



MIT  
Science, Technology, and  
Global Security Working Group

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# The Proposed US Missile Defense in Europe: Technological Issues Relevant to Policy

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American Association for the Advancement of Science  
Washington, DC  
August 28, 2007

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## Major Questions that Need to Be Addressed

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### Major Issues

- **What Are the Benefits Versus the Costs Associated with the Current Plan to Deploy a Missile Defense in Europe?**
- **Could This Deployment Cause an Avoidable Major Policy Confrontation with Russia at a Time When Russian-US Cooperation is Critical?**
- **Will the System Provide the Promised Performance Benefits?**
- **Are There Alternative System Configurations that Could “Do the Job” that would Not Be Perceived as a Threat by the Russians?**

# Summary of the Technological Issues Relevant to Policy (1 of 2)

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- **Aegis system interceptors are kinematically able to provide intercept coverage for a missile defense of Europe.**
- **There are as yet unresolved questions about whether the Aegis interceptor Kill Vehicle has adequate acquisition and divert capabilities to reliably find and maneuver to hit Intermediate Range Ballistic Missile (IRBM) warheads.**
- **However, the Missile Defense Agency has made statements that the Aegis can do the job.**
- **Two-Stage Ground-Based Interceptors sited in Poland are kinematically able to provide intercept coverage for most, but not all, of Europe.**
- **The Two-Stage Ground-Based Interceptors are also capable of intercepting Russian ICBMs launched towards targets on the East Coast of the United States.**
- **Missile Defense Agency claims that such intercepts are not possible are inaccurate.**
- **There are still many unresolved engineering and technical problems associated with both the two-stage and three-stage Ground-Based Interceptors.**
- **It is not clear that the unresolved performance uncertainties associated with the Ground-Based Interceptor are less than those that confront Aegis.**
- **Thus, from the perspective of performance uncertainties, Aegis interceptors appear to be as viable a choice for policy makers as Ground-Based Interceptors.**

# Summary of the Technological Issues Relevant to Policy (2 of 2)

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- **The planned radar support for the European missile defense is woefully inadequate.**  
X-band radars are fundamentally not suited for the role of acquisition and surveillance. Lower frequency radars operating at VHF, UHF, or L-Band are all far more suitable for this mission.
- **The radar acquisition and surveillance problem could probably be solved by using multiple Forward-Based X-Band radars placed strategically between Iran and Europe.**  
These radars would probably only be able to acquire and track cone-shaped ballistic missile warheads at ranges less than 1000 km range. They would, however, be able to track the upper rocket stage that deploys the warhead at greater range. This may make it possible for the radar to cue on upper rocket stages as part of a process aimed at acquiring and tracking the warhead.
- **The radar acquisition and surveillance problem could also be solved by using the Russian Voronezh Class VHF Early Warning Radar in Armavir, Russia.**
- **Even if the funding for the Missile Defense Program were expanded to a substantial part of the entire Department of Defense budget, the resulting missile defense system would still be fundamentally unreliable, unless it can be demonstrated that the system can tell the differences between simple decoys and warheads.**
- **There is overwhelming evidence that exoatmospheric Missile Defenses are fundamentally vulnerable to exoatmospheric decoys. This near-certain vulnerability has far ranging implications for the viability of exoatmospheric missile defenses and the nation's security. Congress should consider investigating this serious and fundamental vulnerability.**



## Proposed Elements Of A European Missile Defense

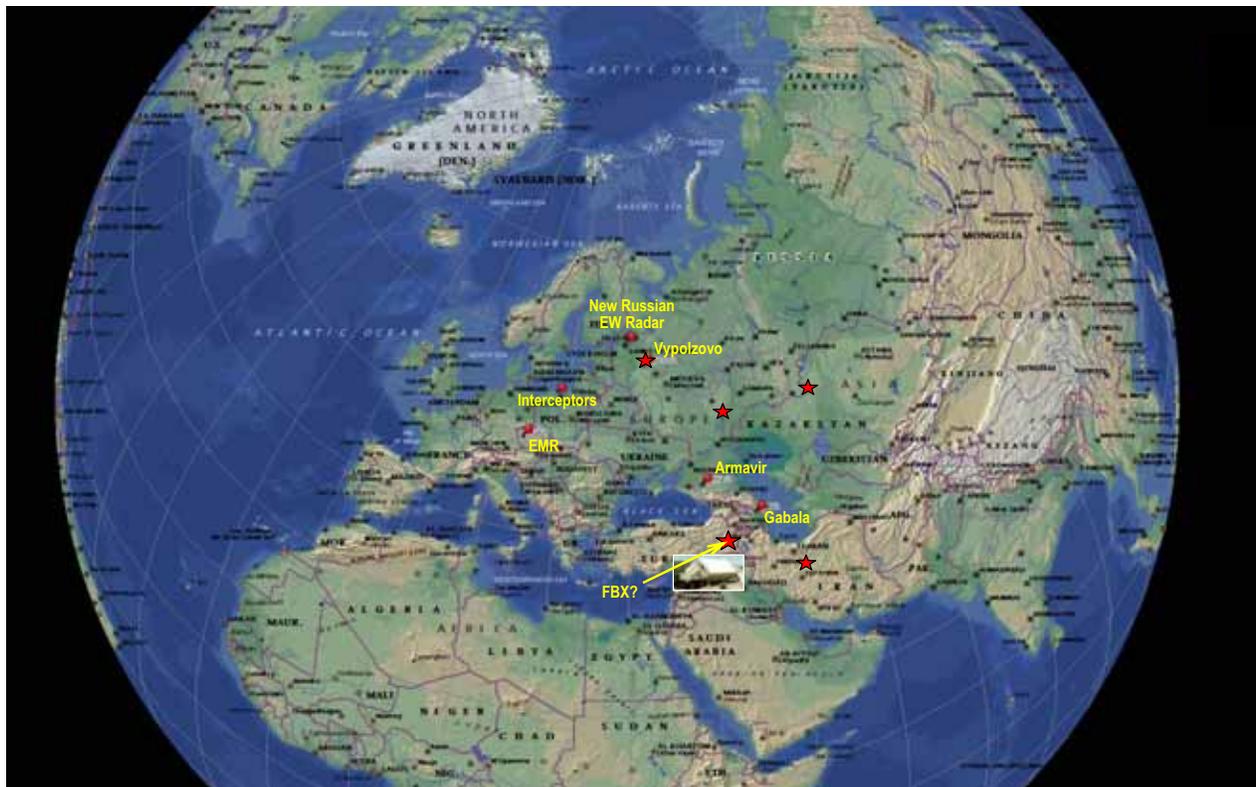
- Up to 10 silo-based long-range interceptors located in Eastern Europe (2011-2013)
- Re-location of a narrow-beam, midcourse tracking radar currently used in our Pacific test range to central Europe (2011)
- Field an acquisition radar focused on the Iranian threat from a forward position to provide detection, cueing, and tracking information (2010-2011)



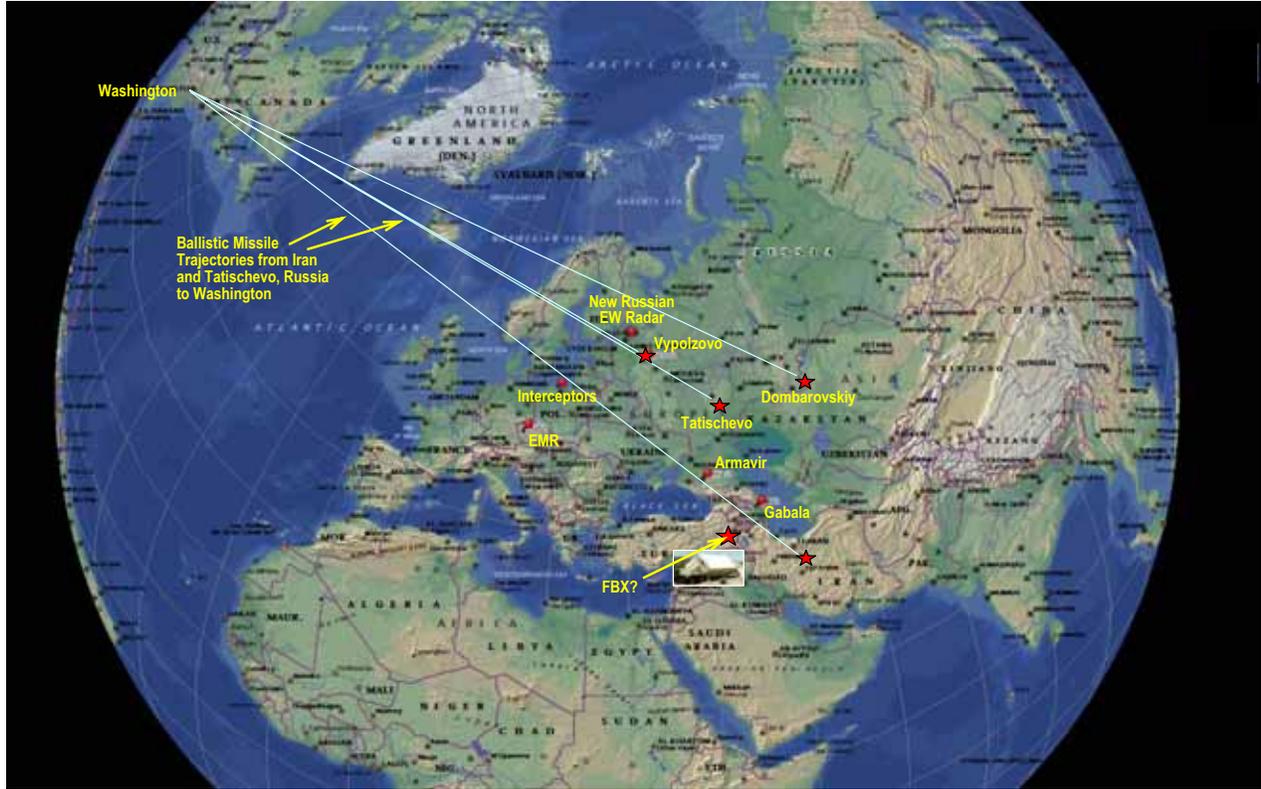
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07-MDA-2332 (9 MAR 07)

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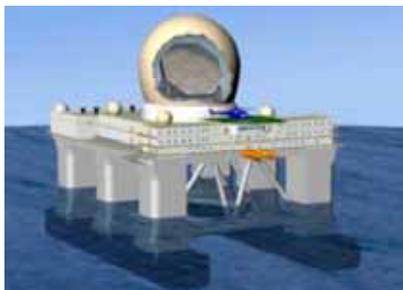
## Locations of Physical Assets Relevant to an Assessment of the Policy Issues



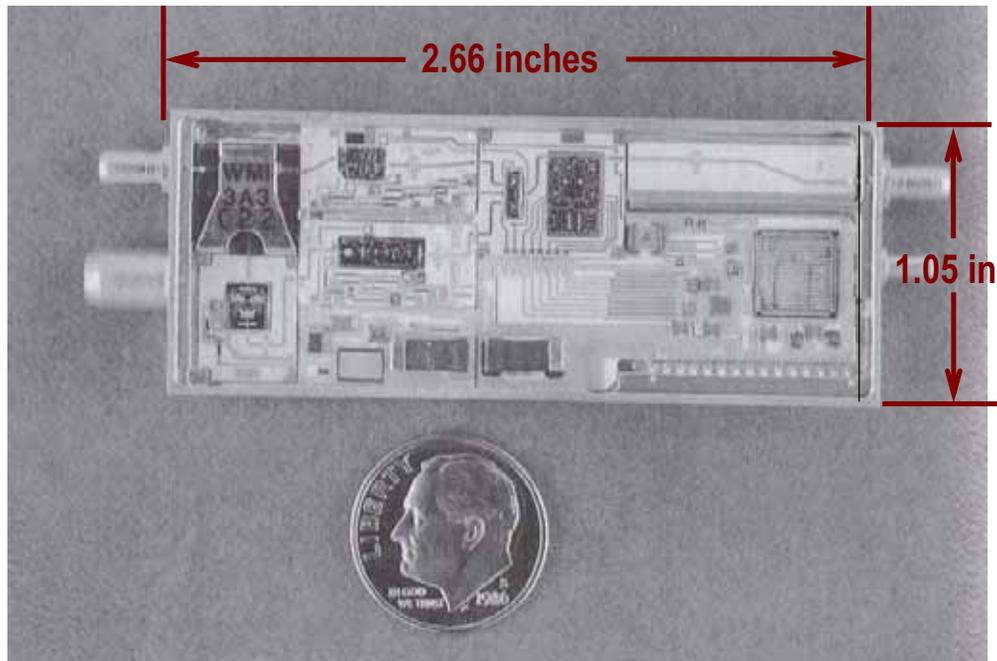
# Ballistic Missile Trajectories from Iran and Tatischevo, Dombarovskiy, and Vypolzovo, Russia to Washington



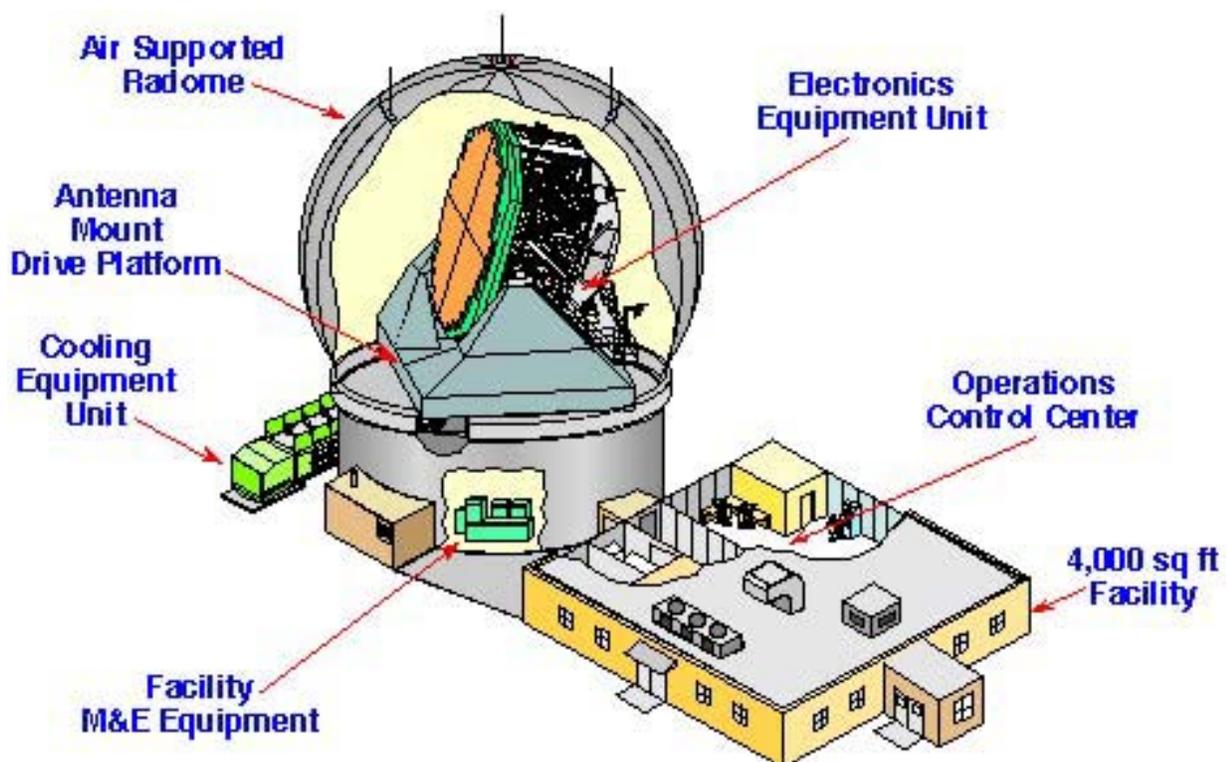
## Phased-Array X-Band Radars



# X-Band Module



## National Missile Defense Ground-Based Radar Prototype (NMD-GBR-P) X-Band Radar to be Used in National Missile Defense System

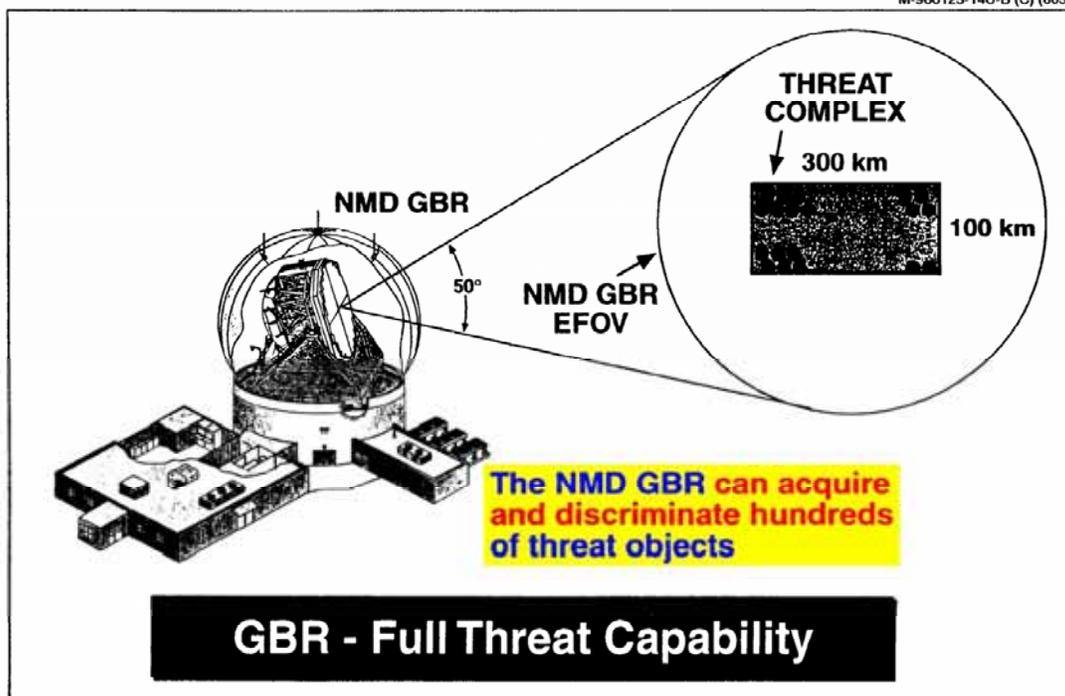




UNCLASSIFIED  
NMD GBR (U)



M-960123-14U-B (C) (6039)



## Presidential National Security Directive 23 (PNSD-23)

### Presidential National Security Directive 23 (PNSD-23)

Signed by President Bush on December 6, 2002.

- PNSD-23 reaffirmed the policy of the Bush administration “to develop and deploy, at the earliest possible date, ballistic missile defenses drawing on the best technologies available.”
- The Directive also states that the United States would begin to deploy missile defenses in 2004 “as a starting point for fielding improved and expanded missile defenses later [emphasis added].”
- And that the ultimate goal was missile defenses “not only capable of protecting the United States and our deployed forces, but also friends and allies.”
- PNSD-23 was preceded in January 2002 by a memorandum from then Secretary of Defense Donald Rumsfeld. The Rumsfeld memo directs the Missile Defense Agency to develop defense systems by first using whatever technology is “available,” even if the capabilities produced are limited relative to what the defense must ultimately be able to do.

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**PNSD-23 Appears to be a Mandate for Continued and Unbounded Expansion and Modernization of the Missile Defense System in Europe and Elsewhere.**

**If this is True, PNSD-23 Would Indicate to the Russians that the Current Defense Deployment in Europe is only the Leading Edge of a Much Larger and More Capable Future Deployment.**

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## X-Band Radars

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The new X-band radars can be divided into two groups:

- THAAD/FBX (which are the same): transportable, multipurpose (surveillance, tracking) radars
- -SBX, GBR-P, GBR, EMR. Large, specialized tracking radars. These all have highly "thinned" antennas. Their antennas all can be rotated.

# X-Band Modules per Radar

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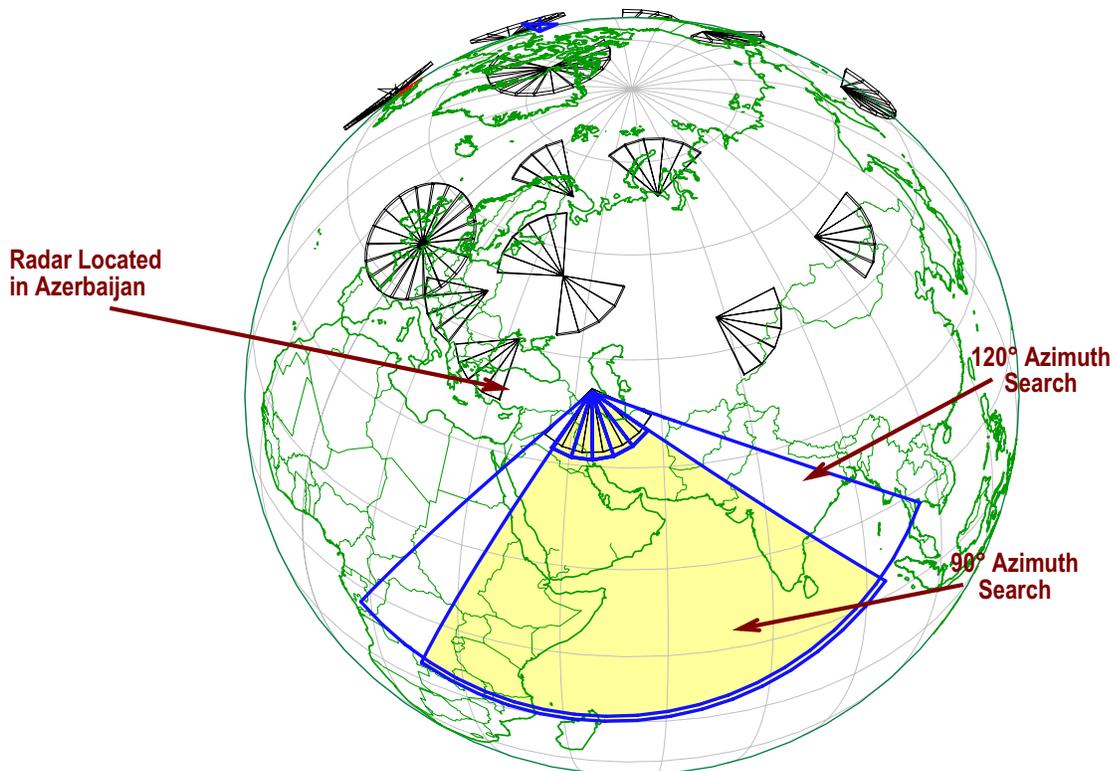
- GBR-P: 16,896
- THAAD/FBX: 25,344
- SBX: 45,264
- GBR: 69,632
- EMR (Czech): ~ 22,000 ???

- Current rate of deployment suggests about enough modules are being made each year to deploy one THAAD/FBX.
- If so, this may explain why EMR won't be available until 2011.
- Modules are expensive, ~\$1,000+ each.

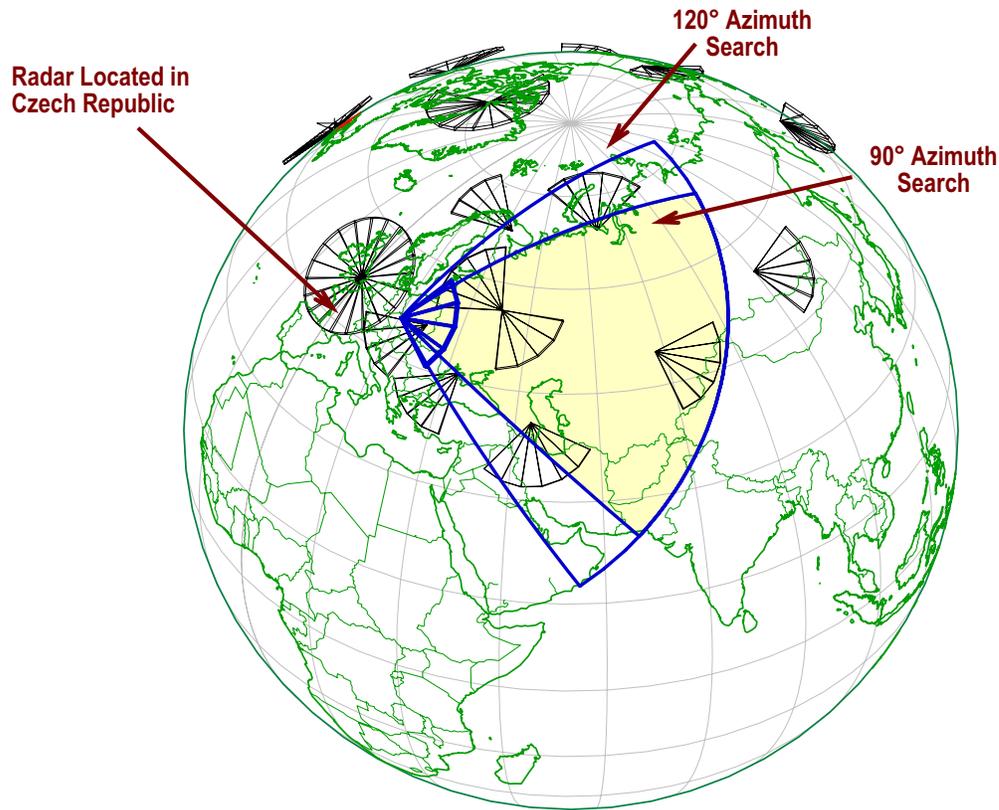
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## Search Coverage of the X-Band Radar Using Electronic Scanning

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# Search Coverage of the X-Band Radar Using Electronic Scanning

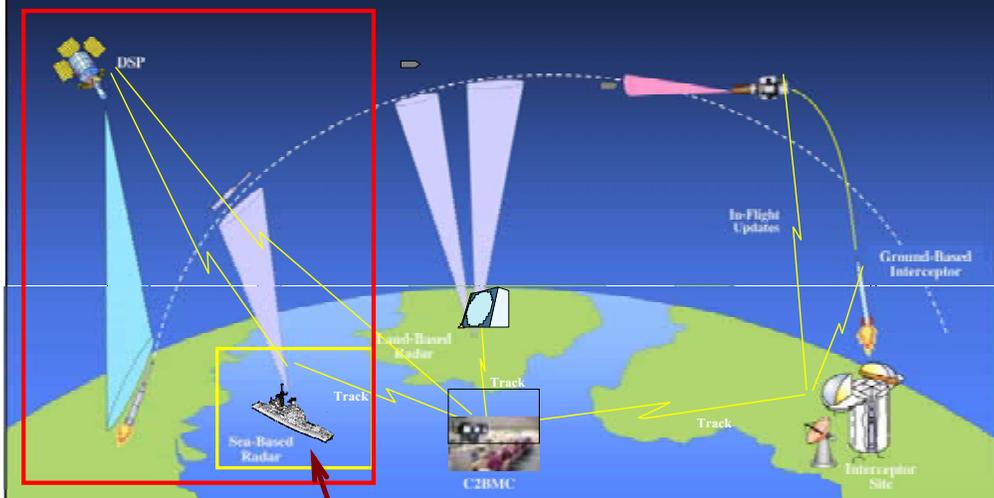


## Precision Cueing Role Played by the EMR in the Czech Republic?



### An Integrated Approach To Ballistic Missile Defense

Combining different sensors with different weapons expands detection and engagement capabilities



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## Precision Cueing Role Played by the EMR in the Czech Republic?

## Reported Demonstrations of How Simple Radar Cueing Information Can Substantially Improve a Missile Defense's Theoretical Capabilities

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“With cueing from an Aegis ship and three ships with the Block 1A capability, we can in fact defend our ally Japan and the U.S. forces there. Additionally, if we station a ship off the Hawaiian Islands with a ship forward, we can in fact defend Hawaii. Likewise, we can defend Guam by moving the detection ship forward. We have run many of these scenarios.”

Rear Admiral Brad A. Hicks  
Program Director,  
Aegis Ballistic Missile Defense  
December 19, 2005 in a talk at the Marshall Institute

Full talk is available at:  
<http://www.marshall.org/article.php?id=363>

## Why Cueing from the European Midcourse Radar (EMR) Could be of Concern to Russian Military Analysts

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Reported by several publications:

On August 19, 2004, Army Col. Charles Dreissnack, THAAD's program manager, said at a conference that recent tests of the THAAD's radar have shown that THAAD will have a “residual” capability against ICBMs.

He said: “We weren't planning to have the ICBM capability,” but the radar is “outperforming what we thought it supposed to do.”

He also said that although deployment won't begin until FY 2009, test assets could be ready to defend Hawaii years earlier.

From  
Marc Selinger, “THAAD displaying ‘residual’ capability against ICBMs,”  
*Aerospace Daily & Defense Report*, August 20, 2004.

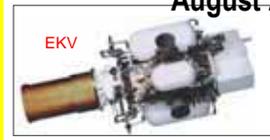
**Note:** This description implies that THAAD's NMD capabilities are limited by the radar, not the interceptor. See “Highly Capable Theater Missile Defenses and the ABM Treaty” in *Arms Control Today*, April 1994. Available on the Web at:

[http://www.ucsusa.org/global\\_security/missile\\_defense/theater-missile-defense-the-abm-treaty.html](http://www.ucsusa.org/global_security/missile_defense/theater-missile-defense-the-abm-treaty.html)

**Interceptors are Modified Ground-Based Interceptors**

**2 Stage Instead of 3 Stage  
30,450 lbs versus 31,500 lbs  
47 Feet Long versus 51 Feet**

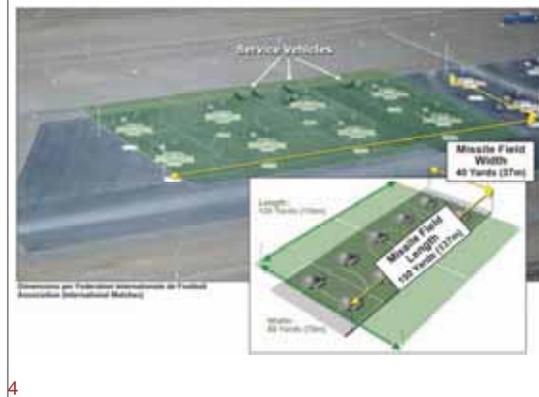
The interceptors planned for Poland are nearly identical to the three-stage interceptors based in the U.S. except that they are a two-stage variant that is quicker, lighter, and better suited for the engagement ranges and timelines for Europe. The silos that house the ground-based interceptors have substantially smaller dimensions (e.g., diameter and length) than those used for offensive missiles, such as the U.S. Minuteman III ICBM. Any modification would require extensive, lengthy, and costly changes that would be clearly visible to any observer.



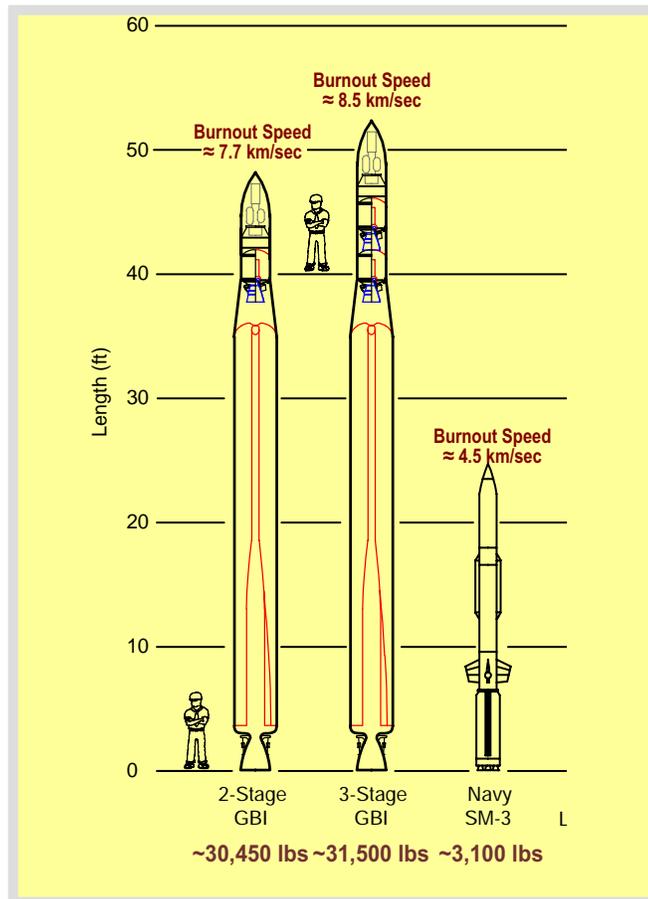
The ground-based interceptors are comprised of a booster vehicle and an exoatmospheric kill vehicle (EKV). Upon launch, the booster flies to a projected intercept point and releases the EKV which then uses on-board sensors (with assistance from ground-based assets) to acquire the target ballistic missile. The EKV performs final discrimination and steers itself to collide with the enemy warhead, destroying it by the sheer kinetic force of impact.

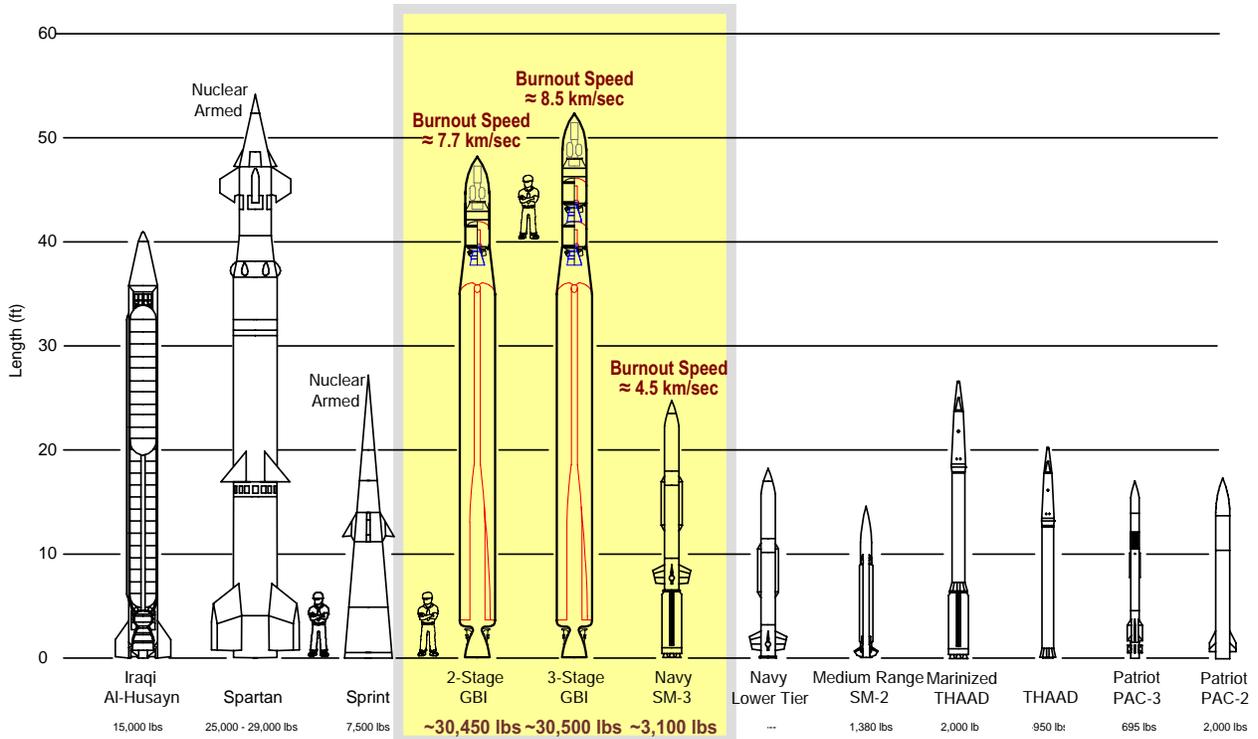


Future European Missile Site – Size Comparison

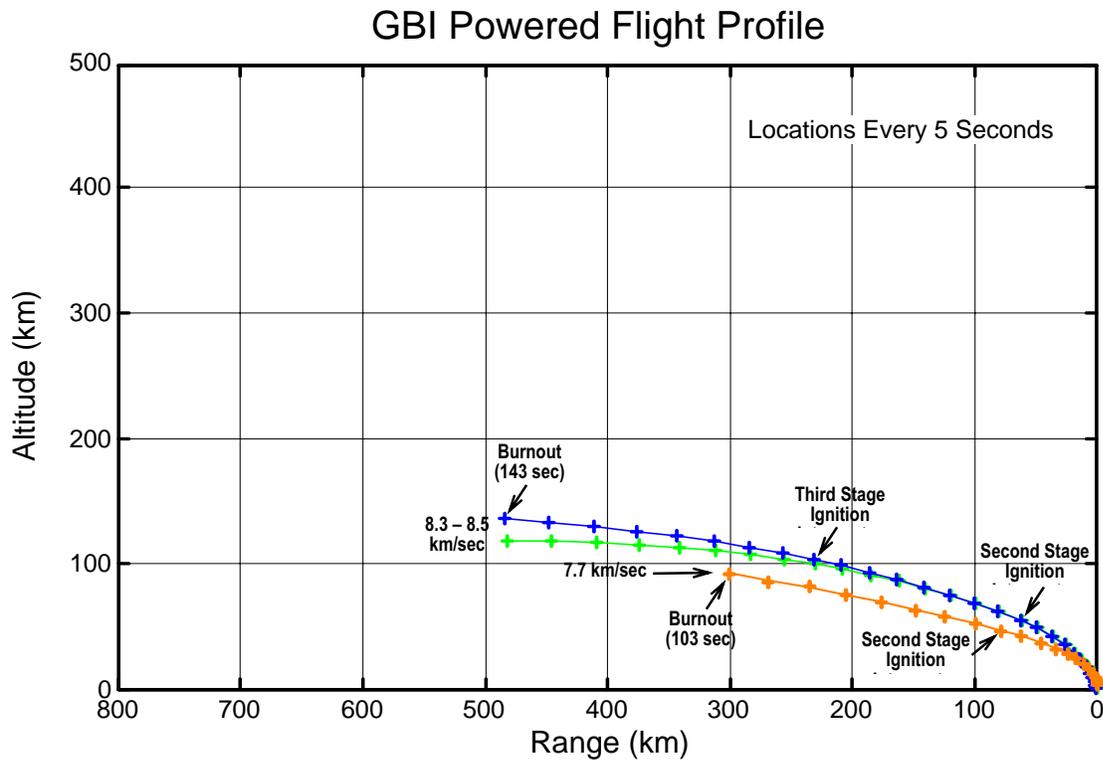


**Relative Sizes and Weights of Candidate European Missile Defense Interceptors**





**Location of US 2-Stage and 3-Stage Ground-Based Interceptor Variants at 5 Second Intervals During Powered Flight**



<p><b>Missile Defense For U.S. Allies And Friends</b></p>  <p>March 2007 Lt Gen Trey Obering, USAF Director Missile Defense Agency</p> <p><small>Distribution Statement A: Approved for public release; distribution is unlimited.</small></p> <p><small>Approved for Public Release 07-MDA-2332 (U S&amp;H 07)</small></p> <p><small>16-100355A / 020707</small></p>	<p><b>Why Poland And The Czech Republic?</b></p> <ul style="list-style-type: none"> <li>• U.S. missile defense interceptors in Alaska and California do not provide protection for Europe</li> <li>• Technical analysis shows that Poland and the Czech Republic are the optimal locations for fielding U.S. missile defense assets in Europe             <ul style="list-style-type: none"> <li>- Maximizes defensive coverage of Europe from ballistic missiles launched from the Middle East</li> <li>- Provides redundant coverage for the U.S. against intercontinental-range ballistic missiles</li> </ul> </li> <li>• Placing the interceptor field in Poland and the radar in the Czech Republic maximizes the defensive coverage of Europe</li> </ul> <p><small>Approved for Public Release 07-MDA-2332 (U S&amp;H 07)</small></p> <p><small>16-100355A / 020707 17</small></p>
<p><b>U.S. System Cannot Counter Russian Offensive Missiles</b></p> <ul style="list-style-type: none"> <li>• U.S. missile defense system deployments are directed against rogue nation threats, not advanced Russian missiles</li> <li>• A European interceptor site (up to 10 interceptors) would be no match for Russia's strategic offensive missile force - would be easily overwhelmed</li> <li>• European interceptor site has no capability to defend U.S. from Russian launches             <ul style="list-style-type: none"> <li>- Not geographically situated in European for this purpose</li> <li>- Too close Russian launch site to be able to engage intercontinental missiles headed for U.S.</li> <li>- Would result in "tail chase" for interceptors launched from a European site</li> </ul> </li> <li>• No plan to expand the number of interceptors in Europe - not in our five year budget</li> <li>• Standing invitation to the Russians to visit U.S. missile defense sites for transparency purposes</li> </ul> <p><small>Approved for Public Release 07-MDA-2332 (U S&amp;H 07)</small></p> <p><small>16-100355A / 020707 21</small></p>	<p><b>Interceptors Cannot Catch Russian Missiles</b></p>  <p><b>U.S. European Interceptor Site Cannot Affect Russian Strategic Capability</b></p> <p><small>Approved for Public Release 07-MDA-2332 (U S&amp;H 07)</small></p> <p><small>16-100355A / 020707 22</small></p>

## Concerns Expressed by the Russians



### Engagement With Russia

- **March 17, 2006 (Washington):** Bilateral Defense Commission Meeting. Under Secretary of Defense Edelman and General Mazurkevich, Chief of the Main Directorate for International Cooperation
- **April 3, 2006 (Moscow):** Briefing of Russian officials by U.S. Embassy (Moscow) on DOD decision to resume consultations with Poland regarding the site of U.S. missile defense assets
- **November 3, 2006 (Moscow):** Dr. Cambone, Lt Gen Obering, DASD Green, Russian Minister of Defense Ivanov, Chief of General Staff Gen-Col Paluevskiy, Gen-Col Mazurkevich
  - Russians did not acknowledge Iran emerging threat as a rationale for deployment of U.S. missile defense assets
- **January 29, 2007 (Moscow):** Strategic Dialogue Meeting. Under Secretaries Joseph and Deputy Foreign Minister Kislyak
  - Ambassador re-committed that U.S. will follow-up with technical briefings/explanations regarding U.S. missile deployment
- **February 9, 2007 (Seville):** Secretary Gates and Minister of Defense Ivanov during NATO-Russia Council Ministerial meeting

Believe Russia is real target  
Russians "portrayed" lack of understanding and confusion on technical aspects of a deployed missile program and proposed architecture. U.S. committed to following-up with technical discussions to Russian counterparts

U.S. Has Offered Future Event Establishing Technical Experts Meeting (Spring 2007)

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## Can the Europe-Based Missile Defense Engage Russian ICBMs and if so Why Does that Matter?

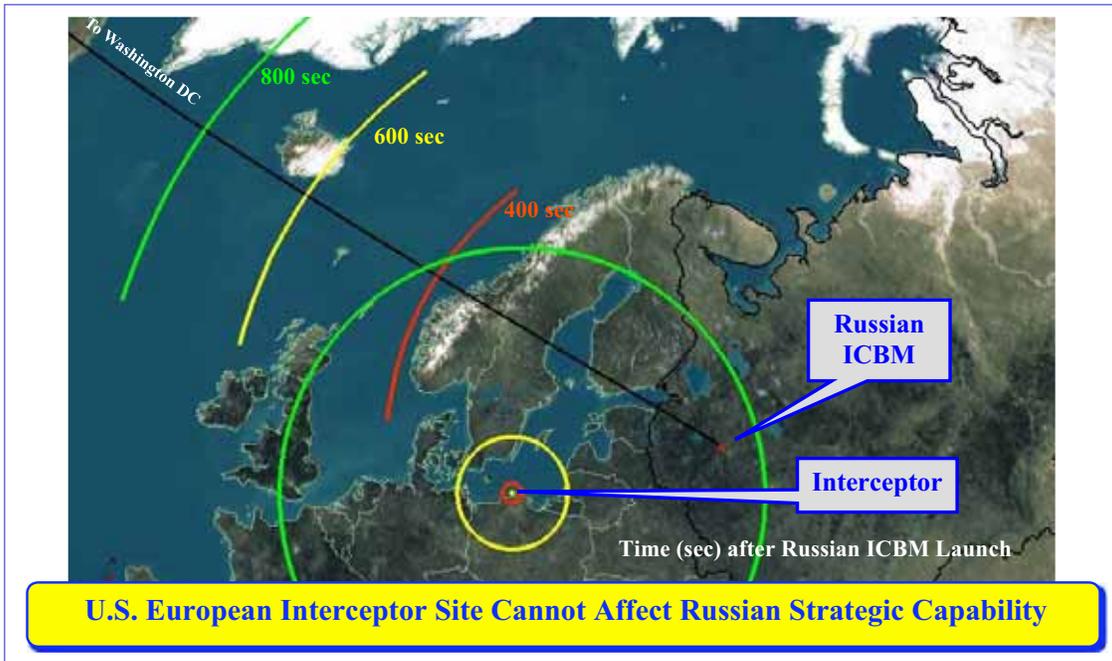
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### General Obering's Original Slide

### Interceptors Cannot Catch Russian Missiles

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**Interceptors Cannot Catch Russian Missiles**

• Interceptor launched ≈ 250-300 sec after threat

ICBM Apogee  
ICBM Burnout  
Russian ICBM  
Interceptor

Time (sec) after Russian ICBM Launch

1,200 sec  
1,000 sec  
800 sec  
600 sec  
400 sec  
250-300 sec

**U.S. European Interceptor Site Cannot Affect Russian Strategic Capability**

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07-MDA-2623 (13 JUN 07)

*Misleading MDA Slide*

ms-109673B / 061407 27



**Obering's Slide With MDA Labels Removed**

**Interceptors Cannot Catch Russian Missiles**

To Washington DC

800 sec  
600 sec  
400 sec

Vypolzovo 18 SS-25s  
Moscow

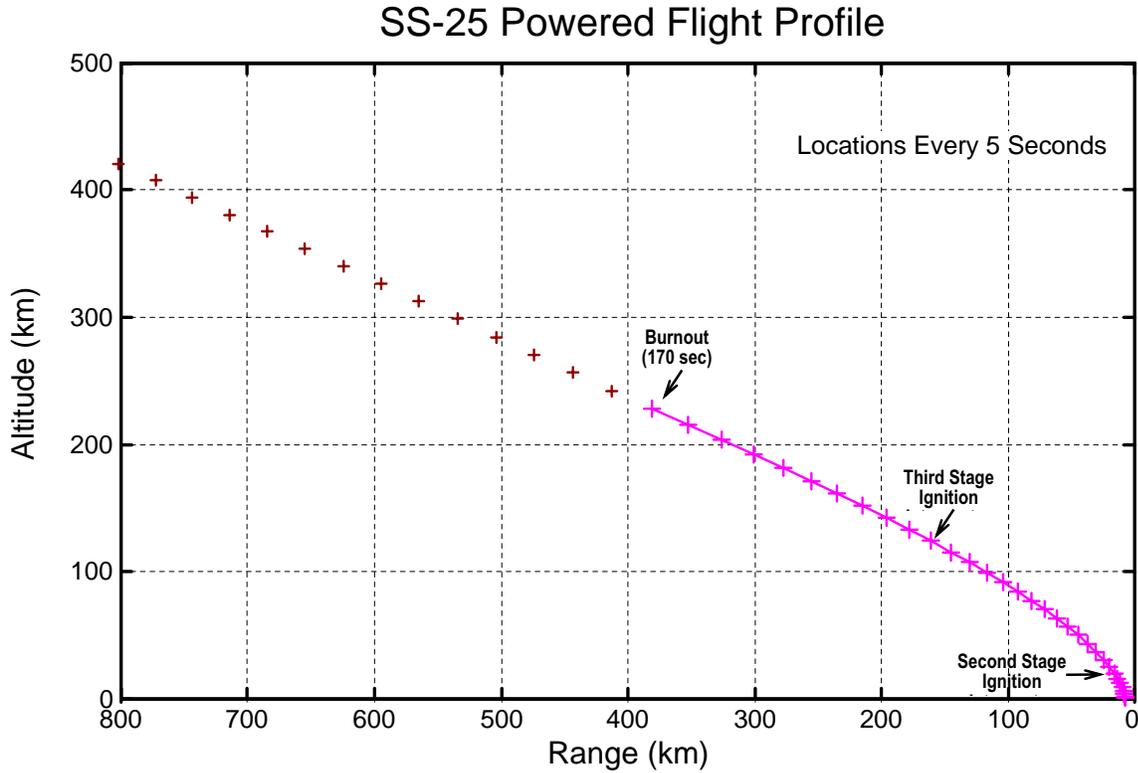
Time (sec) after Russian ICBM Launch

**U.S. European Interceptor Site Cannot Affect Russian Strategic Capability**

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07-MDA-2332 (9 MAR 07)

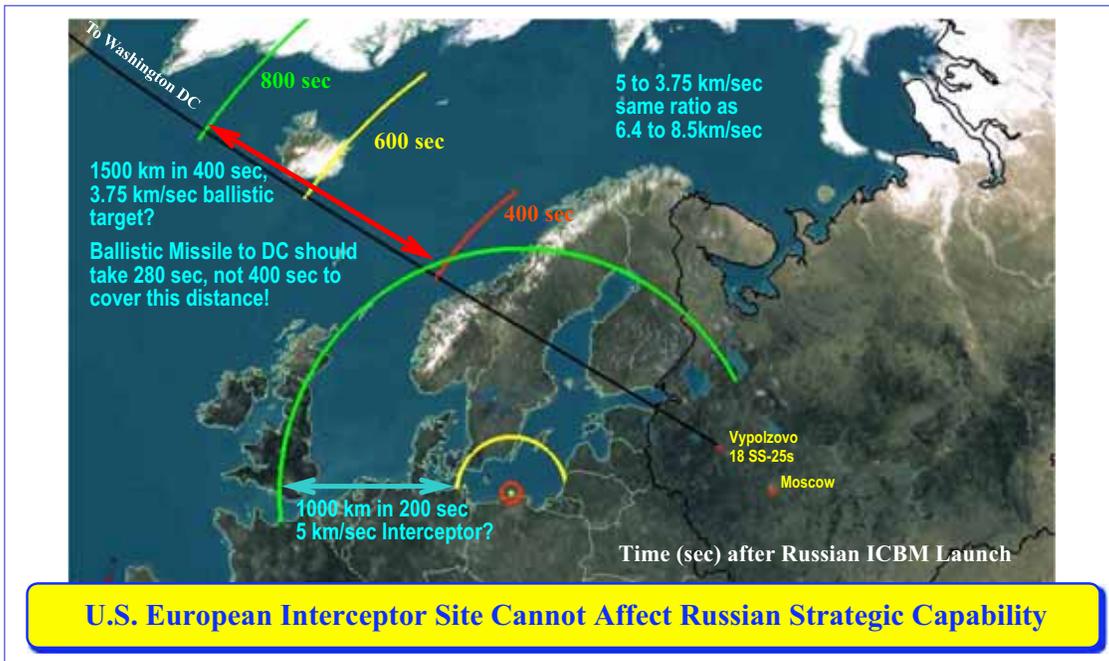
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# Location of SS-25 Russian ICBM at 5 Second Intervals During Powered Flight



## Obering's Slide – Distances and Speeds Wrong

### Interceptors Cannot Catch Russian Missiles





# Actual Timelines for an Engagement

## Interceptors Cannot Catch Russian Missiles



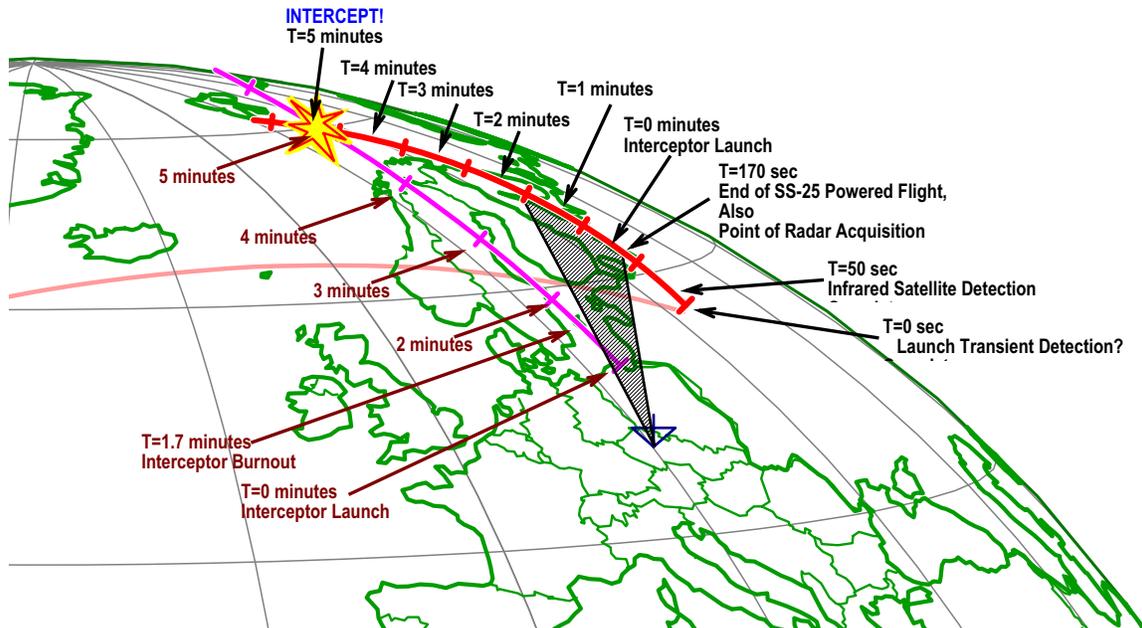
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**This statement is wrong**

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## Engagement Event Timeline for Engagement of SS-25 from Vypolzovo with 2-Stage Missile Defense Interceptor

T=500 sec  
Interceptor and  
warhead Collide



# Misleading MDA Slide Indicating Interceptors Cannot Engage Russian ICBMs



*Misleading MDA Slide*

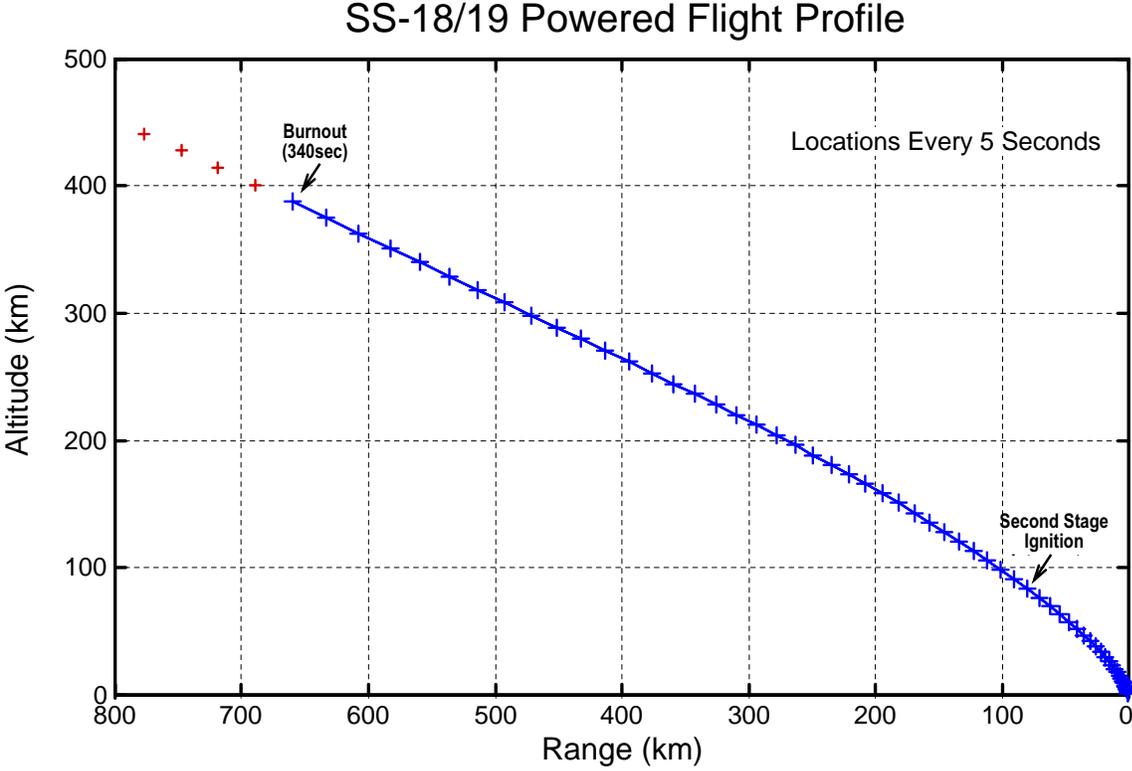
## Misleading MDA Slide that Indicates Interceptors Could Never Intercept Russian ICBMs

Slide Overstates the Speed of ICBMs by 15% and Understates the Speed of Interceptors by more than 30%

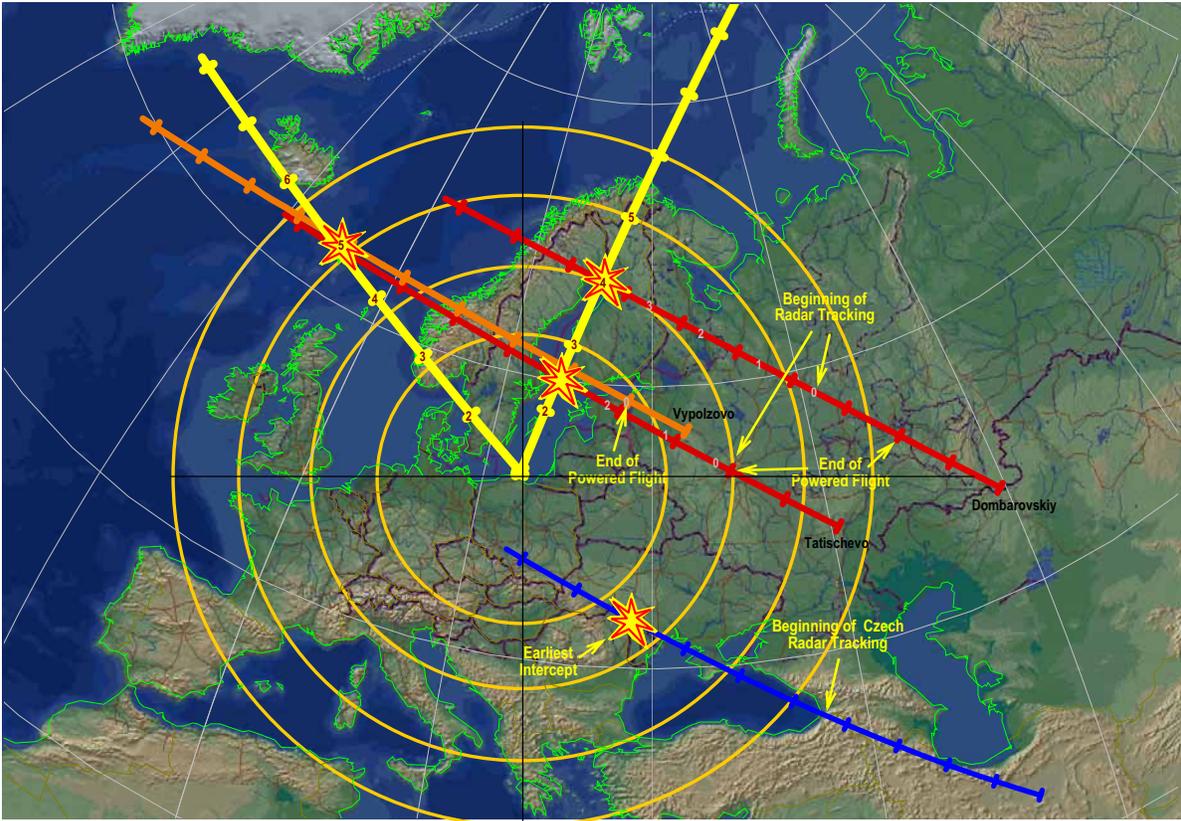
### Interceptors Cannot Catch Russian Missiles



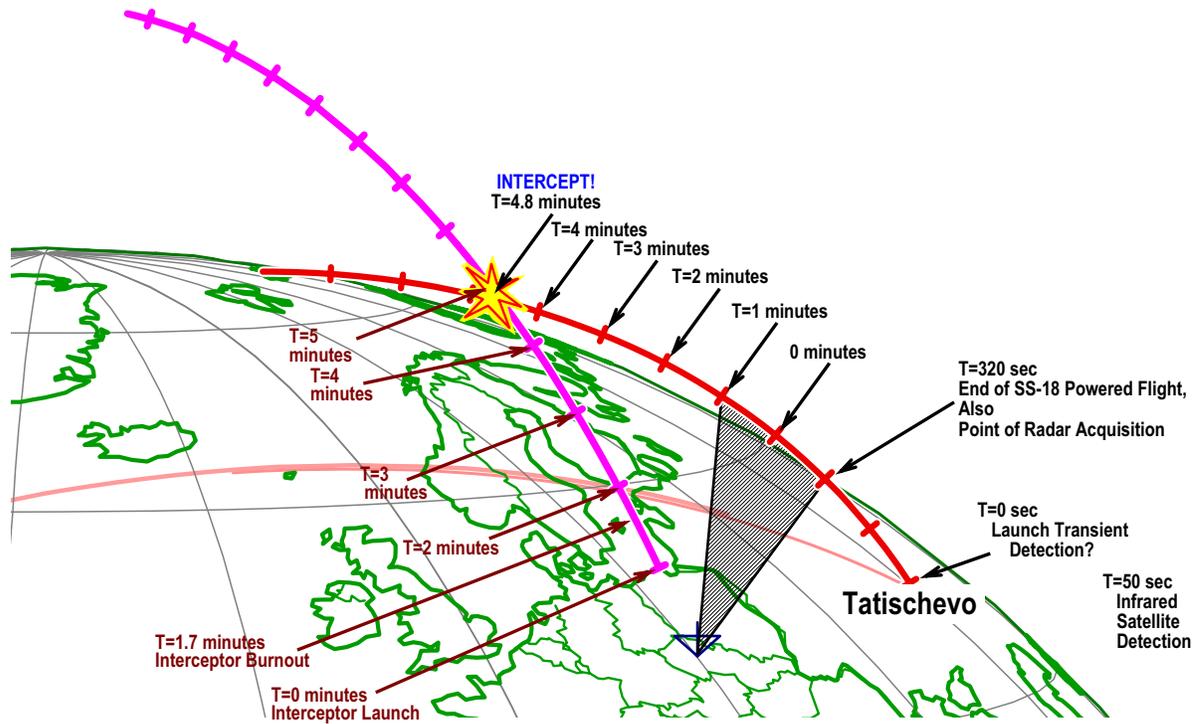
*Misleading MDA Slide*



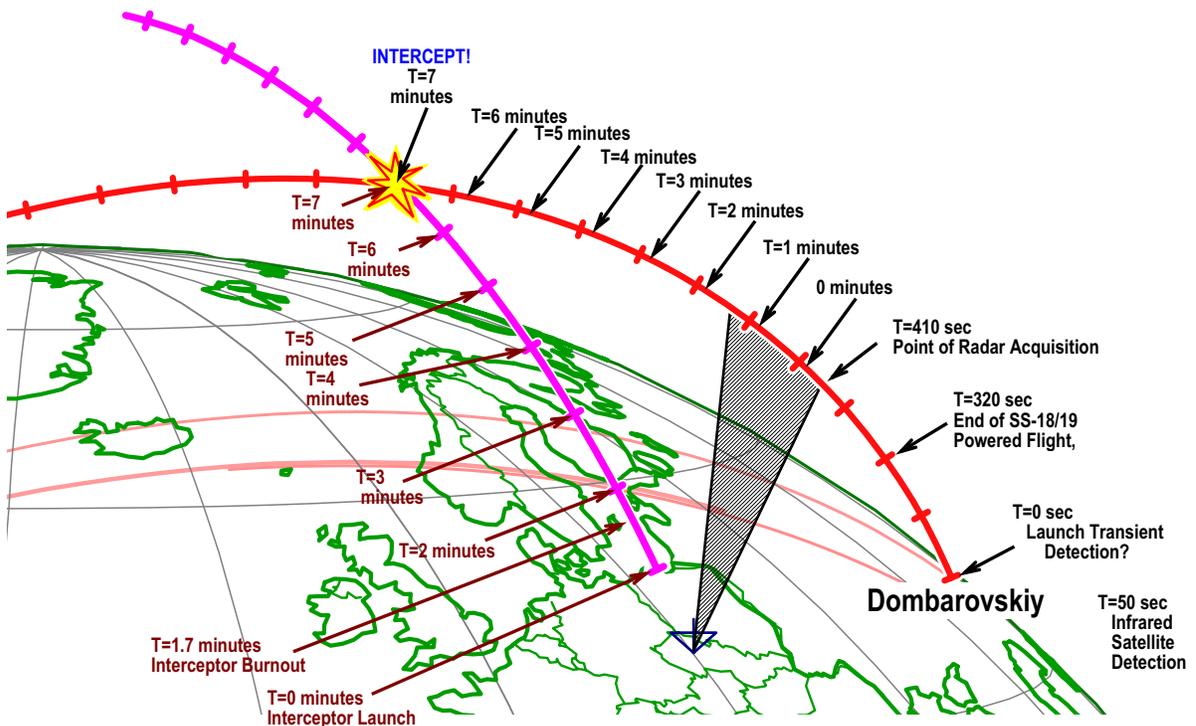
### Timelines and Events for Intercepts with Two-Stage Variant of the GBI



## Engagement Event Timeline for Engagement of SS-18/19 from Tatischevo with 2-Stage Missile Defense Interceptor



## Engagement Event Timeline for Engagement of SS-18/19 from Dombarovskiy with 2-Stage Missile Defense Interceptor



## Major Foreign Policy Issue

### US May Need to Explain to the Russians Why US Interceptors Cannot Engage Russian ICBMs



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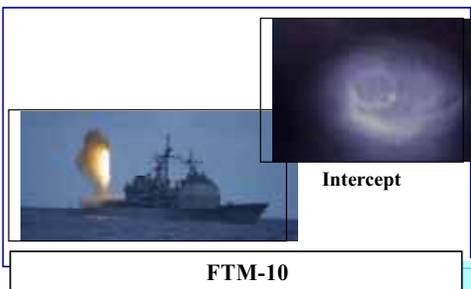
## Major Issue

Is There Another Option to Base Interceptors so they Do Not Pose a Perceived Threat to Russian ICBMs?

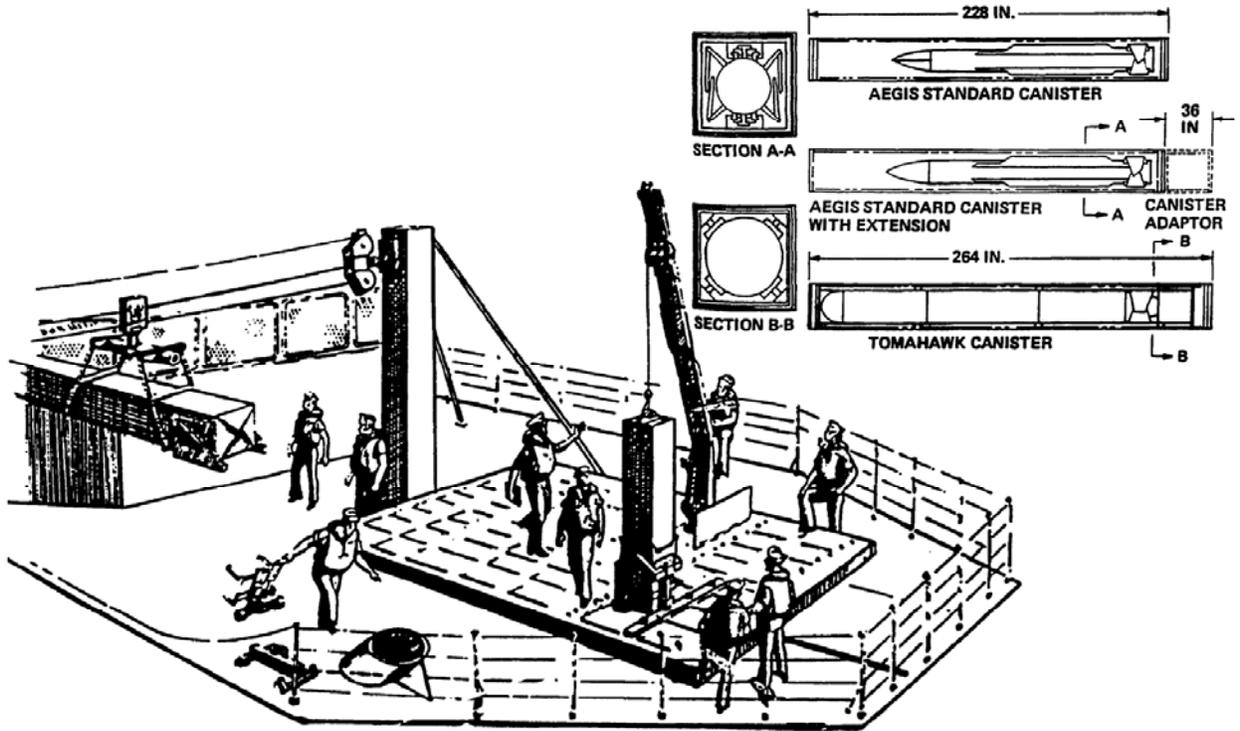
An alternative way of asking this question is:  
Could the Aegis System "Do the Job"?



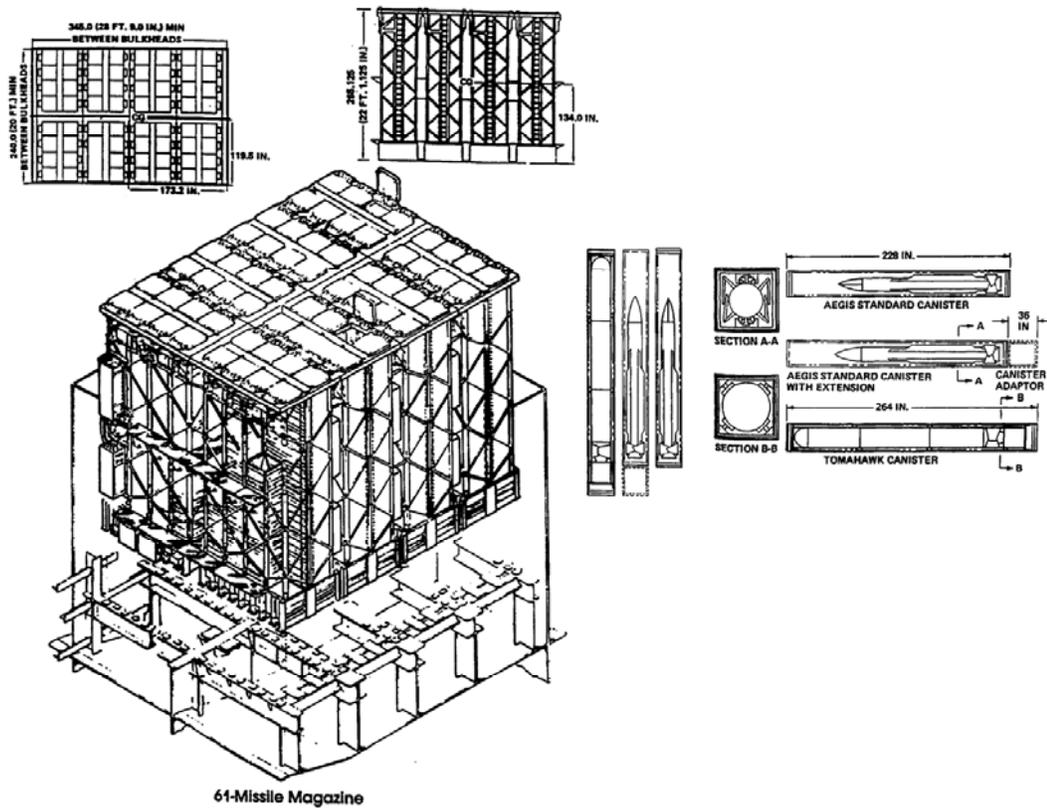
## Emergency Engagement Capability



If Directed, Capability Available



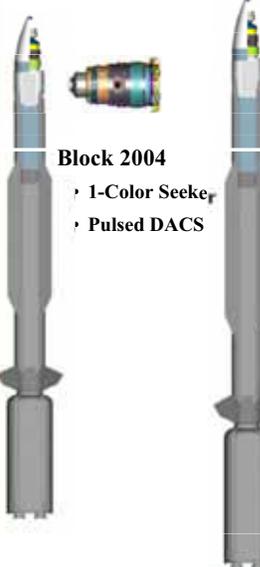
Basic Characteristics of the Vertical Launch System Components



61-Missile Magazine



## Aegis BMD SM-3 Evolution Plan

Block IA	Block IB	Block II	Block IIA
 <p><b>Block 2004</b></p> <ul style="list-style-type: none"> <li>• 1-Color Seeker</li> <li>• Pulsed DACS</li> </ul>	 <p><b>Block 2008</b></p> <ul style="list-style-type: none"> <li>• <b>2- Color Seeker</b> <ul style="list-style-type: none"> <li>- Increased IR Acquisition</li> <li>- Improved Discrimination</li> </ul> </li> <li>• <b>TDACS</b> <ul style="list-style-type: none"> <li>- Increased Divert</li> <li>- Lowers AUR Cost</li> </ul> </li> <li>• <b>All-Reflective Optics (ARO)</b></li> <li>• <b>Advanced Signal Processor (ASP)</b></li> </ul>	<p style="text-align: center;"><b>High Velocity Variant</b></p>  <p><b>Block 2010 / 2012</b></p> <ul style="list-style-type: none"> <li>• <b>Block IB Seeker</b></li> <li>• <b>21" Propulsion</b> <ul style="list-style-type: none"> <li>- 2<sup>nd</sup> &amp; 3<sup>rd</sup> Stage</li> <li>- Increased Missile Vbo = xx</li> </ul> </li> <li>• <b>21" Nosecone</b></li> <li>• <b>MK 41 VLS Compatible</b></li> </ul>	<p style="text-align: center;"><b>High Divert Variant</b></p>  <p><b>Block 2012 / 2014</b></p> <ul style="list-style-type: none"> <li>• <b>Large Diameter KW</b> <ul style="list-style-type: none"> <li>- Advanced Discrimination Seeker</li> <li>- High Divert DACS</li> </ul> </li> <li>• <b>21" Propulsion</b> <ul style="list-style-type: none"> <li>- 2<sup>nd</sup> &amp; 3<sup>rd</sup> Stage</li> <li>- Increased Missile Vbo = yy</li> </ul> </li> <li>• <b>21" Nosecone</b></li> <li>• <b>MK 41 VLS Compatible</b></li> </ul>
Block 2004	Block 2008	Block 2010 / 2012	Block 2012 / 2014

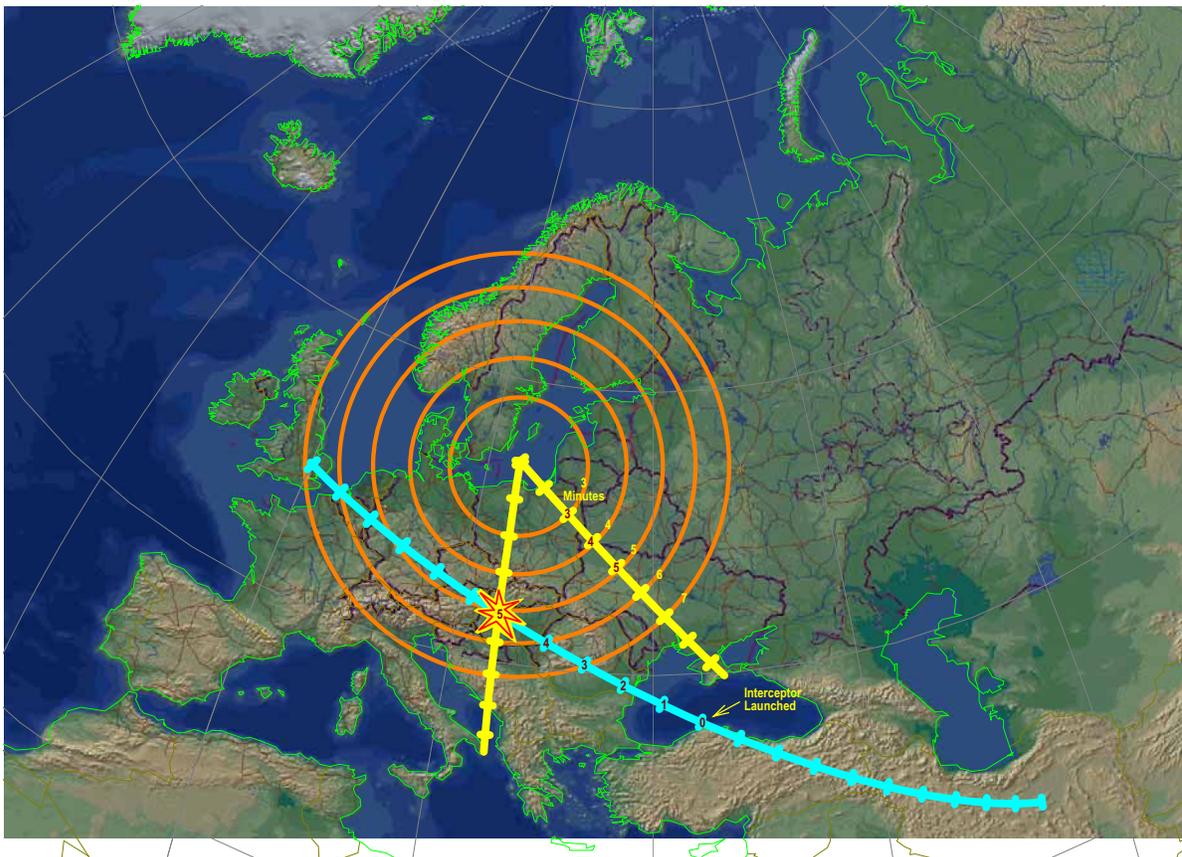
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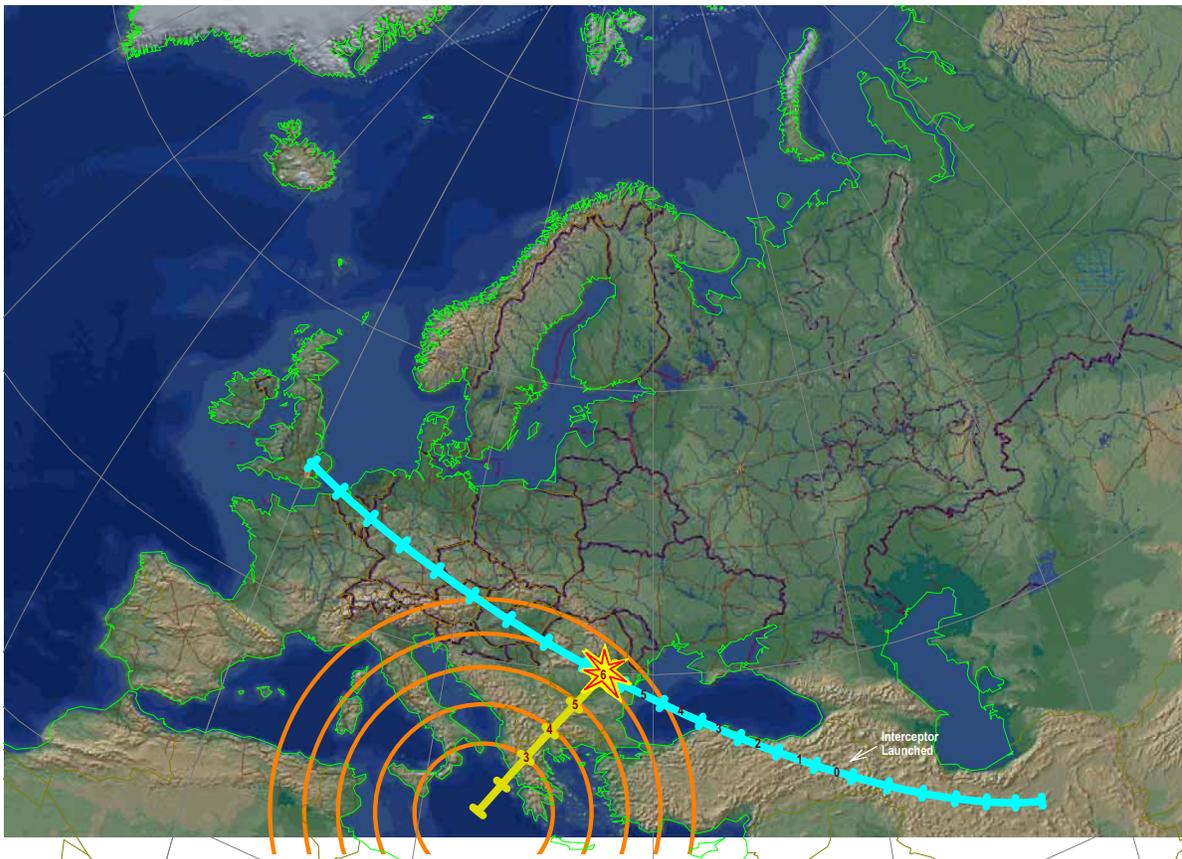
■ Funded Since PB06   
 ■ Capability Change From Previous Block

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## Aegis Engagement Timelines for Defense of UK from the Baltic Sea





## Conclusions with Regard to Interceptor Capabilities

### Assuming systems work as MDA claims:

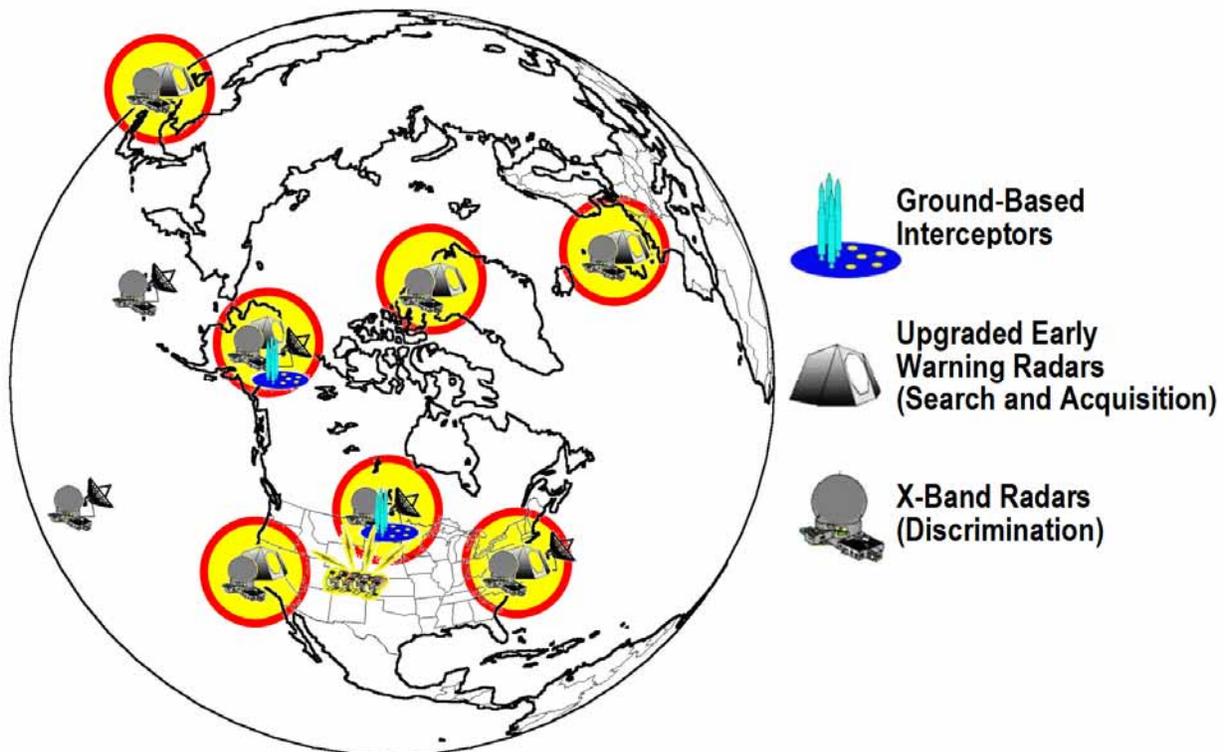
- The current proposed system could engage Russian ICBMs.
- Russian ICBMs will be observable by the EMR in the Czech Republic during their bussing operations, allowing for warheads and decoys to be tracked as they are deployed and providing potentially very valuable cueing information to missile defense units in the continental United States.
- There are many other alternative deployments that could easily meet the US stated objective of defending against postulated Iranian ICBMs.
- Aegis system interceptors are kinematically able to provide intercept coverage for a missile defense of Europe.
- Two-Stage Ground-Based Interceptors sited in Poland are kinematically able to provide intercept coverage for most, but not all, of Europe.
- The Missile Defense Agency has made statements that the Aegis can do the job, but there are as yet unresolved questions about whether the Aegis interceptor Kill Vehicle has adequate acquisition and divert capabilities to reliably find and maneuver to hit Intermediate Range Ballistic Missile (IRBM) warheads.
- There are also many unresolved engineering and technical issues associated with the Two and Three Stage Ground-Based Interceptors *and* the EKV.
- Thus, from the perspective of performance uncertainties, Aegis interceptors appear to be as viable a choice for policy makers as Ground-Based Interceptors.

# Can the System "Do the Job"?

## The Complementary Role of Acquisition and Tracking Radars in the European Missile Defense

### What Has Happened to the Acquisition Radars the US Missile Defense Program?

Original System Plans Required that the UEWRs be Used for Acquisition  
and X-Band Radars be Used for Discrimination!



Capability of Radar Determined by Average Power Radiated from Antenna

Size of the Antenna

Radar Cross Section (RCS) of Targets to be Engaged

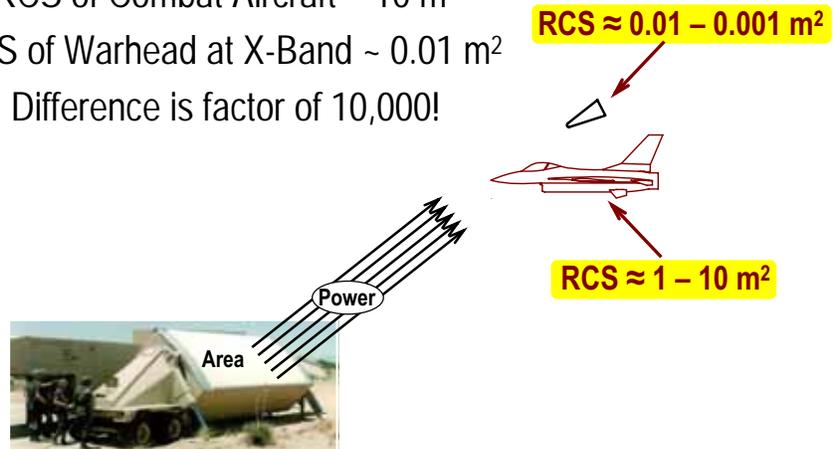
Radar Cross section Reduction

This is why Stealth can be effective against previously capable radars

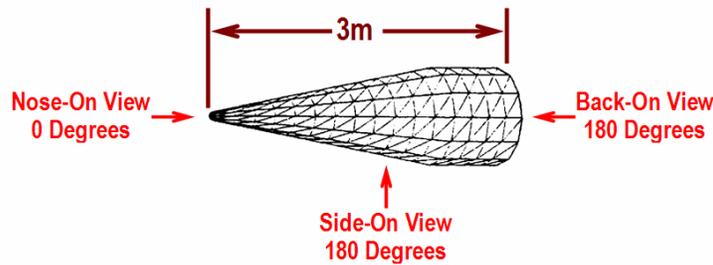
RCS of Combat Aircraft ~ 10 m<sup>2</sup>

RCS of Warhead at X-Band ~ 0.01 m<sup>2</sup>

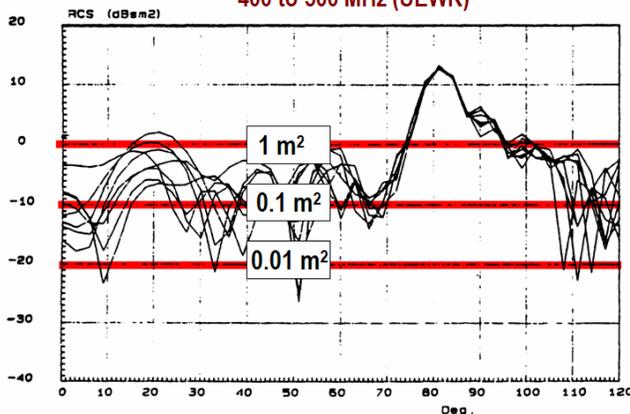
Difference is factor of 10,000!



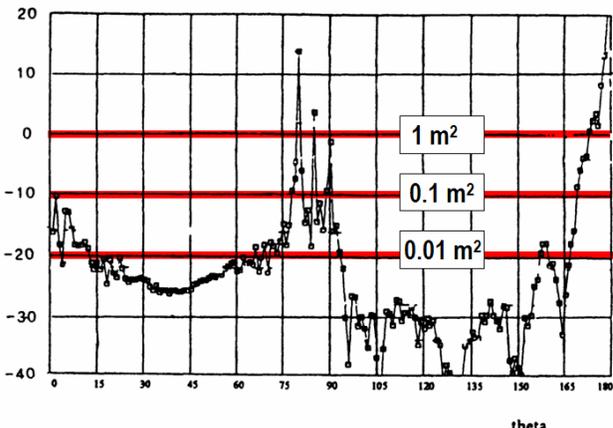
## Radar Cross Section of Large Round-Nose Warhead



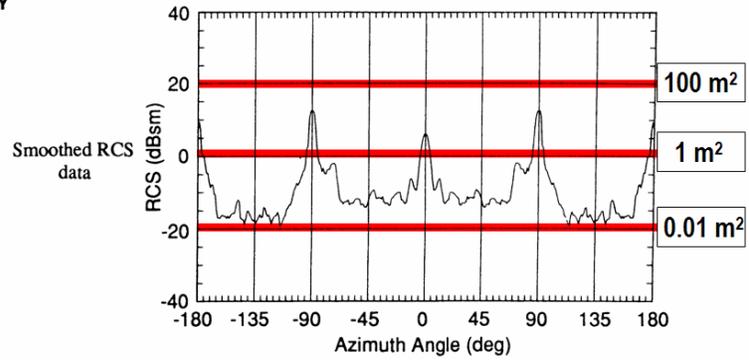
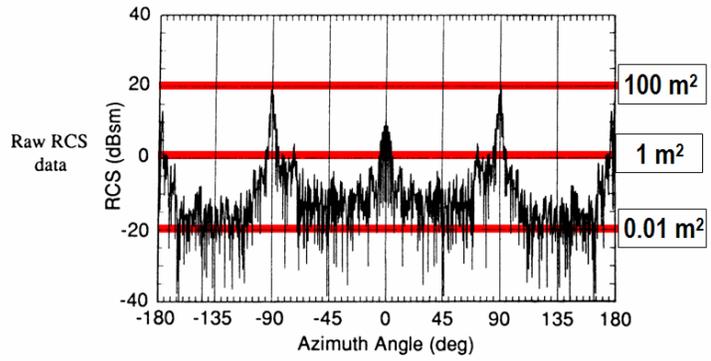
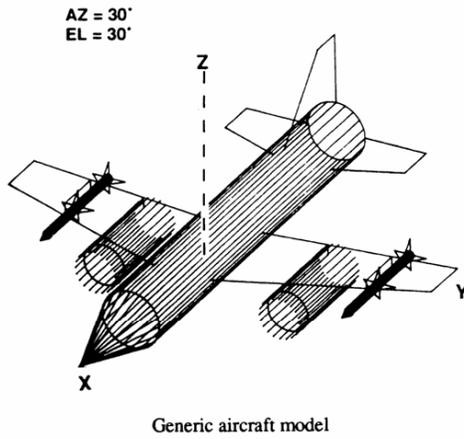
UHF Radar Cross versus Look Angle  
400 to 500 MHz (UEWR)



X-Band Radar Cross versus Look Angle  
10,000 MHz (10 GHz)



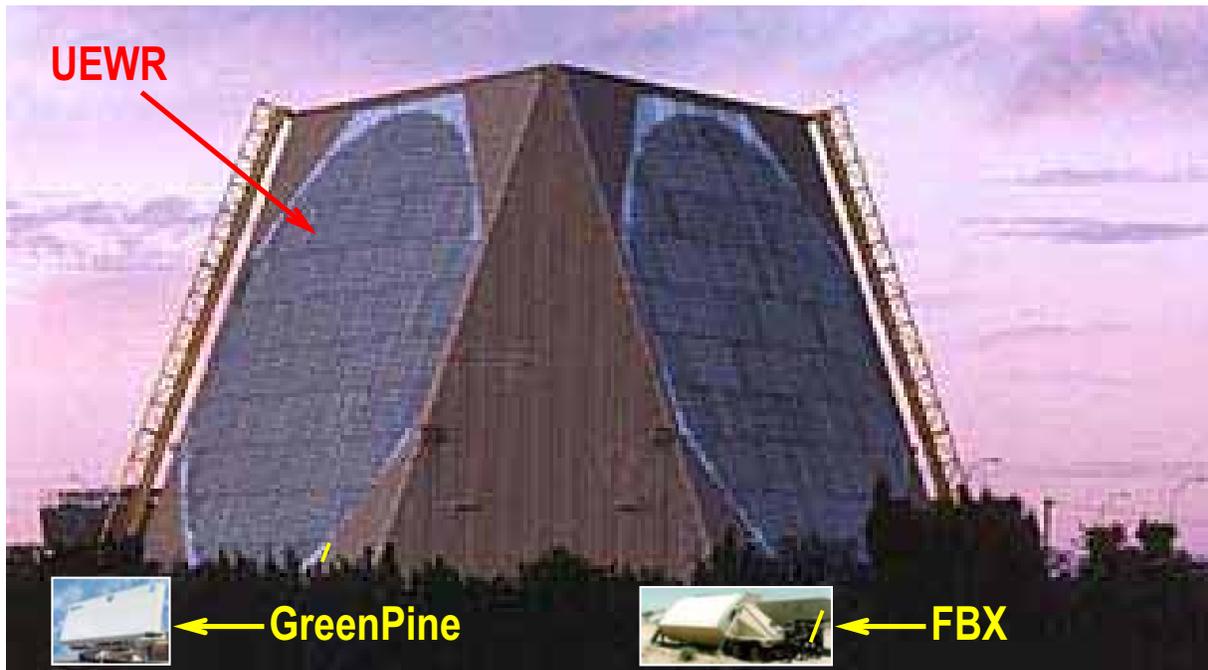
# Radar Cross Section of Generic Aircraft



Computed raw and smoothed RCS data for generic aircraft model at 10 GHz. Smoothed data is the median within each 5° window with 2° slide.

## Phased Array Warning System (PAVE PAWS) UHF Radar Being Used in National Missile Defense System

The size of the FBX and its limited average power make it considerably less capable than large lower frequencies radars like the US UEWR and the Russian Voronezh VHF radars for acquiring and tracking naturally stealthy ballistic missile warheads at long-range.



# Russian Voronezh Class Third Generation Upgraded VHF Early Warning Radar that is Potentially Usable in a "Light" National Missile Defense System

The size of the FBX and its limited average power make it considerably less capable than large lower frequencies radars like the US UEWR and the Russian Voronezh VHF radars for acquiring and tracking naturally stealthy ballistic missile warheads at long-range.



Russian Voronezh  
VHF Early Warning  
Radar

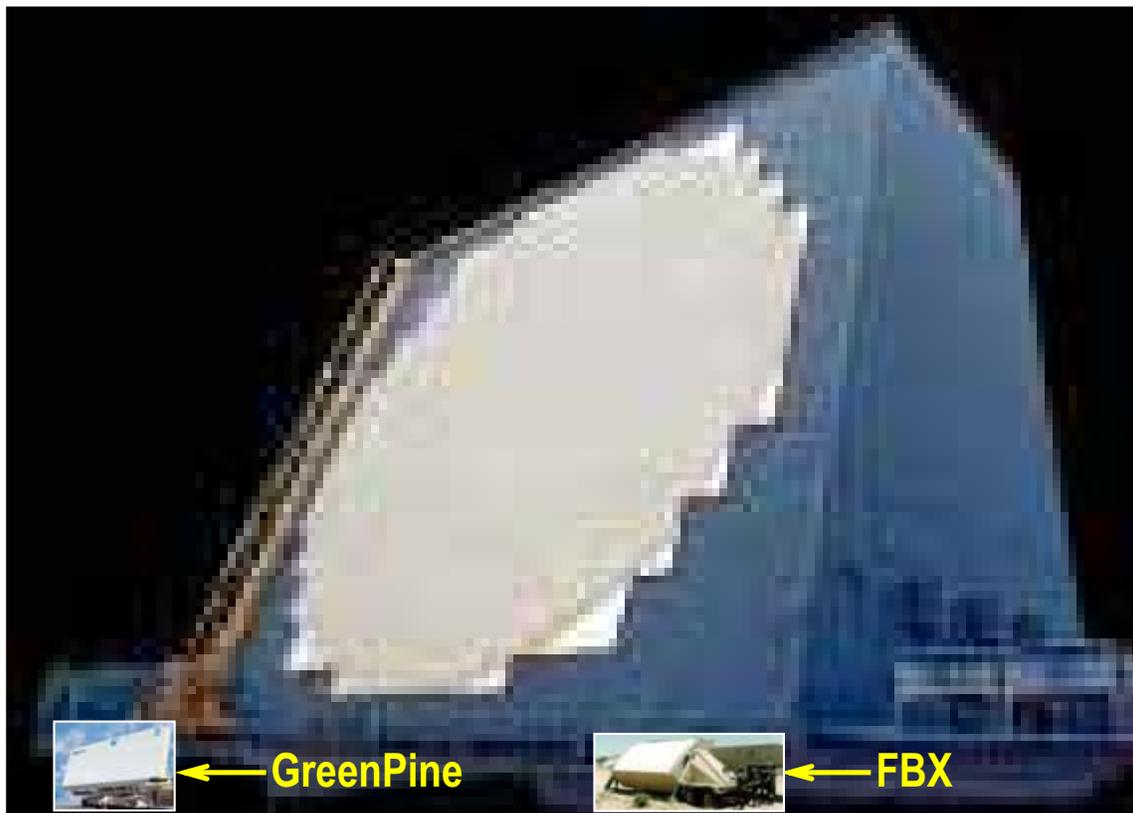
Arrow GreenPine  
Missile Defense  
Radar



Forward-Based  
X-Band Radar  
(FBX)



## Cobra Dane L-Band Phased Array Intelligence Radar Being Used in National Missile Defense System



GreenPine



FBX

## The Forward-Based X-Band Radar (FMX) Has Limited Acquisition Abilities Against 0.01 m<sup>2</sup> Cone-Shaped Warheads at Ranges Greater Than 1000 km

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1000 km Range – Dwell Time = 0.05 sec; Radar Cross Section = 0.01 m<sup>2</sup>, S/N = 20, Area Searched at Distance = 4.3 km x 10.3 km  
1500 km Range – Dwell Time = 0.25 sec; Radar Cross Section = 0.01 m<sup>2</sup>, S/N = 20, Area Searched at Distance = 6.5 km x 15.5 km

## The Israeli Green Pine L-Band Missile Defense Radar (1 – 2 GHz) can Acquire and Track a 2 m<sup>2</sup> Target at 500 km and a 0.02 m<sup>2</sup> Target at 50 km

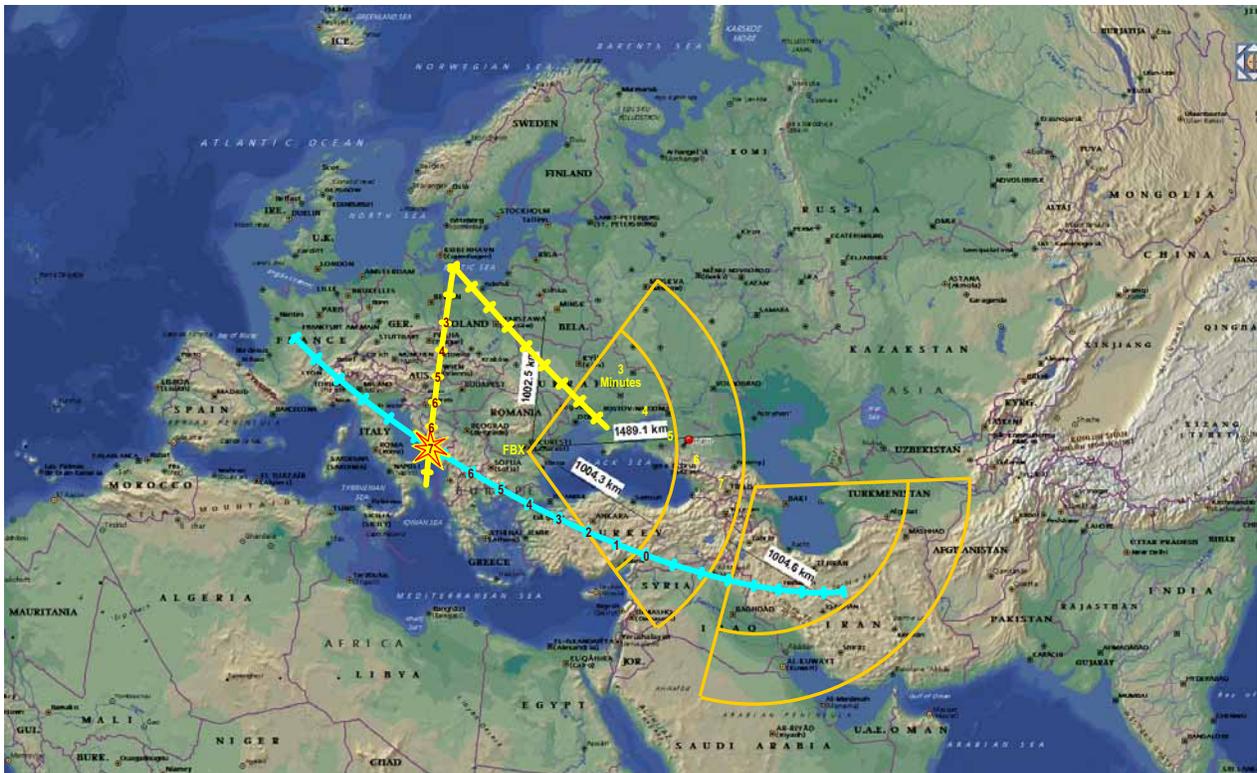
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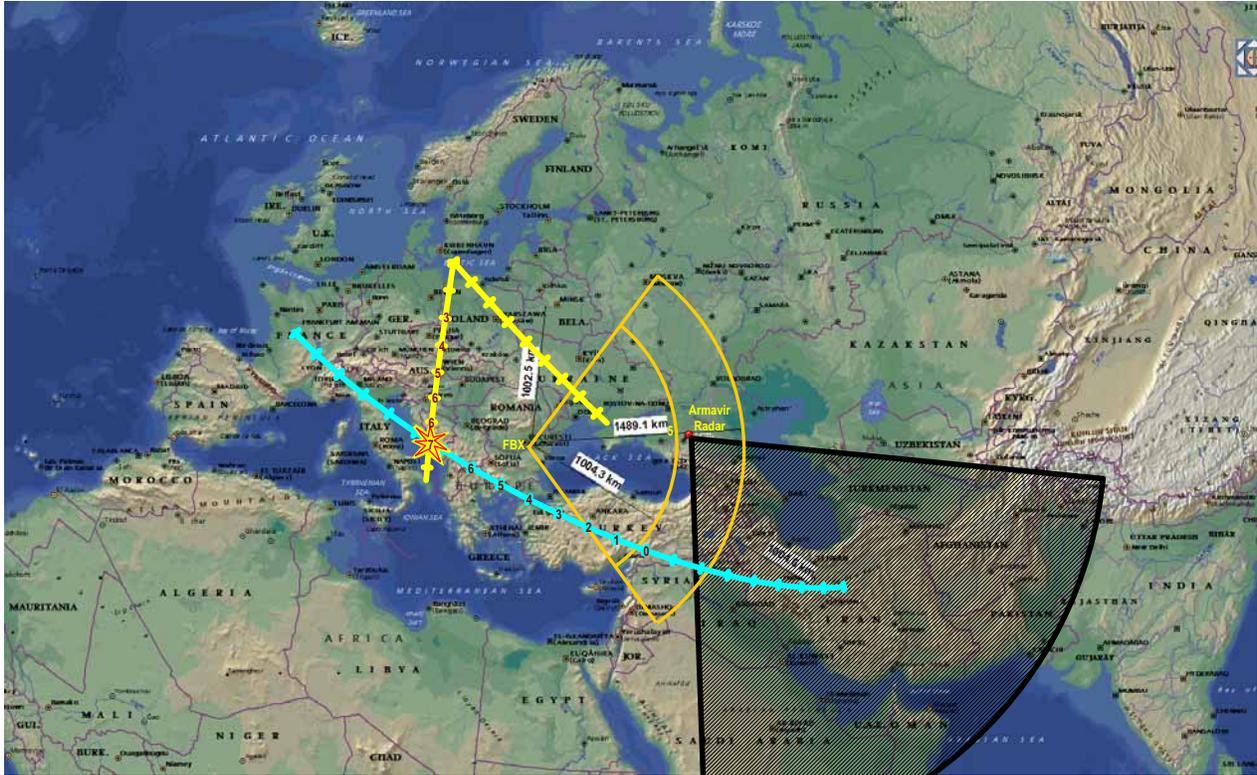
# Practical Ranges at Which the FBX Radar can Acquire and Track a 0.01 m<sup>2</sup> Cone-Shaped Warhead



# Practical Ranges at Which the FBX Radar can Acquire and Track a 0.01 m<sup>2</sup> Cone-Shaped Warhead



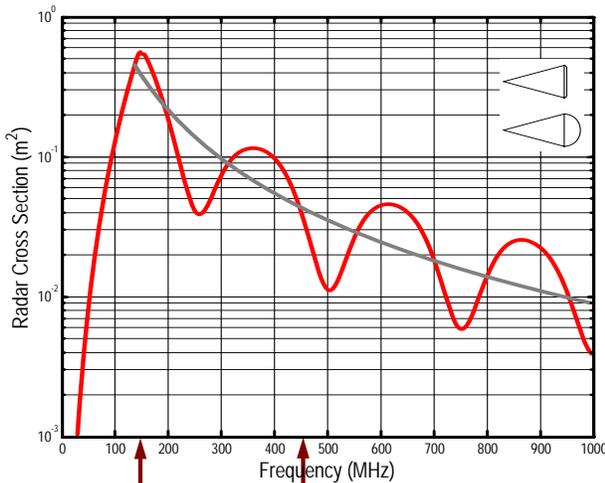
# Armavir Acquisition Capability for an FBX Radar in Romania Against a Cone-Shaped Warhead with a 0.01 m<sup>2</sup> Radar Cross Section at X-Band



## Operating Frequencies of Early Warning and Missile Defense Radars

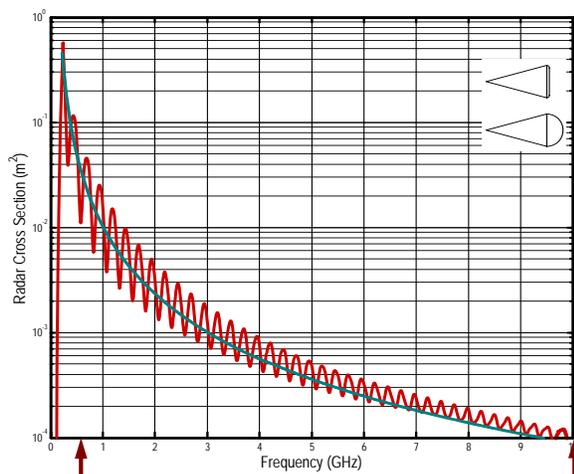
### Radar Cross Section of Rounded-Back Cones

The operating frequency of Russia's Early Warning Radars was chosen so that the radar reflectivity of warheads approaching Russia would be as large as possible, thereby making it easier for the radars to detect the approaching warheads at very long range. However, a serious drawback associated with radars operating at these frequencies is that they highly vulnerable to blackout effects from high-altitude nuclear explosions.



Russian Hen House and Large Phased Arrays

US PAVE-PAWS and BMEWS Early Warning / Missile Defense Radars



US Upgraded Early Warning / Missile Defense Radars

US Ground-Based X-Band Radar

### *The Radar Support Requirements for the System are Woefully Inadequate*

- **The planned radar support for the European missile defense is woefully inadequate.**  
X-band radars are fundamentally not suited for the role of acquisition and surveillance. Lower frequency radars operating at VHF, UHF, or L-Band are all far more suitable for this mission.
- **The radar acquisition and surveillance problem could probably be solved by using multiple Forward-Based X-Band radars placed strategically between Iran and Europe.**  
These radars would probably only be able to acquire and track cone-shaped ballistic missile warheads at ranges less than 1000 km range. They would, however, be able to track the upper rocket stage that deploys the warhead at greater range. This may make it possible for the radar to cue on upper rocket stages as part of a process aimed at acquiring and tracking the warhead.
- **The radar acquisition and surveillance problem could also be solved by using the Russian Voronezh Class VHF Early Warning Radar in Armavir, Russia.**

## Findings of the Technical Analysis (2 of 2)

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### *Assuming systems work as MDA claims:*

- The current proposed system could engage Russian ICBMs.
- Russian ICBMs will be observed during their bussing operations, allowing for warheads and decoys to be tracked as they are deployed.
- There are many other alternative deployments that could easily meet the US stated objective of defending against postulated Iranian ICBMs.
- The Russian proposal to instead use radars (Russian and US) in Azerbaijan would allow the US to meet its stated objective of defending against postulated Iranian ICBMs without posing a threat to Russian ICBM forces.
- A system of equal or greater capability than the one currently being proposed by the US could use radars in Azerbaijan and/or Turkey, with interceptors placed in Albania, Bulgaria, Greece, or Turkey

Fundamental Issue that Needs to Be Addressed

- Even if the funding for the Missile Defense Program were expanded to a substantial part of the entire Department of Defense budget, the resulting missile defense system would still be fundamentally unreliable, unless it can be demonstrated that the system can tell the differences between simple decoys and warheads.
- There is overwhelming evidence that exoatmospheric Missile Defenses are fundamentally vulnerable to exoatmospheric decoys. This near-certain vulnerability has far ranging implications for the viability of exoatmospheric missile defenses and the nation's security. Congress should consider investigating this serious and fundamental vulnerability.

Some Photos of Objects that Could Appear Like Warheads



Large Balloon  
With Reflecting Coating



2.2 Meter Diameter Balloon  
With Black Coating



Balloon With White Coating



Light Rigid Replica Decoy



The IEO, an inflatable erectable decoy for Minuteman  
(L'Garde, Inc. Photo)

Minuteman Inflatable Decoy



Mk 12A Minuteman III Reentry Vehicle

Minuteman Warhead

From a Purely Technical Perspective:

- There appears to be no credible *technical* reason that the stated US objective to defend against postulated future Iranian ICBMs could not be fulfilled by other types of deployment configurations.
- Recent statements made by the MDA, and numerous past technically misleading and inaccurate statements made by the MDA, would likely cause skepticism and suspicion among Russian military analysts who advise their political leadership.
- It is therefore understandable that Russian military analysts might suspect that US motivations are different from those that have been stated.

**Soviet Capabilities for Strategic Nuclear Conflict, 1983-93 (NIE 11-3/8-83)**

*Soviet Capabilities for Strategic Nuclear Conflict, 1983-93 (NIE 11-3/8-83)*  
Formerly Top Secret

Key Judgments of US Intelligence Community in 1983

We have major uncertainties about how well a Soviet ABM system would function, and the degree of protection that future ABM deployments would afford the USSR. Despite our uncertainties about its potential effectiveness, such a deployment would have an important effect on the perceptions, and perhaps the reality, of the US-Soviet strategic nuclear relationship.

•••

widespread Soviet defenses, even if US evaluations indicated they could be overcome by an attacking force, would complicate US attack planning and create major uncertainties about the potential effectiveness of a US strike.

