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FACT SHEET

Space-Based Missile Defense

A space-based boost-phase missile defense system is intended to target ballistic missiles in the first few minutes of flight, while the missile's engines are burning and providing a bright target.

Proponents argue that by engaging a missile during boost phase, the defense could avoid the difficult, unsolved problem of discrimination that plagues systems designed to destroy warheads during midcourse phase—after the engine burns out and when the warhead is traveling above the atmosphere. Specifically, in midcourse, lightweight decoys and other countermeasures can confuse the defense and keep the interceptor from destroying the warhead. Boost-phase defense would target the missile before it deploys warheads and countermeasures. In addition, a boosting missile is a more attractive target than a warhead because it is large, easy to detect (given its large plume), and vulnerable to attack (it is not hardened).

Because of these advantages, there is a recurring interest in developing a space-based boost-phase missile defense system. However, these advantages are vastly outweighed by the unavoidable drawbacks of such a system. In particular, many hundreds of orbiting space-based interceptors (SBI) are required to defend against just one or two missiles—an extremely expensive approach. Even setting cost aside, space-based missile defenses have inherent vulnerabilities that strongly limit their effectiveness.

Space-Based Defenses: Enormously Expensive, Inherently Ineffective

Boost-phase is short because the engines burn for only a few minutes, so boost-phase interceptors must be located near the launch site to reach the missile before it burns out. Thus, SBIs must be stationed in low-altitude orbits. However, in these orbits SBIs move rapidly with respect to the ground and cannot stay over any one location on Earth. Therefore, ensuring that at least one interceptor is within reach at all times of even a single missile launch site requires many SBIs in orbit.

The National Academy of Sciences 2012 report on boost-phase defenses ["Making Sense of Missile Defense"] stated that space-based boost-phase missile defense would require hundreds to several thousands of orbiting interceptors. Even if North Korea is limited to relatively slow, liquid-fueled missiles, several hundred SBIs would be required to defend against a single missile. This estimate is consistent with a 2003 American Physical Society study, which showed that a constellation of many hundreds or thousands of SBIs would be required to provide limited coverage against ballistic missiles launched from areas of concern. Doubling the number of missiles that a space-based missile defense could engage requires doubling the size of the constellation.

> *The National Academy estimates [space-based missile defense] to be 10 times as expensive as any other alternatives, at least $300 billion for a limited capability.*

Given the technology expected for the next decade, each SBI would weigh up to a ton or more. As a result, deploying such a system would be enormously expensive: the National Academies estimates it to be 10 times as expensive as any other alternatives, at least $300 billion (in FY 2010 dollars) for a limited capability. Launching several hundred to several thousand tons of material into orbit and replenishing the constellation would exceed current U.S. launch capabilities. As a benchmark, at present just over 500 U.S.-owned satellites are actively operating in Earth orbit, including commercial, scientific, and military satellites, half of which were launched more than a decade ago. Additionally, such a system would raise significant issues for crowding, debris mitigation, and traffic management in space.

Even if Built, Space-Based Missile Defense Can be Defeated

Yet even if a complete SBI constellation was built and the technology worked perfectly, it would not provide a reliable defense, for two reasons. First, it could be quickly overwhelmed by simultaneously launching multiple missiles from one location, as a constellation of hundreds to thousands of interceptors provides only one or two SBIs in position to reach any given launching missile in time to destroy it.

Second, an attacker could "punch holes" in the system using attacks intended to remove interceptors. Because SBIs would be in low-altitude orbits they could easily be detected and tracked from the ground; an adversary would know their current and future locations. As a result, any SBI would be vulnerable to attack by relatively inexpensive short- or medium-range missiles. These missiles could loft homing ASAT weapons at the SBIs, and would burn out at too low an altitude to be intercepted by the SBI. By destroying relatively few SBIs in this way, an attacker could create a gap in the defense through which it subsequently could launch its long-range missiles.

Moves toward a globally-based missile defense capability will strain important strategic relationships, in particular with China and Russia.

In short, an enormously costly defense based on deploying hundreds or thousands of SBIs is vulnerable to defeat by a handful of enemy missiles.

Space-Based Interceptors and Space Control: Reducing U.S. Security

Even a small number of SBIs, deployed in the guise of a test bed, can be problematic even while bringing no defensive capability. SBIs could have a significant ability to destroy satellites, which travel in predictable orbits with speeds similar to those of long-range missiles. Homing on a satellite rather than a boosting missile would require a different (possibly additional) sensor on the SBI, but an observer on the ground would not be able to tell which sensor the SBI was carrying. Additionally, SBIs would require very high thrust and maneuverability, which would allow them to reach and attack satellites in geosynchronous orbits as well as those in lower orbits.

Developing such a clearly capable space-based destructive ASAT weapon may encourage similar development by other countries, and reduce the security of the United States, which depends heavily on space. Additionally, a constellation of SBIs would be ineffective as a defense against direct-ascent ASAT attacks on U.S. satellites for the same reasons it is not adequate as a missile defense.

Funding Even Small Space-Based Missile Defense Projects Is a Bad Idea

Moves toward a globally-based missile defense capability will strain important strategic relationships, in particular with China and Russia, all without reaping any capability. Congress has been getting consistent advice over many years that space-based missile defense is not a technically or economically feasible solution to the development of long-range ballistic missiles, and no technological breakthrough has changed this. The United States has difficult choices ahead in deciding how and whether to fix its ailing Ground-Based Midcourse Defense homeland missile defense system in a constrained fiscal environment, but space-based missile defense is not a viable alternative.

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