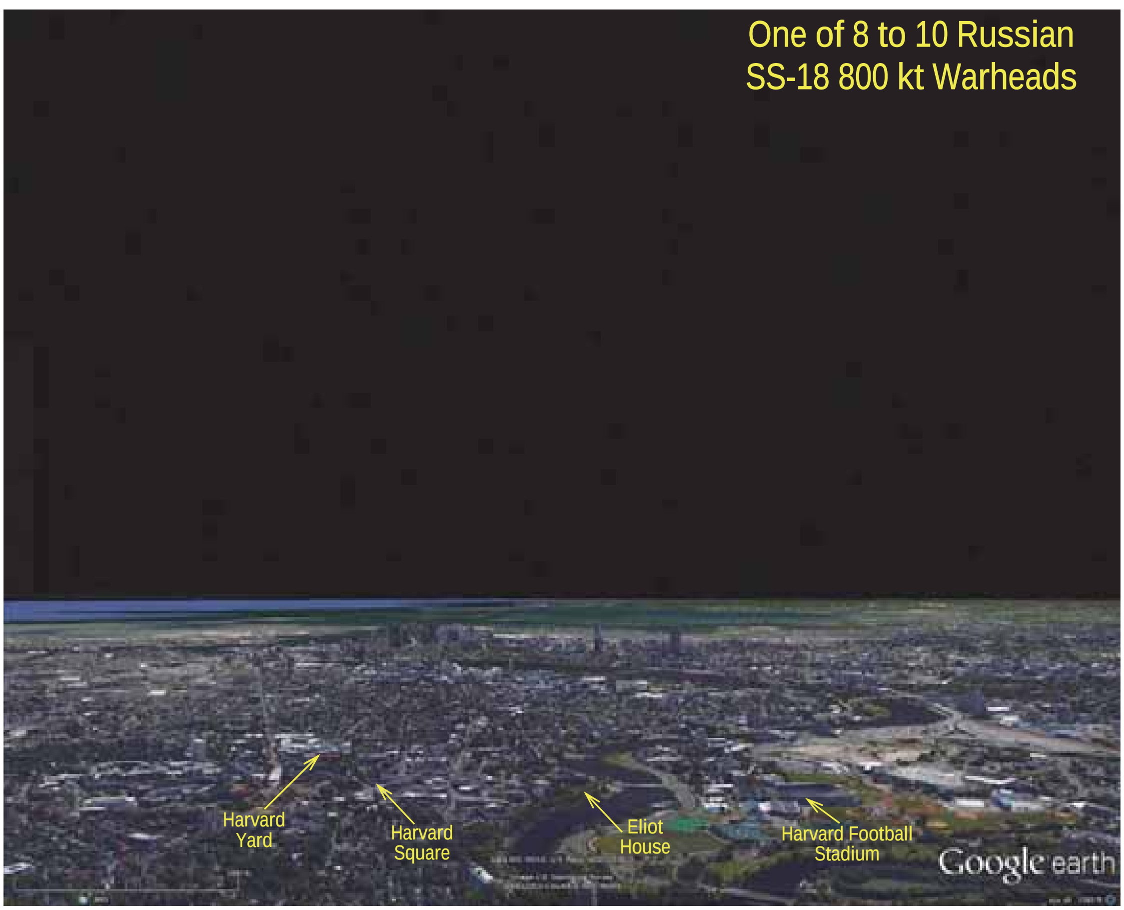
MIT
Science, Technology, and
National Security Working Group

How the US Nuclear Weapons Modernization Program Is Increasing the Chances of Accidental Nuclear War with Russia

Theodore A. Postol
Professor Emeritus of Science, Technology, and National Security Policy
Security Studies Program, Massachusetts Institute of Technology
e-mail: postol@mit.edu

Harvard College Peace Action
February 25, 2016

Boston Downtown Skyline Viewed from Nearly Above the Harvard University Campus



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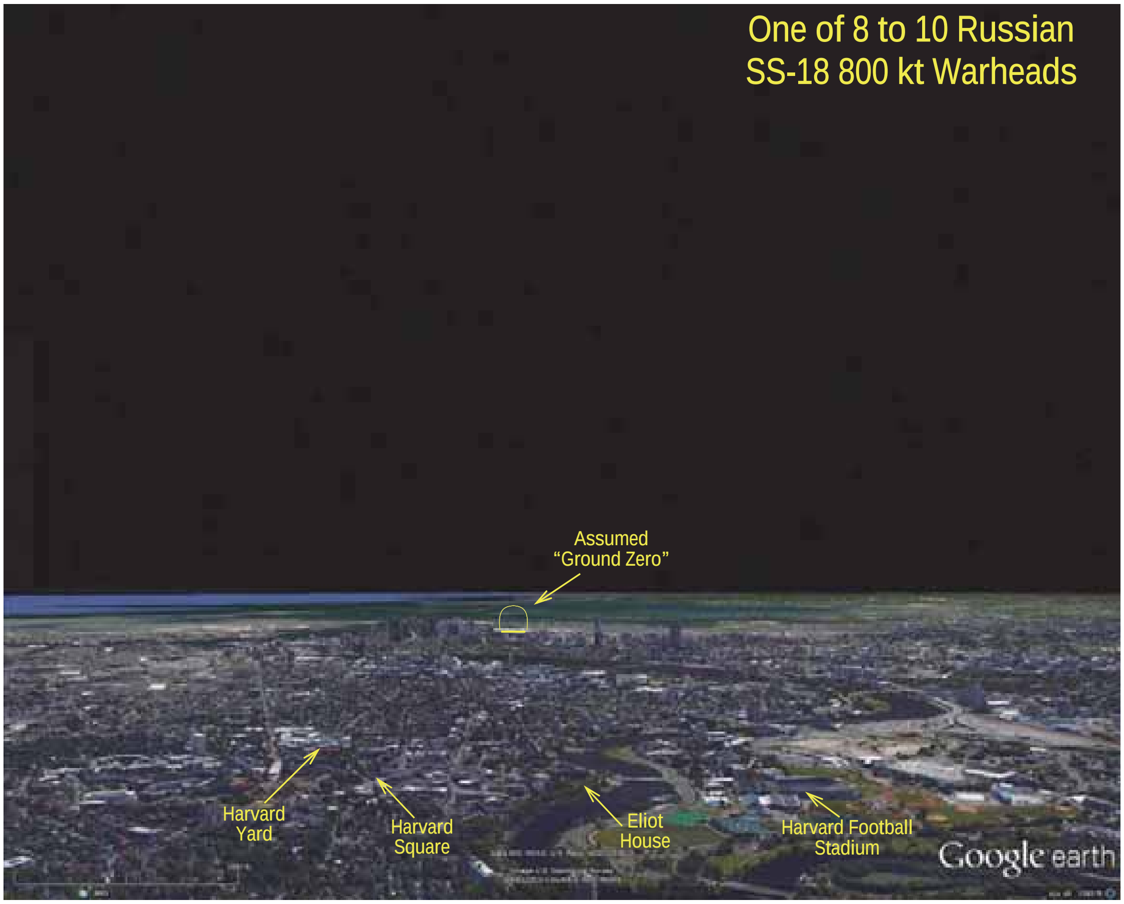

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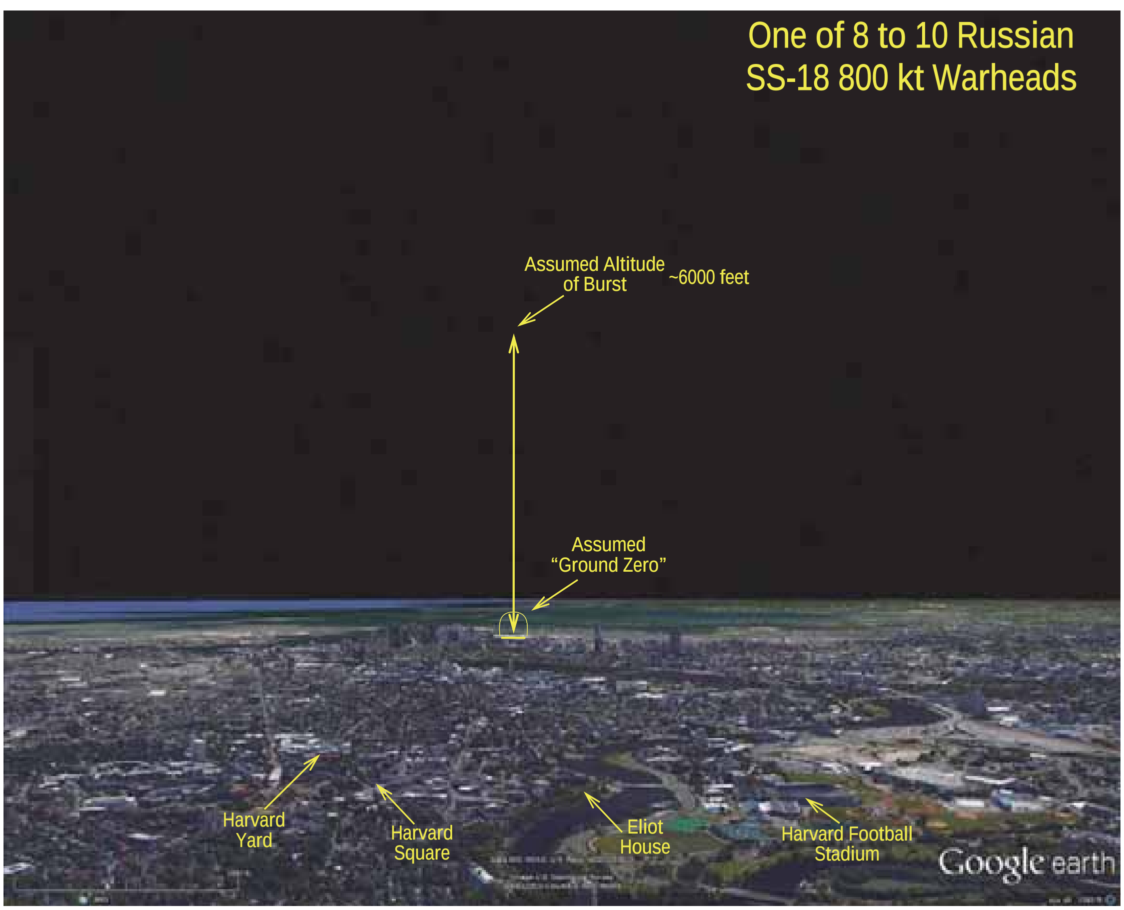
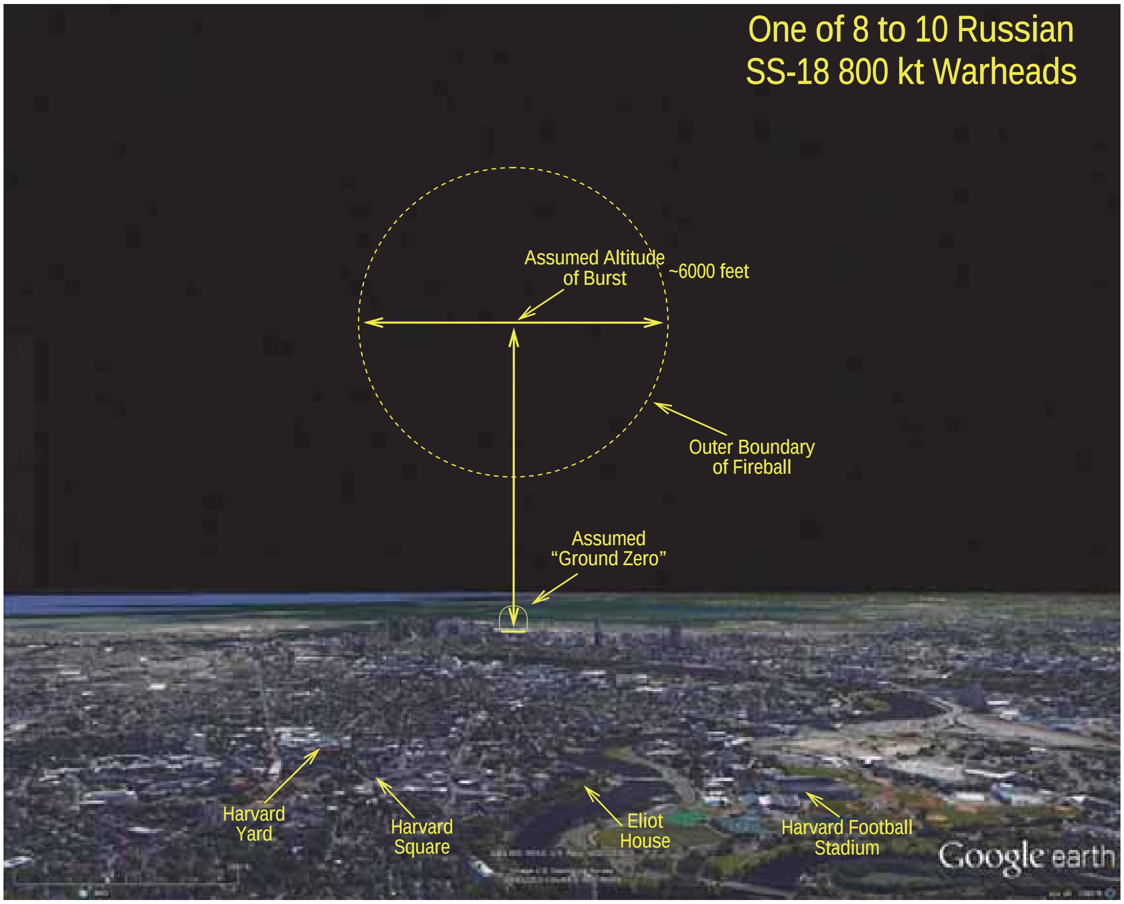


Boston Downtown Skyline Viewed from Nearly Above the Harvard University Campus



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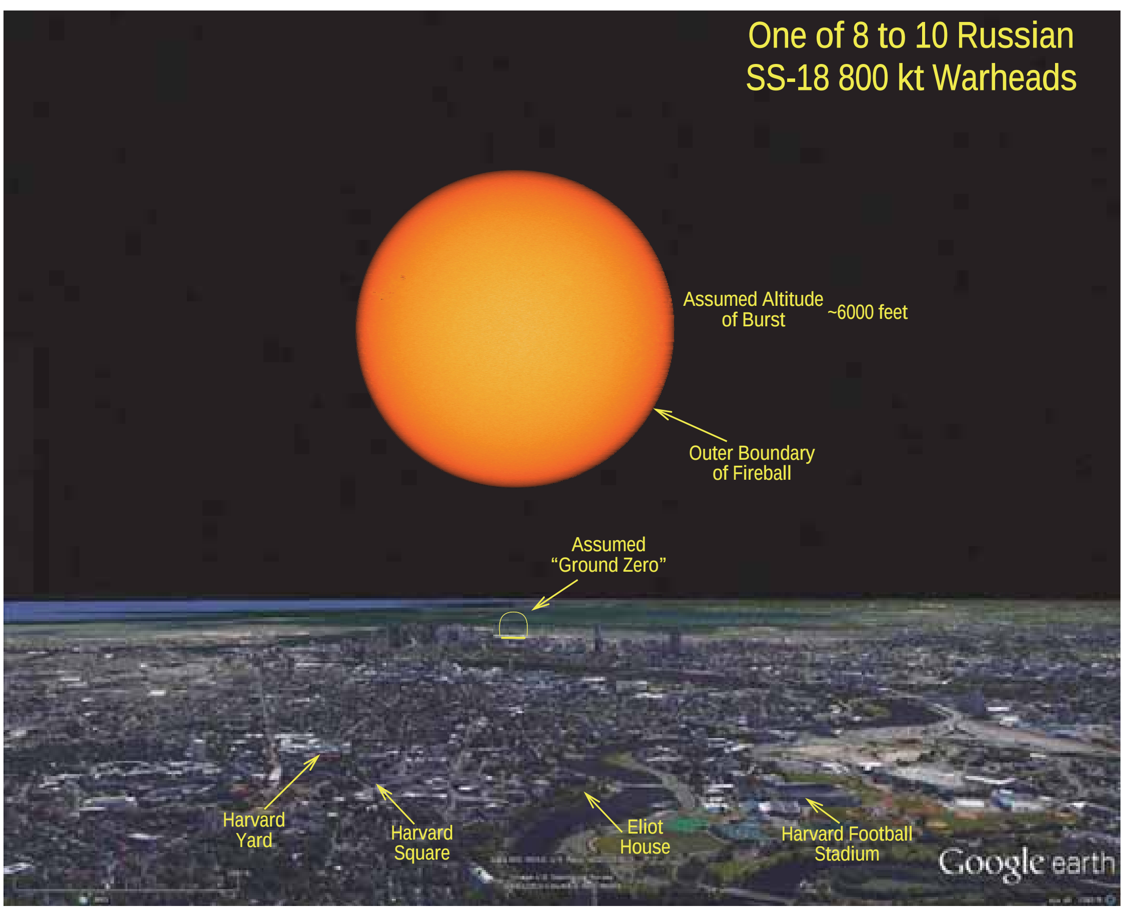

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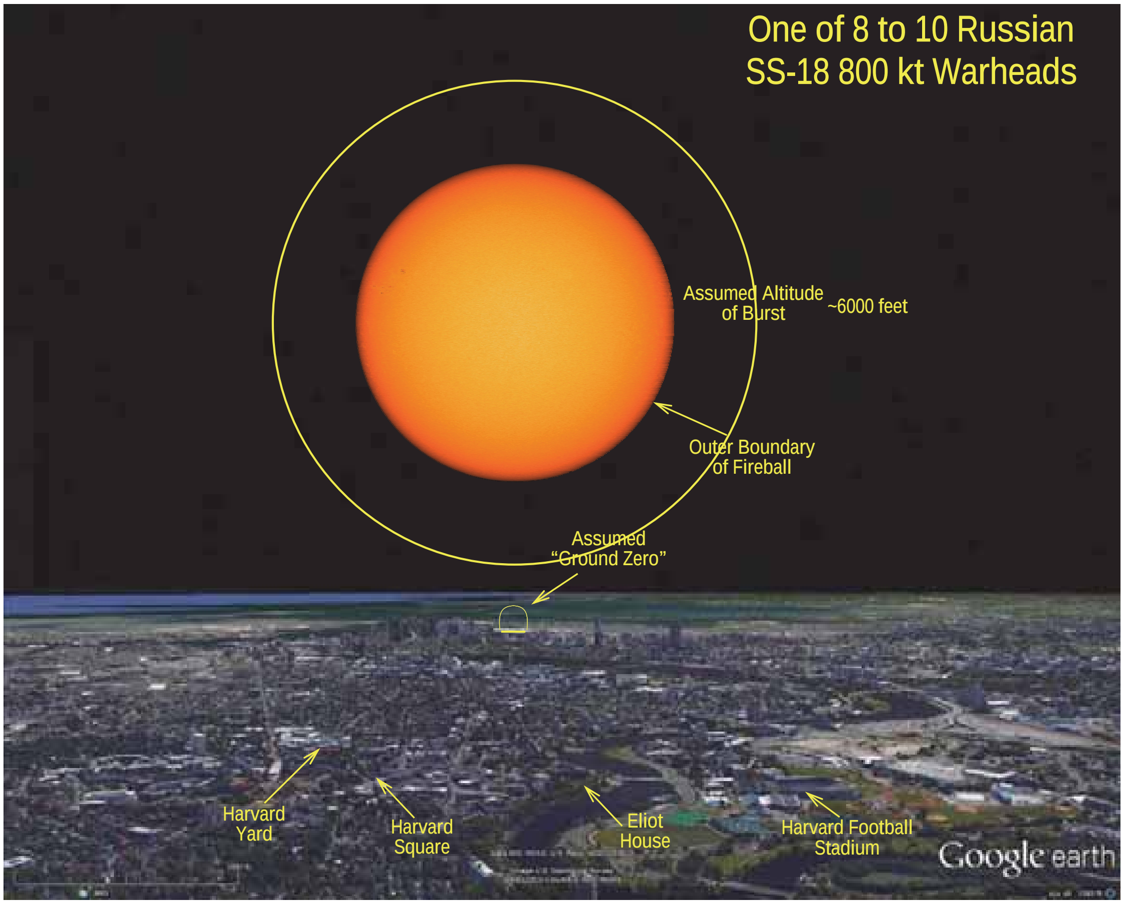

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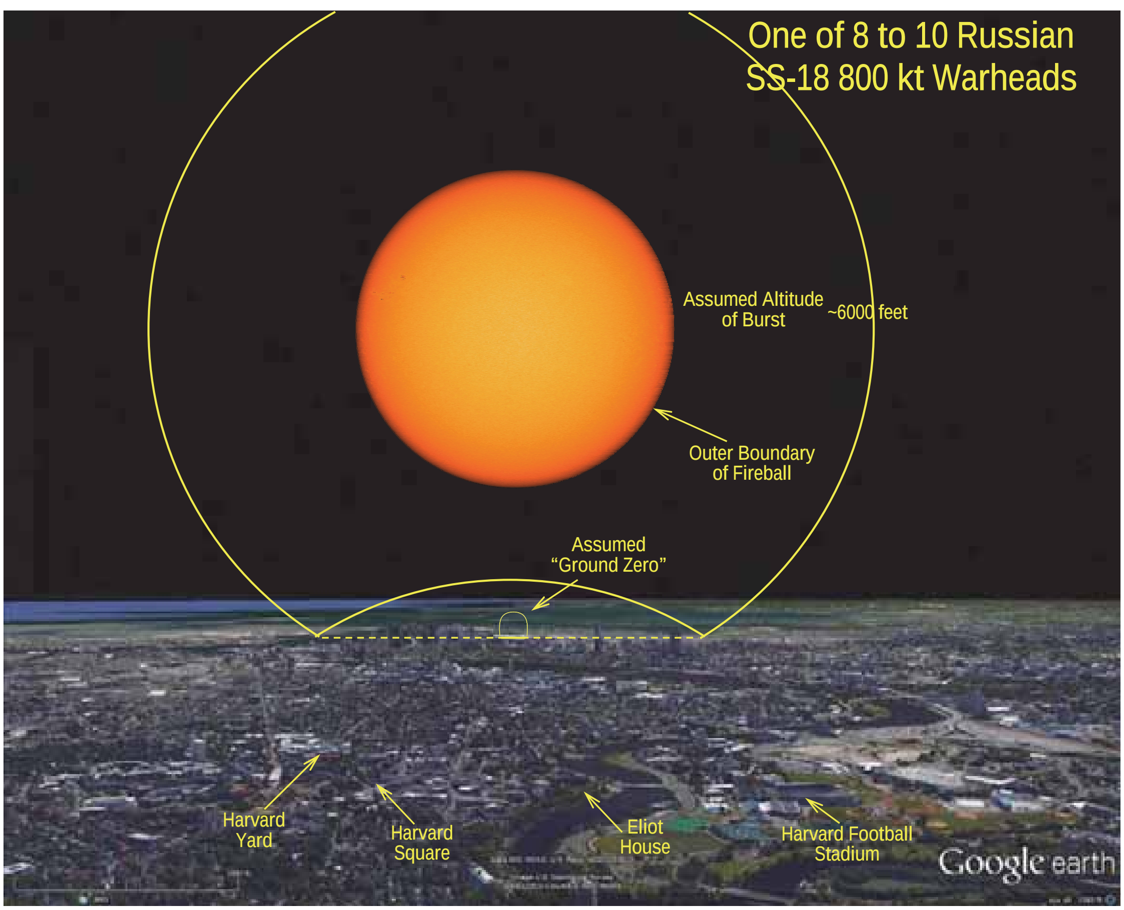

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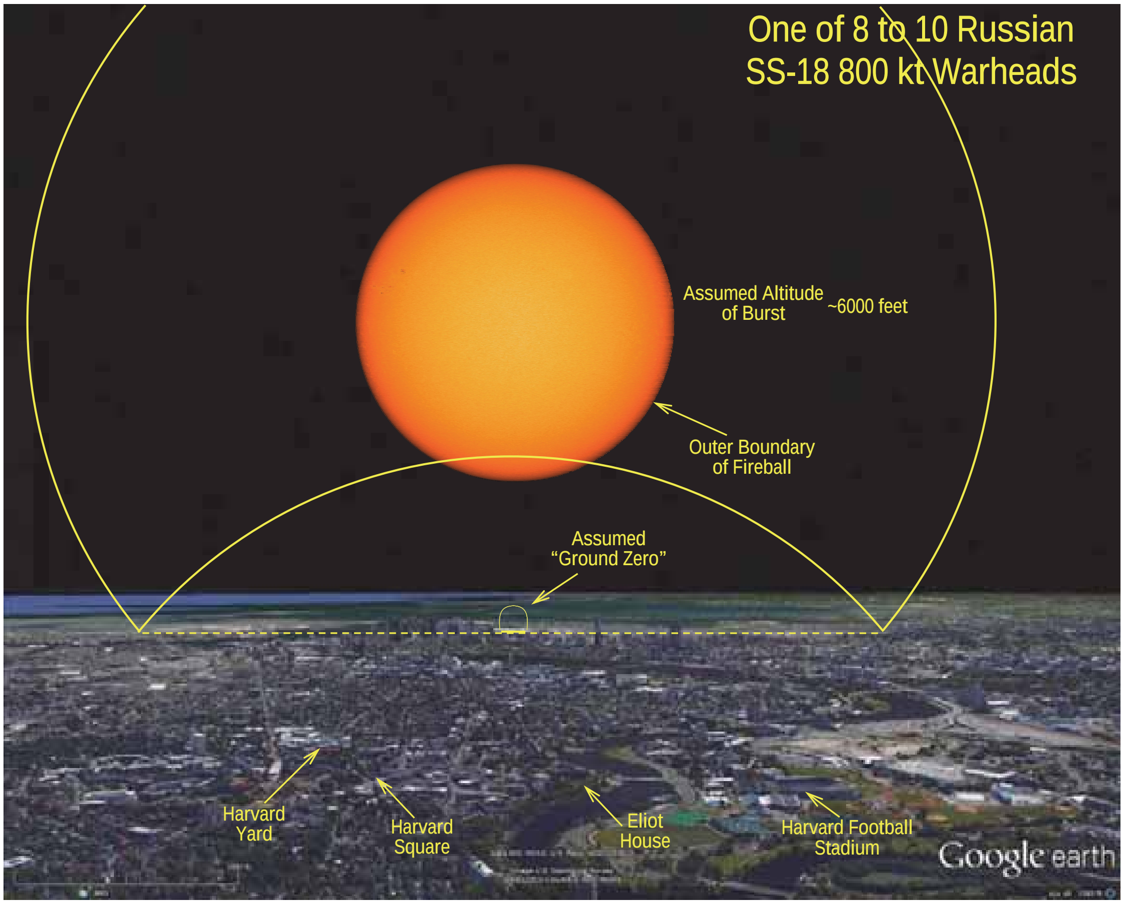

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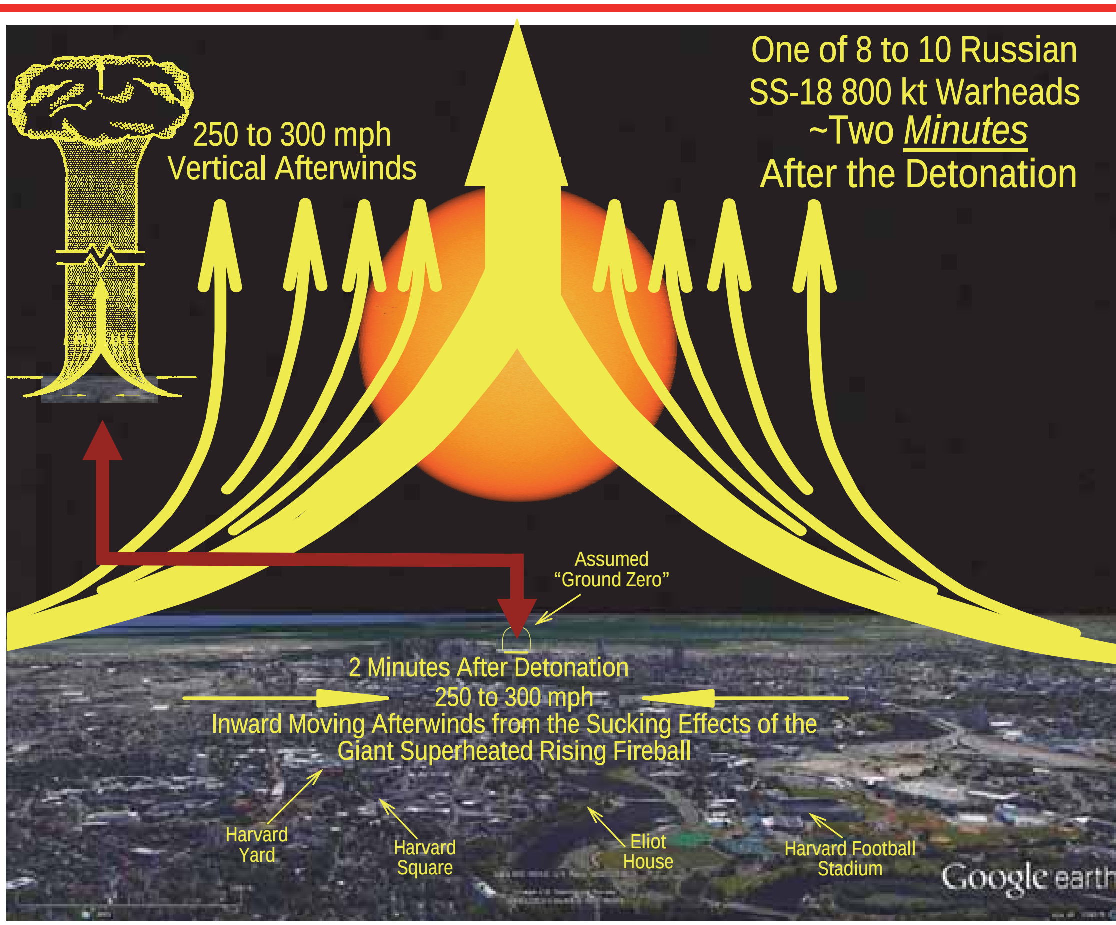

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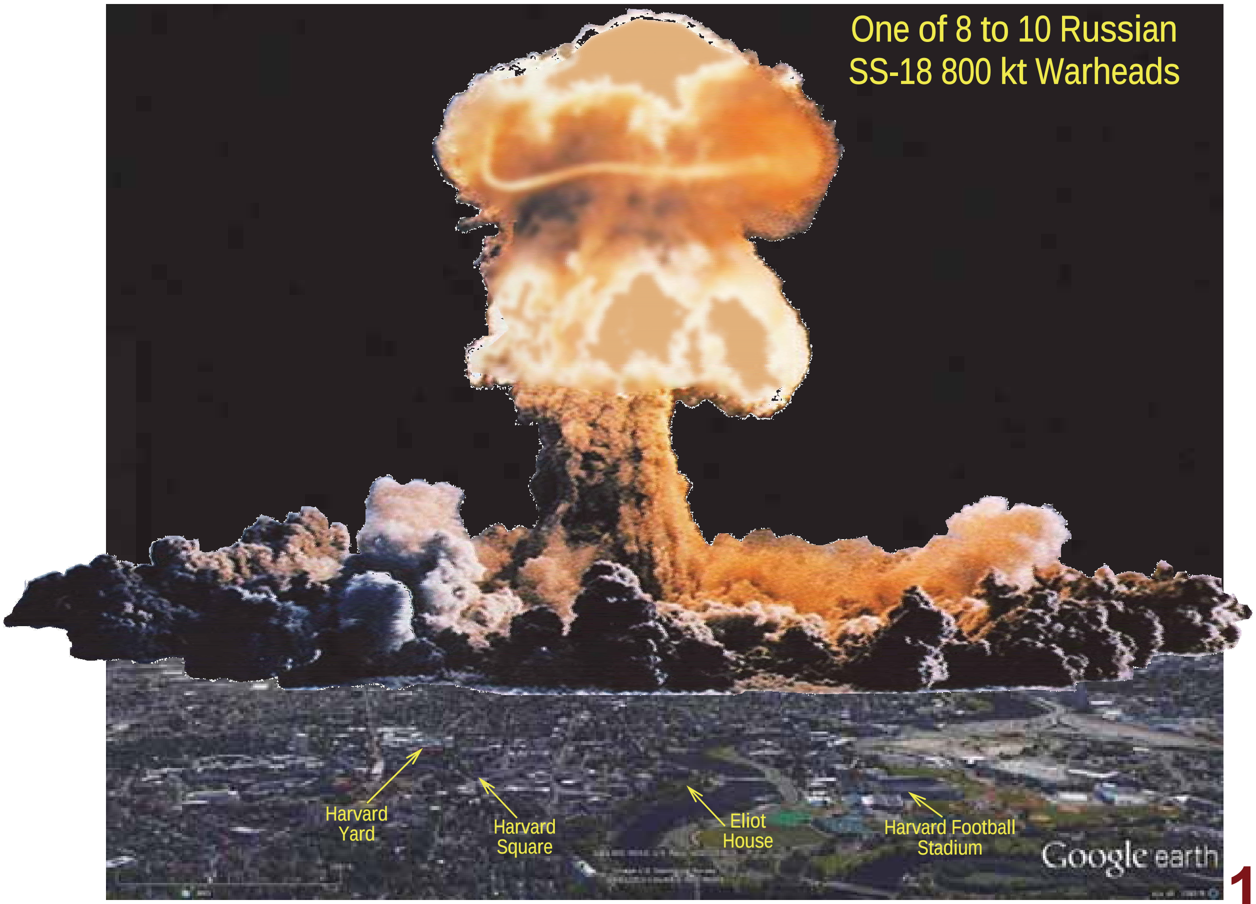
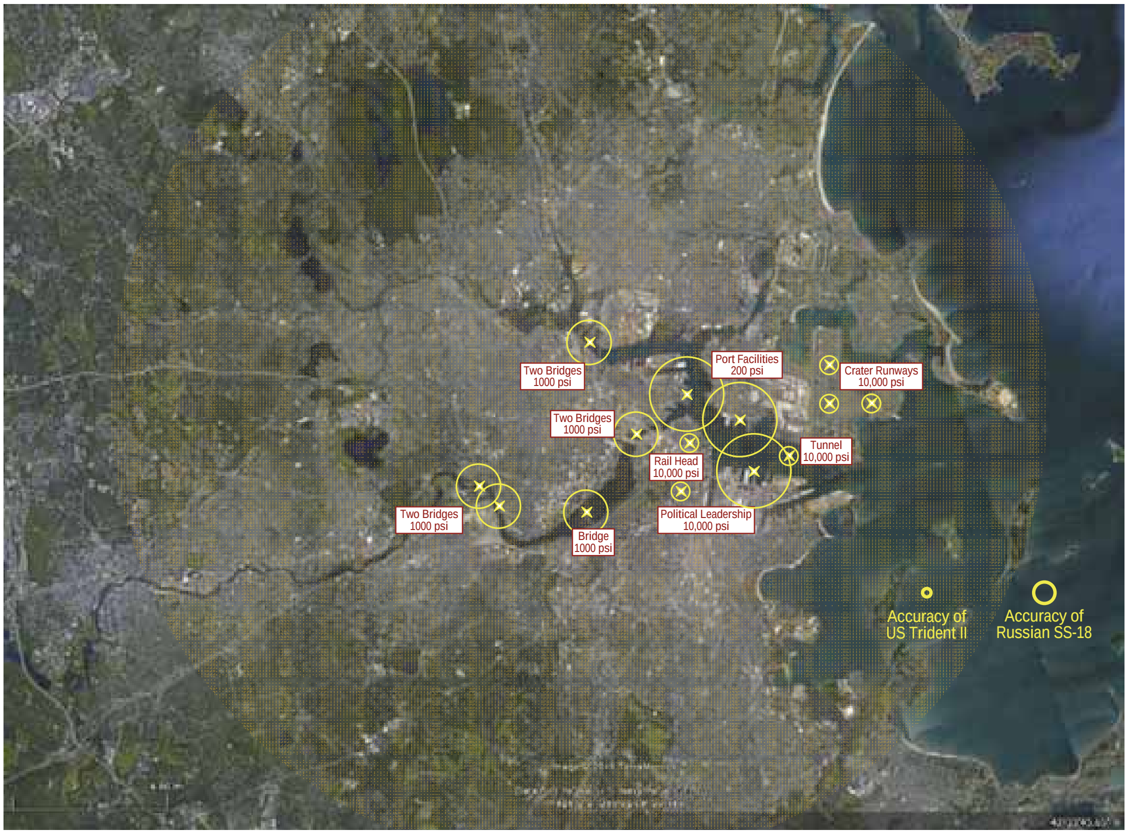


Boston Area Potentially Subject to Damage from a Single SS-18 800 kt Warhead

Area of Boston Potentially Completely Destroyed by Firestorm from a Single SS-18 800 kt Warhead

Warfighting Plan: SS-18 Warheads Against “Urban-Industrial” Targets in Boston

Warfighting Plan: SS-18 Warheads Against "Urban-Industrial" Targets in Boston



A Basic Fallacy: It is Possible to Fight and Win a Nuclear War With Russia

Is It Possible to Fight and Win a Nuclear War With Russia?

- The US forces that are needed for fighting and winning a nuclear with Russia have unambiguous characteristics. But in order to understand why these forces need these characteristics, it is first necessary to understand what "winning" means.
- Nuclear war fighters considered nuclear weapons to be similar to conventional weapons, but more powerful.
- This allows them to define "victory" as circumstances where the "winner" has a larger and more capable nuclear force relative to the "loser" when the conflict ends.
- This argument ignores the existential fact that the loser can still totally annihilate the winner's nation with only an infinitesimal surviving nuclear force.
- It also ignores the fact that the secondary consequences of nuclear attacks would certainly be disastrous for the nations of the northern hemisphere and would also result in massive losses of life elsewhere on the planet.

What Forces Are Required to Fight and Win the Nuclear War?

- The theory of nuclear war fighting requires that the victor be able to destroy most or all of the adversary's forces
- The only way to do this is to destroy the adversary's forces before they can be launched.
- The only way to destroy the adversary's forces before they can be launched is to attack first.
- An ability to destroy, cripple, or overwhelm the adversary's early warning systems is also essential to any strategy that aims at destroying an enemy's forces before they are launched
- Nuclear antimissile defenses are also critical to blunt the effects of any counterattack from residual enemy nuclear forces that survive the initial attack.

Circumstances Relevant to Nuclear War Against Russia

- Early warning system has no space-based component.
- Russia has substantial nuclear forces and fixed ground-based missile silos that can now be destroyed by the US submarine launched ballistic missiles (and US ICBMs as well).
- Nuclear arms reductions with the United States will only increase Russia's vulnerabilities to a US nuclear first-strike.
- Russians remember that the US has repeatedly not been helpful in providing for Russian early warning.
- The US supported the Latvian government when it demanded that Russia close down a new early warning radar that was covering major attack orders from United States.
- The US is now drastically increasing the ability of all its submarine-launched ballistic missile warheads to destroy Russian silo-based forces and command centers. These improvements will free up many US nuclear weapons that would have otherwise been dedicated to that mission.
- The US relentless and irrational preoccupation with global missile defenses is seen by the Russians as yet another US program aimed at reducing Russia's ability to retaliate after a US nuclear first-strike.
- The Russian analysis of US modernization programs and behavior can only lead them to conclude that the United States is trying to create an option to fight and win a nuclear war against Russia.
- The US nuclear weapons modernization program is unambiguously oriented toward achieving these goals.

Potential Consequences

- The Russians have no space-based satellite early warning systems to alert them to the launch of US nuclear-armed ballistic missiles from the ocean.
- The Russians may be in the process of trying to reconstitute a primitive and limited space-based system that could with some reliability observe the launch of US land-based missiles.
- However, the most capable ballistic missile systems are now on submarines, which have warheads of much higher killing power and can be launched from unmonitored locations in the ocean.
- Since the US has been improving its capability to preemptively attack Russia, the only choice the Russians have is to streamline their decision-making capabilities.
- Because the Russians cannot see over the curved-earth horizon with space-based satellite sensors, they can only depend on line-of-sight radars.
- This means there warning time could be a short as 10 to 15 minutes.
- The only way to guarantee the ability to launched before Russian forces are destroyed by a preemptive US attack this if some method of pre-delegated launch authority is put in place.
- The response times of the streamlined launch authority are by necessity very short.
- The time-pressure to take actions can, in crisis, greatly increase the chances of an accidental launch Russian central strategic nuclear forces.
- Thus, the US Nuclear Weapons Modernization Program is pushing the Russians to take actions that could, in a crisis, lead to a massive accident that could well destroy most of the countries in the northern hemisphere.

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Some Technical and Political Factors That Will Impact the Stability of Future Nuclear Forces

Theodore A. Postol
Professor Emeritus of Science, Technology, and National Security Policy
Security Studies Program, Massachusetts Institute of Technology
Voice: 617 253-8077; FAX: 617 258-5750; e-mail: postol@mit.edu

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Technical and Political Factors That Will Impact the Stability of Future Nuclear Forces

1. There are NO Foreseeable ICBM Threats from Iran or North Korea.
2. There is NO Foreseeable Nuclear Threat from Iran to Western Europe
3. If US missile-defense activities continue, they will almost certainly block deep nuclear reductions.
4. Since the pursuit of missile defenses has little or no relationship to the capabilities or promise of these systems, diminishing these programs will require a political change in the culture of "running away from the problem" in the Democratic Party.
5. Russia does not have the technology to build a viable space-based infrared early warning system. This means that Russia has no early warning against SLBM attacks.
6. It also means that Russia has half as much early warning time (~15 minutes or less) as the US.
7. The US is tripling its hard target kill per warhead, greatly increasing the threat to Russia's nuclear forces.
8. This also means that the hard target killing power of US forces will increase even if there are deep numerical reductions in US forces.
9. The continuing heavy reliance by Russia and the US on fixed land-based ICBMs will result in basically vulnerable fixed silo-based forces in both Russia and the US.
10. Russian reliance on land mobile missiles could well increase crisis instability due to the need for timely decisions to disperse the forces for survivability.
11. As long as Russia continues to rely heavily on land-mobile and fixed silo-based ICBMs, it will have a very substantial vulnerability to a short-warning attack from the United States.
12. The extreme vulnerability of Russian VHF early warning radars to high-altitude nuclear explosions, in combination with Russia's lack of space-based early warning and its dependence on timely dispersal of mobile ICBMs, will present serious stability problems for future Russian and US nuclear forces.

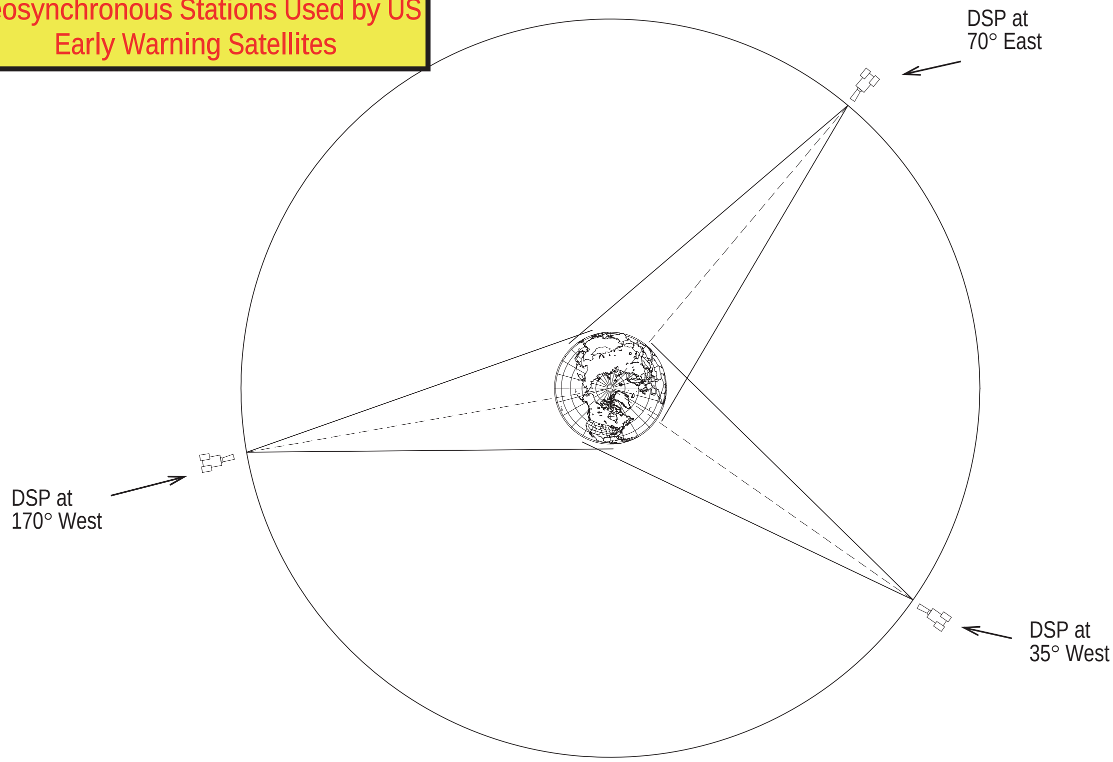
Technical and Political Factors That Will Impact the Stability of Future Nuclear Forces

13. The introduction of new weapons like the "Advanced Hypersonic Weapon" will create enormous stresses on both Russian and possibly US early warning systems. US space-based infrared satellites will be able to detect the launch of a Russian hypersonic glide weapon and may alsol be able to track such weapons in the glide phase as well. This latter possibility needs to be studied, as it could seriously contribute to othe destabilizing developments as well.
14. Continued NATO actions, like lying about the true circumstances associated with the Turkish shoot down of a Russian Sukhoi 24 over Syria, will further increase Russian concerns about Western intentions towards Russia in future crises. In the case of the Turkish shoot down, it is clear that the role of Turkey and the US in the incident has not been forthrightly explained. It is imperative that NATO and the West develop a clear strategy of being forthright about such incidents when they occur.

POINT OF INSTABILITY
The Russians Do Not Have Space-Based Early Warning!
This Limits Their Early Warning to Line-of-Sight (Less Than 15 Minutes Relative to 30 Minutes)

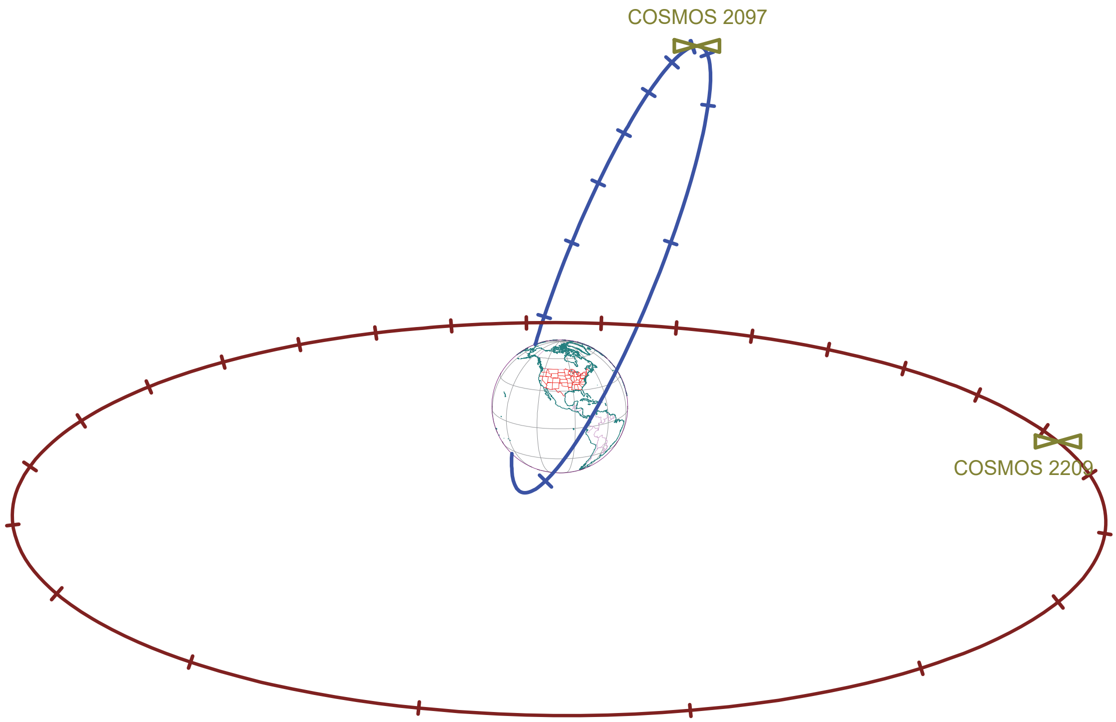
Russian and US Space-Based Early Warning Systems

Geosynchronous Stations Used by US Early Warning Satellites



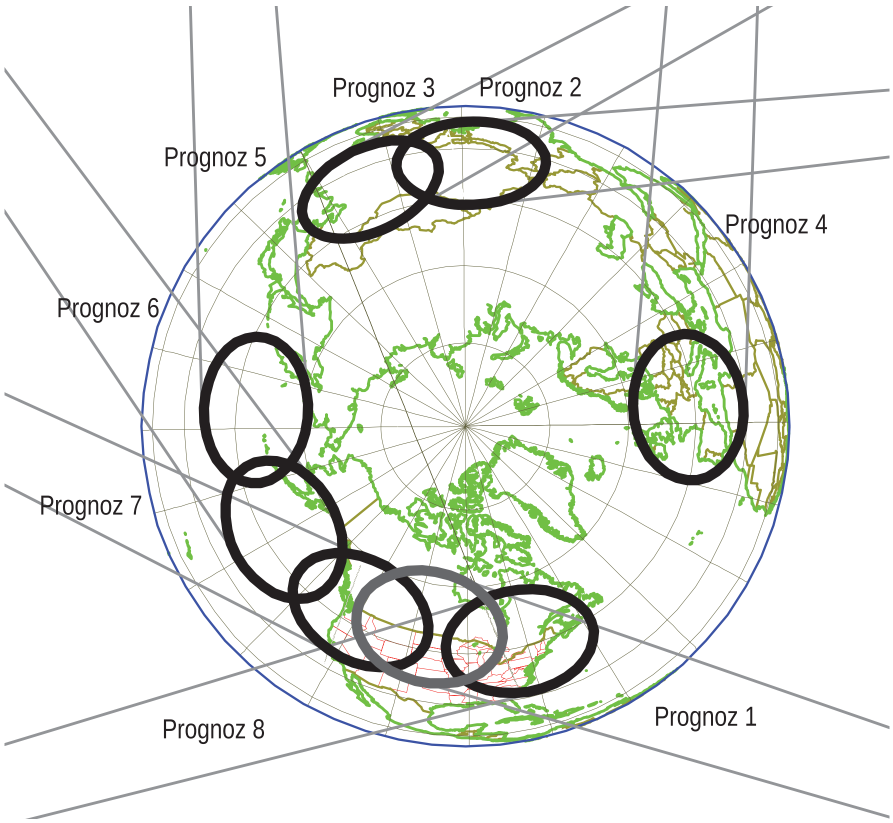
As can be seen from the above diagram, the look-down capability of the satellites make it possible to obtain warning of missile launches from all land and sea areas on the planet, providing the US with highly reliable warning of either SLBM or ICBM attack

View of Cosmos 2209 and Cosmos 2097 Orbits



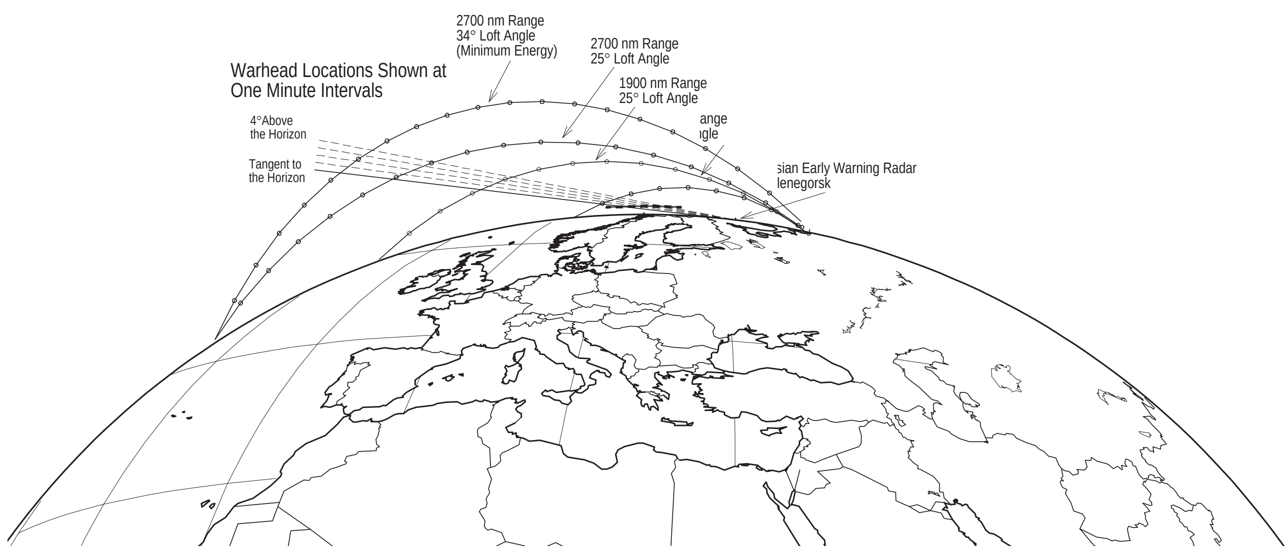
Russian and US Space-Based Early Warning Systems

Russian and US Space-Based Early Warning Systems



Line-of-Sight Constraints Associated with Early Warning Radars

Line-of-Sight Constraints Associated with Early Warning Radars



Estimated Time Needed to Carry Out Nuclear Launch-Operations No Matter What Response Is Chosen

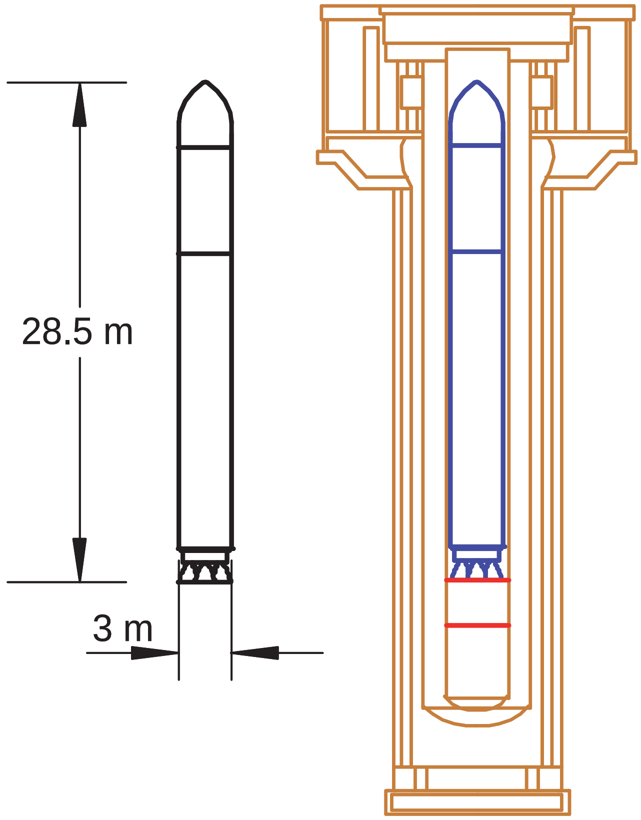
Time Needed to Carry Out Basic Nuclear Weapons Launch-Operations

Time for attacking missiles to rise over the horizon into the line-of-sight of early warning radars	1 minute
Time for radars to detect, track, and characterize detected targets, and to estimate the size and direction of motion of targets	1 minute
Military and civil command conference to determine response	1 to 3 minutes
Time for command and unit elements of silo-based forces to encode, transmit, receive, decode, and authenticate a launch order	2 to 4 minute
Time for missile crews to go through full launch procedures	1 to 3 minutes
Time for launched missile to reach a safe distance from its launch-silo	1 minute
Total time consumed in unavoidable and essential operations	7 to 13 minutes

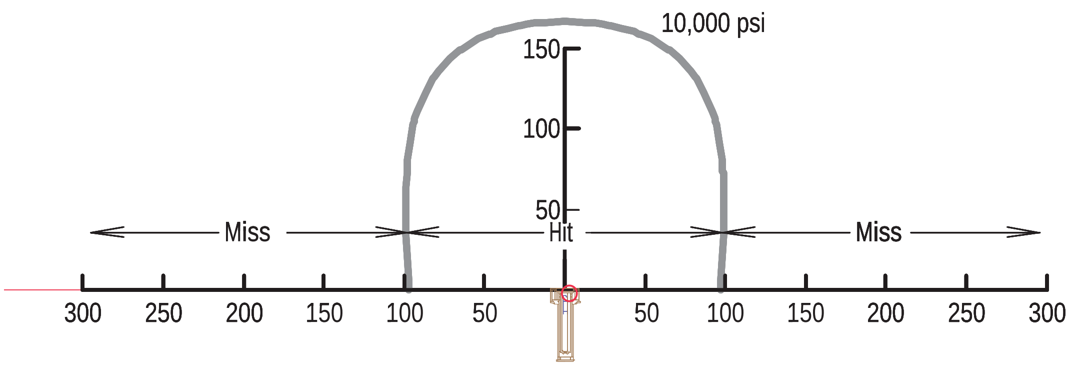
If a short time-line attack is attempted against Russia, a Russian response aimed at launching silo-based missiles before nuclear weapons detonate on them would require time for several technical operations. Time would also be needed by political leadership to assess the situation and decide whether or not to launch the silo-based missile force. The amount of time available for decision-makers to assess the situation and decide whether or not to launch silo-based nuclear forces is the difference between the time it takes for warheads to arrive at targets and the time needed to carry out operations no matter what response is chosen.

POINT OF INSTABILITY
US is Dramatically Increasing Its Hard Target Capabilities

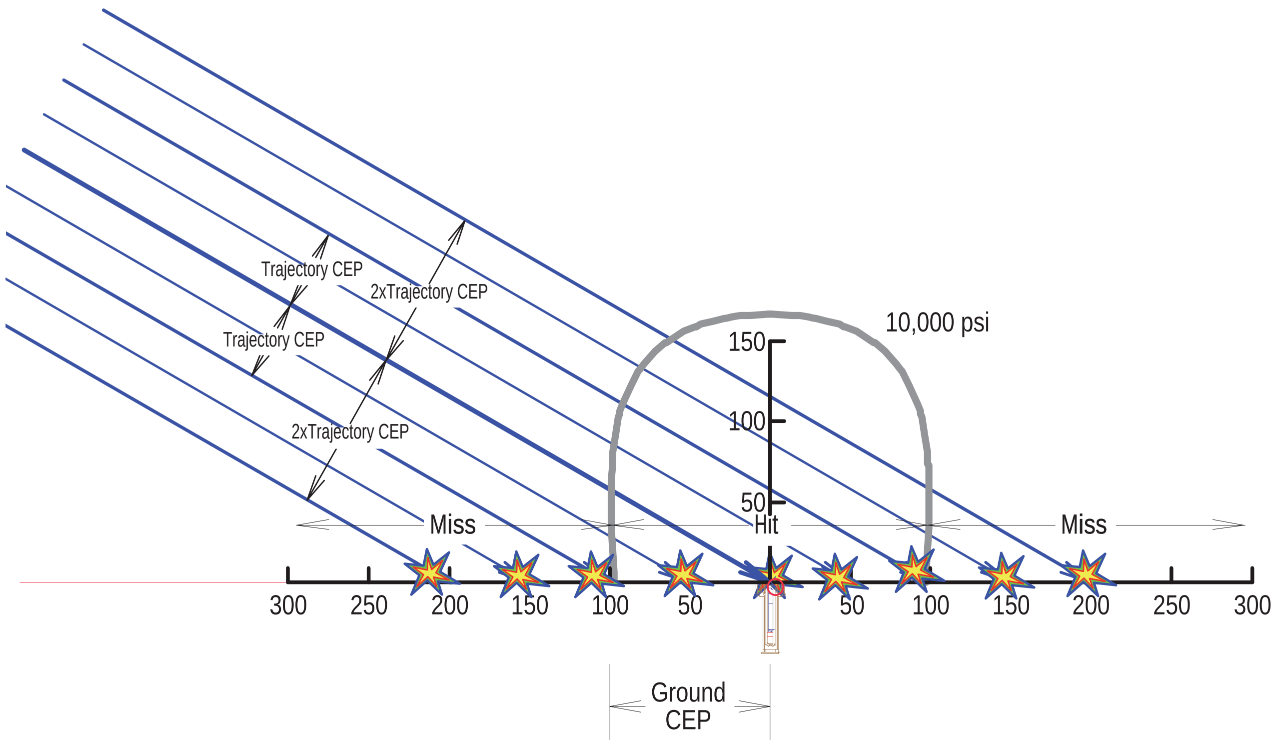
Estimated Dimensions and Characteristics of a Russian SS 18 Silo



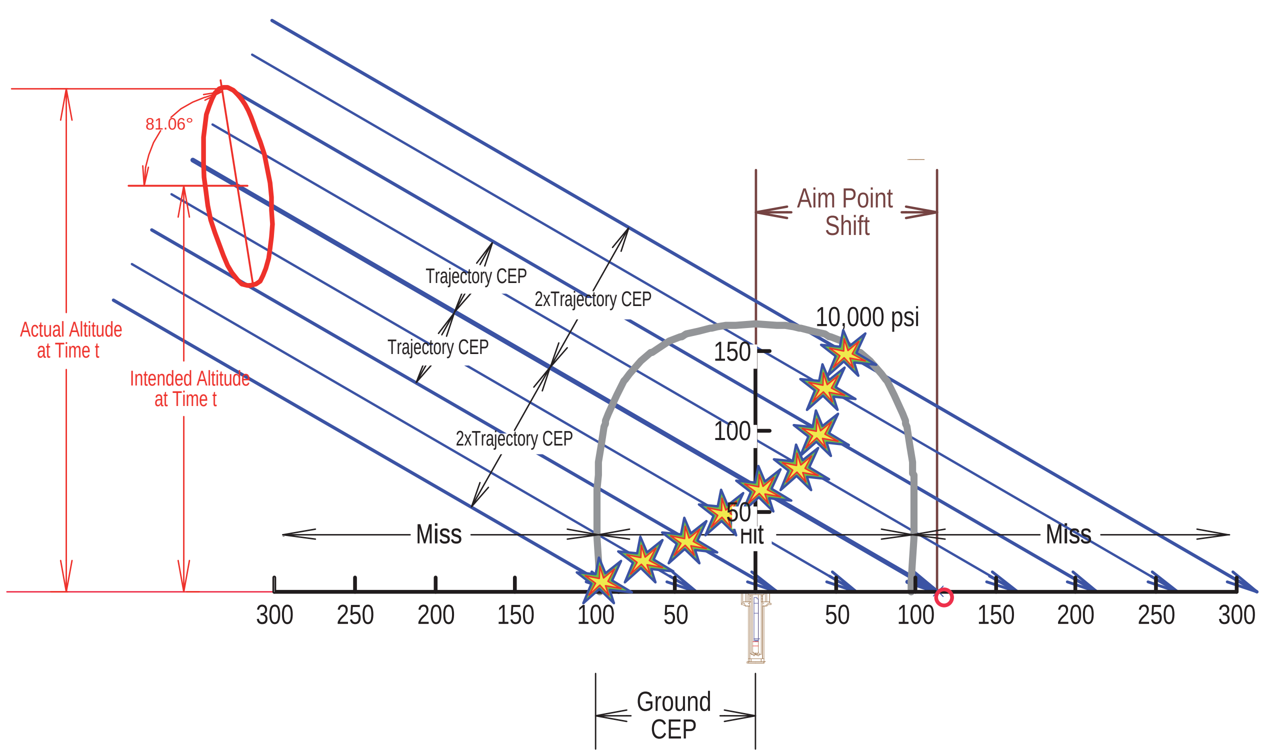
Estimated Dimensions of the Volume Where a 100 Kt W-76 Warhead Creates a Blast Overpressure of 10, 0000 Psi or More



Distribution of Hits and Misses for the Mk4 100 Kt W-76 Nuclear Warhead Armed with a Conventional Fuse

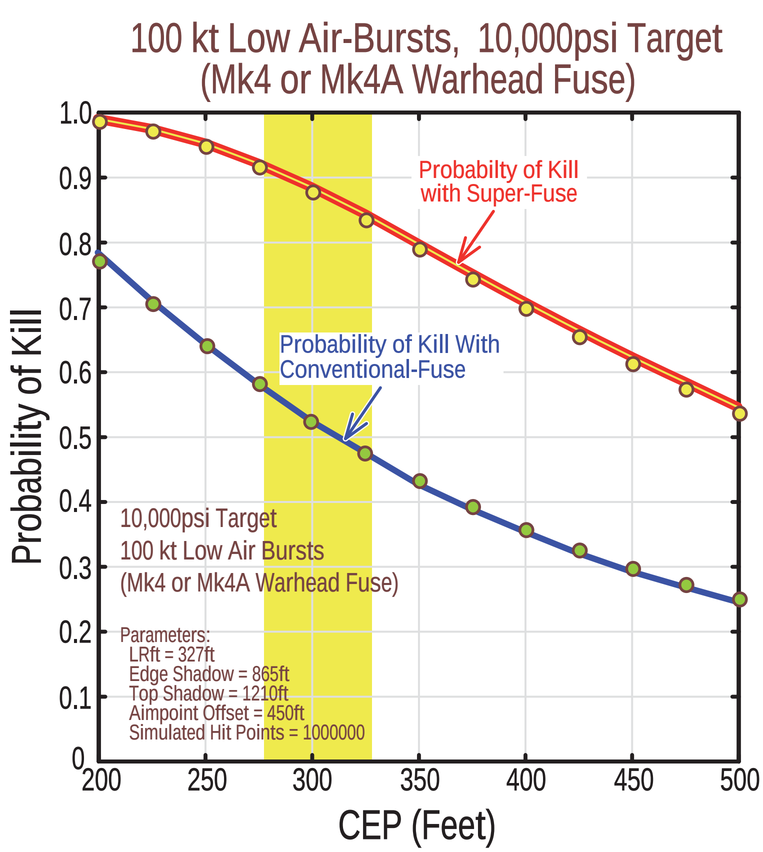


Distribution of Hits and Misses for the Mk4 100 Kt Nuclear Warhead Armed with the Accuracy Enhancing Super-Fuse

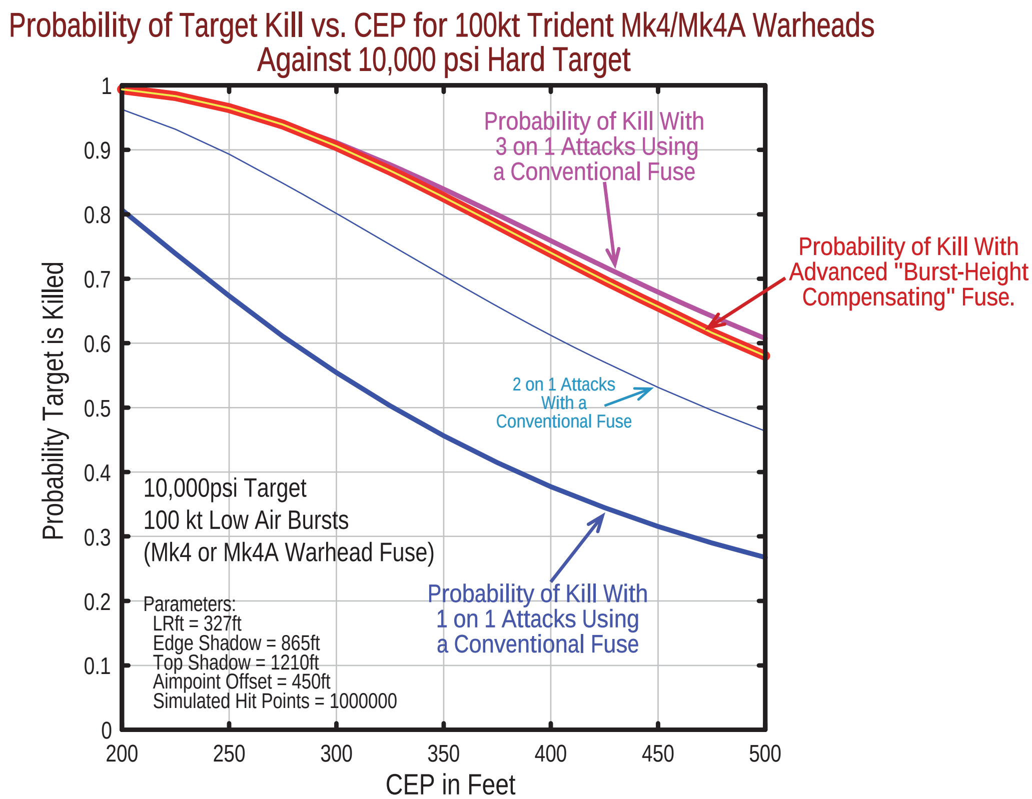


POINT OF INSTABILITY
Essentially All US SLBM Warheads Will Have a Very High Probability of Kill Against the Hardest Russian Silo-Based ICBMs

Probability of Kill for a 100kt W-76 Warhead Against 10,000 psi Target with Conventional and Super-Fuses

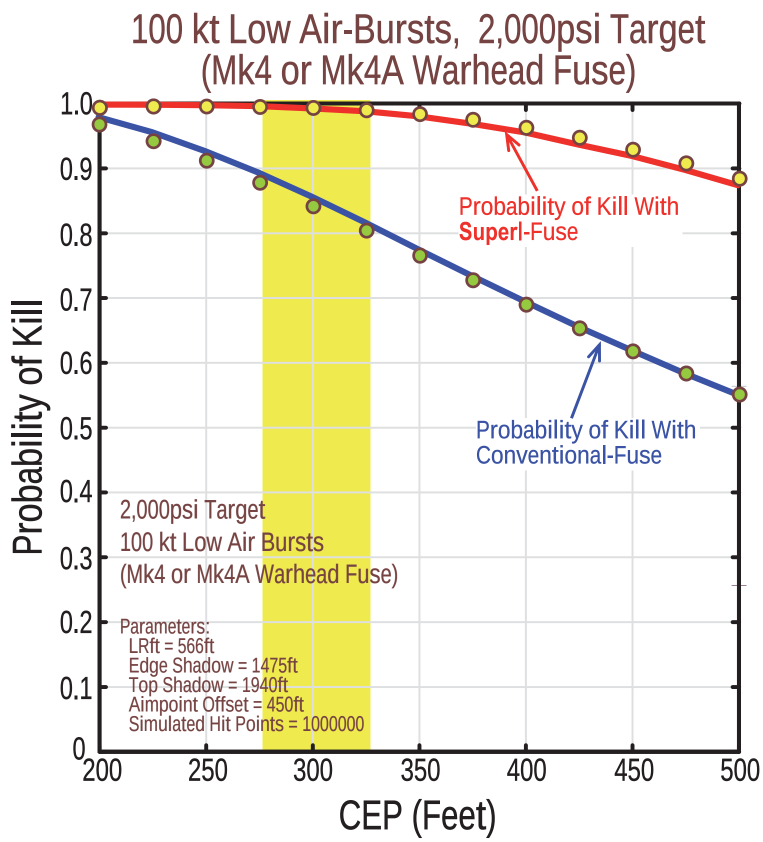


Probability of Target Kill vs. CEP for 100kt Trident Mk4/Mk4A Warheads Against 10,000 psi Hard Target

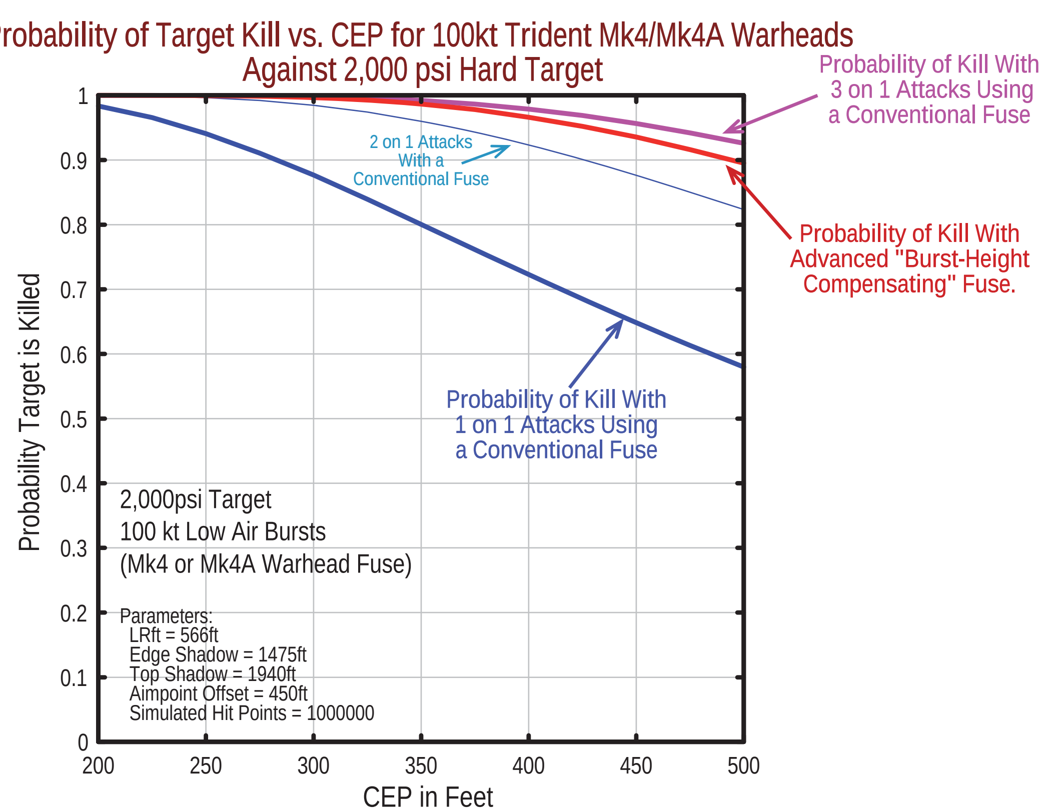


POINT OF INSTABILITY
The US Treats the Hardest Russian ICBMs as Hard to the Effects of a 10,000 psi Blast
The Russians Assess The Hardness of Their ICBMs to be Less Than 2,000 psi Blast

Probability of Kill for a 100kt W-76 Warhead Against 2,000 psi Target with Conventional and Super-Fuses

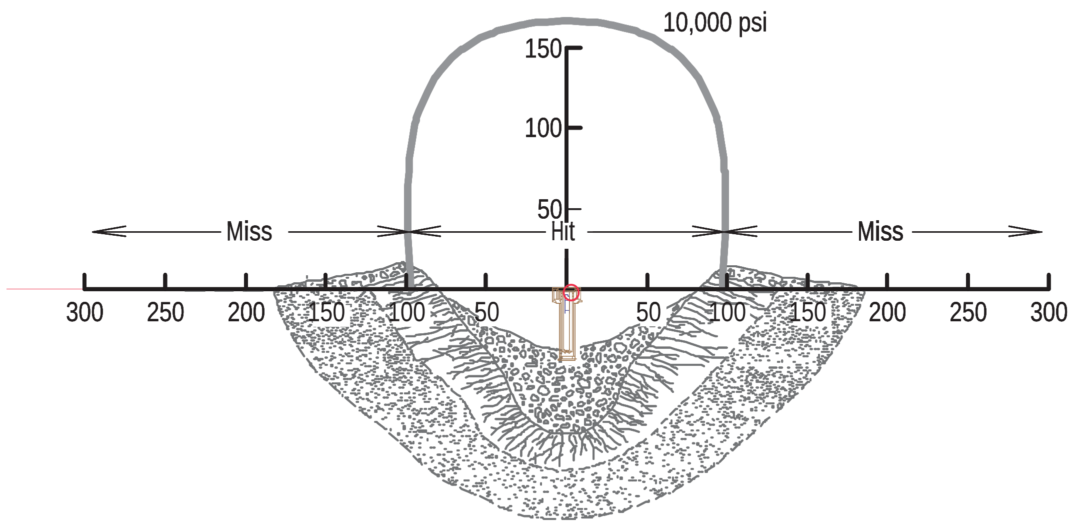


Probability of Target Kill vs. CEP for 100kt Trident Mk4/Mk4A Warheads Against 2,000 psi Hard Target

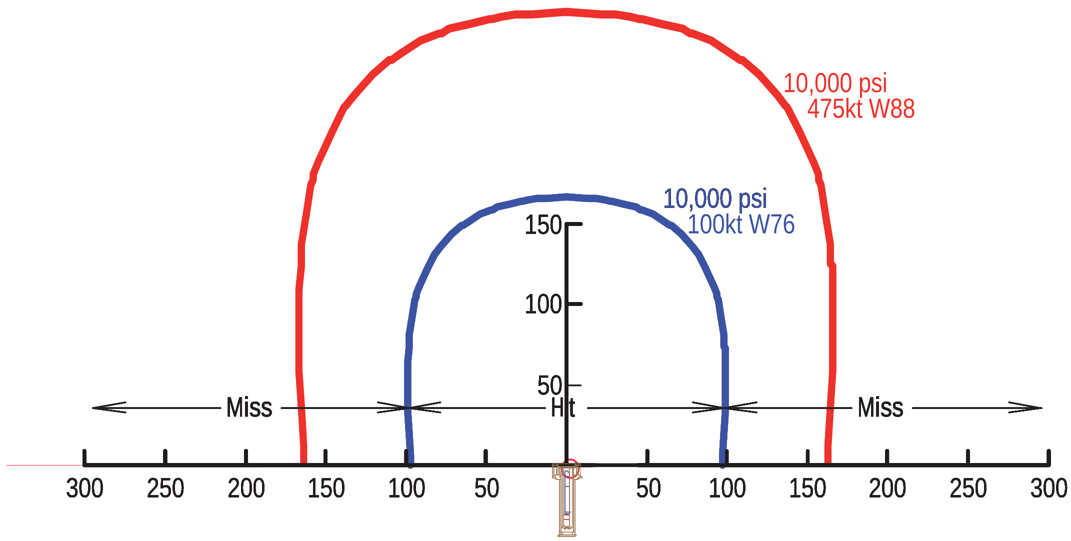


POINT OF INSTABILITY
The tremendous increase in the killing power of the 2000 100 kt submarine launched ballistic missile warheads (SLBMs) will now make it possible for the higher yield warheads in the US arsenal that were formerly assigned to silo-based hard targets to be used against other types of hard targets

Crater Dimensions from a 100kt W-76 Near-Surface Nuclear Explosion

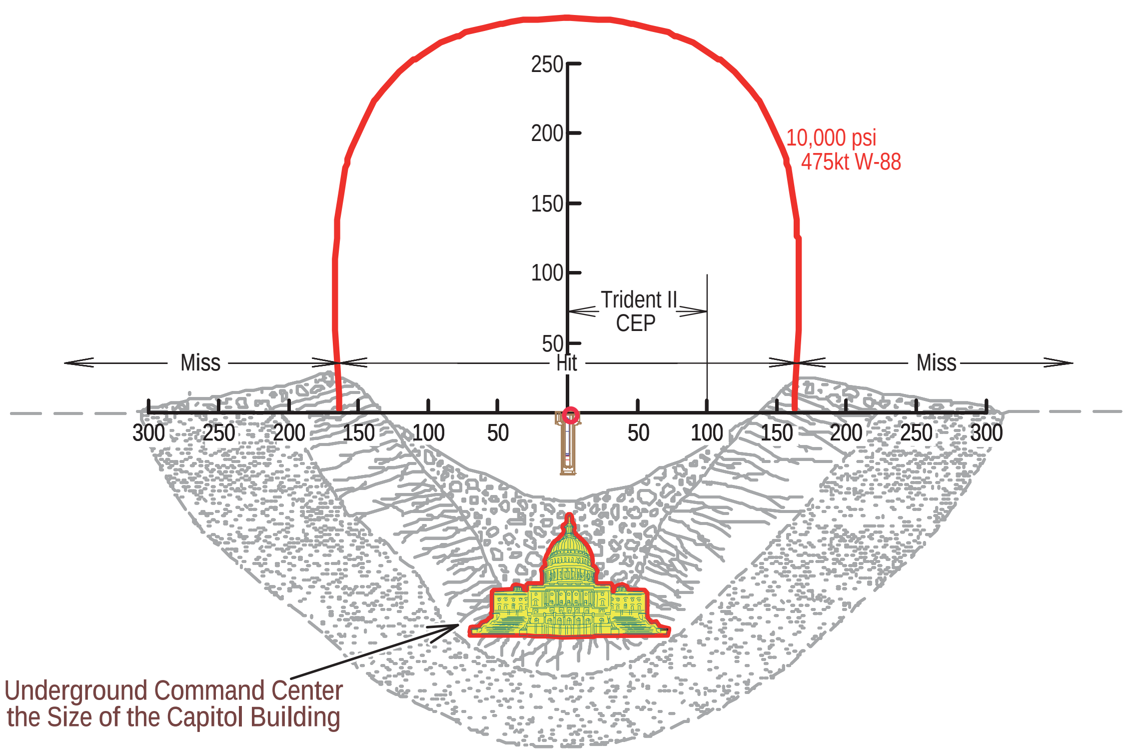


Estimated Dimensions of the Volumes Where a 100 Kt W-76 and 475 Kt W-88 Warheads Create a Blast Overpressure of 10, 0000 Psi or More



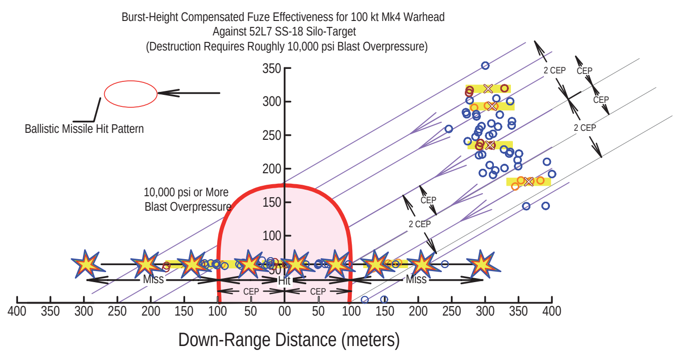
Crater Dimensions from a 475kt W-88 Near-Surface Nuclear Explosion

Trident II W88 475 kt Warhead
Against a Deeply Buried Underground Command Post

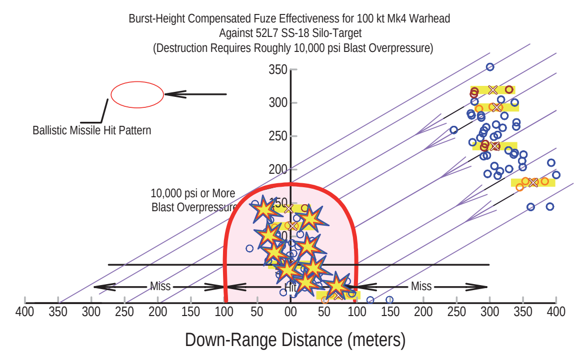


Comparison of the Effects of
"*Constant* Burst Height" and "*Variable* Burst-Height" Fuses for 100 kt Mk4 Warhead
Against 52L7 (10,000 psi) SS18 Silo-Targets

HOW THE TRIDENT ADVANCED FUSE
INCREASES THE KILLING POWER OF THE MK4A WARHEAD



Warheads All
Detonate at the
Same Altitude



Warheads Detonate
Within
Lethal Volume

Comparison of the Effects of
"*Constant* Burst Height" and "*Variable* Burst-Height" Fuses for 100 kt Mk4 Warhead
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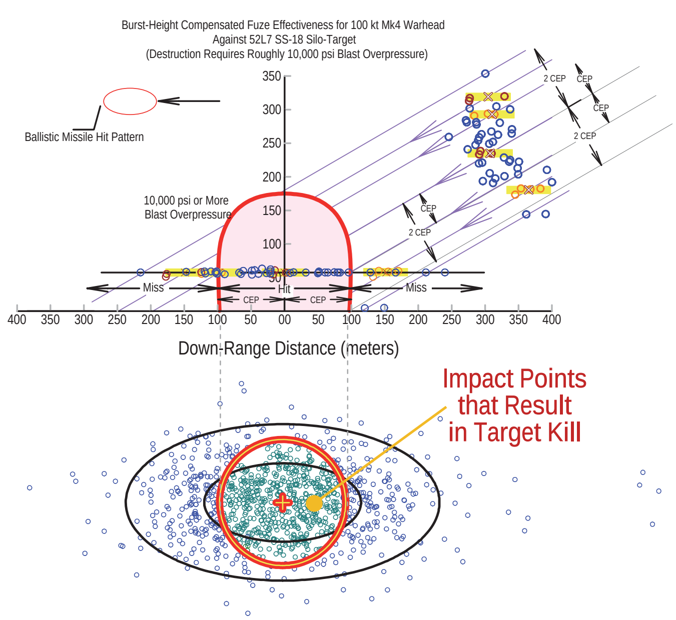
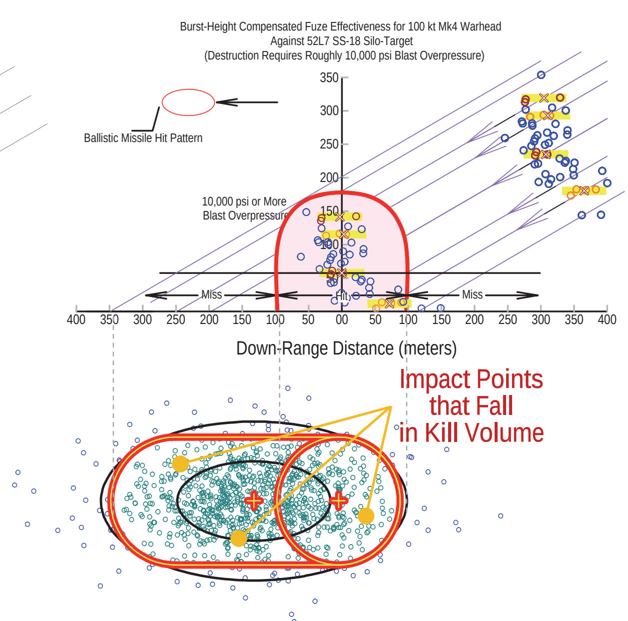


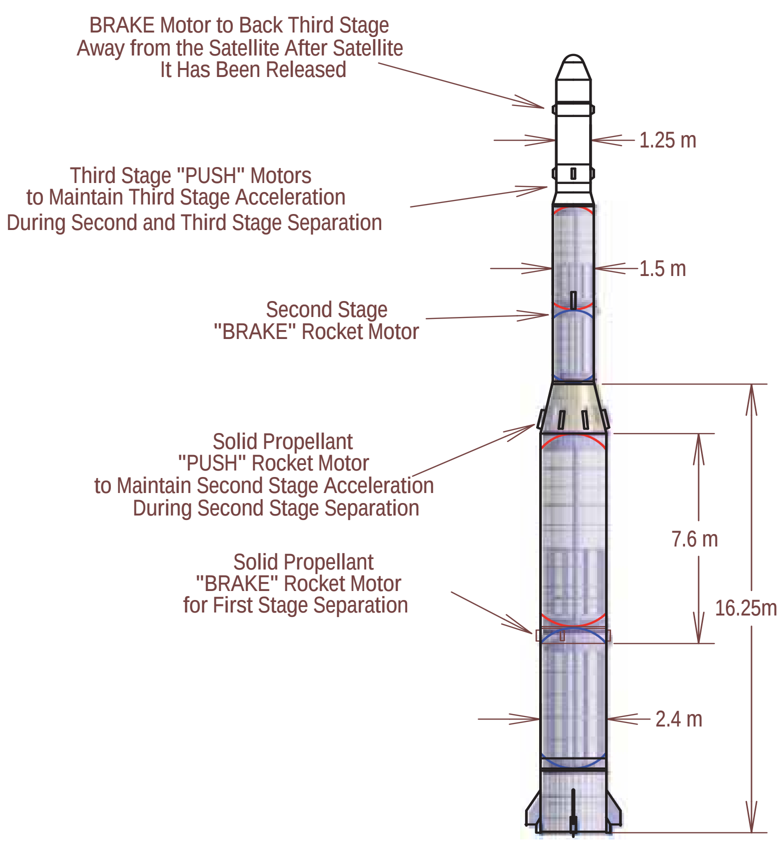
Probability of Detonating Within Lethal Volume = 0.56



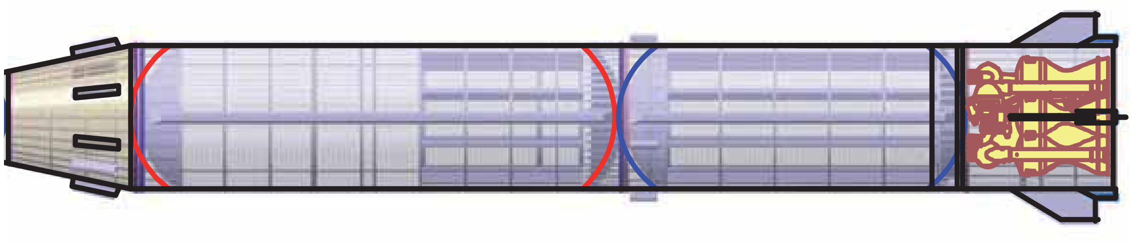
Probability of Detonating Within Lethal Volume = 0.91

POINT OF INSTABILITY
The Russians Do Not Believe US Claims of Nuclear-Armed ICBM Threats from North Korea and Iran
This Feeds Their Concerns that US Missile Defense Programs Have Another Purpose

Functional Diagram of the Unha-3 Satellite Launch Vehicle

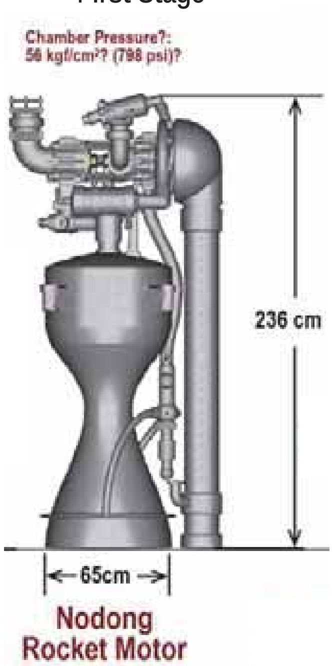


Unha-3 First Stage

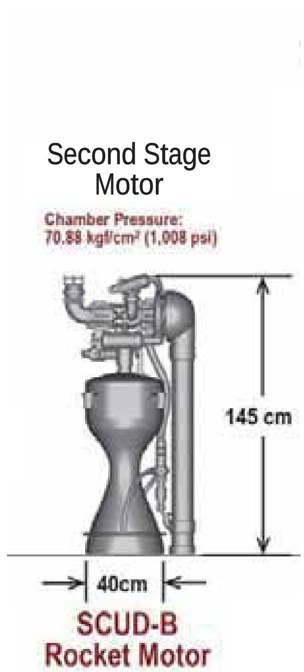


Motors Used in the Unha-3 Launch Vehicle: Nodong, SCUD-B, and R-27 Vernier Motors

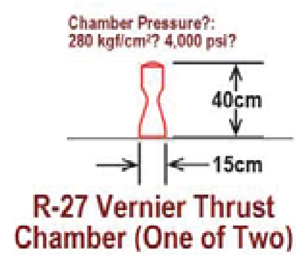
Four Nodong Motors +
Four Vernier 3 ton
Thrust Motors in
First Stage



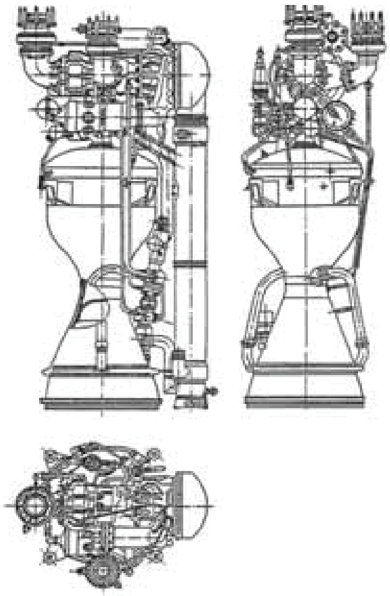
Second Stage
Motor

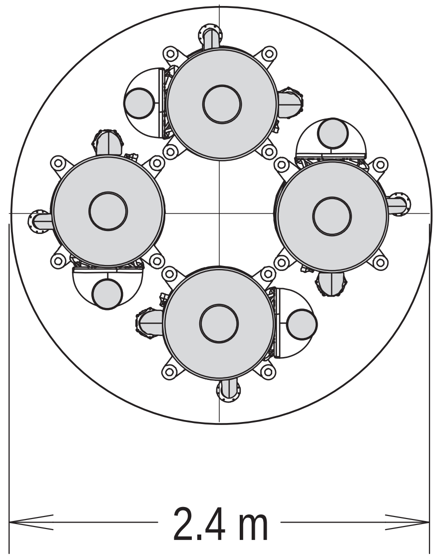


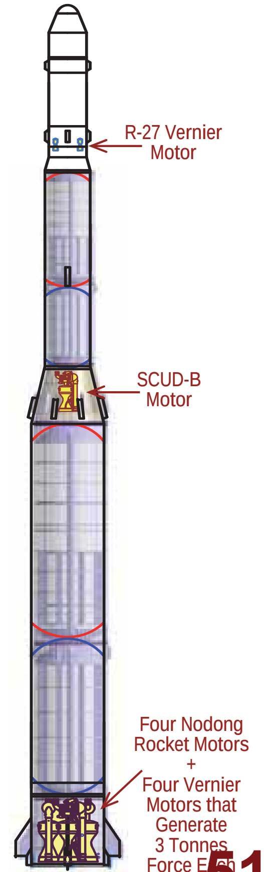
Third Stage
Motor



Motors Used in the Unha-3 Launch Vehicle: Nodong, SCUD-B, and R-27 Vernier Motors





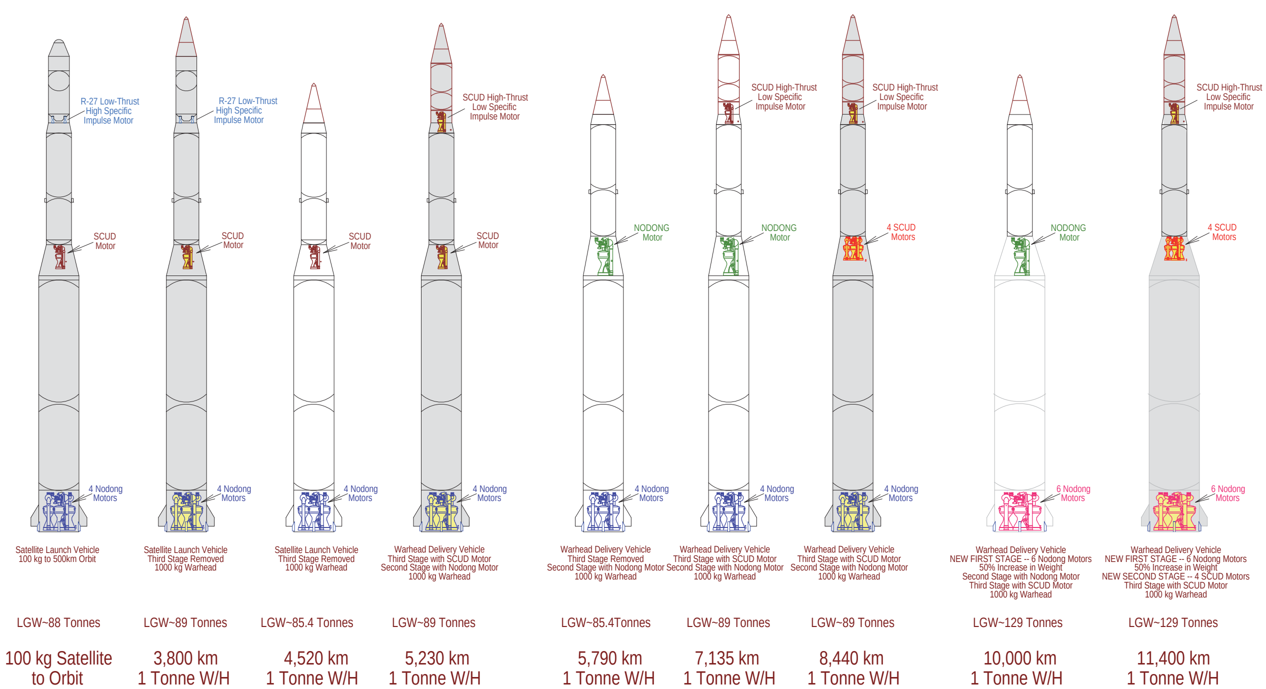


Potential Variants of Long-Range Missiles that Could Use North Korean Rocket Technologies

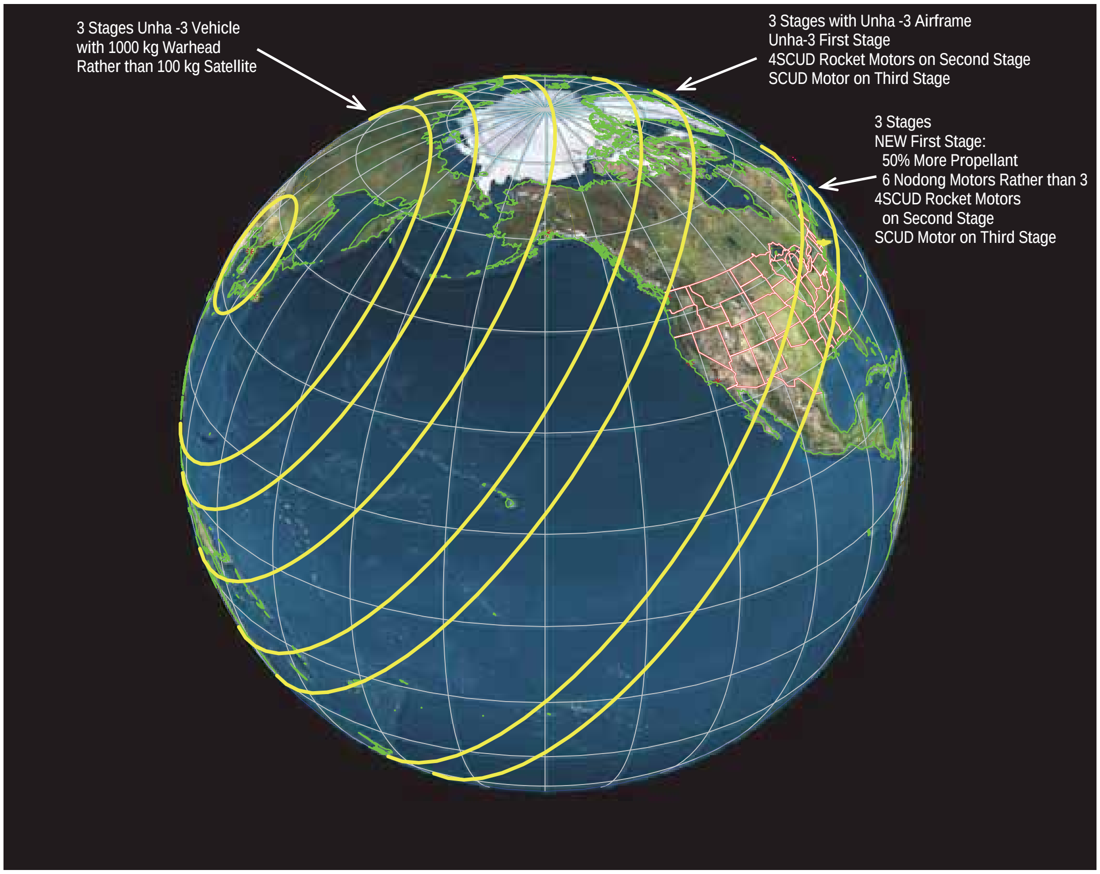
Existing Missile Technologies

Modified Us of Existing Missile Technologies

New Missile Technologies



Range Contours for Variants of Long-Range Missiles that Could Use North Korean Rocket Technologies



Unha-3 Characteristics Derived by *Markus Schiller* and *Robert Schmucker* Following the December 12, 2013 Launch of a 100 Kg Satellite by North Korea

Unha-3 Characteristics

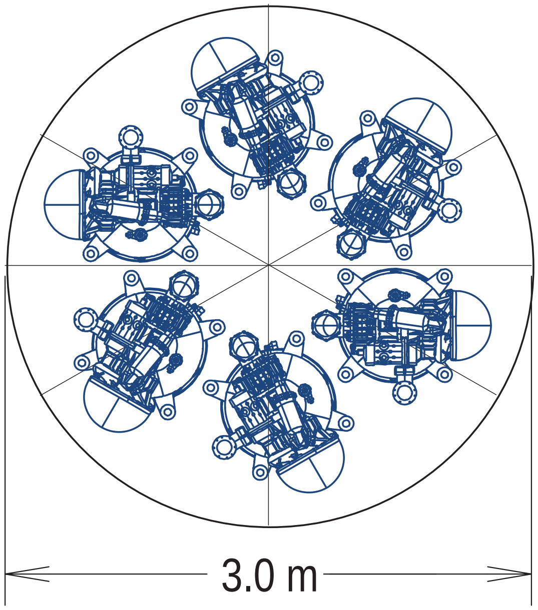
Stage 1
4 Nodong and 4 Control Engines
Thrust at Sea Level = 120 tonnes
Burn Time=120 seconds
Used Propellant=62.6 tonnes
Launch Mass=71.3 tonnes
Structure Factor (With No Residual Fuel)=0.122
Structure Factor (Including 4% Residual Fuel)=0.0869
I_{SP} = 120,000/(62,600/120) = 230 sec (sea level)
Used Propellant = (62,600×2.2) = 137,970 lbs Fuel

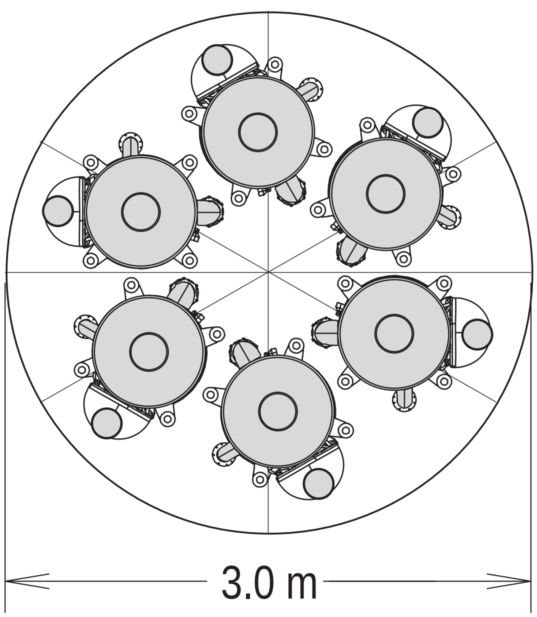
Diameter of Nodong Engine ≈
Hence, I_{SP} vacuum ≈ 250 sec

Stage 2
SCUD-B Engine
Thrust in Vacuum = 14.5 tonnes
Burn Time=200 seconds
Used Propellant=11.6 tonnes
Launch Mass=13.1 tonnes
Effective Structure Factor (With Only Used Fuel) = 0.1145
Structure Factor (Including 4% Residual Fuel) = 0.0791
I_{SP} = 14.5/(11.6/200) = 250 sec (vacuum)
Used Propellant = (11,600×2.2) = 25,752 lbs Fuel

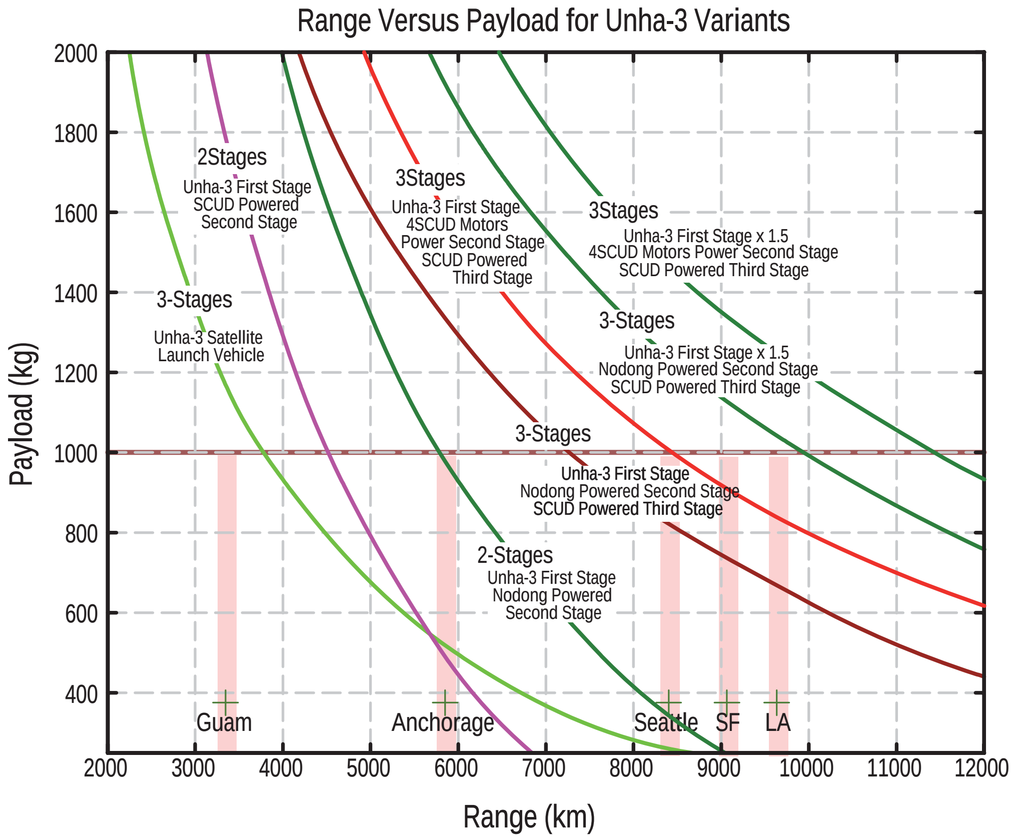
Stage 3
2 NTO-UDMH Burning Engines
Thrust in Vacuum = 2.9 tonnes
Burn Time=260 seconds
Used Propellant=2.6 tonnes
Launch Mass=3.3 tonnes (Including 100 kg Payload)
Launch Mass=3.2 tonnes (Excluding 100 kg Payload)
Effective Structure Factor (With Only Used Fuel and 100 -150 kg Payload *Excluded*)=0.22
I_{SP} = 2900/(2600/260) = 290 sec (vacuum)
Used Propellant = (2600×2.2) = 5730 lbs Fuel

Launch Gross Weight = 71.3+13.1+3.3=87.7 tonnes


3.0 m
2.4 m


3.0 m
2.4 m

Range versus Payload for Variants of Long-Range Missiles that Could Use North Korean Rocket Technologies



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Is the US Trying to Build a National Missile Defense Aimed at China?

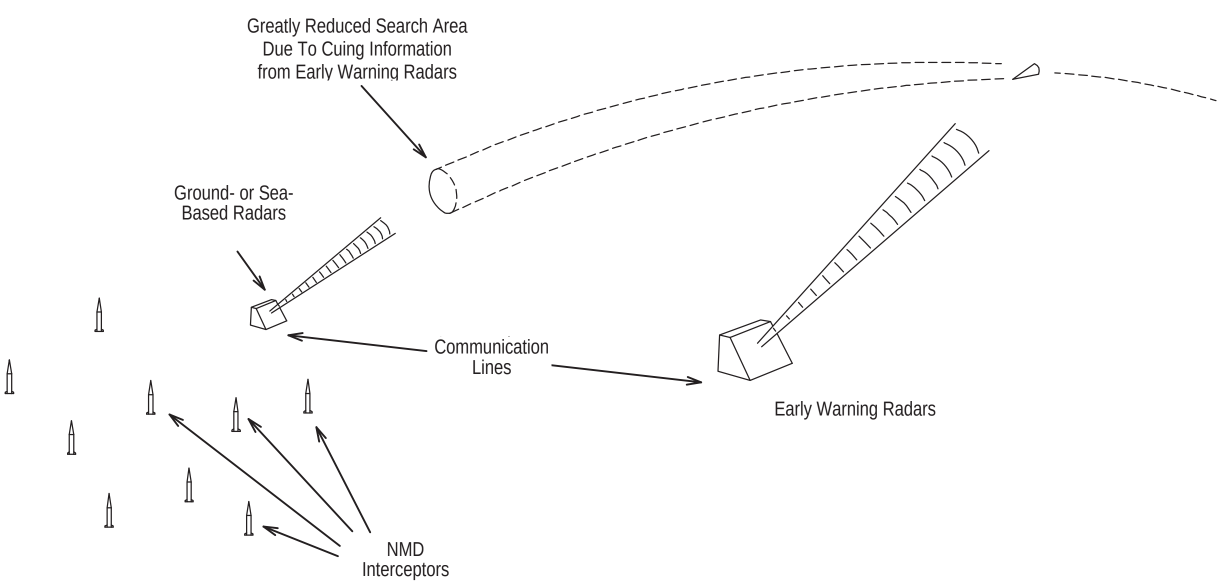
George N. Lewis
Peace Studies Program
Cornell Universty
Voice: 607 342-5407, e-mail: gnl3l@Cornell.edu

Theodore A. Postol
Professor Emeritus of Science, Technology, and National Security Policy
Massachusetts Institute of Technology
Voice: 617 543-7646, e-mail: postol@mit.edu

Carnegie Endowment for International Peace
October 15, 2015

The Basic Components of Missile Defenses and How They Work

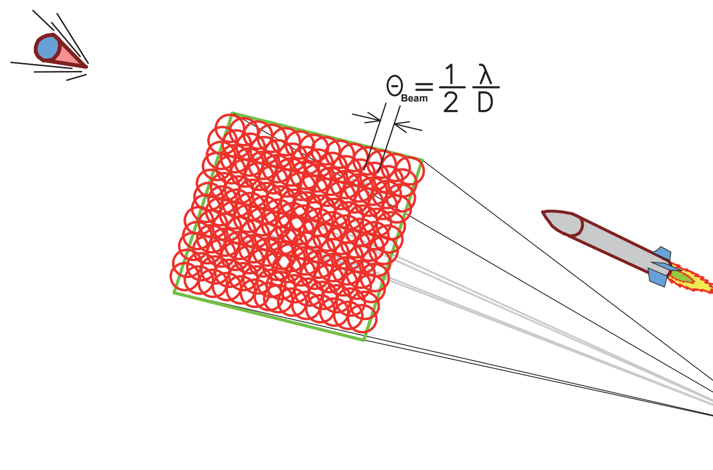
Basic Functional Architecture of a Baseline and Expanded National Missile Defense



How Cuing Information Can Be Used to Greatly Extend the Acquisition and Tracking Range of a Radar

Size of Search Solid Angle for Different Radar Ranges

$$\text{Area of Sky That Can Be Searched} = \frac{1}{\text{Range}^3}$$



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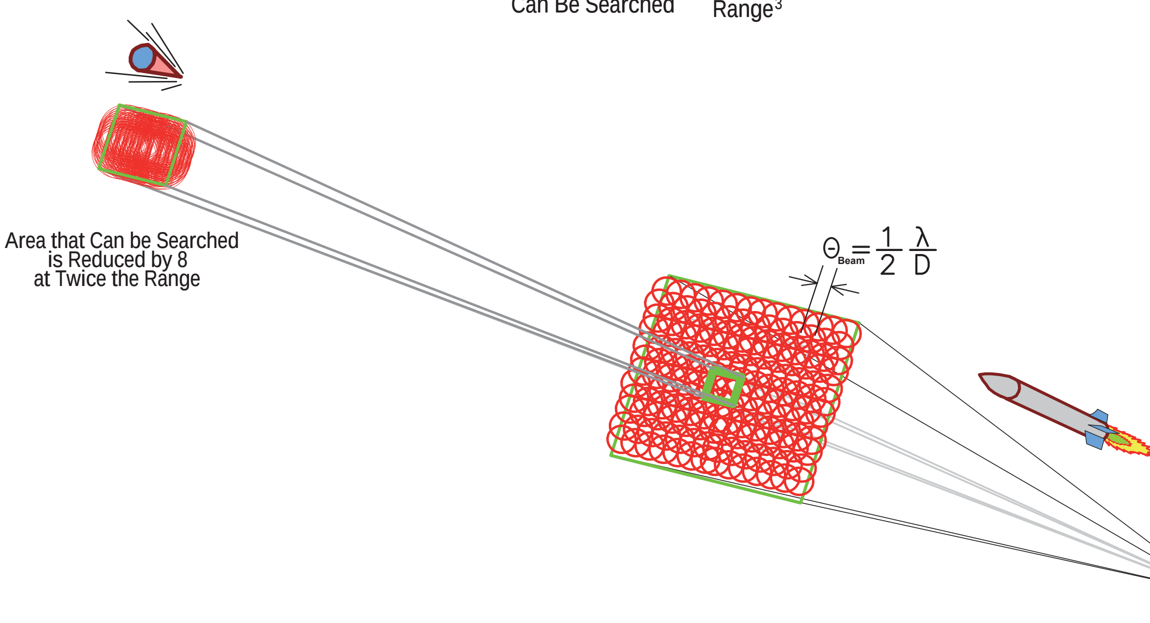
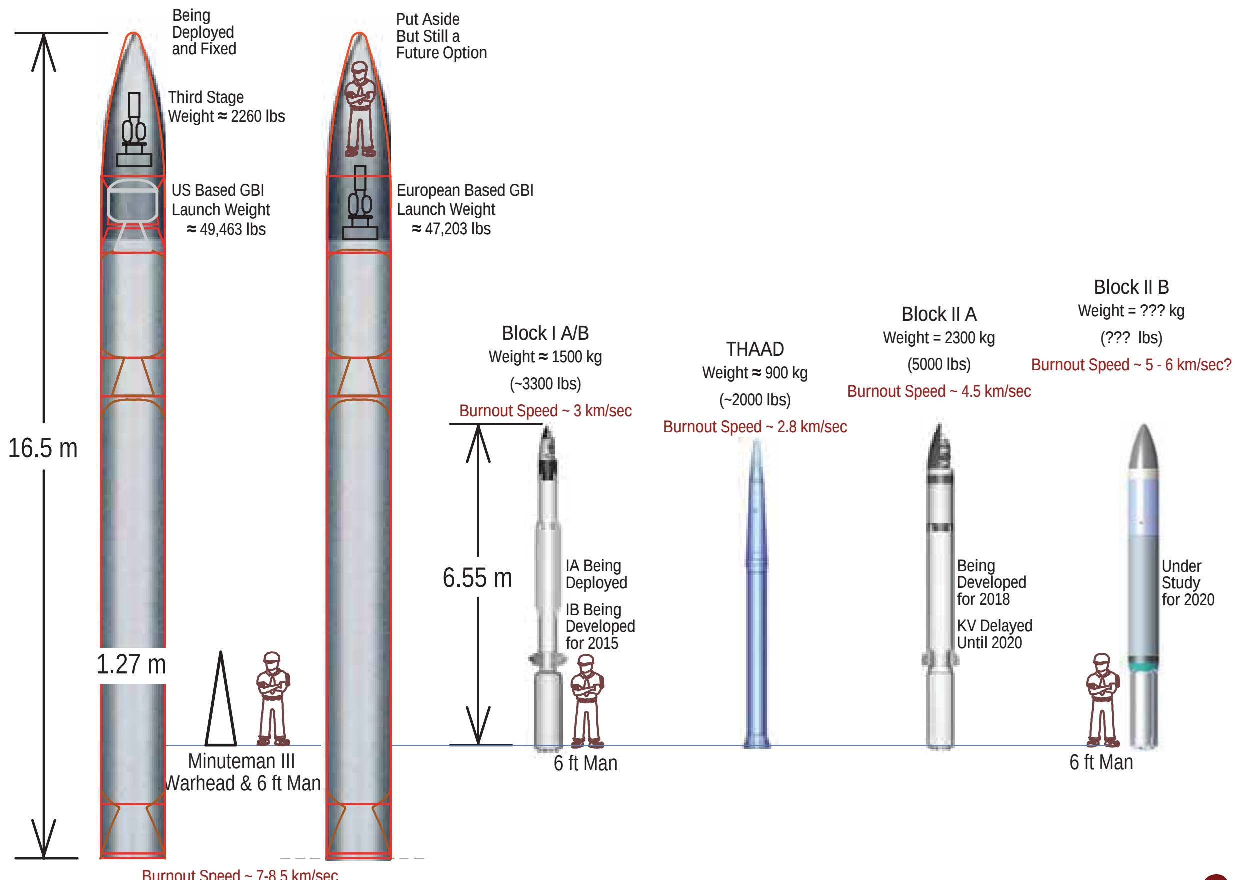


MIT
Science, Technology, and
National Security Working Group

Interceptors

US Interceptors Under Development, Modernization and/or Being Deployed



The AN/TPY-2 Radar

A Marvel of Radar Technology That Is Still Not up to the Job of Reliable Discrimination

Assumed Characteristics of the AN/TPY2 Radar

Average Power = 81,000 Watts; Antenna Gain = 116,092;
Antenna Effective Area = 7.49 m^2; System Losses = 6.3;
System Temperature = 406 ºK;

Has the US Properly Informed an Important Ally in Northeast Asia? (South Korea)

The US State Department and Military, and the Primary Contractor, Raytheon, Have Not Explained to the South Korean Government and Public the Difference between the FBM and TM Radar Modes

- Terminal Mode (TM) –
  radar only has a range of about 500 km
- Forward-based Mode (FBM) –
  radar has a range of between 1500 and 2000 km
- FBM mode has NO utility against short range North Korean ballistic missiles but poses a threat to Chinese ICBMs that would fly north of South Korea towards the United States.
- FBM mode could be used as an integral part of the US national missile defense

Questions Asked by Numerous Individuals from the South Korean Government, by Journalists, and South Korean Technical Experts.

- The details of this radar are totally unknown to South Koreans, and even the experts in South Korea.
- If the U.S. officials' assertions were to be correct, in other words, if only the TM mode is possible when it is deployed in South Korea, what would be the radars detection range?
- If only the TM mode is possible in South Korea, why are the Chinese so upset about this radar?
- There are some reports that the configuration of the TM mode could be rapidly changed to the FBM mode in an emergency or due an independent decision made by the United States, could this be true?
- It is known that two AN/TPY-2 radars are operating in the FBM mode and have been already deployed in Japan.

  Many people believe that these radars might be serving as adjuncts in support of the U.S. GMD system for protecting the U.S. mainland from the launch of a North Korean ICBM.

  Considering the role of those two radars in Northeast Asia, what role might the THAAD with AN/TPY-2 in South Korea be playing in the U.S. government's broader BMD strategy?

Size of Search Solid Angle for Different Radar Ranges

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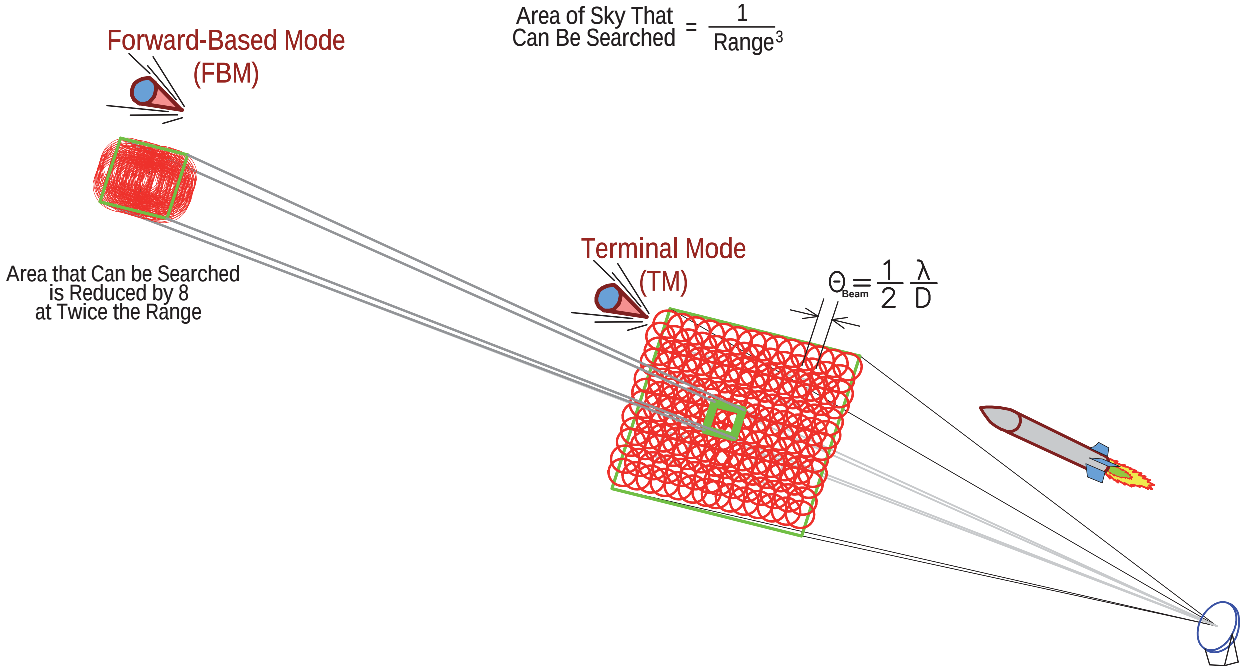
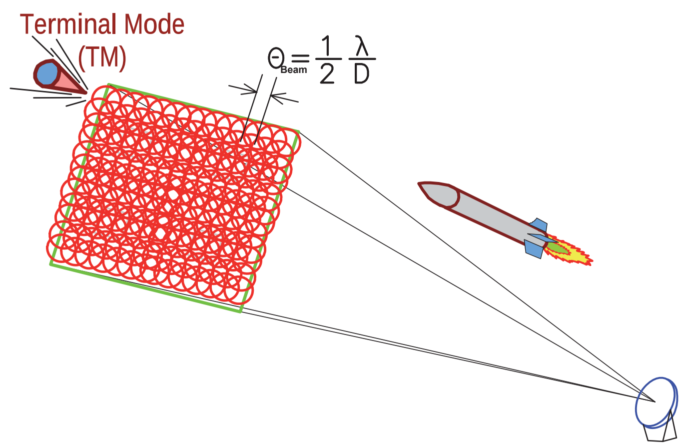


We Found That Terminal Mode, Which Assumes No Cuing Information, Would Need to Search an Azimuth of About 76º and an Elevation of 8.5º – 640 Square Degrees to a Range of Roughly 500 Km to Set up a Defense-Surveillance Fence against North Korean Ballistic Missiles

Size of Search Solid Angle for Different Radar Ranges

$$\text{Area of Sky That Can Be Searched} = \frac{1}{\text{Range}^3}$$



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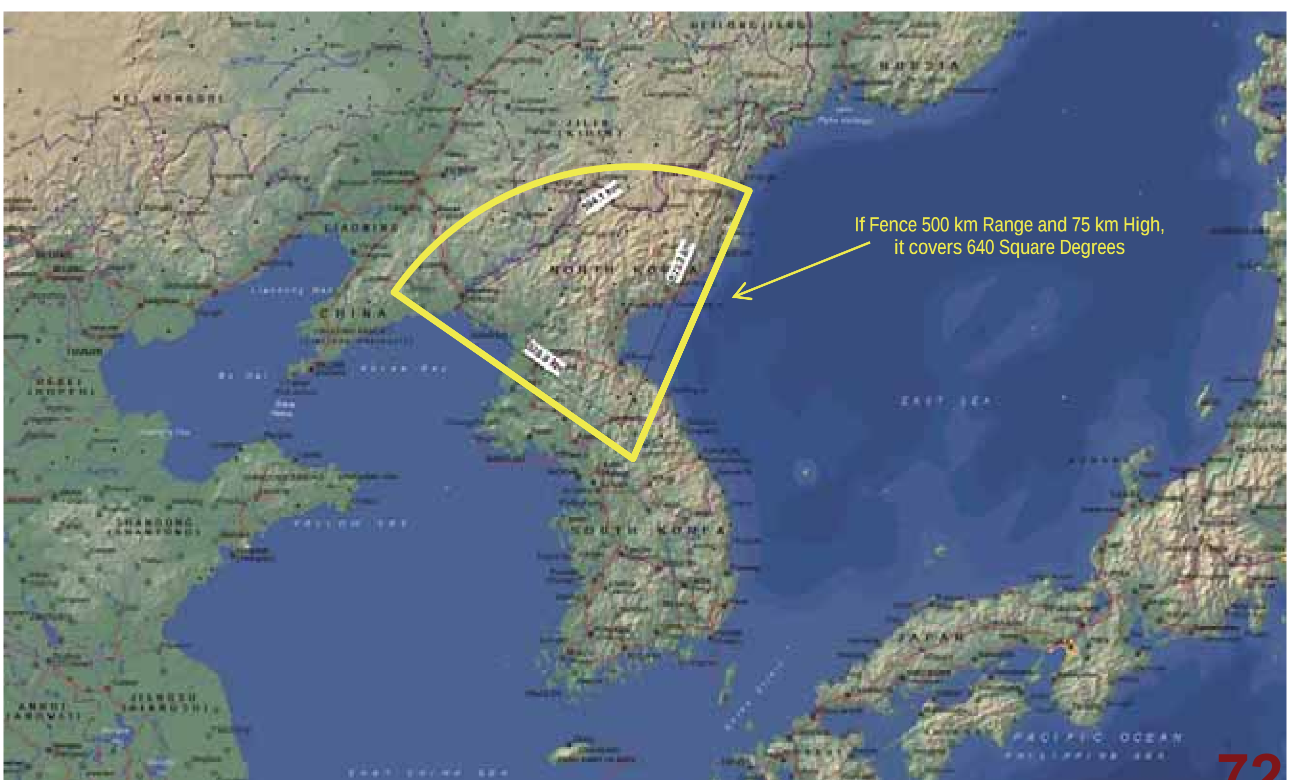

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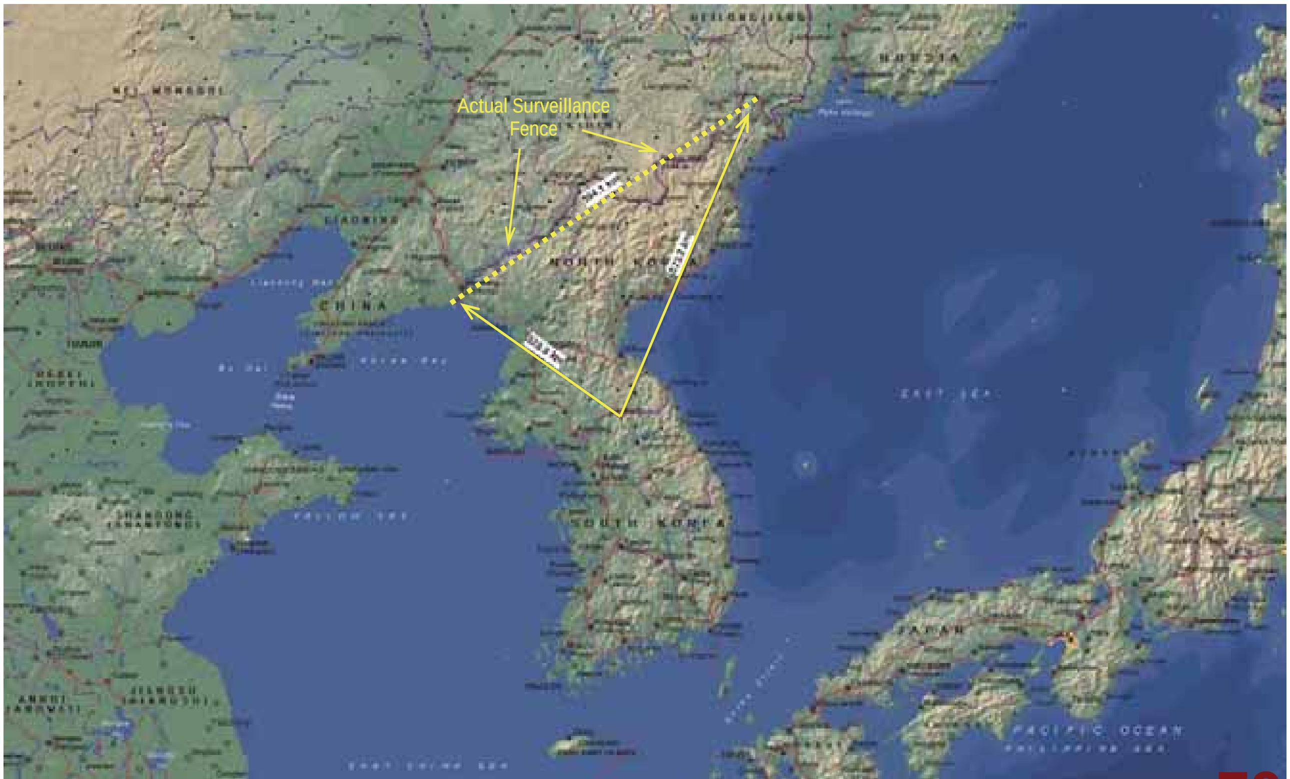

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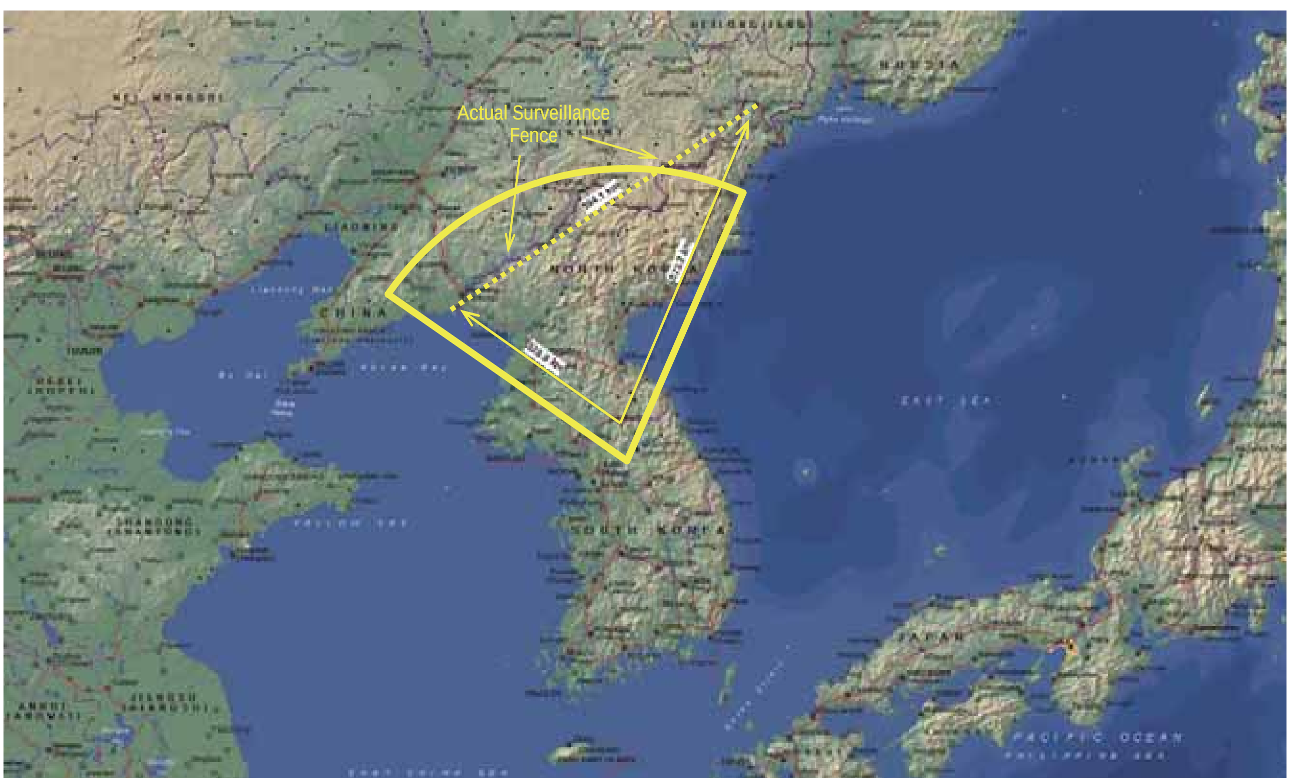


W however, the only difference between TM mode and FBM mode is simply what the software tells the radar to do. If the radar is programmed to search 10 square degrees at maximum range it has the resources to search at a range of roughly 2000 km! The information needed to verify this FACT is shown below

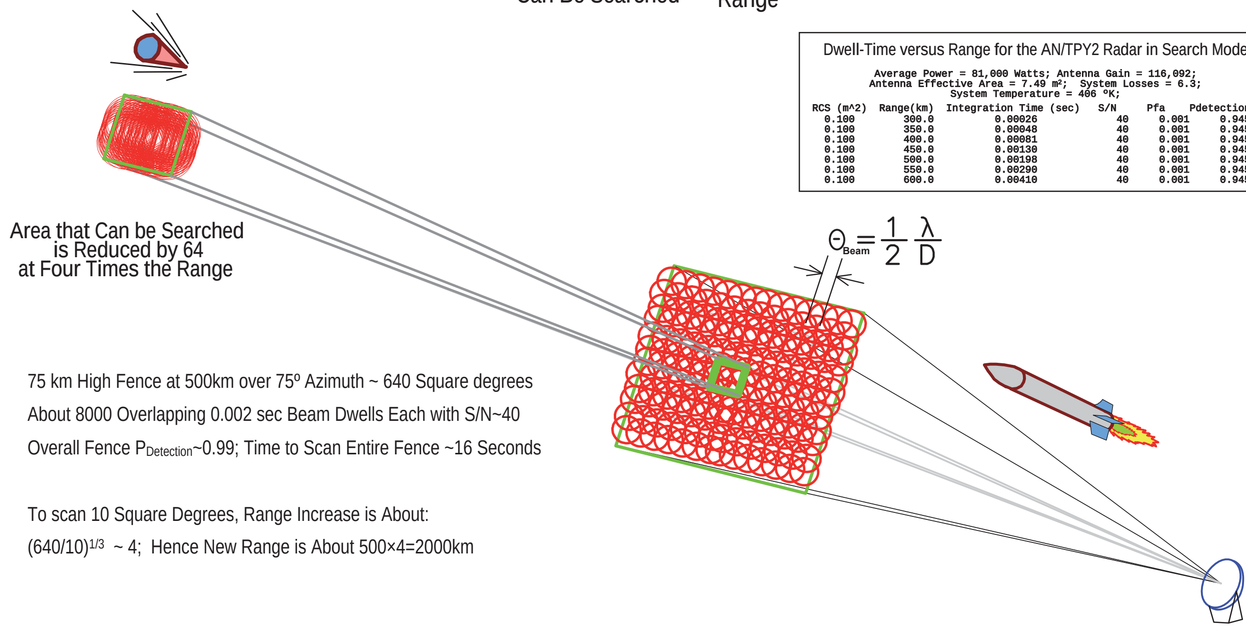
Size of Search Solid Angle for Different Radar Ranges

$$\text{Area of Sky That Can Be Searched} = \frac{1}{\text{Range}^3}$$

Dwell-Time versus Range for the AN/TPY2 Radar in Search Mode

Average Power = 81,000 Watts; Antenna Gain = 116,092;
Antenna Effective Area = 7.49 m^2; System Losses = 6.3;
System Temperature = 406 °K;

RCS (m^2)	Range(km)	Integration Time (sec)	S/N	Pfa	Pdetection
0.100	300.0	0.00026	40	0.001	0.945
0.100	350.0	0.00048	40	0.001	0.945
0.100	400.0	0.00081	40	0.001	0.945
0.100	450.0	0.00130	40	0.001	0.945
0.100	500.0	0.00198	40	0.001	0.945
0.100	550.0	0.00290	40	0.001	0.945
0.100	600.0	0.00410	40	0.001	0.945



75 km High Fence at 500km over 75° Azimuth ~ 640 Square degrees

About 8000 Overlapping 0.002 sec Beam Dwells Each with S/N~40

Overall Fence $P_{Detection}$~0.99; Time to Scan Entire Fence ~16 Seconds

To scan 10 Square Degrees, Range Increase is About:

$(640/10)^{1/3}$ ~ 4; Hence New Range is About 500×4=2000km

The US State Department and Military, and the Primary Contractor, Raytheon, Have Not Explained to the South Korean Government and Public the Difference between the FBM and TM Radar Modes

Questions Asked by Numerous Individuals from the South Korean Government, by Journalists, and South Korean Technical Experts.

- The details of this radar are totally unknown to South Koreans, and even the experts in South Korea.

  THE DETAILS OF THE RADAR ARE NOW KNOWN TO THE SOUTH KOREAN GOVERNMENT AND PUBLIC

- If the U.S. officials' assertions were to be correct, in other words, if only the TM mode is possible when it is deployed in South Korea, what would be the radars detection range?

  THE RADAR RANGE IN THE TM MODE IS ABOUT 500 KM. BUT THE TM MODE ASSUMES THE RADAR GETS ABSOLUTELY NO CUING DATA. THIS WILL NOT BE TRUE IN OPERATIONAL CIRCUMSTANCES

- If only the TM mode is possible in South Korea, why are the Chinese so upset about this radar?

  THE CHINESE ARE UPSET BECAUSE THE RADAR CAN READILY OPERATE IN THE FBM MODE, WHICH IN PRINCIPLE GIVES IT CAPABILITY TO TRACK CHINESE ICBMS BEFORE THEY RISE OVER THE HORIZON INTO THE VIEW OF THE LRDR

- There are some reports that the configuration of the TM mode could be rapidly changed to the FBM mode in an emergency or due an independent decision made by the United States, could this be true?

  THE RADAR WAS DESIGNED FROM ITS BEGINNING TO QUICKLY BE AVAILABLE IN THE FBM MODE

- It is known that two AN/TPY-2 radars are operating in the FBM mode and have been already deployed in Japan.

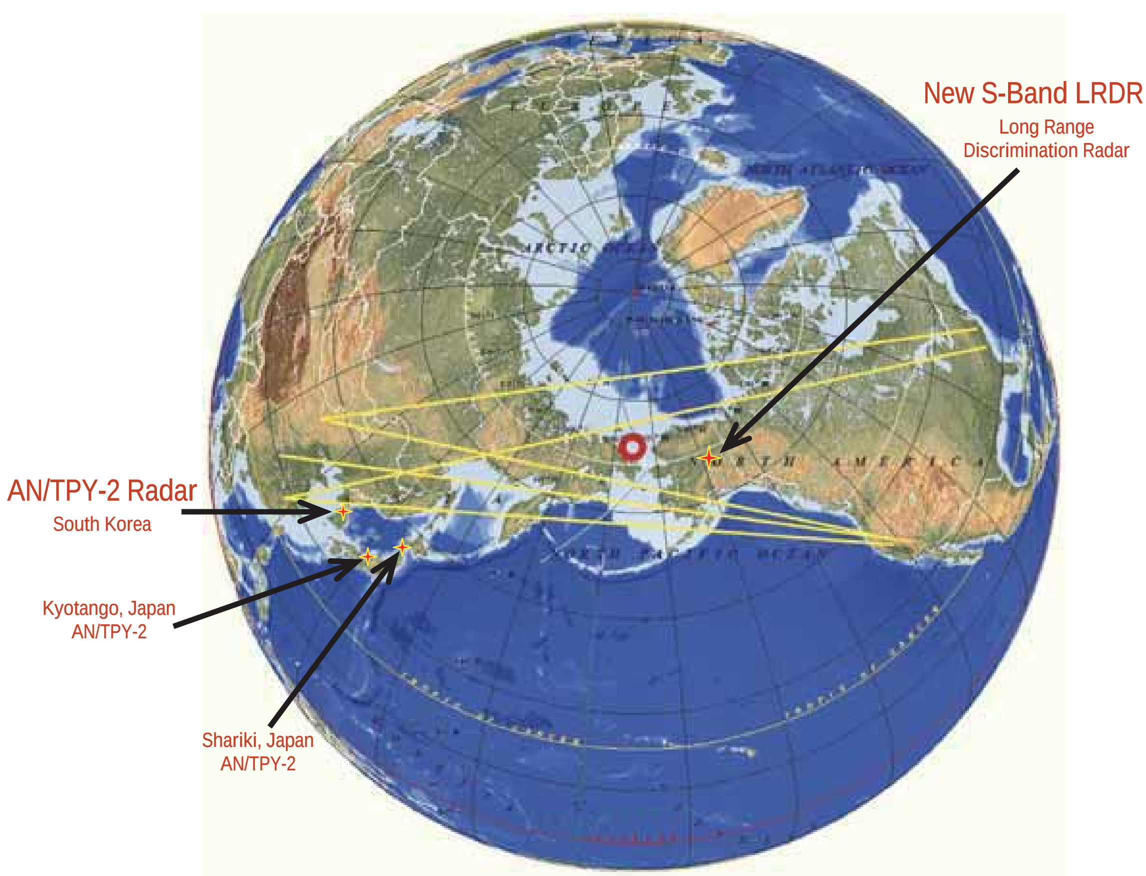
  Many people believe that these radars might be serving as adjuncts in support of the U.S. GMD system for protecting the U.S. mainland from the launch of a North Korean ICBM.

  Considering the role of those two radars in Northeast Asia, what role might the THAAD with AN/TPY-2 in South Korea be playing in the U.S. government's broader BMD strategy?

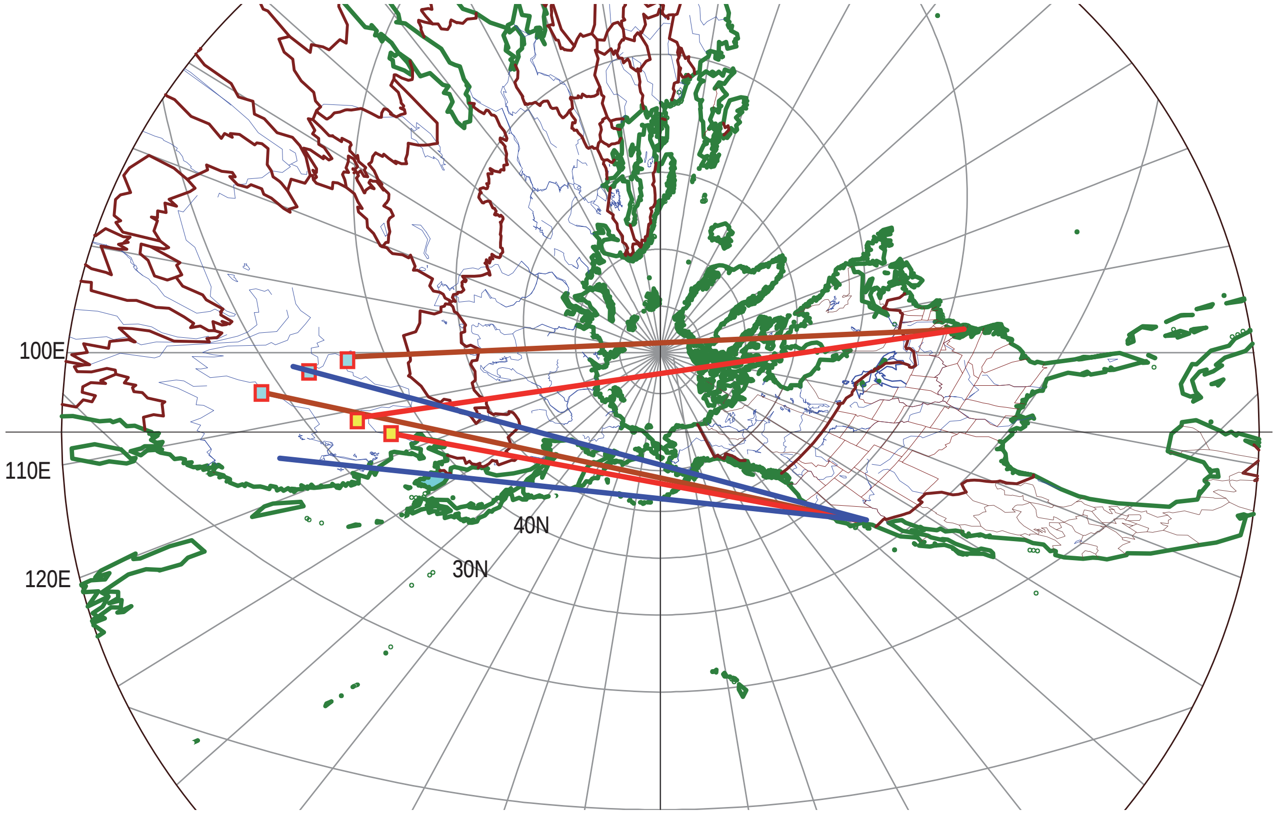
  THE AN/TPY-2 RADAR IS VASTLY MORE CAPABLE THAN REQUIRED FOR MANAGING ENGAGEMENTS AGAINST RELATIVELY SHORT RANGE NORTH KOREAN MISSILES. HOWEVER, IT IS WELL-SUITED TO PROVIDE EARLY TRACKING DATA FOR A US NATIONAL MISSILE DEFENSE.

What Role Could an AN/TPY-2 Radar in South Korea Play As a US National Missile Defense System Aimed at China?

Qualitative View of Chinese ICBM Trajectories Towards the United States



Precise View of Chinese ICBM Trajectories Towards the United States



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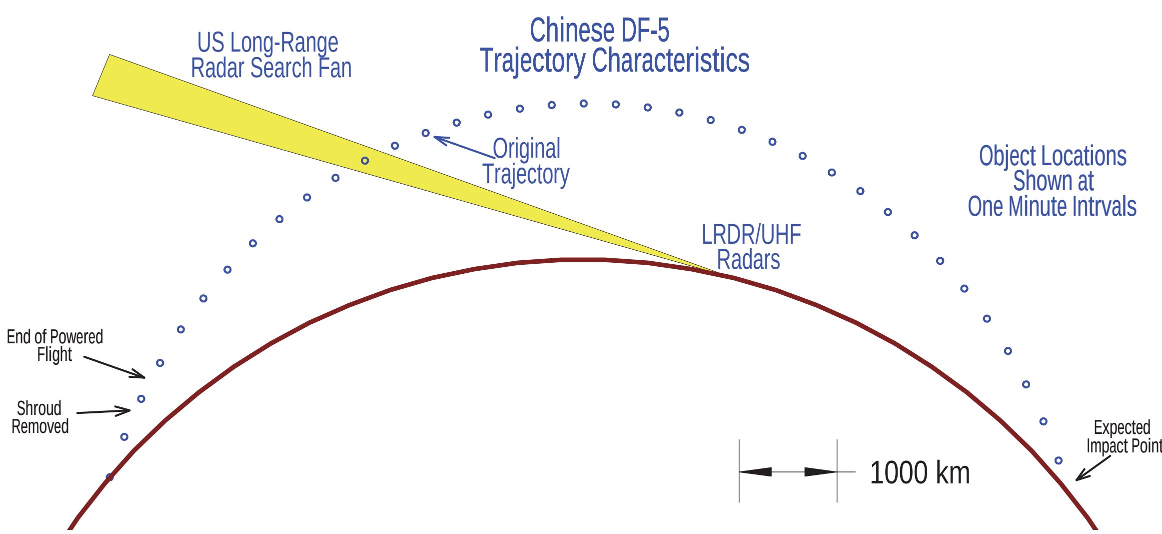
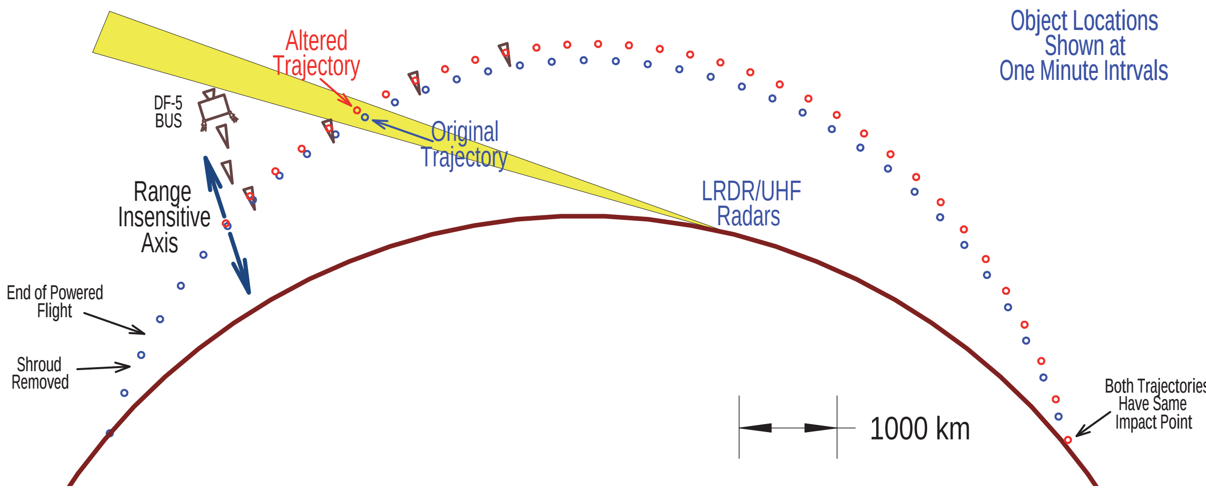
Chinese ICBM Trajectories and Horizon Limitations of US Radars Operating in Clear, Alaska

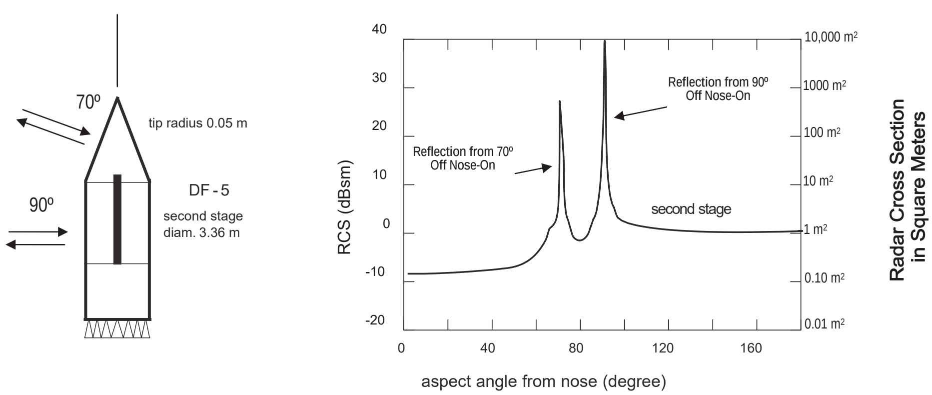


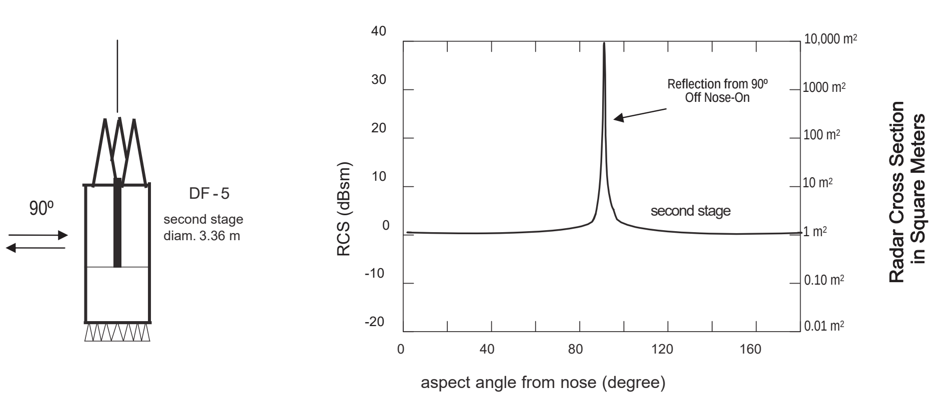
80

Chinese Warhead and Decoy Deployments During Below the Horizon Operations



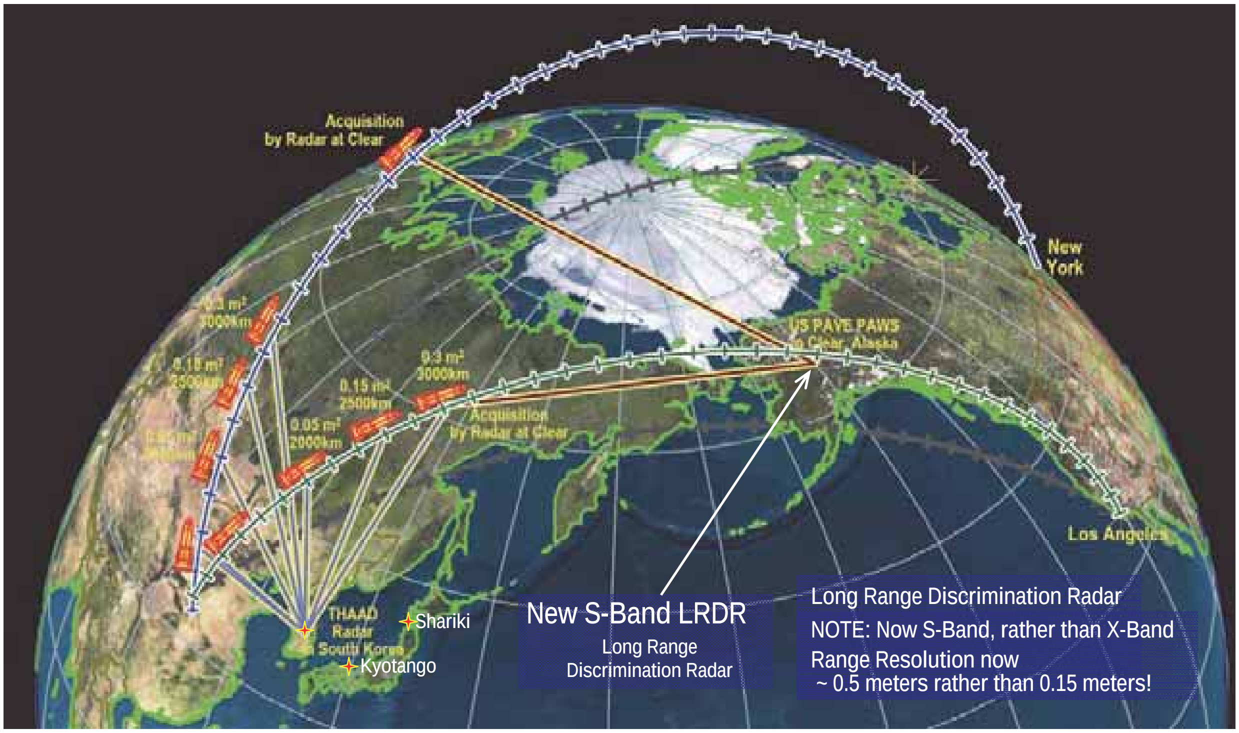
Radar Cross-Section Behavior of the Chinese D5 ICBM





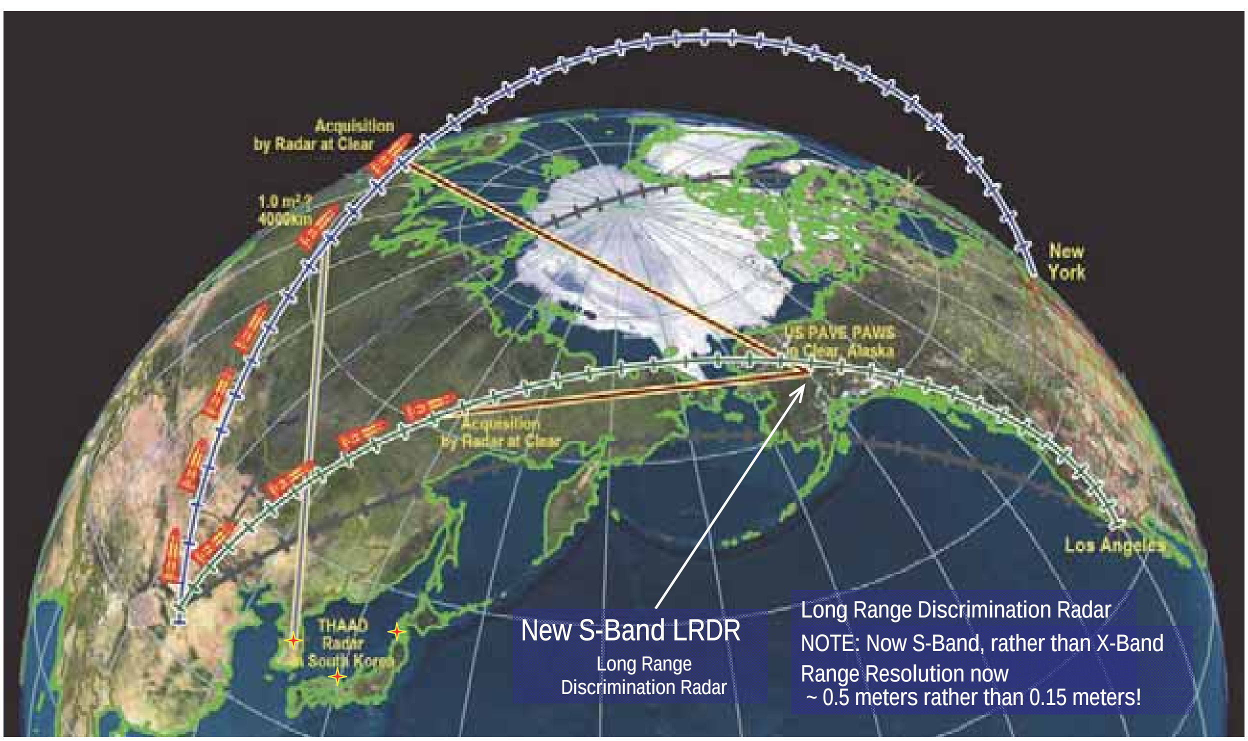
AN/TPY-2 Radar Ranges for Chinese ICBMs That Have *Not* Deployed Their Shrouds

AN/TPY-2 radar Ranges for targets with radar cross-section between 0.05 and 0.3 m^2



AN/TPY-2 Radar Ranges for Chinese ICBMs That Have Deployed Their Shrouds

AN/TPY-2 radar Ranges for targets with radar cross-section of about 1 m^2



Why Is the Deployment of the AN/TPY-2 Radar to South Korea of Importance to the Security of Northeast Asia and Why It Is Dealing with the Wrong Threat? (1 of 2 Slides)

1. The Chinese have legitimate concerns that the AN/TPY-2 radar will be capable of providing early tracking and discrimination data to the long-range discrimination radar (LRDR) that is now being built in Clear, Alaska.
2. Claims made by the US that this is not true, are technically false, and can easily be verified by both government and independent analysts in China, South Korea, Japan and the US. Such overtly false claims by US diplomats undermine confidence with our allies that the United States can be relied upon.
3. In spite of the capabilities of the AN/TPY-2 radar, any tracking and discrimination data obtained from it will be easily rendered useless by simple Chinese countermeasures. However, the appearance that the United States might be trying to take advantage of this radar deployment for US national missile defense will have significant implications for US diplomatic relations with South Korea and China.
4. There is significant domestic pressure in South Korea against accepting this radar. The sitting government, however, has indicated that it considers the THAAD defense system and the radar of potential use to South Korea for defending against North Korean ballistic missiles.
5. The Chinese are trying to pressure the South Koreans into not accepting the AN/TPY-2 radar.
6. China is now South Korea's largest trading partner.
7. South Koreans may conclude that by not being forthright, the US is misleading South Korea and putting South Korea into a direct confrontation with China.
8. The Chinese may conclude that the US is attempting to mislead both South Korea and China about its true intentions to build a missile defense aimed at China.
9. If the South Koreans conclude that the United States has made false and misleading statements about an important matter related to their national security and their relationship with China, it will further undermine diplomatic trust between South Korea and the United States.
10. There are very serious technical questions about whether the THAAD missile defense system could be expected to perform any better than the South Korean Cheongung air and missile defense system.
11. There is a powerful domestic argument for South Korea to develop its own missile defense systems, in part because the costs would be much lower, and in part because the South Koreans would not be dependent on the unreliable word of US contractors and State Department officials.

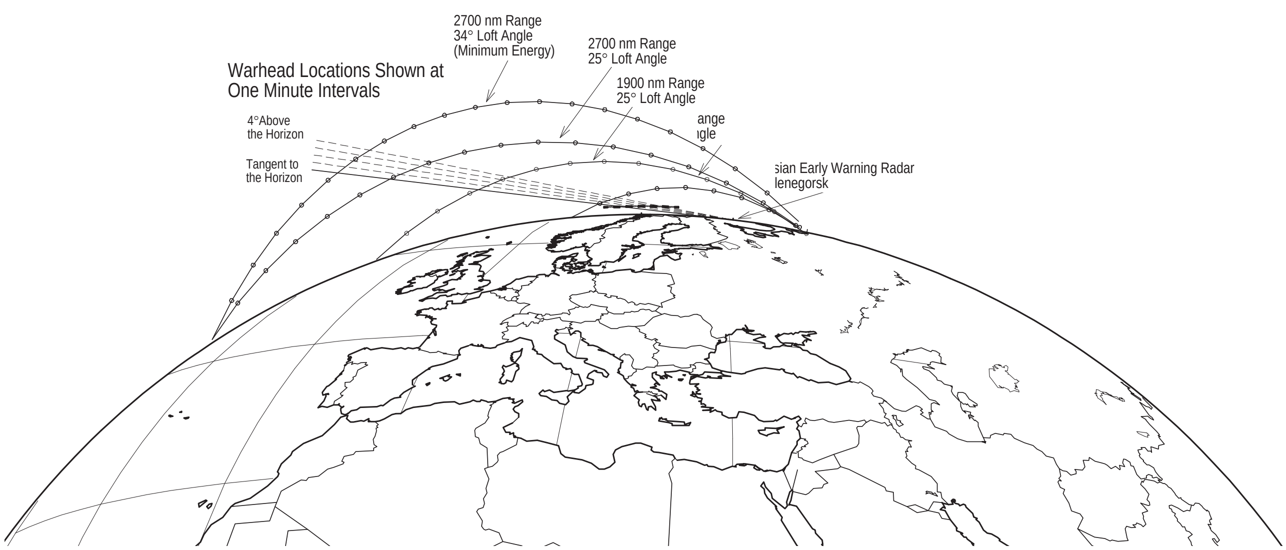
Why Is the Deployment of the AN/TPY-2 Radar to South Korea of Importance to the Security of Northeast Asia and Why It Is Dealing with the Wrong Threat? (2 of 2 Slides)

12. A South Korean missile defense based on the Cheongung system would not perform well against North Korean ballistic missiles, but neither will the THAAD missile defense system.
13. The claim that the US is aiming its missile defense at North Korea is simply nonsense. The North Korean Unha-3 is a satellite launch vehicle and could never be modified to carry a 1 ton payload to the continental United States.
14. It would be possible for North Korea to build an ICBM based on the rocket technologies observed in the Unha-3. However this ICBM would have to weigh about 130 tons rather than the roughly 90 ton weight of the Unha-3. Developing such an ICBM could take 10 or 15 years, based on past rate of missile development seen in North Korea.
15. All of these points could be rendered irrelevant by a potentially serious new North Korean ballistic missile threat that appears to be being downplayed by the US Department of Defense.
16. This threat is the development of submarine launched ballistic missiles (SLBMs) by North Korea.
17. Frame by frame examination of video of a North Korean SLBM launch performed by Markus Schiller and Robert Schmucker shows clearly that North Korea may not yet have solved the problem of ejecting an SLBM from an underwater launch system and igniting the rocket motor once the rocket has been propelled above the water surface. These two tasks are perhaps the technically most challenging technical problems associated with developing and SLBM capability.
18. There is also not yet evidence that North Korea has been able to launch an SLBM from an actual submarine. But this next step would be relatively small if the ejection and rocket motor ignition problem is solved.
19. There is no answer to a diesel electric submarine armed with nuclear capable ballistic missiles. Antisubmarine warfare is completely inadequate against this threat, as are missile defenses.
20. This gigantic new threat, which may only be in a beginning phase, could signal the beginning of the development of a global nuclear threat from North Korea.
21. It is of the utmost importance that North Korea not develop a nuclear weapon that is compact and light enough to fly on a ballistic missile. All efforts must be made to stop this capability from being deployed.

POINT OF INSTABILITY
The Russians Do Not Have Space-Based Early Warning!
This Limits Their Early Warning to Line-of-Sight (Less Than 15 Minutes Relative to 30 Minutes)

Line-of-Sight Constraints Associated with Early Warning Radars

Line-of-Sight Constraints Associated with Early Warning Radars



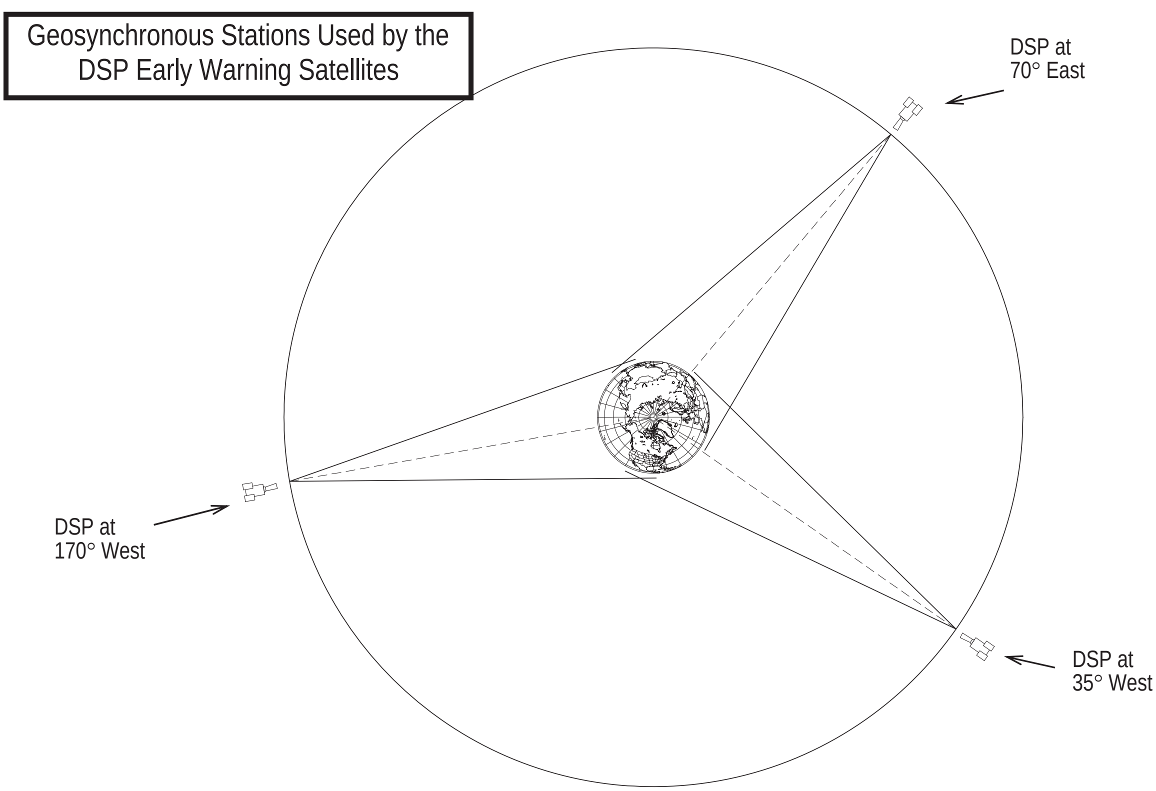
Estimated Time Needed to Carry Out Nuclear Launch-Operations No Matter What Response Is Chosen

Time Needed to Carry Out Basic Nuclear Weapons Launch-Operations

Time for attacking missiles to rise over the horizon into the line-of-sight of early warning radars	1 minute
Time for radars to detect, track, and characterize detected targets, and to estimate the size and direction of motion of targets	1 minute
Military and civil command conference to determine response	1 to 3 minutes
Time for command and unit elements of silo-based forces to encode, transmit, receive, decode, and authenticate a launch order	2 to 4 minute
Time for missile crews to go through full launch procedures	1 to 3 minutes
Time for launched missile to reach a safe distance from its launch-silo	1 minute
Total time consumed in unavoidable and essential operations	7 to 13 minutes

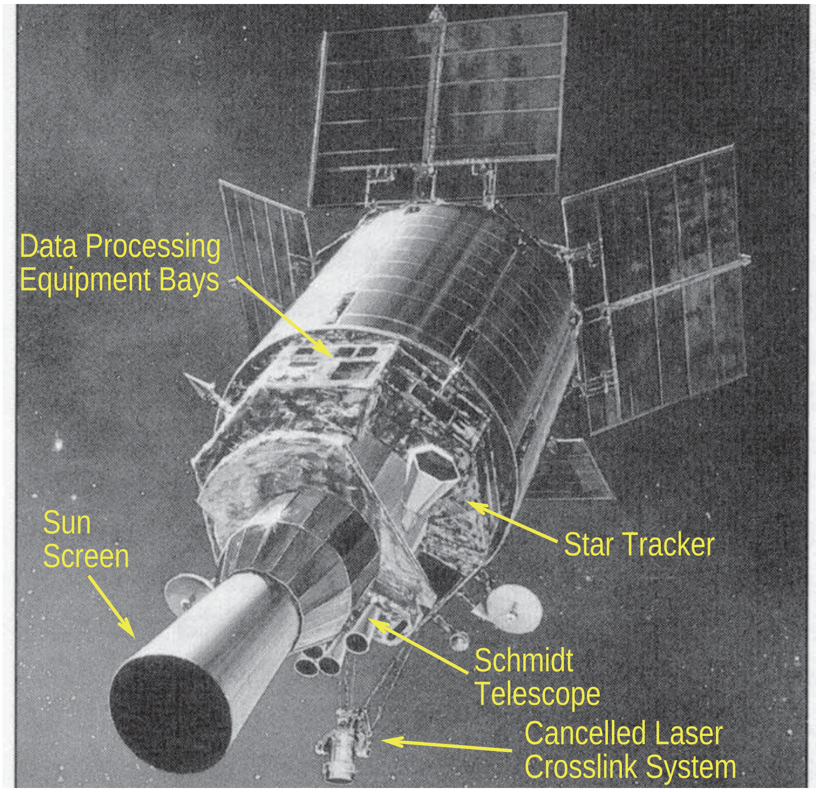
If a short time-line attack is attempted against Russia, a Russian response aimed at launching silo-based missiles before nuclear weapons detonate on them would require time for several technical operations. Time would also be needed by political leadership to assess the situation and decide whether or not to launch the silo-based missile force. The amount of time available for decision-makers to assess the situation and decide whether or not to launch silo-based nuclear forces is the difference between the time it takes for warheads to arrive at targets and the time needed to carry out operations no matter what response is chosen.

Russian and US Space-Based Early Warning Systems

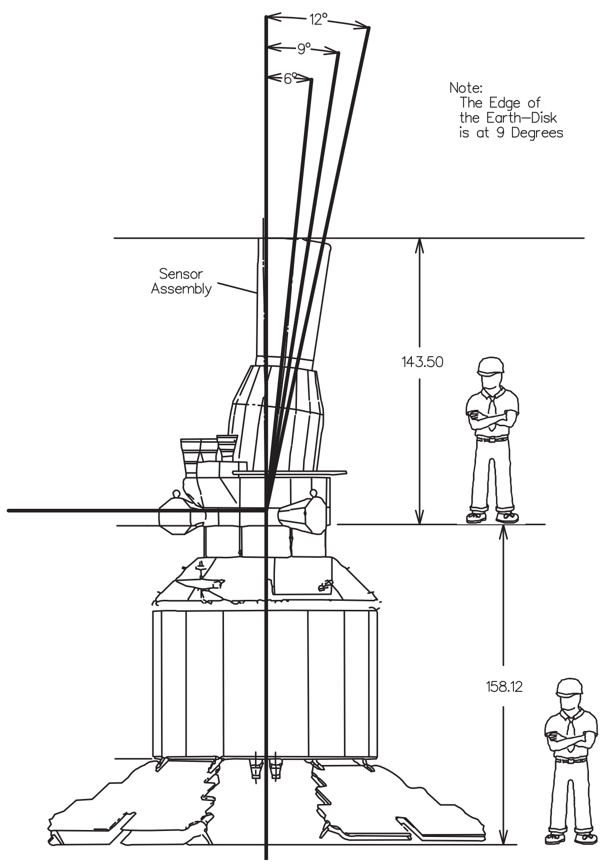


As can be seen from the above diagram, the look-down capability of the satellites make it possible to obtain warning of missile launches from all land and sea areas on the planet, providing the US with highly reliable warning of either SLBM or ICBM attack

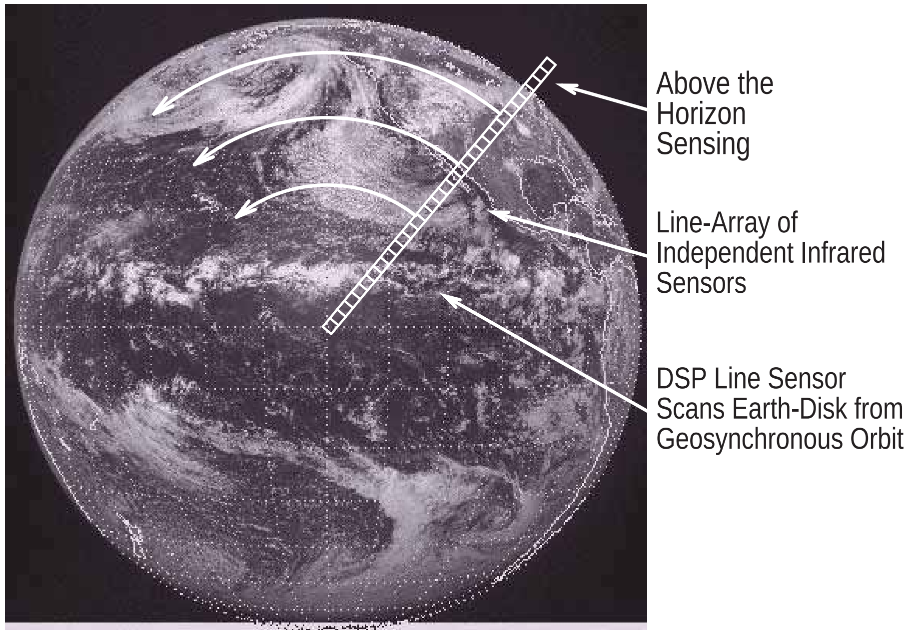
DSP-1 (Block 14) Satellite on Orbit



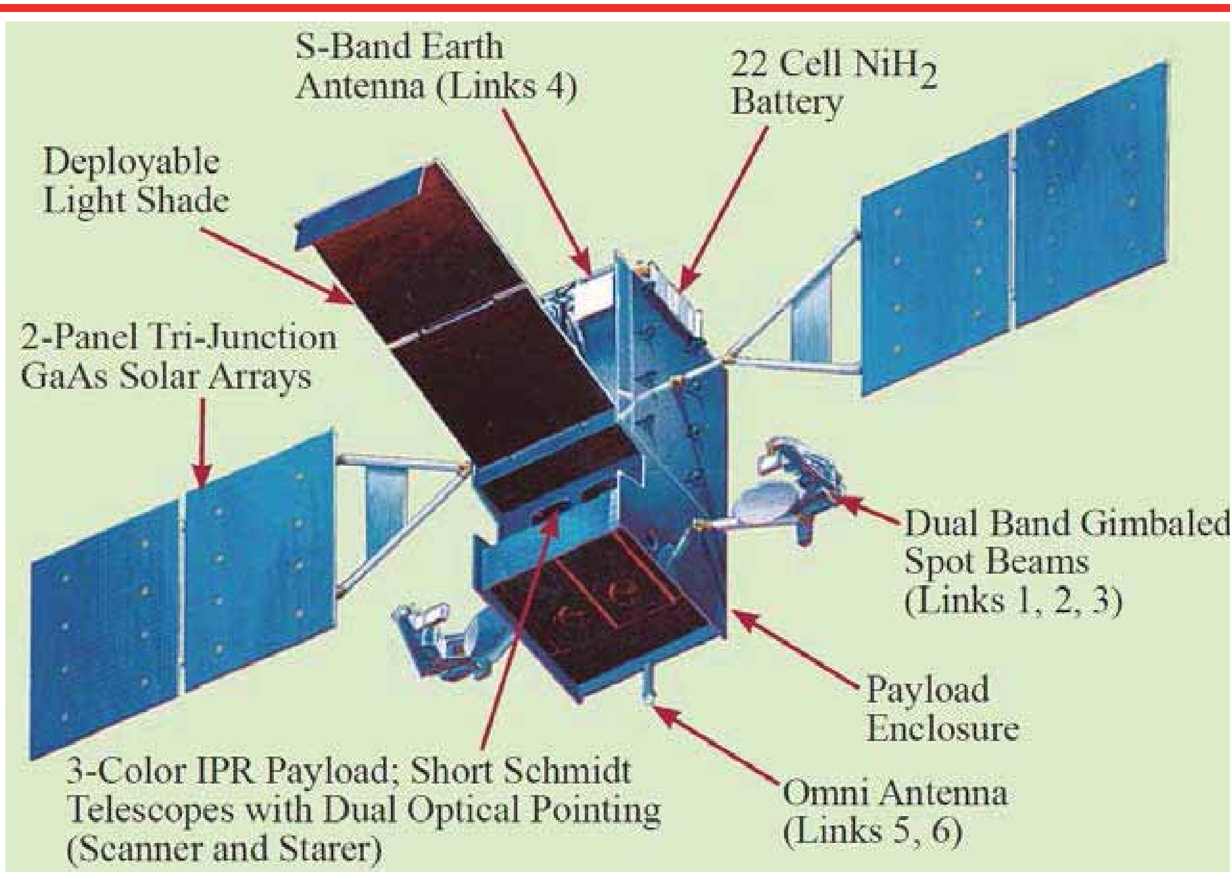
DSP Phase 2 Satellite –
First Launches
in Late 1975 and
Mid-1976



Subtraction of Sunlight Background Reflected From Cloud Tops
Ten Second DSP Revisit Time to Each Pixel

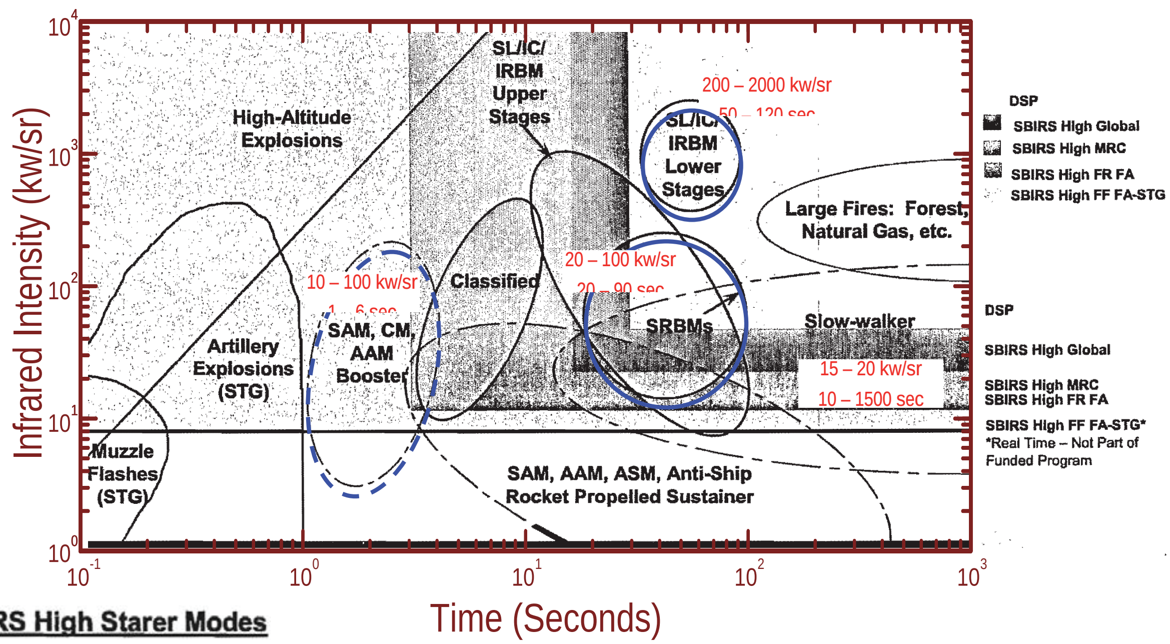


The Space-Based Infrared Satellite (SBIRS) Geosynchronous Spacecraft



Unclassified

Representative SWIR & STG Intensity and Duration of IR Events



SBIRS High Starer Modes

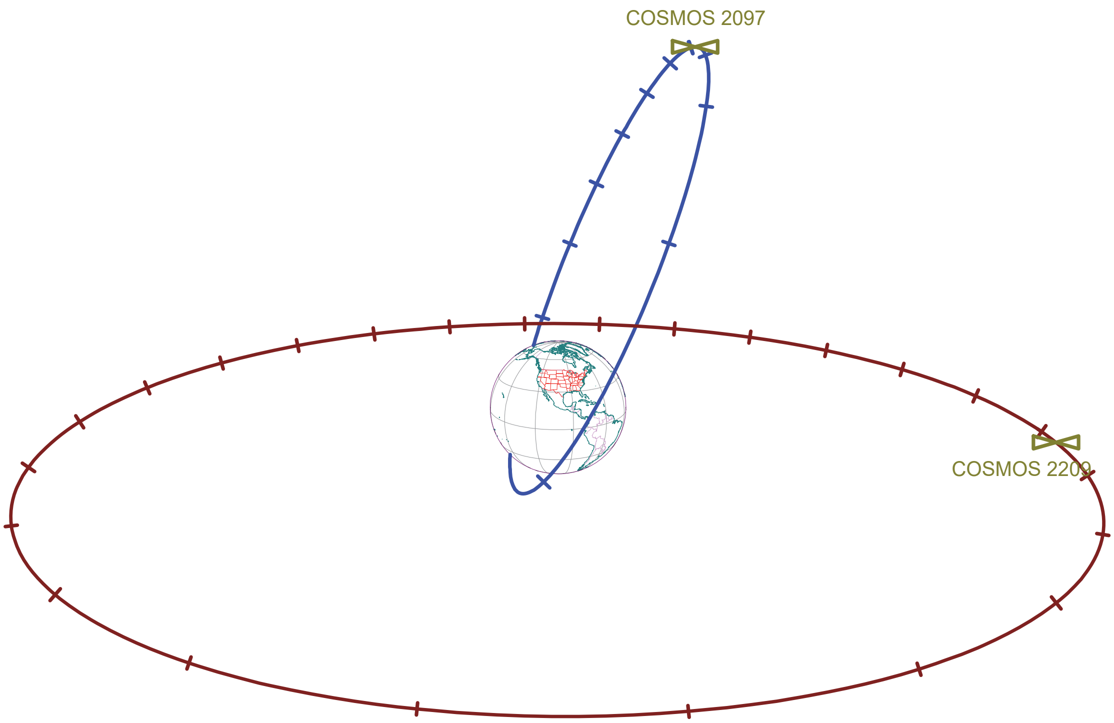
- Step-Stare - Theater Major Regional Conflict (MRC)
- Step-Stare - TI Fast Revisit Focused Area (FR FA)
- Dedicated Stare – Fast Frame Focused Area (FF FA)*
- *Step-Stare - TI High Sense Focused Area (HS FA) – not shown*

SBIRS Transformational Capability
Col. Roger Teague
Commander, Space Group
Space Based Infrared Systems Wing

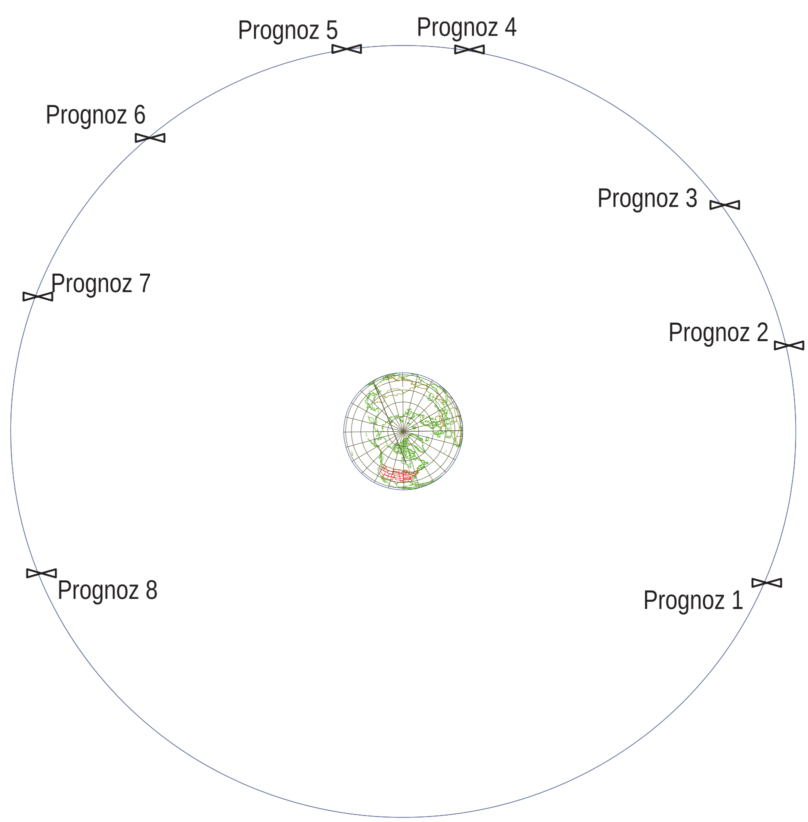
9

How Do the Characteristics and Capabilities of Existing Russian Space-Based Infrared Early Warning Systems Differ from those Deployed by the US

View of Cosmos 2209 and Cosmos 2097 Orbits

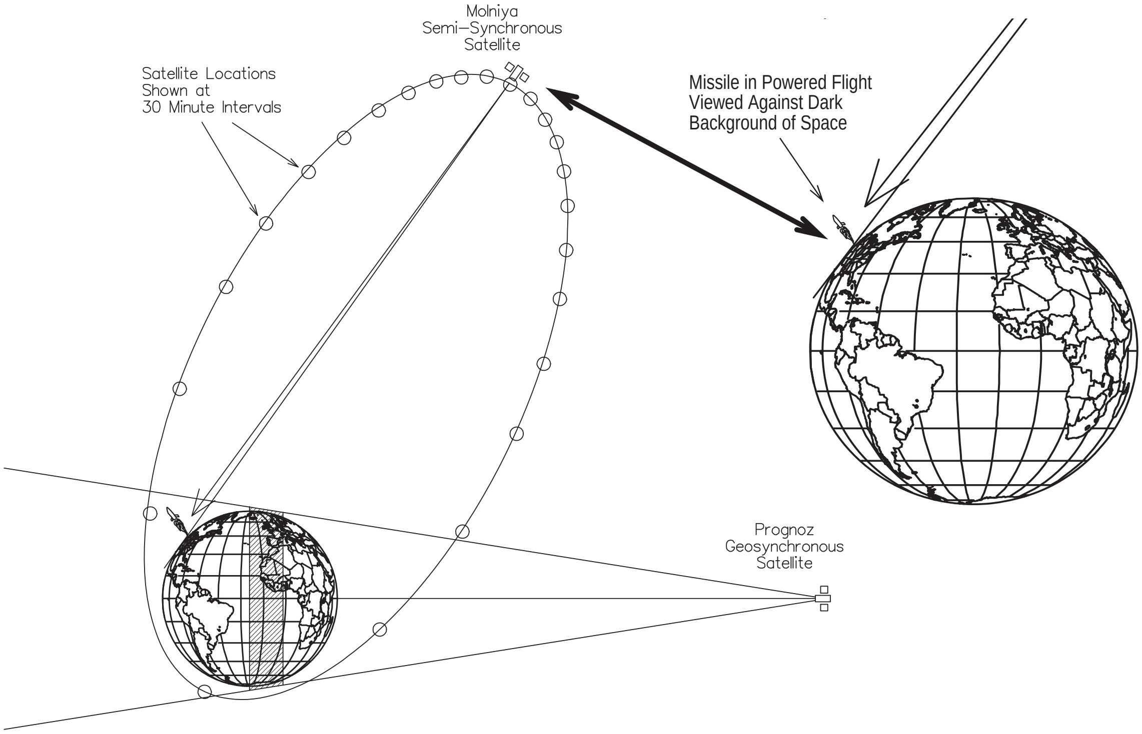


Russian and US Space-Based Early Warning Systems

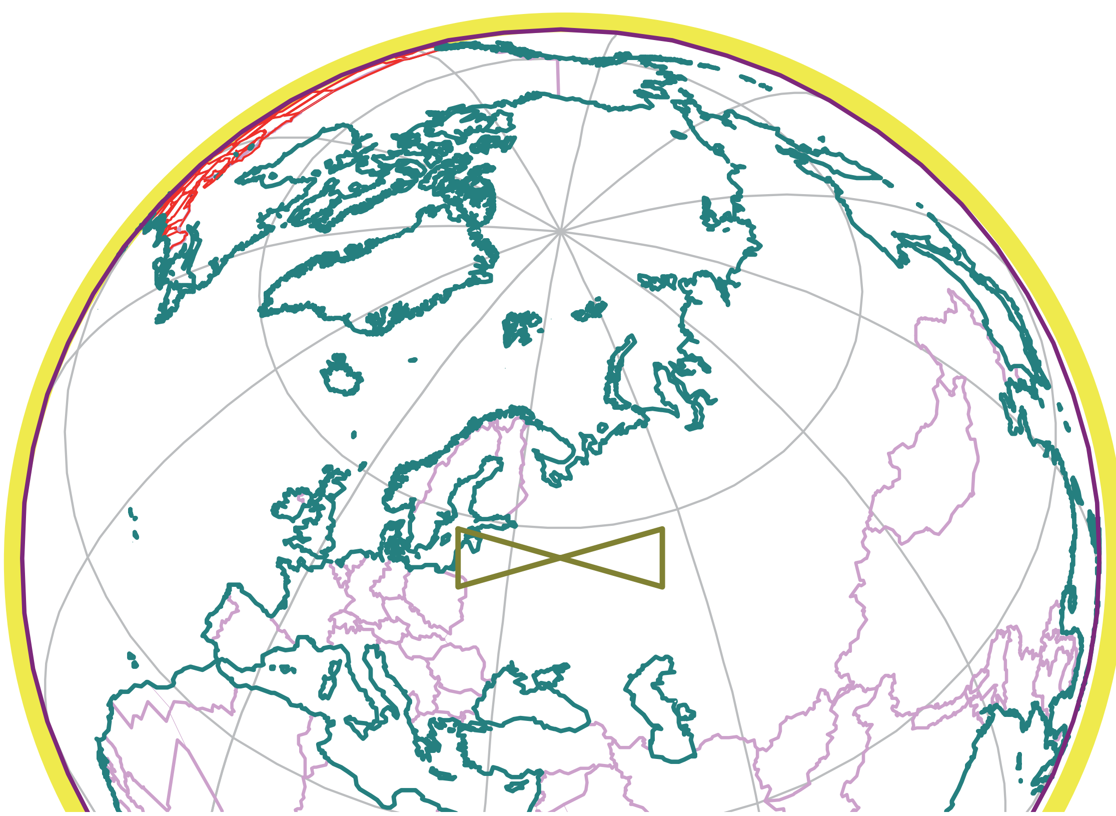


Russian Molniya Infrared Early Warning Satellite Constellation

(Nine Satellites Required for 24 Hour Coverage. Only Five Are Currently Operational in July 1998)

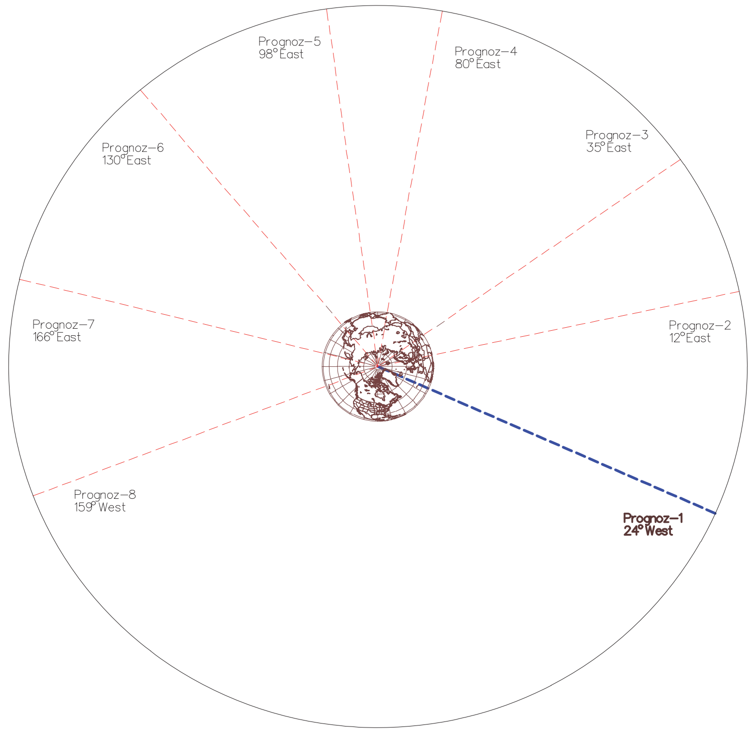


View of Earth from Cosmos 2097 at Apogee

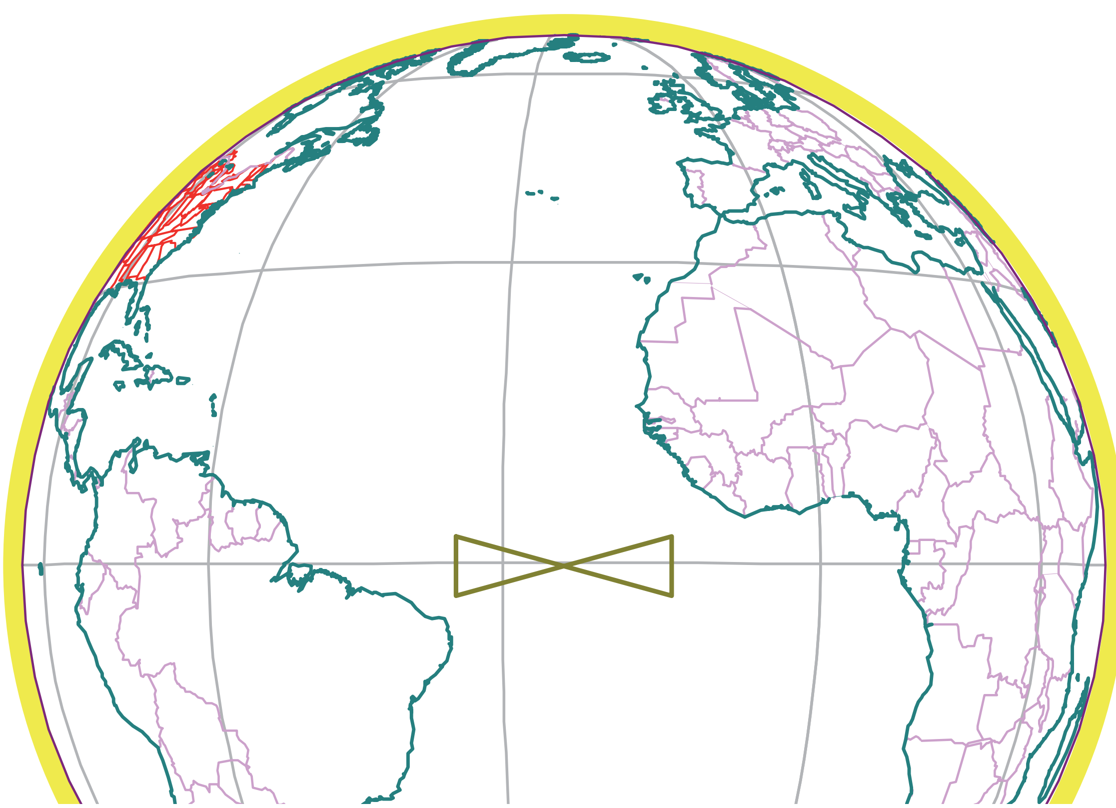


Russian and US Space-Based Early Warning Systems

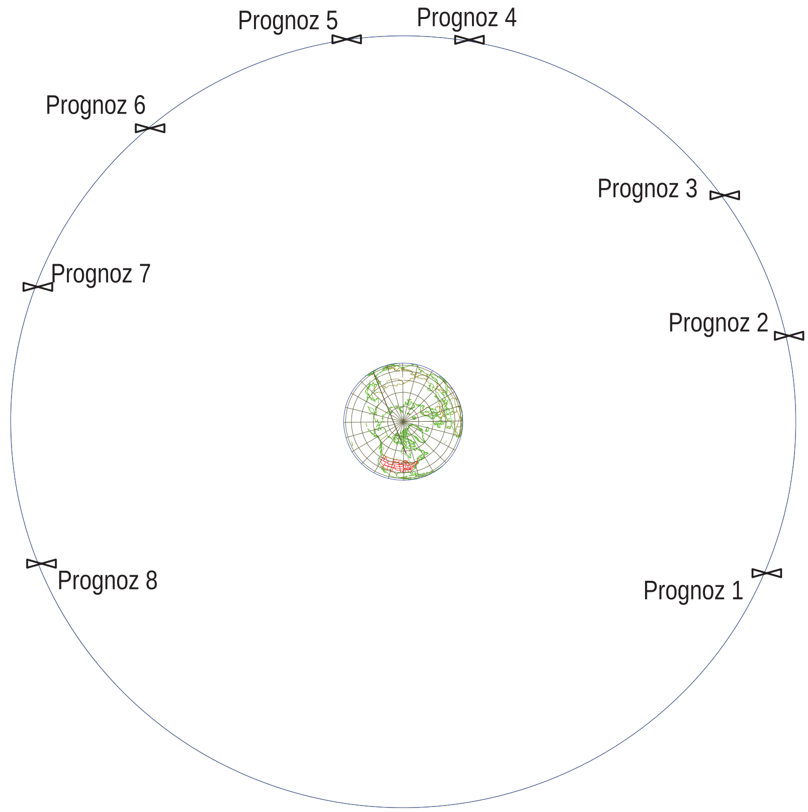
Geosynchronous
Satellite Stations
Reserved for
(But Not Necessarily
Occupied by)
the Prognoz Early
Warning



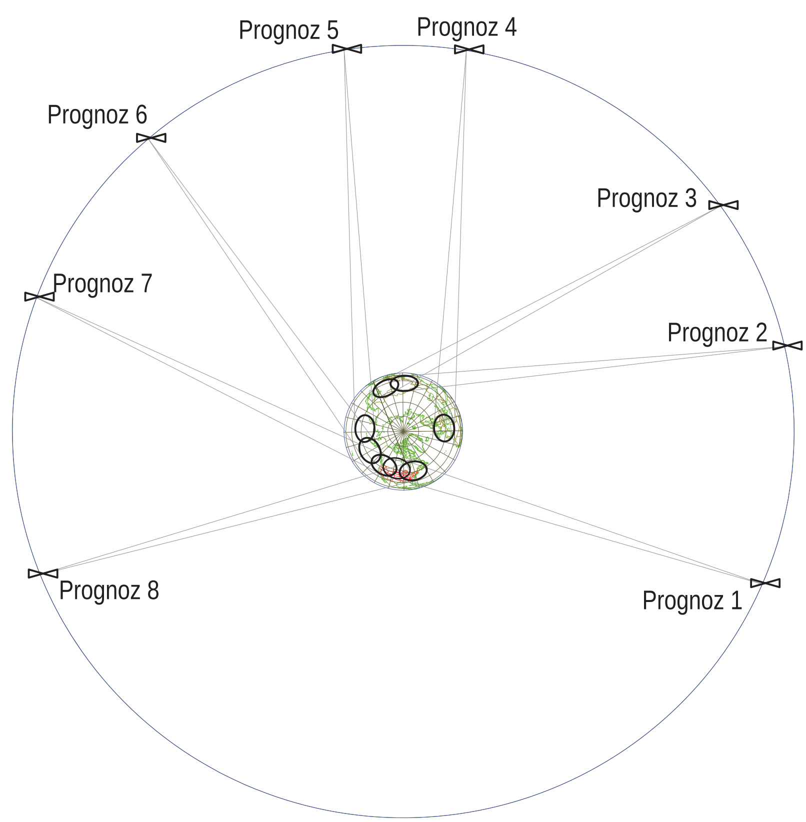
View of Earth from Cosmos 2297 at Apogee

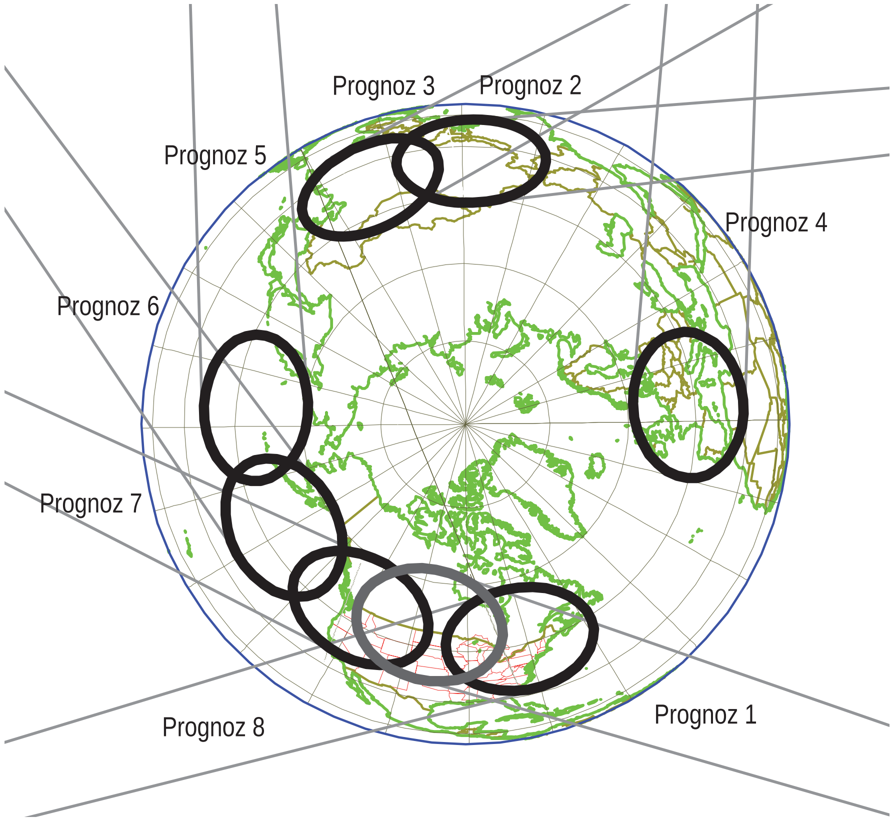


Russian and US Space-Based Early Warning Systems



Russian and US Space-Based Early Warning Systems

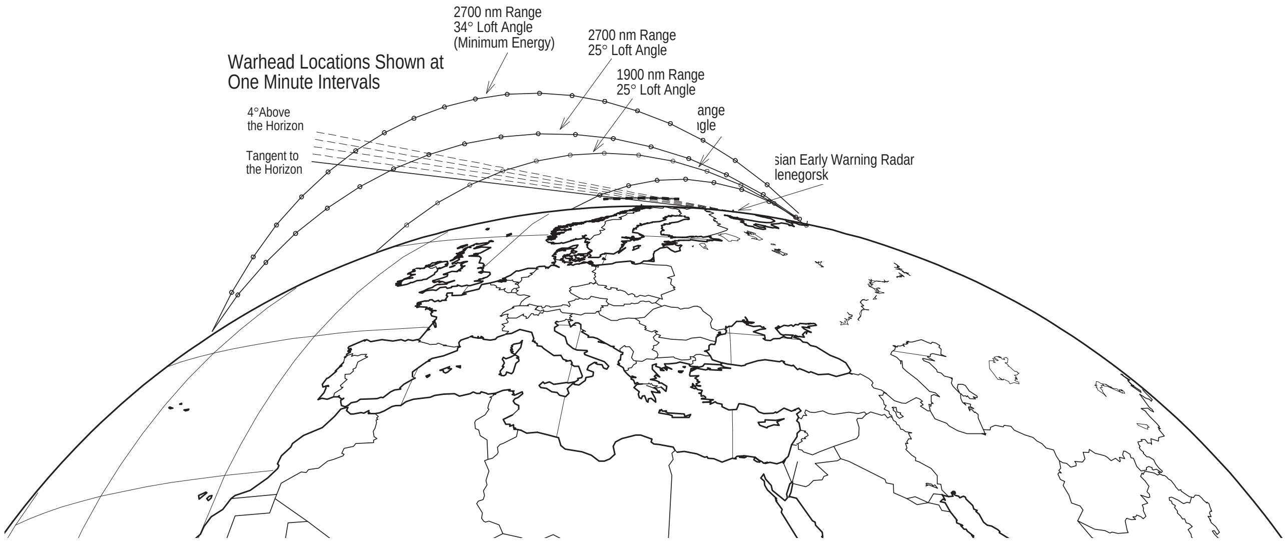




POINT OF INSTABILITY
Russian Early Warning of Nuclear Attack from US Submarines is Inadequate

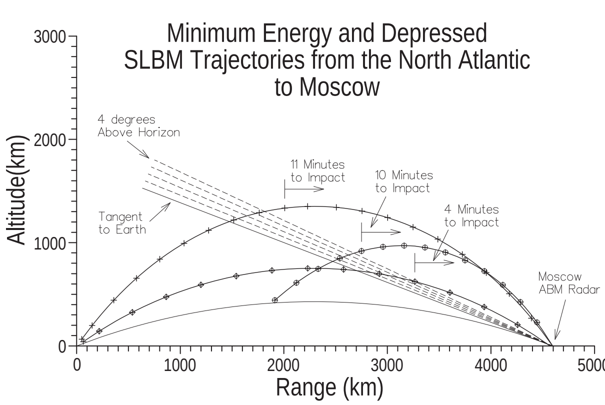
Line-of-Sight Constraints Associated with Early Warning Radars

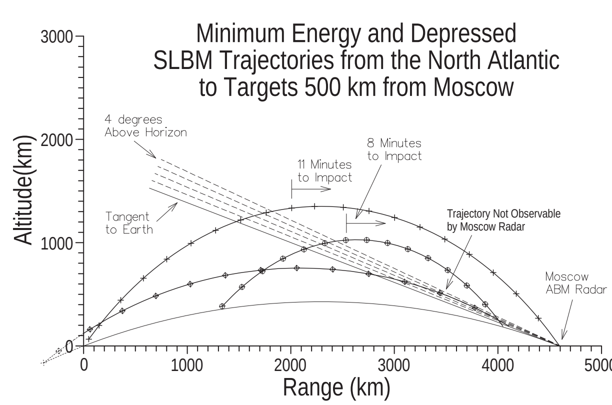
Line-of-Sight Constraints Associated with Early Warning Radars



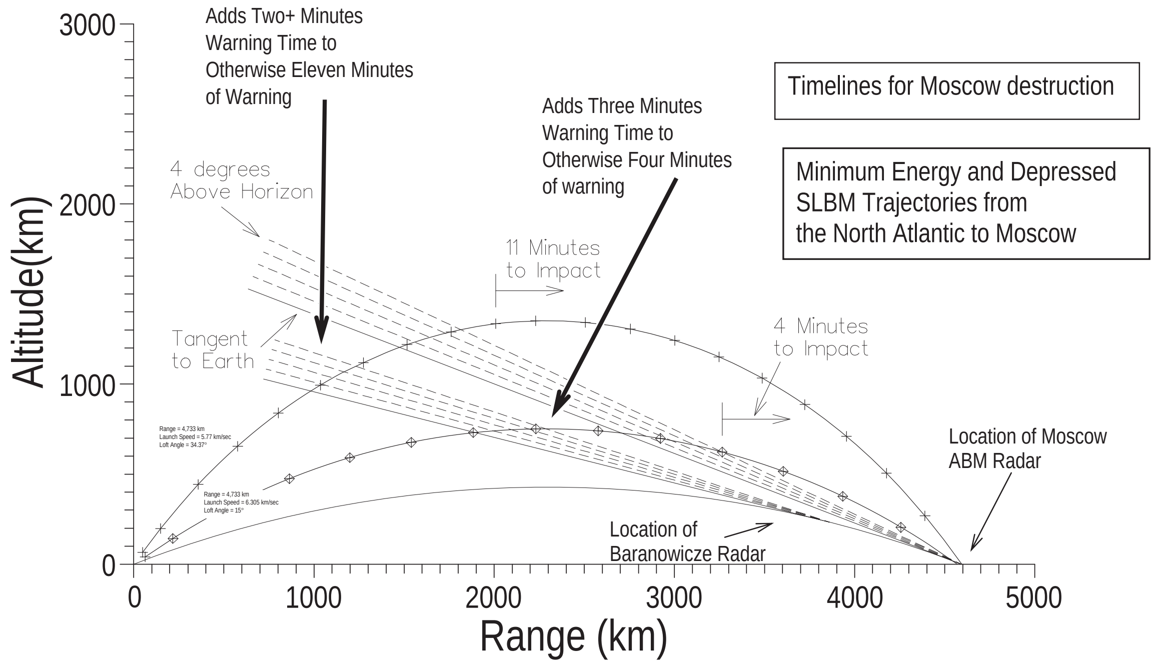
Russian Radar Early Warning Timelines

Timelines for SLBM Trajectories from North Atlantic Submarine Launch Areas that are Observable and Non-Observable by Moscow ABM Radars





Warning Times for Trajectories from North Atlantic Launch Areas to Moscow Within Baranowicze and Moscow Radar Fans



Estimated Time Needed to Carry Out Nuclear Launch-Operations No Matter What Response Is Chosen

Time Needed to Carry Out Basic Nuclear Weapons Launch-Operations

Time for attacking missiles to rise over the horizon into the line-of-sight of early warning radars	1 minute
Time for radars to detect, track, and characterize detected targets, and to estimate the size and direction of motion of targets	1 minute
Military and civil command conference to determine response	1 to 3 minutes
Time for command and unit elements of silo-based forces to encode, transmit, receive, decode, and authenticate a launch order	2 to 4 minute
Time for missile crews to go through full launch procedures	1 to 3 minutes
Time for launched missile to reach a safe distance from its launch-silo	1 minute
Total time consumed in unavoidable and essential operations	7 to 13 minutes

If a short time-line attack is attempted against Russia, a Russian response aimed at launching silo-based missiles before nuclear weapons detonate on them would require time for several technical operations. Time would also be needed by political leadership to assess the situation and decide whether or not to launch the silo-based missile force. The amount of time available for decision-makers to assess the situation and decide whether or not to launch silo-based nuclear forces is the difference between the time it takes for warheads to arrive at targets and the time needed to carry out operations no matter what response is chosen.