sensor and algorithm development)**
  - **Redundancy in sensors**
  - **Layered defense approach**
  - **Counter-Countermeasures Program – we have flown advanced countermeasures against our radars and infrared sensors**
- **In the future, MDA has funded development of future capabilities to defeat sophisticated countermeasures (develop birth-to-death tracking, boost phase defenses, advanced discrimination and algorithms, and volume kill capability)**

Countermeasures

Myth

The enemy can use reflective white paint that would cause the ABL laser to bounce off

Fact

- **We have conducted hundreds of tests on coatings and paints**
  - **ABL's lethality analyses have been done on a variety of missile targets in varying configurations and paint schemes, including white paint**
  - **In the 1995 timeframe, full-scale tests were conducted at HELSTF using the MIRACL laser to validate analyses – during these tests approximately half of the test targets were painted white. These tests were successful**
- **More recently we conducted more robust tests of ABL that indicate that we do not have an issue with white paint**
- **We continue to conduct tests to ensure ABL's lethality against new threats**

Operational Effectiveness
– European Site –

Myth

GBIs in Poland can engage Russian ICBMs

Fact

- **Assumptions overestimate the engagement potential by attributing to the Ground-Based Interceptor**
  - **Faster booster burnout speed**
  - **Shorter interceptor burnout time**
  - **Shorter system reaction time**
- **Intercept timelines assume a system reaction time that is significantly shorter than estimated to be possible by MDA and exceeds the thermal and structural limitations of the GBI**
- **The combination of optimistic assumptions in mass properties, propulsion and flyouts leads to faulty analysis involving trajectories with unrealistic performance**

Operational Effectiveness
– European Site –

Myth:

Russian President Putin's offer to use the radar in Azerbaijan makes more sense than deploying a new radar in the Czech Republic

Fact

- **Russia offered the use of the radar in Azerbaijan only to monitor Iranian missile launches – not for ballistic missile defense**
- **They conditioned the use of the radar on the suspension of the fielding of the European Site**
- **The radar in Azerbaijan will only be capable of surveillance and cannot provide the discrimination capability offered by the European Midcourse Radar**

Operational Effectiveness
– European Site –

Myth

The GBIs in Europe can be converted to offensive missiles

Fact

- **The GBI only carries a kinetic warhead, not high explosives or any other type of offensive reentry vehicle**
- **The GBI has never been integrated with an offensive weapons package and the C2BMC infrastructure does not support offensive strike operations**
- **All of our future activities with the European silos will be transparent to our allies and the Russians**
- **There are other options (e.g., airborne and sea-based platforms) for conducting an offensive strike that would be more efficient and effective**

Funding

Myth

We don't have much to show for the $115-120B we have spent on missile defense (more money than was spent on the Manhattan and Apollo projects)

Fact

- **We cannot forget that the BMD program has been modified significantly several times since 1983 - many programs were started and never completed**
  - **40% invested in space defenses cancelled by the Clinton Administration**
  - **The balance was spent across the entire program to develop and field long-, medium-, and short-range defenses and to fund an aggressive development program**
- **The BMDS has been used twice in less than 2 years in real-world situations to improve stability (July 2006) and safety (February 2008)**
- **Today we are building the backbone of a needed missile defense force**

Funding

Myth

It is cheaper for the enemy to increase its offenses than it is for the defender to increase its defenses

Fact

- **Our missile defense is only one element in a spectrum of diplomatic and military responses – an adversary still must consider U.S. preemption and retaliation capabilities**
- **When a warhead is in the air – ONLY BMD can defeat it**
- **Our missile defense system also reassures our allies and discourages proliferation**
- **It is even cheaper for the enemy if we have no defense**

Funding

Myth

Ballistic missile defense is a procurement program masquerading as a R&D effort

Fact

- **We are a modern-day acquisition program that has thrown off the vestiges of the Cold War**
- **Our acquisition approach has allowed us to field increments of capability on an urgent timeline**
- **Our acquisition approach will give flexibility to mature the system by integrating advanced technologies over time to deal with future threat uncertainty**

Coyle's "50 Questions"

- **August 2000, Phillip Coyle, as DOT&E, submitted 50 recommendations to the Department regarding the NMD (now GMD or BMDS) test program to help evaluate operational effectiveness and suitability of the system**
- **MDA has made significant progress in meeting the intent of the Coyle 50 recommendations – however, some recommendations are now inconsistent with the BMDS development policy/strategy**
  - **25 recommendations completed**
  - **22 recommendations have been incorporated in test program**
  - **2 not planned to be addressed, and 1 not applicable**
- **By the way, we have had a defense capability in place for 4 years – something we wouldn't have had under Coyle**

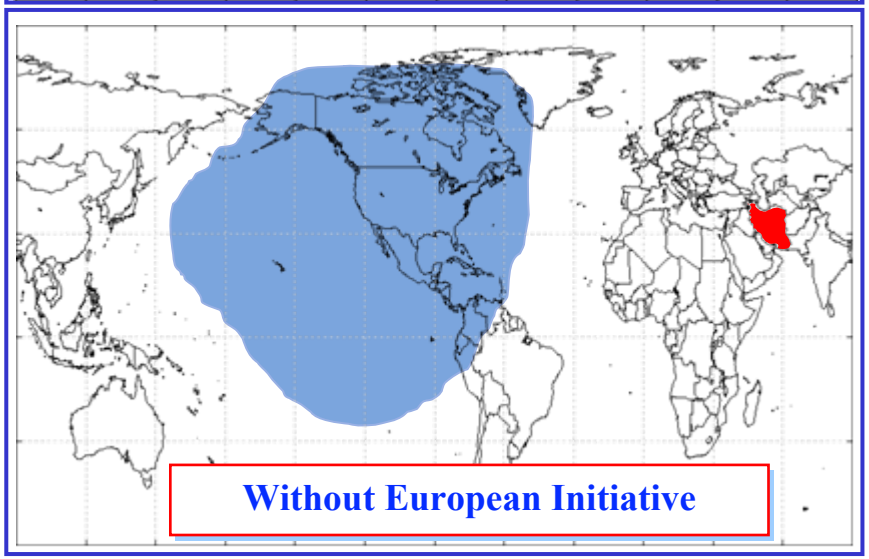
Advantages Of Missile Defense

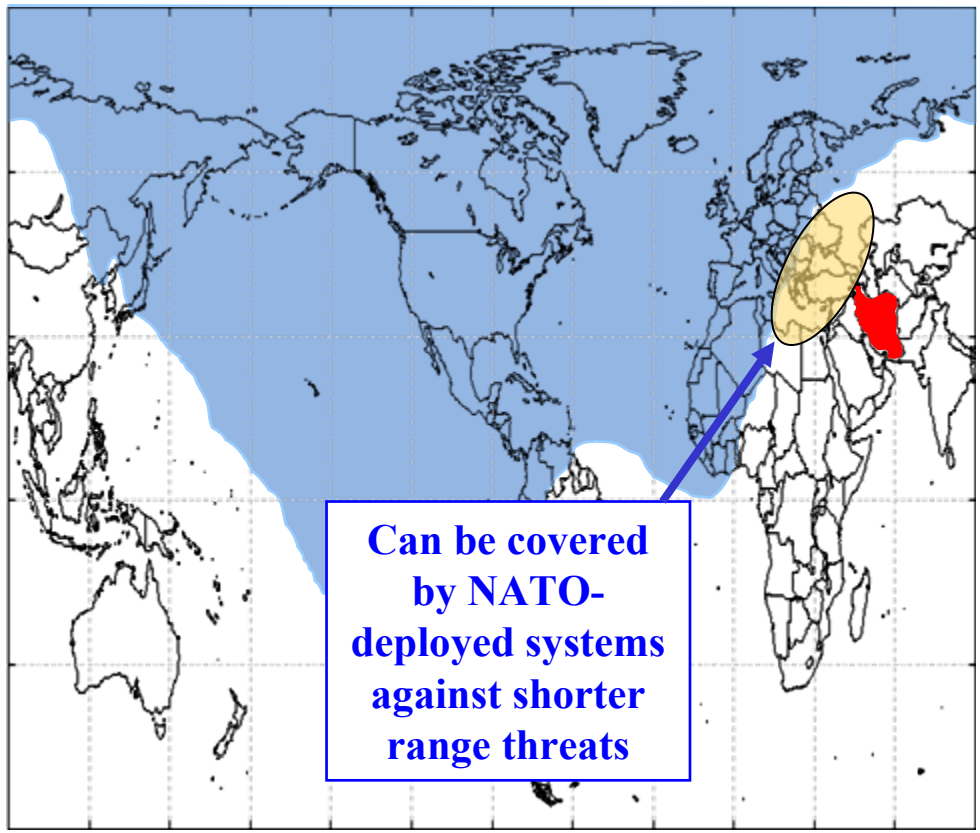
- **Can be a major arms control tool that could devalue missiles thereby reducing their proliferation**
- **Bolster deterrence by increasing the effectiveness of offensive forces**
- **Influence nations not to develop their own nuclear weapons**
- **Provide U.S. and NATO leaders options in addition to preemption or retaliation**
- **Can stabilize events in a crisis and could buy time for a potential diplomatic resolution**
- **Augment offensive capabilities available for the protection of population centers and critical assets in event of hostilities**


MISSILE DEFENSE AGENCY
DEPARTMENT OF DEFENSE

BACKUP

Capability Provided Versus Iranian Intermediate- To Long-Range Ballistic Missiles





BMD System with / Interceptor Field (Poland) + Midcourse Radar (Czech Republic) + Forward Based Radar (TBD)

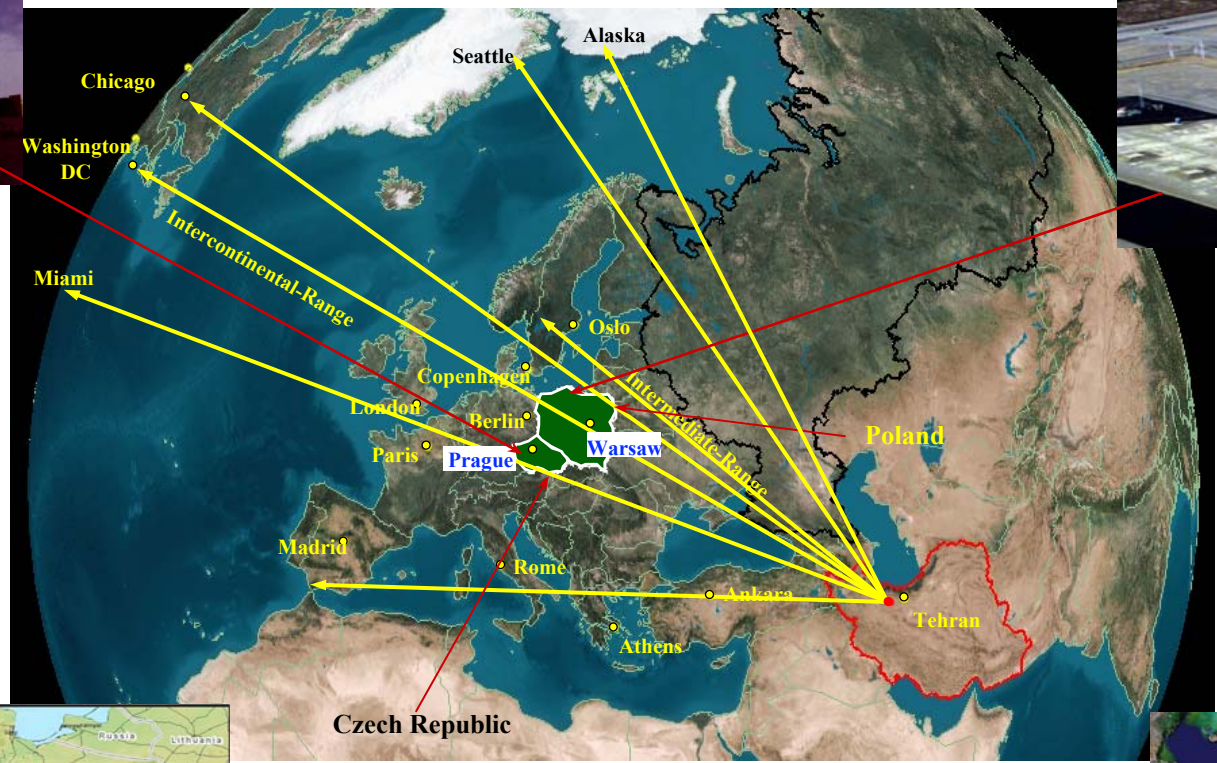
European Site Initiative

Proposed Long-Range Missile Defense Elements In Europe

(2012)

Schedule

- Construction Start 3QFY09
- Integration Start 4QFY11
- Operational Capability 3QFY12



(2013)

Schedule

- Construction Start 3QFY09
- Integration Start 2QFY12
- Operational Capability 3QFY12 (FCD 2QFY13)

Why Poland and Czech Republic

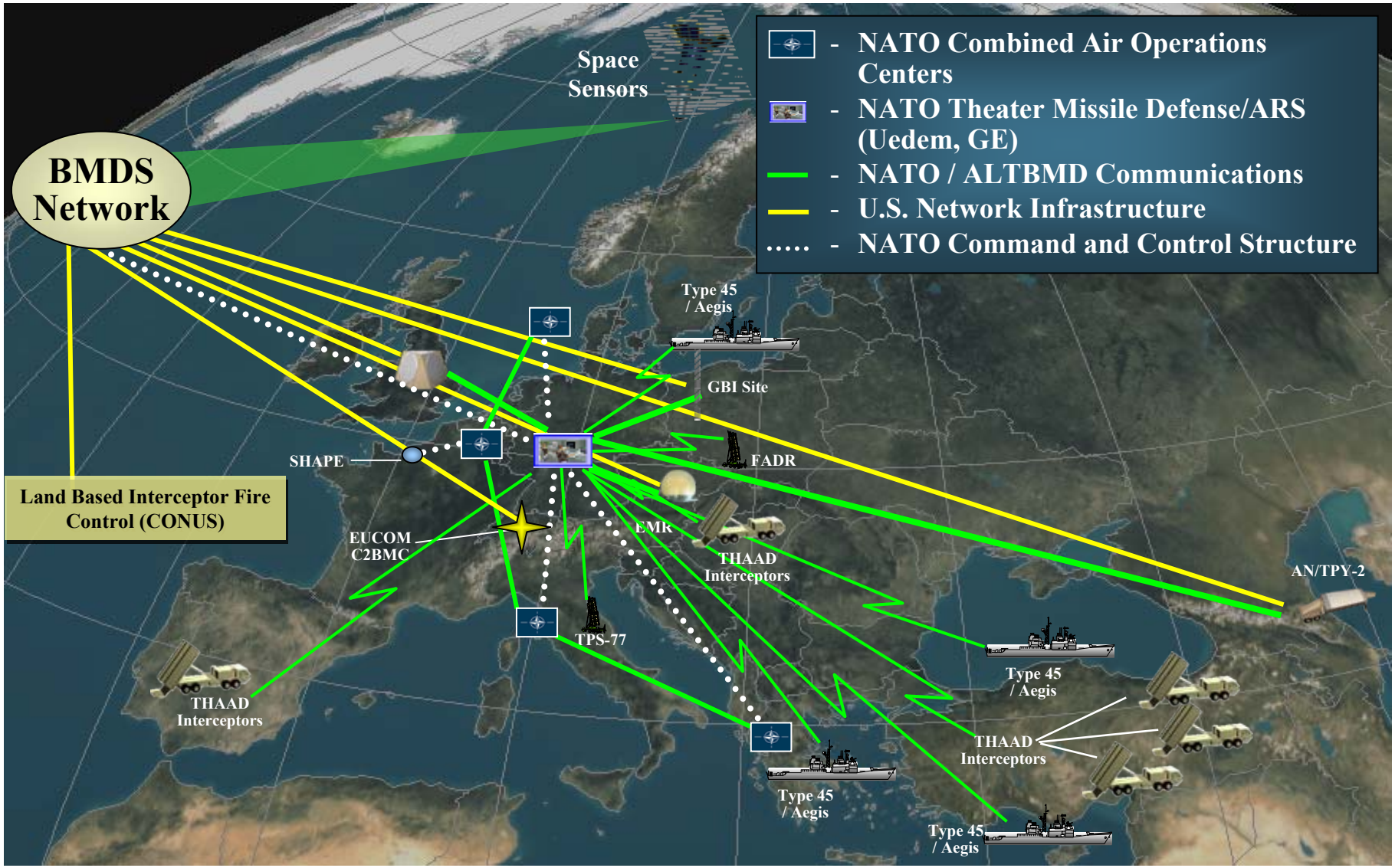
- Azimuthal range
- Range from Iran

(TBD)

Available Components For Missile Defense Regional Architecture

	U.S.	NATO / ALTBMD
Command & Control	• Command, Control, Battle Management and Communications (C2BMC)	• Air Command and Control System (ACCS)
Sensors	• European Midcourse Radar (EMR) • Forward Based Radar • Aegis SPY Radar • Terminal High Altitude Area Defense (THAAD) radar • PATRIOT radar	• Type 45 Destroyer • Air Defense Command Frigate (Early Warning) • Tactical Transportable Radar System (TPS77) • Forward Air Defense Radar/Deployable Air Defense Radar (FADR/DADR)
Long-Range Interceptors	• Ground Based Interceptor (2-Stage)	
Short to Medium Range Interceptors	• Aegis Standard Missile Family • Terminal High Altitude Area Defense (THAAD) • PATRIOT	• PATRIOT • MEADS • Principal Anti Air Missile System (PAAMS) • SAMP-T

U.S. And NATO
Possible Command And Control Architecture



International Activity Highlights

BMDS Participants

UK: Fylingdales UEWR, lethality studies system-level analyses, advanced technology programs, target development

Czech Republic: Missile Defense Consultations; agreed to host midcourse radar

Denmark: Upgrade Thule Early Warning Radar; potential BMD upgrade to patrol frigates

Australia: Missile defense activities on hold pending new administration policy position

Japan: Forward-based X-Band radar siting, 21" Missile Development, trilateral discussions

NATO: Working with Active Layered Theater BMD office to integrate NATO and U.S. systems; assessing European site initiative

Ukraine: Conducting two missile defense projects; RDT&E being staffed

Spain: U.S. -Spain Missile Defense Technical Group established

BMDS Partners

Republic of Korea: Expressed interest in missile defense

Netherlands: PAC-3, Maritime Cooperation

France: Desire BMD cooperation; discussions in progress

Poland: Missile Defense Consultations and Workshops; expressed interest in hosting missile site

India: Missile Defense Discussions ongoing

Russia: Theater Missile Defense Exercise Program; technical discussions, transparency into system

United Arab Emirates: Expressed interest in missile defense

Israel: Arrow Deployed, Arrow System Improvement Program; development of short-range BMD

Italy: MEADS partner

Germany: MEADS partner, laser cross-link technology

MDA's PB09 President's Budget

TY $ in Millions

	FY08	FY09	FY10	FY11	FY12	FY13	Total FY08-13
Development	6,634	6,872	6,315	7,021	7,669	8,280	42,791
Fielding	1,285	1,749	2,405	1,613	1,077	542	8,672
Sustainment	736	715	727	824	877	956	4,835
Total PB09 Submit	8,655	9,336	9,447	9,459	9,623	9,778	56,298

Threat

Myth

There will be little justification for the BMDS if diplomacy succeeds and North Korea gives up its ballistic missile arsenal

Fact

- **North Korea could be one of several potential adversaries with ballistic missile capabilities**
- **New ballistic missile threats could emerge at any time**
- **Missile defense accomplishes multiple goals**
  - **Removes U.S. vulnerability to ballistic missile attacks**
  - **Devalues ballistic missiles by creating doubt in the minds of potential adversaries about their capabilities**
  - **Preserves U.S. freedom of action**
  - **Reassures our allies**

Testing

Myth

MDA has only conducted five GMD tests in the last five years, 3 of which failed, a success rate of 40 percent

Fact

- **Since 2001, we have conducted 9 GMD flight intercept tests**
  - **6 have been successful (2 with operationally configured GBI)**
  - **1 intercept missed because the EKV did not separate from booster**
  - **2 tests were "no launches" – intercept capability not tested**
- **We also had one "no test" due to a target failure**

Testing

Myth

MDA has only conducted 2 successful flight tests in the last five years. It will take MDA about 50 years to conduct the 20 necessary successful flight tests to meet the requirements for realistic operational testing

Fact

- **MDA testing plan is approved by DOT&E – it is event driven, not schedule driven**
- **In order to analyze the data from each test and roll the results into the next test, we can only conduct two intercept tests per year**
- **DOT&E and Service test organizations support the use of ground tests and models and simulations to further validate BMDS performance**

Operational Effectiveness

Myth

MDA misleads policy-makers to believe the BMDS has more capability than it really does and may cause them to rely on the system in a time of crisis

Fact

- **MDA has provided frequent and up-to-date assessments to policy-makers on the capabilities and performance of the BMDS**
- **Policy-makers recognize and know that the BMDS is still in development and may not operate perfectly**
- **Many policy-makers believe a imperfect system is infinitely better than having no defense at all against ballistic missile attacks**

Operational Effectiveness
– European Site –

Myth:

The primary purpose of the European Site is to defend U.S. radars in Greenland and the UK, not to defend Europe

Fact

- **We are putting in place defenses to protect our NATO allies against an emerging Iranian long-range (nuclear?) threat**
- **The European Site will provides a 24/7 days a week defensive coverage for the European Site and will augment existing U.S. defensive coverage against ballistic missile threats from the Middle East**
- **In fact, the protection of Europe is why we are planning to use a 2-stage GBI – it has less burn time and can intercept earlier**

Linked Charts

FTT-07


Terminal High Altitude Area Defense
THAAD FTT-07
None Shall Pass
5 April 2007
THAAD
Pacific Missile Range Facility (PMRF)
Kauai, Hawaii
FTT-07
Pacific Missile Range Facility - PMRF
Kauai, Hawaii

FTM-12 22 JUN 07

FTM-13 6 NOV 07

FTG-03a


Ballistic Missile Defense System
Ground-based Midcourse Defense
Flight Test - 03a
September 28, 2007

Kinetic Energy Static Firing

ABL

SSTS

Back to Intercept

Satellite Intercept