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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, yet they push potential adversaries to counter their deployment in ways that hurt U.S. security overall.

## 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 able to reach even a single missile launch site requires large numbers of 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 launched from the same location that a space-based missile defense could engage requires doubling the size of the constellation.

> ***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.***

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. While the costs of launching into space may significantly decrease in the future, in these estimates, getting the interceptors to orbit comprises 40 percent or less of the total cost. So even a decrease in launch cost by a factor of 10 would not make this affordable. Additionally, launching several hundred to several thousand tons of material into orbit and replenishing the constellation would exceed near-term U.S. launch capabilities. As a benchmark, at present around 600 U.S.-owned satellites are actively operating in Earth orbit, including commercial, scientific, and military satellites. Half of those were launched more than a decade ago.

The Pentagon has not requested any money for space-based missile defense since 2008. In 2016, the Director of the Missile Defense Agency, Vice Admiral James Syring, testified that "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."

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

Yet even if a complete SBI constellation were built and the technology worked perfectly, it would not provide a reliable defense. It could be overwhelmed by the simultaneous launch

of multiple missiles from one location, a capability North Korea has demonstrated. 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. While ground-based defenses can be defeated by a salvo attack, each additional ground-based interceptor would be in the right place to be used against an additional adversarial missile. A space-based defense must essentially replicate its entire constellation to have an additional defensive interceptor in place.

An attacker need not use relatively expensive long-range missiles to mount a successful salvo attack. An SBI would be vulnerable to attack by relatively inexpensive short- or medium-range missiles. These missiles could loft anti-satellite weapons at one or more SBIs, while burning out at too low an altitude to be intercepted by them. These shorter-range missiles could also be used to "punch holes" in the system: using them to destroy relatively few SBIs to create a gap in the defense which can be exploited later with long-range missiles. 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.

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

While an SBI constellation has been described as potentially providing protection against direct-ascent anti-satellite attacks on U.S. satellites, in reality it would be ineffective in that role. It may be simply overwhelmed in the same manner that it would in a missile defense role.

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

Some members of Congress have proposed funding a "space testbed" that would build prototype SBI and the necessary ground support facilities, and begin to test SBI in orbit. However, even a testbed project would be destabilizing internationally and would ultimately undermine U.S. security. Space-based interceptors are inherently anti-satellite weapons. Satellites 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 what types of sensors the SBI was carrying. Additionally, the high thrust and maneuverability required of SBIs would allow them to reach and attack satellites in geosynchronous orbits as well as those in lower orbits.

As a result, putting prototype interceptors in space would be viewed by adversaries and allies alike as putting the first dedicated space weapons in orbit. It would likely encourage development of similar technologies or other types of anti-satellite weapons by others. This would reduce U.S. security, which depends heavily on secure access to satellites. The centerpiece of Russia and China's proposal for a space security treaty is the prevention of placing weapons in space, and space-based missile defenses has long been a contentious issue. The United States could enhance its security by working to keep these weapons out of space, rather than leading the way in developing and deploying such weapons.

Moves toward a globally-based missile defense capability will strain important strategic relationships, in particular with China and Russia, while not protecting the United States or its allies. 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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