Space-Based Interceptors

Still Not a Good Idea

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Clothing designers know that fashion is cyclical—styles ebb and flow in popularity, but they keep coming back. Oddly enough, this maxim is starting to seem true for national security too. The same enemies, areas of conflict, and weapons programs keep resurfacing, which sometimes is understandable. In other cases, however, it seems unfathomable why certain programs continue to receive political and financial support. Space-based missile defense is one of the latter cases. It was originally conceived by the Reagan administration in the 1980s as part of an impenetrable bubble that was to protect the United States against an onslaught of missiles from the Soviet Union. Today, the Pentagon is once again examining the basing of interceptors in space as part of its overall missile defense program, despite continuing scientific and engineering challenges—as well as prohibitive costs—to developing and deploying on-orbit weapons for this, or any other, mission.

The Bush Administration's own version of "Star Wars" indicates that the United States is ready to abandon its decades-long policy of restraint regarding the weaponization of space. Even more worrisome, the current U.S. administration is pursuing the elusive and dangerous policy goal of dominating space in the absence of a serious public debate about the ramifications for U.S. security and global stability.

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Rejected, Embraced, Rejected. Through much of the Cold War, space-based missile defenses were considered so destabilizing and technically challenging that neither side regarded the pursuit of such systems as reasonable. Indeed, the 1972 Anti-Ballistic Missile (ABM) treaty between the United States and the Soviet Union, designed to preserve nuclear stability, specifically forbade their development. The ABM treaty's Article V spelled it out: "Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, *space-based*, or mobile land-based [emphasis added]."[1]

A historic change in U.S. policy toward missile defense—and specifically toward space-based interceptors (SBIs)—came with President Ronald Reagan's March 1983 speech announcing his "Star Wars" program. Reagan's Strategic Defense Initiative (SDI) called for the basing of interceptors in space to defend some 3,500 potential U.S. "targets" against Soviet missile attacks.[2] The U.S. Department of Defense's Strategic Defense Initiative Organization launched its formal SDI development and acquisition program in 1986 and envisioned initial deployment in 1997, to include both space-based and ground-based interceptors.[3]

The program faced huge technical hurdles and enormous projected costs, as well as a backlash from Congress and the American public. Indeed, even the uniformed military was skeptical of the program, particularly because the projected price tag for developing and deploying SDI (which ranged from $30 billion to $200 billion) was seen as likely to eat into conventional service priority programs.[4] Acutely aware of ongoing technical and cost issues, the Pentagon redesigned in 1989 the plans for the SBI originally envisioned in their initial Phase I architecture, replacing the concept of several hundred large satellites equipped with multiple interceptors with a new architecture, which envisioned thousands of smaller, individual interceptors orbiting alone rather than housed within a large satellite "garage," and networked together under a concept called "Brilliant Pebbles."[5]

After launching a review in 1989 due in part to technological issues and in part to the new international landscape after the fall of the Berlin Wall, President George H.W. Bush redesigned the missile defense program in 1991, calling it "Global Positioning Against Limited Strikes" or GPALS. GPALS would have kept the Brilliant Pebbles concept, but reduced the system's planned coverage capability, requiring it to intercept only some two hundred warheads launched by "rogue states."[6] Under President Bill Clinton, however, the missile defense program was radically restructured to focus on theater- and ground-based missile defense, and Brilliant Pebbles was quietly dropped.[7]

Embraced Again. The administration of George W. Bush came into office in 2001 with a resolute commitment to missile defense, which by 1994 had become by a tenet of the Republican Party as part of the "Contract for America."[8]

Under Bush, the newly re-named Missile Defense Agency (MDA) ambitiously began to investigate how to achieve missile defense, raising concerns from arms control advocates that the United States was stretching the boundaries established by the ABM treaty.[9] In December 2001, Bush announced that the United States was giving a six-month notice of intent to pull out of the ABM

treaty. With Washington's June 2002 abrogation of the treaty, the only international agreement which forbade space-based missile defenses was rendered null and void.

Free as a Bird. Freed from legal restraints, MDA began to reexamine concepts for missile defense that had been earlier abandoned, including SBIs. In December 2002, MDA officials announced that the agency was opening a search for a contractor to develop a ground-based kinetic energy boost-phase interceptor (KE-BPI), possibly to be followed by a space-based test bed. In the Fiscal Year (FY) 2003 defense budget, $30 million was appropriated for space-based kill vehicles.[10] Although these funds were not spent because MDA officials had decided that the contractor for a space-based KE-BPI would not be selected until after choosing one for a terrestrially-based interceptor, space-based kill vehicles resurfaced in the next budget cycle. Tucked into MDA's FY 2004 budget request was a request for a $14 million space-based missile defense test bed. Following criticism from congressional Democrats, MDA reversed course in the summer of 2003 and announced that the space-based KE-BPI program was being put on hold, citing budget constraints and technological concerns.[11]

Yet MDA's stated trepidation about the technological readiness of SBIs was not enough to stop the program from going forward. In DoD's FY 2005 budget request, MDA re-embraced the concept of an SBI test bed. While only $10 million was requested for the program, MDA officials told congressional staffers and the media that the goal was to undertake on-orbit experiments in the 2010 time frame, and deploy an initial constellation of three to six interceptors in 2012.[12]

Arguments for SBIs. The current concept of space-based missile defense is focused primarily on intercepting ballistic missiles in their boost-phase shortly after launch using kinetic energy, or hit-to-kill missiles. Boost-phase intercept is attractive to missile defense planners for technical and strategic reasons.

From a strategic viewpoint, intercepting a missile over an enemy's own territo ry is obviously a better option than waiting until the missile is closer to home.

There are three main technical reasons cited by those favoring boost-phas. First, a missile which is in its boost phase burns very brightly and shows up vividly on radar, making it a fairly obvious target. Second, missiles are at their slowest speed during their boost phase. Third, missiles which are still undergoing booster burnout have not had time to deploy decoys or other countermeasures, unlike in the mid-course phase.[13] Scientists have long been concerned about the challenges of defending against these countermea sures and, given the test record of the current ground-based Midcourse Missile Defense program, little progress is likely in the foreseeable future.[14] Therefore, any system that could negate ballistic missiles before they release countermeasures

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would be an attractive one.

However, ground-, sea-, and air-based boost-phase systems would all face geographical limitations for several reasons. First, the speed of required intercept is a challenge. ICBMs burn out very quickly, about three minutes for solid-propellant missiles and four minutes for liquid-propellant missiles, but an interceptor would have less time than that to make the kill because, at a minimum, some 45 to 65 seconds would be required to detect and track the launch.[15] Further, the useful range of interceptors is limited by their speed and the intercept time requirements.[16] Space-based interceptors (SBIs) would overcome the location problem. As a scientific study recently concluded, "boost-phase interceptors fired from orbiting satellites could in principle defend the United States against ICBMs launched from anywhere on Earth. [...] Their coverage would not be constrained by geography."[17]

Space-basing Limitations: Size, Weight, and Cost. An SBI would likely comprise a kinetic kill vehicle, rockets for on-orbit maneuvering, and a "life jacket" that would provide the support and station-keeping needed to ensure that the SBI satellite functions throughout its designated lifetime. Under design now by the Pentagon and weapons laboratories is, according to officials familiar with on-going studies, a constellation of relatively small interceptors that would be based in Low-Earth orbits and would ease the adoption of trajectories toward regions of concern.

However, there are critical questions about the size and weight of the constellation that would be required to provide a meaningful defense. MDA officials and supporters of space-based interceptors at the U.S. national laboratories argue that only 300 to 600 interceptors would be required at a cost of $50 billion.[18] Some of Reagan's original Star Warriors, such as former Ambassador Henry (Hank) Cooper, have even argued that a Brilliant Pebbles-like program could be revived and deployed for as little as $10 billion.[19]

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These calculations are widely disputed by independent scientists. A study by the non-partisan American Physical Society, for example, determined that in order for an SBI system to be capable of intercepting a single solid-fueled ICBM launched from North Korea or Iran during its boost phase, "at least 1,600 interceptors would be required for a system having the lowest-possible on-orbit mass and providing an optimistically short time to construct a firing solution... Such a system would have a mass in orbit of at least 2,000 tonnes (metric tons)."[20] Considering that current launch costs for Low-Earth Orbit payloads hover at $22,000 per kilogram, fielding even this minimal space-based KE-BPI capability would cost $44 billion in launch costs alone.[21] The APS study, basing its estimate on those of the U.S. national intelligence community, assumed that "countries of concern" could obtain solid-fuel missile technologies in ten to fifteen years.[22]

This baseline analysis by APS stemmed from the appreciation that the ground trace of the satellites over the earth would necessitate a very large constellation of very high speed, and thus very heavy interceptors to ensure that potential trouble spots are adequately covered. The APS panel based its report on the assumption that the interceptors would accelerate at an average rate of 10-g, adding 4 km/s of velocity to the kill vehicle, and have an 820 kilogram mass (not including the lifejacket, which is estimated to have a mass that would be 50 percent of the interceptor's).[23]

The APS study did not examine how exactly this constellation of 1,600 interceptors would be managed on orbit, but it is evident that the command and control (C2) costs would be tremendous, as would the challenge of creating a C2 network that could guarantee space situational awareness and an up- and downlink system that would be one hundred percent reliable.

Space Weaponization: The Debate Is Launched. Even if SBIs were technologically feasible and cost effective, there would still be one major concern regarding their development: basing interceptors in space would open the door to weaponizing space, a move that would prove extremely destabilizing to international security and thus to the United States.

If the United States decides to deploy weapons in space, then it is guaranteed that other countries will follow: the United States is not only a model for accepted behavior by state actors all around the world, but other powers will also grow uneasy if the United States aggressively pursues space hegemony.[24]

One only needs to look at how Russia, no longer considered an adversary, has reacted to the planned U.S. missile defense deployment to gain an indication of the unease with which other nations are regarding U.S. efforts. In February 2004, Russia held the biggest exercise for its strategic forces in nearly two decades. Afterwards, Russian President Vladimir Putin announced that his strategic forces will soon "receive new hypersound-speed, high-precision new weapons systems that can hit targets at intercontinental distance and can adjust their altitude and course as they travel."[25] According to Col.-Gen. Yuri Baluyevsky, first deputy chief of the General Staff of the Russian Armed Forces, this maneuver reentry vehicle "would make any missile defense useless."[26] This whole new class of weapons is being developed to make sure that Russia is still relevant in the face of the U.S. missile defense deployment.[27] This gives some context to the way U.S. actions can motivate arms development by other nations, and sets the stage for how Russia might react to the development of space-based defenses.

Current allies regard U.S. intentions in space with apprehension as well. The European Union has decided to establish its own version of a satellite navigation network, known as Galileo, so that it will not be beholden to the United States' Global Positioning System (GPS). The overall Galileo project is projected to cost 3.25 billion euros, with 200 million euros now expected from China and a similar contribution from India.[28] That is a significant investment to confirm that the Europeans will not be harmed by a possibly uncooperative U.S. government in the future. U.S. allies in Europe are all on record as supporting U.N. sponsored talks, known as

the Prevention of an Arms Race in Outer Space (PAROS) aimed at an eventual space weapons ban. Indeed, the United Nations General Assembly has passed a resolution supporting PAROS every year since 1981; and PAROS became an item on the agenda of the Geneva-based Conference on Disarmament in 1982 where it remains on the table today.[29] While PAROS is supported by a majority of the world's nations, it has in the past fallen afoul of big-power politics among the United States, China, and Russia. Today, the discussions remain stalemated in large part due to shifting U.S. priorities and the Bush administration's disdain for international treaties.

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Snowball Effect. The mere act of weaponizing space will set in motion a series of moves by other countries that would threaten U.S. space assets. Despite the wide gap in capabilities and spending between the U.S. military and the rest of the world in space plans, the United States can be rendered vulnerable by relatively inexpensive, rudimentary technologies. If other countries genuinely believe that the United States intends them harm using space assets, these counteractions cannot be ruled out. Regular ballistic missiles could possibly be modified to provide anti-satellite capabilities. U.S. ground stations could be attacked, harming command and control to the point where space systems would be made worthless. A low-yield nuclear warhead placed on a ballistic missile could menace satellites in Low Earth Orbit. Or something as basic as gravel, unleashed at the right time against a satellite, might degrade U.S. space capabilities to a dangerous low.[30]

Along those lines, orbital debris from space weapons cannot be overlooked. The smallest chips can prove lethal at the astonishing high speeds in which objects orbit the Earth—some 10 km per second in Low-Earth Orbit.[31] The destruction of satellites or space weapons would undoubtedly spawn scores of dangerous new objects that could collide with satellites and spacecraft. Presently, the U.S. Air Force's Space Surveillance Network tracks some 13,000 on-orbit objects, only about 6 percent of which are working satellites and spacecraft, the rest being debris.[32] While improving U.S. space situational awareness is currently a high priority for the Air Force, space weapons would only add to this already-challenging space surveillance mission.[33]

Blinded Eyes in the Sky. Space weapons also would be highly destabilizing for global security. Space-based weapons would be high-value but highly vulnerable military assets, thus imparting a "use it or lose it" mentality on their operators. That is, because such space assets might be quickly made useless by a first strike, the urge to employ them in a conflict before they are made ineffectual would no doubt be strong. Such hair-

trigger weapons could lead the United States very quickly into a disaster in a time of hostilities.[34]

During recent war games, military commanders have been stunned at how quickly the employment of space weapons escalated conflicts into nuclear war. If mil itary commanders cannot see what their adversaries are doing, an ability provided primarily by those same, highly vulnerable space based assets, they must assume the worst and act accordingly.[35] The real-life implications of that fact are haunting.

Aside from the threat of nuclear conflict stemming from the use of weapons in space, U.S. commanders would also have to worry about their basic military fighting capabilities. At present, the U.S. military is more dependent on the use of space than any other. Even the loss of civilian satellite capacity would harm the military. During Operation Iraqi Freedom in 2003, 80 percent of the military's communications in-theater was provided by commercial satellite networks.[36] About one-third of the 30,000 munitions dropped on Iraq were GPS-guided.[37] A disintegrated satellite picture, whether it was military or commercial, would have a ripple effect on U.S. national security.

Only Part of A Trend. For the rest of the world, the $10 million MDA is hoping to have for its space-based BPI test bed is worrisome because of what it bodes for the future. Does the United States intend to slip into the weaponiza tion of space by paving a path through its missile defense program? Many observers think so. Canadian analysts in particular are nervous that their country will be initially brought on to assist with ground-based missile defense command and control, but then find itself in a few years irreversibly entwined in a system and a strategy that results in weaponizing space. That would firmly go against the Canadian government's long-standing policy of promoting a space weapons ban, and even more firmly against the wishes of the Canadian public.[38]

More removed observers see both the U.S. missile defense program and a possible arsenal of U.S. space weapons in the light of Washington's recent actions abroad. Many nations are concerned that the strategy of "dominating the ultimate high ground" is indicative of an overall aggressive posture by the United States under which only unilateral goals are considered. The leaked 2002 Nuclear Posture Review[39] and interest in a new-generation of "bunker buster" nuclear weapons, the 2003 "preemptive" invasion of Iraq, the February 2004-released U.S. Air Force Space Command Strategic Master Plan for FY 06[40] that spells out how the service intends to guarantee "space control"—these illustrate a disturbing pattern of behavior by the Unit ed States. To put it simply, the United States is seen by many other nations as not being a supportive player in the international system.

Conclusion. A space-based missile defense program would drain U.S. financial resources, be years in coming, and in the interim create a hostile environment that would immediately make the United States less secure. Moreover, by opening the door to the weaponiza tion of space, it represents a short-sighted policy that, in the long run, would undermine international security as well. The U.S. Congress should put the brakes on current MDA plans, or the United States will be at risk of propelling itself into a new arms race that it cannot win.

NOTES

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