December 6, 2018
UCS BACKGROUNDER
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What to Expect in the Trump Missile Defense Review

The Trump administration's missile defense review (MDR) was expected to appear sometime around the February release of the administration's Nuclear Posture Review, but has been delayed for nearly nine months. This delay suggests that either significant areas of disagreement had to be resolved or the administration wanted to avoid releasing it while embroiled in a sensitive foreign policy initiative with North Korea, or both. In any case, it is likely to be released in the next few weeks.

Congress, in its FY17 National Defense Authorization Act (NDAA), asked for a review of the capability, policy, and strategy to defeat missiles, including "left of launch" options that would stop missiles from being developed or launched in the first place, as well as passive and active measures, kinetic and non-kinetic systems. The MDR will likely call for expanding current theater and strategic ballistic-missile defense systems and developing new systems to defend against such threats. It may even endorse developing new systems to defend against new classes of threats.

This review is late, but even without a new high-level mandate, the FY18 and FY19 budgets already significantly expanded funding for existing missile defense systems. Congress also has gotten ahead of the administration and added requirements in the FY19 NDAA for the Pentagon to scope and develop new systems, including space-based missile defenses, drone-based interceptors, and defenses against hypersonic delivery systems.

Below are some of the issues to look out for.

Boost-Phase Ballistic Missile Defense

The MDR likely will propose new boost-phase missile defense concepts. Boost-phase defenses target an adversary's missiles while their engines are still burning just after they are launched to avoid dealing with decoys and other countermeasures, which can significantly impede defense effectiveness. Because the boost phase of intercontinental-range missiles lasts only three to five minutes (and less for shorter-range missiles), hitting a missile in powered flight requires a defense system to be near an adversary's launch site. Boost-phase proposals include placing interceptors or lasers on ships, drones, airplanes, and satellites.

1. Space-based boost-phase system

A key question is whether the MDR will call for a space-based missile defense system to intercept long-range missiles. (Interceptors or lasers in space should not be confused with space-based sensors to detect and track missiles.) Whether or not the MDR endorses the concept, the FY19 NDAA directs the Pentagon to develop a regionally focused, space-based boost-phase missile defense program and to potentially hold a live-fire boost-phase intercept test in fiscal year 2022 although Congress has not provided funding to cover these activities. The defense bill

also directs the Pentagon to examine space-based lasers, not only interceptors, but laser technology is far from being ready for such a mission.

The problem with a space-based missile defense system, however, is it would be exorbitantly expensive, easy to overwhelm or defeat, and politically destabilizing. Even a regionally focused, space-based missile defense would require hundreds of orbiting interceptors and cost hundreds of billions of dollars. (Claims that this could be done with a much smaller system are not correct). A 2012 congressionally mandated study by the National Academies of Science and Engineering concluded that a space-based, boost-phase missile defense system would cost 10 times more than any terrestrial alternative. A system with an "austere," or simple, capability to counter a few North Korean missiles, for example, would cost at least $300 billion. But even that amount of money would not produce an effective defense. Its interceptor constellation would be vulnerable to an attack by anti-satellite weapons and could be overwhelmed by a salvo of missile launches.

Space-based boost-phase missile-defense interceptors would have an inherent capability to attack satellites, not only those that are close to Earth but also those in more distant geosynchronous orbits. Thus, even a small number of boost-phase interceptors deployed as a "testbed" would be perceived by US adversaries and allies alike as the first dedicated weapons based in space. Some adversaries might respond by developing similar capabilities or attacking US space-based interceptors from the ground. In either case, deploying even a rudimentary system would increase the potential threat to US satellites and increase the risk of conflict.

Advocates in Congress have consistently inserted language promoting such a system in successive defense bills despite the fact that the Pentagon has not asked for any funding for the concept in a decade. In 2016, then-Missile Defense Agency Director Vice Admiral James Syring testified, "I have serious concerns about the technical feasibility of interceptors in space, and I have serious concerns about the long-term affordability of a program like that." In early September of this year, Under Secretary of Defense for Policy John Rood also was less than enthusiastic, stating that a decision to deploy weapons in space is "some time away given the level of examination" required for such a significant step.

Key Questions

Will the MDR reverse the longstanding reluctance of both Democratic and Republican administrations to pursue space-based missile defenses that has held for more than a decade? If so, what factors have changed that would lead to such a significant change?

2. Air-based boost-phase systems

North Korea's geography—a relatively compact peninsula—allows for the possibility of deploying defenses on its periphery. They could be sea-based or air-based. A regional boost-phase defense system against North Korean ICBMs would have potential advantages. The system is designed to catch launched missiles before they can deploy countermeasures that can confuse or overwhelm midcourse defenses. Compared to space-based, boost-phase defense systems, which require large constellations of interceptors, they can be effective with fewer deployed interceptors or lasers, keeping costs relatively low. And unlike ground- and ship-based

midcourse defense systems, they can potentially be designed to interfere minimally with Chinese and Russian nuclear forces, preserving strategic stability.

The Airborne Laser system was just such a program, but it was cancelled in 2010 because its technology and operational concept were not workable.

Describing another approach, the current director of the Missile Defense Agency, Lt. General Samuel Greaves, told Congress earlier this year that F-35 aircraft could target boosting missiles with their air-to-air interceptor missiles. However, these systems are only good at very close range and after the defense has air superiority, and therefore are not strategic systems. Moreover, it would be very expensive to keep a large number of these systems patrolling in the air for extended periods of time.

Currently the focus of boost-phase defense research and development is on high-powered lasers carried by patrolling drones. This program would require developing technology that does not yet exist and it is not clear it will ever be feasible.

The MDR may include other boost-phase options such as a drone-based interceptor. The House FY19 NDAA funds a Federally Funded Research and Development Center study of this concept. (See Section 1676.) Drones would be based around 125 miles (200 kilometers (km)) from North Korea's borders, where they would be relatively protected from North Korean anti-aircraft defenses. Such a system, which could feasibly be based on existing technology, would be stationed far enough away from Chinese and Russian land-based ICBMs to target them.

Key questions

Will the MDR shift the focus away from midcourse defense systems toward regional boost-phase systems for defense against long-range missiles?

Cruise Missile Defense

Unlike ballistic missiles, which have a short stretch of powered flight and then fall predictably under the force of gravity (with much of the travel in the vacuum of space), cruise missiles travel by continuous powered flight under aerodynamic lift using the atmosphere, more like airplanes. Cruise missiles can fly close to the Earth's surface, and therefore can avoid detection by radars and other sensors designed to track ballistic missiles.

While the United States fields defenses against cruise missiles in the theater, Congress required the MDR to address the threat of cruise missiles against the US homeland. Because existing cruise missiles do not have intercontinental range, any cruise missiles targeting the US homeland must be launched from submarines, ships, or airplanes. However, earlier this year Russia announced that it plans to develop a nuclear-armed *and* nuclear-powered cruise missile that theoretically would have intercontinental range.

Cruise missiles can maneuver so that their trajectories approaching and within US airspace could be complex and unpredictable. Simply detecting and tracking them is a challenge. In addition, because they travel in the atmosphere, the defensive interceptors that could engage them would have to have relatively short ranges. The US homeland is a very large area to defend, so such a

defense would almost certainly only be considered for key sites. Past research and development on sensors (the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System, aerostat-based radars) was expensive and failed to produce a workable system.

Key questions

What kind of area will the MDR propose defending from cruise missiles, if any? And how it would to better than the last attempt?

Hypersonic Missile Defense

In the FY17 budget, Congress established a program for defending against hypersonic "boost-glide vehicles" and conventional prompt-strike capabilities. Boost-glide systems deliver weapons by carrying them on ballistic missiles to a high altitude and speed and then releasing them to glide in the atmosphere toward their target. A key difference between delivery by boost-glide vehicles and ballistic missiles is a boost-glide vehicle can maneuver in the atmosphere. Ballistic missiles, once launched, follow a predictable path. Hypersonic delivery systems travel at faster speeds than cruise missiles, but slower than long-range ballistic missiles.

Because hypersonic vehicles spend most of their time at relatively low altitudes, they present a tracking and interception challenge. Unless a boost-phase system was in place to attempt to intercept the missile launching the glider, intercept would need to take place within the atmosphere. Such a defense would require a different set of sensors than ballistic missile defense.

Additionally, all the currently fielded long-range missile defenses (Ground-based Midcourse Defense, Aegis ship-based missile defense) operate in midcourse, when targets are in the vacuum of space. Their interceptors cannot engage targets within the atmosphere. The Terminal High Altitude Area Defense (THAAD) and Patriot missile defense systems can engage targets in the atmosphere but defend a relatively small footprint (around 125 miles (200 km) and 12.5 miles (20 km), respectively). Like cruise missiles, if the hypersonic defense system is intended to defend particular sites, such as military facilities in the theater, such systems might be the right size. But very large numbers of defense units would be needed to defend larger areas.

The FY18 budget included some $70 million for this effort. The administration requested $120.4 million in FY19 and Congress added additional money to accelerate its development.

Key questions

At this time, no country has developed a working long-range hypersonic delivery system. Given the technical difficulties of defending against such a threat, could it be addressed more effectively by cooperatively agreed limits on the technology? The administration has not embraced the idea of negotiated constraints, but now is the right time to explore that option.

Expanding the Ground-based Midcourse Defense System

The Trump administration already has made clear that the Ground-based Midcourse Defense (GMD) system is a priority, directing Congress in November 2017 to add $4 billion of emergency missile defense funding to the administration's 2018 budget request, including $568

million to build a new interceptor field at Fort Greely and $393 million to start building 20 more interceptors with a redesigned kill vehicle for the GMD system. The FY18 authorization bill called for increasing the number of GMD interceptors from 44 to 72 and developing a plan to field as many as 104 at the current sites, and for another 104 at a third future, to-be-determined site. However, new interceptors cannot be acquired until a new kill vehicle has been designed and tested, which will not occur for several years. This largesse continues in the Trump administration's 2019 request, which includes an additional expenditure of nearly $1.5 billion to support GMD expansion and nearly as much to improve the system's interceptors and sensors. The MDR is likely to cement the GMD system's importance to the administration, despite the fact that it is extremely expensive and has a poor track record.

The Pentagon has already spent tens of billions of dollars on the system, and the Government Accountability Office estimates the GMD system will cost at least $67 billion. Since the GMD system was declared operational more than 15 years ago, it has failed to destroy its target in six out of 10 tests, despite the fact that the tests were conducted under artificially simplified conditions.

The system, currently the only one designed to protect the United States from long-range ballistic missiles, would almost certainly fail to provide effective defense against a real attack. Meanwhile, a marked increase in the size and capability of the GMD system could prompt Russia and China to improve or expand their own nuclear capabilities. Regardless, the program has faced little meaningful resistance in Congress or in successive presidential administrations.

Midcourse missile defenses such as the GMD system are vulnerable to decoys and other countermeasures. In the vacuum of space both the heavy warhead and lightweight look-alike decoys travel follow the same paths since they are unaffected by atmospheric drag, making it difficult to discern the real threat from fakes.

The Missile Defense Agency has responded to criticism about the system's vulnerability to decoys and countermeasures by funding new discrimination radars and proposing a space-based infrared sensor system to track targets for a longer time. That would not address the fact that decoys can be made to appear indistinguishable from real warheads to radars and infrared sensors. Nearly 20 years ago, the National Intelligence Estimate of Foreign Missile Developments stated that Iran and North Korea could develop penetration aids and countermeasures by the time they flight-test their missiles. That is still true today.

Key questions

The GMD system is mainly oriented to defend against North Korean missiles and the administration is doubling down on the system. But the administration has been focused on a diplomatic track with North Korea. Will the MDR lay out a broader strategy to deal with North Korean missiles and the eventual scope and size for the GMD system?

Additionally, the Missile Defense Agency conducted an environmental assessment for a third US site for the GMD system, the results of which were due last year. The Pentagon evaluated three sites: Fort Drum, New York; Fort Custer, Michigan; and Ravenna, Ohio. Congress required the MDA identify the most promising site. Will the MDR identify a site, and will it recommend building it?

Defense Against Whom?

An important question the MDR will answer is the relative balance between theater and regional missile defense and strategic defense. The MDR will lay out the policy and strategy, and the execution of this policy should be seen in the administration's budget requests. The Obama administration's 2010 missile defense review shifted focus to regional defenses with less emphasis on homeland defense.

Currently, the administration is pursuing more of everything. The administration requested supplements to the FY18 budget that included substantial increases both for strategic systems such as the GMD as well as regional and theater systems, such as the Navy Aegis Ballistic Missile Defense (BMD) system and the Terminal High Altitude Area Defense (THAAD) system. The current budget continues to fund them at a high level.

The THAAD deployments in South Korea and Guam are intended to defend sites from North Korean missiles. The Aegis BMD ships in east Asia are intended for regional defense against North Korean missiles, and ships based out of Rota, Spain, and the Aegis Ashore sites in Romania and Poland are intended for NATO defense against Iranian missiles. The Aegis SM-3 IIA missiles under development with Japan will be significantly more capable than the current SM-3 IB interceptors and will have some capability to intercept intercontinental-range missiles. Indeed, Congress in its FY18 Authorization Act has required the Pentagon to test this capability against a long-range missile by 2020.

Describing a relatively limited scope for missile defense, the Trump National Defense Strategy states: "Investments will focus on layered missile defenses and disruptive capabilities for both theater missile threats and North Korean ballistic missile threats." It does not envision the possibility of defending against a long-range missile threat from near-peer states, such as Russia and China, or one from Iran.

The National Security Strategy is more explicit. While it calls the "revisionist" powers of Russia and China one of the US' primary challenges, the Trump administration takes pains to point out that missile defense is not meant to defend against them:

> The United States is deploying a layered missile defense system focused on North Korea and Iran to defend our homeland against missile attacks. This system will include the ability to defeat missile threats prior to launch. Enhanced missile defense is not intended to undermine strategic stability or disrupt longstanding strategic relationships with Russia or China.

Until 2016, US missile defense policy was guided by a 1999 law, the National Missile Defense Act, which was carefully negotiated by Congress and called for deploying an effective system to defend against a limited missile attack on the United States. This was understood to be missiles from a country such as North Korea or a small accidental attack by China or Russia. In 2016, Congress rewrote the legislation, with little substantive debate. The Act no longer constrains missile defense to be focused solely on a limited threat, rather the scope has been expanded to "the developing and increasingly complex ballistic missile threat."

Congress' instructions for the MDR requires that it considers cruise missile threats to the US homeland and future hypersonic delivery vehicles, mainly from China and Russia. It is also possible that the MDR will create an even more expansive mandate and include potential long-range missile threats from China and Russia. Even if China and Russia are not explicitly made the focus of US missile defenses, a significant buildup of strategic-capable ballistic missile defenses, including the GMD system and the Aegis ship- and shore-based missile defense, will likely have strategic implications for them.

Key questions

The set of threats missile defense is designed to address has steadily expanded. However, the Pentagon and Congress have yet to provide a rigorous assessment of what the requirements would be for taking on these threats, the cost-effectiveness of building such systems, or the arms control implications of developing the systems. The national defense strategy did not include Chinese and Russian ballistic missile arsenals in its set of threats, though hypersonic and cruise missile defense are likely to be. Will the MDR?

Background on the Missile Defense Review

The Obama administration released its own Ballistic Missile Defense Review in 2010, but the scope of the Trump review will be much broader by congressional direction. The mandate, detailed in Section 1684 of the FY17 NDAA, directed the administration to perform a "review of the missile defeat policy and strategy of the United States" conducted jointly by the secretary of defense and the joint chiefs of staff. The MDR is to cover "left- and right-of-launch" missile defense for both regional and homeland purposes and include defense measures from passive to active, across all platforms—land, air, sea, and space. The MDR must address defense from ballistic missiles, hypersonic glide vehicles deployed from ballistic missiles, and cruise missiles targeted at the US homeland.

Congress required some accountability mechanisms. The MDR must set standards for the military utility, operational effectiveness, suitability, and survivability of these systems as well as their near- and long-term costs and cost-effectiveness. It is also supposed to address the impact of countermeasures and denial-and-deception practices on the system's capability. The director of cost assessment and program evaluation must report annually on the progress of the implementation of the strategy. The MDR must be submitted in unclassified form, though it may have a classified annex.

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