Ballistic Missile Defense Review: Next-Generation Missile Defense
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Good morning everyone. Thanks for the kind introduction. I'm happy for the opportunity to address this very important element of the defense of our homeland, deployed forces and allies.

Before I discuss the topic of the Next Generation Missile Defense, I would like to take just a moment to congratulate MDA and their industry partners on the tremendous success they've had in providing this nation with its first generation of integrated ballistic missile defense capability.

In the face of strong resistance from some in Congress and the prior administration, and overcoming numerous state-of-the-art technological challenges, MDA, along with the Services and COCOMs, have been able to successfully develop and deploy:

- Upgraded EW radars and new X-band radars in Alaska, California, UK, Greenland, Massachusetts, Japan, Turkey, Israel, and a powerful sea-based radar in Hawaii
- Hundreds of mobile PAC-3 interceptors and sea-based Standard Missile-3 interceptors on Aegis BMD capable ships
- Land-based SM-3 interceptors at the Aegis Ashore site in Romania with another scheduled to be completed in Poland in 2018
- Terminal High Altitude Area Defense (THAAD) batteries with the most recent keeping watch in South Korea
- Long range interceptors in Alaska and California with more planned by the end of 2017
- Operational command and control centers in Alaska, Colorado, Nebraska, Hawaii, Washington DC and Germany

The inventories and capabilities of the current interceptors and radars should continue to expand and improve.

But today, we are here to discuss the topic of the ongoing BMDR which should address our next missile defense generation.

This next generation should be a quantum leap from what we have today, taking advantage of our historic superiority in technology achievements.

So, what should our strategy be going forward?

Next Generation Missile Defense Strategy

Whether we are addressing the rogue nation threat or stepping up to defend the nation from peer or near-peer threats, we must no longer think in terms of building just “limited” missile defense capabilities.

And if fact, both the 2016 and 2017 NDAAs call for just such a change in thinking about missile defense.

These statutes describe developing "an effective, robust layered missile defense...” and “architectures for a hypersonic defense capability” as well as providing "a plan for developing one or more programs of record for a space based ballistic missile intercept layer..."

When you put these in the context of our overall national security strategy, you can draw the conclusion that we need to develop both the capability and capacity to defend against any and all missile threats from North Korea and Iran.

And that we have the capability to defend against any missile threat presented by Russia and China while building the necessary capacity to ensure continued deterrence when combined with our offensive forces.

In other words, we must develop a qualitative and quantitative defense against rogue nations, and a qualitative defense combined with our existing and planned offensive capabilities to deter peers and near-peers, and to win if deterrence fails.

The United States should begin the journey to develop next generation capabilities that will form the foundation for our missile defense strategy well into the future.

What are some of these needed capabilities of a next generation missile defense system?

Next Generation Missile Defense System Capabilities

1. **Global birth to death tracking and discrimination** to maximize interceptor effectiveness and kill assessment against both ballistic and maneuvering threats; this would enhance both homeland and regional defenses
2. **Ability to intercept warheads in complex threat suites** including advanced countermeasures and decoys

3. **Ability to handle substantial raid sizes** from rogue nations, and to handle enough of a raid by peers or near-peers to ensure an overwhelming strategic response
4. **Multi-object kill capability** to handle complex countermeasures and multiple warheads from a single missile
5. **Boost phase intercept/kill capability** to assist in the defense against substantial raids and complex threats
6. **Maneuvering target capability** for both tracking and killing
7. **Hypersonic defense capability** including surveillance, detection, tracking, targeting, fire control and intercepting
8. **Cyber robustness** of command and control systems, as well as the sensors and interceptors themselves
9. **Survivability** both in terms of numbers as well as functionality, including nuclear hardness
10. **Fully Integrated Offense and Defensive capability** to take advantage of the precision of the defense and the responsiveness of the offense.

Next Generation Missile Defense Programs

To provide these capabilities, the US should pursue a new portfolio of programs delivering in the near, mid and far term to continue to meet the evolving threats.

These programs should include:

- *A Space-Based Sensor Layer to Provide Precision Surveillance, Detection, Tracking and Fire Control*
- *Advanced Discrimination Algorithms and Techniques*
- *Multiple Object Kill Vehicles*
- *Advanced Interceptor X*
- *Boost Phase Directed Energy*
- *Space-Based Kill Layer*

Let's look at each of these programs in a little more detail…

Space-Based Precision Tracking (SBPT) Layer

We currently use space-based sensors to warn us of an adversary missile launch and then use the data to predict approximate impact points. These sensors do not, however, provide the accuracy needed to intercept the incoming warhead, so we rely on terrestrially based radars to provide missile tracks.

The ability to provide persistent, "birth-to-death" missile tracking can only be done cost effectively from space, and doing so improves discrimination of the warhead from countermeasures and other objects, as well as providing many other collateral benefits in terms of comprehensive U.S. space situational awareness.

Not only would a space-based tracking layer contribute to the defense of the U.S. homeland, the tracks would significantly expand the operating and defended areas of regional defenses. When integrated with terrestrial sensors, a space-based sensor layer would also enable tracking more advanced threats, such as maneuvering hypersonic missiles.

In 2009, MDA launched two Space Tracking and Surveillance System (STSS) demonstration satellites to determine the feasibility of providing intercept quality tracking from space. The results of the demonstration flights have been outstanding, and indicate that this capability is certainly achievable.

The United States should build an initial precision tracking constellation as a foundational capability. Further expansion and resilience could be added using more cost-effective and innovative approaches, such as putting payloads in commercial constellations and using other organizations' satellites as hosts.

Advanced Discrimination Algorithms and Techniques

In 2006, MDA began developing advanced discrimination approaches that were suspended by the MDA director in 2010 in favor of another path that did not materialize.

MDA has now revitalized these efforts, and *they should be continued and fully implemented in their terrestrially based sensors*.

In addition, there are several innovative contractor-developed approaches that significantly improve the ability of the BMDS to handle more complex threat suites. While outside the security scope of this talk, these efforts must be properly funded and deployed.

Multiple Object Kill Vehicles (MOKV)

No matter how much sensor discrimination capabilities are improved, they will never be foolproof. Therefore, the ability to destroy more than one "credible object" with a single interceptor is vitally important.

These credible objects could include decoys, simulated warheads, debris, post-boost vehicles, and empty upper stages. In addition, having a multiple kill capability addresses those threat missiles with multiple real warheads.

A similar program called Multiple Kill Vehicle (MKV) was launched by MDA under President Bush, and later canceled under President Obama. The value of such a capability was so compelling, however, that MDA established the Multiple Object Kill Vehicle (MOKV) program.

Each MOKV would have independently targetable kill vehicles that could be assigned to the credible objects. Each kill vehicle would steer itself to a target and destroy it.

Modern communications technologies, algorithms, and processing power could significantly enhance the overall effectiveness of this "swarming" approach.

MOKV is a critical element of the next generation of missile defense. It will enhance nearly all aspects of the missile defense challenge, including discrimination, raid size, and kill assessment.

MOKV capability could be provided to not only the GBIs but potentially also SM-3 Block II interceptors. The effort should be given the highest priority in the interceptor development portfolio.

When MOKV capability is combined with the first two initiatives of precision space-based tracking and advanced discrimination algorithms, the system begins to be able to handle even the most advanced threat suites.

Advanced Interceptor X (AIX)

Today we enjoy the protection provided by deployed interceptors that were the result of technology investments made by the US during the SDIO and BMDO phases in the 80s and 90s.

Likewise, it is time for the US to make investments in technology that will result in game-changing interceptor performance to defeat any missile threat from any country…rogue, near-peer or peer.

We have always relied on the superiority of disruptive US technologies to deter or defeat our enemies. Today should not be any different.

Now is the time to begin again to make the crucial investments to build an advanced interceptor capable of defeating even the most complex and capable missiles…including hypersonic threats.

There is technology today existing in US industry and laboratories to be able to achieve such a goal…it just requires the will and resources to do so.

Boost Phase Directed Energy

The optimum approach to ensuring the warheads are destroyed in the presence of countermeasures is to destroy the enemy missile before it has a chance to deploy either the warheads or countermeasures. In other words, destroy the missile in the boost phase.

Boost phase intercept provides advantages and disadvantages. The advantage in destroying the missile in its boost phase includes the destruction of the warhead without having to deal with the countermeasures.

The disadvantage is that the boost phase is typically short, so there is generally not time to launch a terrestrially based kinetic interceptor against many trajectories, especially against adversary countries that are geographically large.

Boost phase intercept is an ideal mission area for the use of a speed-of-light weapon such as a High Energy Laser (HEL). Using HELs against ballistic missiles is much more cost-effective than kinetic interceptors.

Today, we must fire multiple, multimillion dollar interceptors against a single threat missile. With a HEL, multiple threat missiles can be destroyed by a single laser magazine.

MDA experimented with just such a weapon, called the Airborne Laser (ABL), beginning in 2004 when it achieved first light and first flight of a megawatt-class HEL onboard a 747 aircraft.

After successfully destroying both a solid propellant as well as liquid propellant missile in 2010 flight testing, the program was canceled by the Obama administration.

Since the beginning of the ABL program in the 1990s, laser technology has come a long way. Today, there have been major advances in solid state and hybrid lasers.

At least one version, the Diode Pumped Alkali Laser (DPAL), promises to deliver high-power capability in a weight and volume to allow it to be deployed on high-altitude unmanned aircraft.

Operating in this regime and with a solid state or hybrid laser would avoid nearly all the technical issues encountered by ABL. It is now possible to have a lethal laser in the next 10 years capable of conducting the boost phase intercept mission from an airborne platform.

MDA has submitted a report to Congress and is in the process of detailing their directed energy roadmap to achieve boost phase intercept. Since ABL, funding for directed energy activities at MDA has been very limited. This needs to change and sufficient funding should be provided to achieve their goals.

Space-based Kill Layer

To meet the missile threats of the future, a move to a space-based kill capability is necessary. The geographies to be covered, the trajectories involved, and the complexity of the threat suites all lend themselves to a space-based kill approach.

Space is where missile defense began under President Reagan's Strategic Defense Initiative. The advantage of the ultimate "high ground" allows global coverage even in large geographies, shoot-look-shoot capability for many trajectories, and more.

In addition, a space-based kill capability can contribute significantly to overcoming the threat posed by hypersonic weapons.

This layer could initially consist of kinetic space-based interceptors (SBI) and later evolve to space-based lasers (SBL) as that technology matures.

The SBI layer should complement terrestrially based assets, and even a modest constellation of satellites with several kill vehicles apiece could have a significant impact on the U.S. ability to defend itself against more advanced threats.

Certainly, such a capability will contribute enormously to confounding the enemy's ability to ensure the destruction of any given target. Creating ambiguity in an adversary's mind concerning what he may be able to accomplish, with what probability, is one of the most valuable features of any missile defense architecture.

An SBI layer would expand the defended area to our allies around the globe as well, and could be used to support both regional and homeland defense.

As directed energy technologies continue to mature, and their size and weight continue to be reduced with increasing power levels, an SBL capability could then augment or replace the SBI capability.

This space-based HEL capability with multiple kills per magazine could address substantial threat missile raid sizes. To start down this path, the United States should fund the development of a space test bed to begin to explore the variety of technologies that could be brought to bear.

This test bed could explore constellation command, control, communications and battle management issues; long-term storage of propellants on orbit; space-to-space engagement environments, and more.

Some critics will state that this type of defense from space is counter to existing treaties such as the Outer Space Treaty of 1967, but that is not the case. The only ban on weapons in space is that of weapons of mass destruction, which obviously does not apply to either SBI or SBL.

So how do we achieve what I've laid out this morning? What are the first steps?

Stable Funding and Empowered Management

When we began the development and deployment of today's BMDS, MDA funding was targeted between $8-10B per year. It was understood that if they experienced overruns or challenges they would stay within this budget.

To be successful in building the required capabilities to meet tomorrow's needs, MDA's funding needs to be restored. A target range today of $10-12B per year would be the right level…which would still only represent < 2% of our annual defense budget.

To put this into context, if we took every penny the US has spent on missile defense since the SDIO inception in 1983 it would be ~ $200B. Compare that to the cost of 9/11 which has been put at $3.3T…and that attack did not involve a weapon of mass destruction.

So, if we prevent just one attack on a major US city, we will have repaid all of the investment to date for our missile defenses nearly 20 times over.

In addition, MDA must continue to be able move with agility, speed and empowered authority both from a programmatic as well as oversight perspective.

Some examples include maximum reprogramming flexibility with a restructured program element approach, minimizing the colors of money, re-establishing the MDEB with principals only and streamlining OSD staff oversight.

These special authorities are critical to the ability of this nation to keep abreast of the ever-accelerating missile threats.

I remember during my tenure one Washington Post reporter that continually asked me when MDA was going to become "normal" like other DoD programs.

Finally, one day I asked him which "normal" DoD program would he like us to emulate? He had no response and he never asked me again.

Whenever there is a change in administration or MDA leadership as is the case today for both, the bureaucracy in DoD will attempt to normalize MDA…this should not be allowed to happen.

In fact, I believe in today's increasingly dangerous world, more DoD programs should emulate MDA's approach to providing war-fighting capability to our forces.

MDA should take advantage of the current window with the new administration and Congress to reassert its existing authorities, recapture some of its empowerment and restore its funding levels.

Benefits of Missile Defense

I would also like to reiterate why it is important to continue to build an integrated missile defense system to protect our homeland, our forces and our allies**.**

First, building a robust missile defense system could dissuade adversaries from developing ballistic missiles in the first place, since their effectiveness would not be clear.

Second, without the protection of a robust missile defense, some nations capable of building their own nuclear weapons for defense might be incentivized to do so.

This would lead to further instability in regions such as the Middle East and the Asia-Pacific.

Third, a robust missile defense capability enhances deterrence by putting doubt in the mind of an attacker. Not knowing which of their offensive missiles would survive severely complicates an attacker's plan.

Fourth, missile defense can stabilize events in a crisis. For example, in 2006 when North Korea was preparing to launch the multistage Taepodong-2 (TD-2) missile and not providing any international notification as required by protocol, several senior former DoD officials called for a preemptive strike against the launch site, which would have been highly escalatory. President Bush decided to rely on the GMD system should the TD-2 missile threaten U.S. territory.

Fifth, missile defense provides the president and other senior commanders an option other than preemption or retaliation, and provides critical additional decision time when faced with an accidental or rogue-directed launch

Finally, and most importantly, if deterrence fails, it is the only option available to destroy warheads once they are launched.

Closing

In closing, as we look toward the future, I believe it is important to look at the past and ensure we do the right thing. Just imagine where we would be today if the country had followed the missile defense critics.

Most of the technology resident in our sensors and interceptors deployed today is based on the research and development that was started under President Reagan's Strategic Defense Initiative.

If the country had listened to the liberal opposition to missile defense like Senators Ted Kennedy, Gary Hart, Robert Byrd and Congressmen Tip O'Neill that program would have been cancelled.

The deployed, integrated ballistic missile defense capabilities we enjoy today are only possible because President Bush withdrew the US from the ABM Treaty.

And again, thankfully, we did not follow Senator Carl Levin, the Senate Armed Services Committee's Democratic chairman in 2001, who threw down a stark

challenge, saying that if President Bush withdraws from the ABM treaty, Democrats are likely to block American missile defenses that do not adhere to principles of that arms control agreement, even if defunct.

Even today, in the face of tremendous success, critics decry missile defense as a destabilizing effect, too costly and not technically feasible.

Most of this criticism coming from the arms control crowd who fundamentally believe we should protect ourselves through agreements alone.

We are at a critical crossroads because the science, technology, research and development we choose to invest in today will dictate the type of missile defenses we have far into the future.

We must make the right decisions.

So, I'll finish where I started…congratulations to the hard-working, dedicated men and women at MDA, the Services, COCOMs and Industry who have provided this nation with its first generation of missile defense capabilities.

Now is the time to build our next generation and we need to get on with it!

Thanks for your attention and I look forward to your questions.