Deterrence and Space-Based Missile Defense

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During the Cold War, the United States relied on the nuclear triad to deter ballistic missile threats emanating from the Soviet Union. Today, the threat is expanding to include rogue elements and proliferators of missile technologies undeterred by Cold War methods. Missile technology is growing despite political attempts to stop it. The United States and other nations are fielding advanced missile defenses to counter the threat posed by proliferating ballistic missiles. However, this air-, land-, and sea-based missile defense architecture lacks redundancy and depends on the proper positioning of assets to intercept missiles in their midcourse and terminal phases of flight. This architecture also lacks a reliable capability to intercept missiles during the boost phase—a capability perhaps best provided from space.

Deterrence before Ballistic Missile Defense

The Department of Defense (DOD) defines *deterrence* as a "state of mind brought about by the exis-

tence of a credible threat of unacceptable counteraction."[1] "Counteraction" conjures up Cold War images of massive retaliation and vulnerability when the adversary could threaten not only vital interests but also national survival. In the absence of ballistic missile defense (BMD), the US military could not negate or counter the missile threat facing the nation without retaliating in kind. Effective deterrence denies an adversary the benefits of his actions, imposes costs, and/or encourages restraint.[2]

The United States refined its deterrence strategy during the Cold War from massive retaliation to mutual vulnerability to assured destruction. Massive retaliation, a policy adopted by the North Atlantic Treaty Organization in 1954, threatened an overwhelming nuclear response to any Soviet aggression.[3] Limited options forced the United States into a position of fighting fire with more fire or, more precisely, fighting threats with more threats.

Massive retaliation evolved into mutual vulnerability in the late 1950s, when the Soviet Union appeared to match US nuclear capabilities: "With each side vulnerable to a nuclear strike by the other, nuclear weapons no longer conferred a simple military advantage, and their use could not be threatened unilaterally to deter general aggression by a nuclear-capable opponent."[4] Mutual vulnerability made sense in a time when BMD could not negate or even reduce the threat.

As the Soviet Union and United States continued to increase their nuclear arsenals, mutual vulnerability was bolstered with assured destruction. In the 1960s, the strategy of assured destruction "required each side to possess a guaranteed second-strike capability, one which could survive the opponent's massive, and possibly unanticipated, first strike."[5] This strategy did not eliminate mutual vulnerability because one side's ability to defend against an attack might weaken deterrence by tempting it to strike its adversary first.

To reinforce the stability provided by assured destruction, both sides agreed to limit BMD severely, as set out in the Anti-Ballistic Missile (ABM) Treaty. Such defenses were considered destabilizing during the Cold War because strategists predicted that a defended nation might strike first, confident that it was protected from the limited retaliatory strikes of its adversary's surviving nuclear forces. In truth, these newly emerging BMD technologies had not matured to the point where nations could trust their performance.

Deterrence and Ballistic Missile Defense

After the Cold War, deterring ballistic missile threats became more complicated due not only to the increasing numbers of nuclear-capable states but also to the rise of hostile rogue elements within a state as well as the proliferation of weapons of mass destruction (WMD), along with missile technology and expertise.[6] According to joint doctrine, "the predominant threat is not from a competing superpower, but more likely from the deliberate launch of a ballistic missile from a 'rogue state,' failed state, or terrorist group."[7] Yet, the United States has difficulty tracking ballistic missiles due to the shortage of accurate and reliable intelligence, having "been surprised in the past by an opponent's earlier-than-expected military technology, including the testing of the Soviet hydrogen bomb, the testing of missiles by Iraq and North Korea, and the acquisition of Chinese missiles by Saudi Arabia."[8] Consequently, the "proliferation of advanced technologies for missiles, guidance systems, and WMD warheads has *increased the potential missile threat to the homeland*" (emphasis in original).[9] Today, the United States must attempt to deter both state and nonstate actors.

Nonstate actors and rogue elements complicate deterrence for a number of reasons.[10] First, rogue elements' decision makers are harder to identify and locate, let alone deter, than their state counterparts. Without the ability to attribute the use of WMDs to a rogue-element actor, or even its state sponsor, the United States may have difficulty deterring an attack. Leaders of rogue elements and proliferators threaten US, regional, and global security interests because they defy international laws or norms of international behavior and use asymmetric means to attack law-abiding nations.

Second, the fact that states operate more in the open allows the United States to gauge their perceptions, based on their actions: "The objective of deterrence is to convince potential adversaries that courses of action that threaten U.S. national interests will result in outcomes that are decisively worse than they could achieve through alternative courses of action."[11] Because rogue elements do not operate in the open, the United States cannot accurately gauge their perceptions of capability and will.

Third, the United States cannot threaten to inflict substantial costs on rogue elements that have few high-value assets, minimal territorial claims, and small populations, compared to their state counterparts.[12] An adversary's hidden calculation of cost, benefits, and risks complicates the US approach to deterrence.

Fourth, it may prove difficult to discern what is important to rogue elements. The United States could easily assume that they share its goals and values—but this is a dangerous assumption.

Fifth, the United States has neither established nor exercised communication channels with rogue elements to the same extent that it has with state actors. Communication is a necessary component of deterrence strategy with regard to relaying the United States' intent to respond to aggression. Even after receiving a clear message, rogue elements may not be deterred. BMD could help the United States deter aggression and respond should deterrence fail.

The Role of Ballistic Missile Defense in Deterrence

BMD should primarily be considered a vital part of a deterrent strategy and secondarily an effective tool to protect against ballistic missile attacks. BMD is an integral part of deterrence because it makes escalation less likely. Confidence in BMD technology may allow US decision makers to accept an increased risk of attack and allow time for other instruments of power to defuse the situation. Adversaries must consider US defensive capabilities in relation to their offensive capabilities. Confident that inbound ballistic missiles will not reach the homeland, the United States could choose not to respond in kind to such provocation.

Extending BMD to friendly states bolsters deterrence because it effectively conveys to potential aggressors the US commitment to defense. Extended deterrence can keep other states out of the conflict. For example, the United States provided Israel with theater missile defense (TMD) during Operations Desert Shield and Desert Storm to protect the Israelis and keep them out of the broader conflict. Extended deterrence may encourage allies to "forgo indigenous development or procurement of duplicative military capabilities, thereby enhancing US counterproliferation efforts."[13] BMD is more than just a defensive measure that the United States possesses to knock down threatening missiles. Decision makers should think of it as a vital part of deterrence to help restrain rogue elements and proliferators.

Presidential Perspectives on Missile Defense

Key political decisions made during the presidential administrations of Ronald Reagan, George H. W. Bush, Bill Clinton, and George W. Bush highlight the progress (or lack thereof) made towards developing potential missile defense capabilities.

Pres. Ronald Reagan

When he entered office in 1981, President Reagan inherited a deterrence strategy based on assured destruction, which relied on the unmistakable ability to inflict an unacceptable degree of damage upon any aggressor or combination of aggressors—even after absorbing a surprise first strike. Frustrated with this strategy, he announced the Strategic Defense Initiative (SDI) in 1983, beginning the United States' pursuit of an active national missile defense (NMD). Thus began a research and development (R&D) effort to protect the United States against a full-scale missile attack from the Soviet Union.[14] The envisioned system would consist of air-, land-, sea-, and space-based sensors and interceptors. Space-based elements included "constellations of Earth-orbiting battle stations" that would destroy ballistic missiles during their boost and midcourse phases.[15] Technologies developed under SDI would allow deterrence policies to rely on defending the United States instead of destroying the enemy.

The concept of using space-based hit-to-kill interceptors emerged from Project Defender, founded in 1958 by the Defense Advanced Research Projects Agency (DARPA), which recognized the promise of advanced weapons and initiated the development of laser technology scalable to the power levels required for BMD.[16] In 1980 DARPA began exploiting newly emerging laser and particle-beam technologies for BMD applications, including space-based laser defense against ballistic missiles and aircraft.[17] DARPA programs brought the United States closer to deterring and responding to ballistic missile attacks from space.

Technologies pursued under SDI could be restricted, depending on the administration's interpretation of the ABM Treaty. According to Article 5 of the treaty, "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."[18] The administration reinterpreted the ABM Treaty to allow for the testing of space-based missile defense (SBMD) technologies.[19] Although members of Congress largely supported increased R&D, they rejected this broad interpretation of the treaty. It was one thing to explore the potential of SBMD on paper and develop technology; it was quite another to test and demonstrate the capability.

SDI challenged the traditional treatment of space as a sanctuary.[20] Believing that the benefits of missile defense outweighed the costs, President Reagan stood up new organizations and attempted to break down barriers, allowing these organizations to explore space capabilities for defense. This display of will to deploy SBMD technologies did not go unnoticed by the rest of the world, the Soviet Union in particular. At a summit meeting in 1986, Soviet president Mikhail Gorbachev pressed President Reagan to "accept limitations to the SDI program as a pre-condition for other agreements restricting offensive arms."[21] The Soviet Union opposed SDI because the new capabilities could weaken its power and security; however, President Reagan refused to accept any restrictions.

In order to win the Cold War, President Reagan was willing to challenge old paradigms about deterrence and rethink treaty obligations, asking, "Wouldn't it be better to save lives rather than to avenge them?"[22] According to Henry Kissinger, former national security adviser and secretary of state, "Soviet leaders were not impressed by Reagan's moral appeals, but they were obliged to take seriously America's technological potential and the strategic impact of even an imperfect defense."[23] President Reagan was looking for a technological alternative to assured destruction. The bipolar world in existence at the start of his presidency would radically change in the next administration.

Pres. George H. W. Bush

President Bush faced the daunting task of shifting the United States from bipolar to multipolar threats. The Warsaw Pact dissolved in 1989, as did the Soviet Union two years later.[24] Regional threats, such as those from Iraq and Iran, as well as continued missile proliferation, became more apparent. Iraq's invasion of Kuwait in 1990 and the global response in the form of Desert Storm charted a course for multilateral relationships. During the Cold War, space systems had focused on the strategic threat posed by the Soviet Union, but as the strategic environment shifted, they began to support multiple regional threats.

President Bush's administration reviewed SDI as part of a broader examination of US strategic requirements for an emerging "New World Order" in which assured destruction no longer formed the basis of deterrence.[25] The review concluded that the most important threat to the United States would come from unauthorized or terrorist attacks by limited numbers of missiles. Additionally, deployed US forces would face increasing threats from shorter-ranged theater missiles due to the proliferation of ballistic missile technology.

Responding to this change in threat, President Bush announced that the DOD was refocusing the SDI program away from defending against a massive Soviet missile attack towards implementing a system known as Global Protection Against Limited Strikes (GPALS), designed to protect US forces overseas, US friends and allies, and the United States itself from accidental, unauthorized, and/or limited ballistic missile strikes.[26] GPALS had three components, only one of which—Brilliant Pebbles—relied on space. Space capabilities played a supporting role in the other two components—TMD and limited NMD. A constellation of small, autonomous, kinetic-energy interceptors, Brilliant Pebbles would detect and destroy ballistic missiles in their boost, postboost, and early midcourse phases of flight.[27] A March 1992 report to Congress highlighted the potential of Brilliant Pebbles for intercepting every Iraqi Scud missile launched against Israel and Saudi Arabia during the Gulf War.[28] This insight was based on simulations of actual Defense Support Program data collected on Scud launches.

The space-based laser (SBL), another program that showed potential for missile defense, sought to detect, track, engage, and destroy theater and strategic ballistic missiles in their boost, post-boost, and midcourse phases[29] The program examined the capability of directed-energy weapons, such as lasers, to destroy targets on or above Earth's surface.[30] Energy delivered by a laser would propagate at the speed of light and stay on target until that energy accumulated to a destructive level.[31] After destroying the missile, the laser could quickly target the next missile and continue this process until it ran out of either fuel or targets.[32] Multiple SBLs could increase the probability of the missile defense architecture's successfully intercepting incoming missiles.

Reassured because the deterrent effect of its missile arsenal would remain intact for the time being, the Soviet Union (now Russia) welcomed the Bush administration's shift from SDI, which emphasized defense against large-scale attacks, to GPALS, which emphasized defense against limited attacks. But rogue elements and other states now had cause for concern since the United States was on a fast track to acquiring BMD capabilities that could negate missile technology they might acquire. President Bush appreciated the value of missile defenses and had the will to field them.

Pres. Bill Clinton

President Clinton continued the shift in focus of missile defense programs from national to theater applications during his administration. This shift became apparent in his narrow interpretation of the ABM Treaty's prohibition of the development, testing, and deployment of sea-, air-, space-, and mobile land-based ABM systems and components.[33] Showing its support for missile defense, Congress continued to fund SBMD development programs. However, because President Clinton preferred land-based missile defense programs over space-based programs, he ended Brilliant Pebbles.[34] The Advanced Technology Kill Vehicle program, which used technology developed through Brilliant Pebbles to produce small, lightweight kill vehicles for use in surface-based interceptors, died as well.

President Clinton also cancelled the *Clementine II* space probe due to concerns about violating the ABM Treaty.[35] By firing small projectiles at asteroids, it would test technologies for use in missile defense applications.[36] *Clementine II* would have demonstrated SBMD-relevant technologies to quell political concerns about the potential of Brilliant Pebbles technology.[37] The first Clementine technology demonstration program also attempted to space-qualify first-generation Brilliant Pebbles miniature, self-contained hardware and software.[38] "This Clementine mission achieved many of its technology objectives during its flight to the Moon in early 1994 but, because of a software error, was unable to test the autonomous tracking of a cold target."[39] Fluctuating political concerns and differing interpretations of the ABM Treaty reflected changes in the US will to deploy SBMD.

These cancellations might have been an instinctive reaction to the end of the Cold War and the perceived lack of a credible ballistic missile threat. However, the world became more dangerous following the Cold War because, instead of the threat emanating from one country, now it came from many smaller countries. Not realizing that the ballistic missile threat was increasing, the United States cut funds for missile defense, and teams of technologists either moved on to other projects or disbanded.

The world remained a dangerous place, so the nation still needed the benefits that missile defenses could offer. In 1998 the Iranians flight-tested their medium-ranged Shahab-3 missile, quickly followed by a North Korean Taepodong-1 missile launch demonstrating their capability to extend the missile's range by using a third stage.[40] Reacting to these two events, the United States began development of TMD, a light, mobile, land-based BMD system that would thwart very limited nuclear attacks.[41]

Russia took the US pursuit of missile defenses seriously. After a summit meeting, President Clinton and Russian president Boris Yeltsin expressed interest in pursuing cooperative TMD activities and issued guidance concerning the TMD capabilities not permitted under their new agreement. Both sides agreed not to "develop, test, or deploy space-based TMD interceptor missiles or components based on other physical principles capable of substituting for interceptors."[42] Even though previous presidents had argued that the ABM Treaty did not ban space-based TMD components, President Clinton committed the United States to refrain from deploying them, thereby reinforcing his views of space as a sanctuary.

With the emphasis now on TMD, the Clinton administration still needed to determine what should happen with NMD. The "3 + 3" program, created in June 2000, accelerated research and testing for the next three years to build up information needed to assist the president in deciding whether or not to deploy an NMD system. Furthermore, the system would then be fielded within three years of the decision to deploy. Although President Clinton had the opportunity to make a deployment decision before leaving office, he did not do so.

Concerns about the costs of missile defense started to override the benefits during President Clinton's administration. The elimination of Brilliant Pebbles and Clementine, as well as the decision to continue studying NMD rather than make a deployment decision, indicates that President Clinton had doubts about the benefits of NMD. His willingness to negotiate with President Yeltsin on TMD criteria showed that he valued missile defense. President Clinton calculated the strategic threat and potential benefits differently than previous presidents. The threats remained, and missile defenses were still viable—but those defenses, particularly space-based components, were too expensive to develop and field.

Pres. George W. Bush

President Bush's administration took an active interest in missile defense. His secretary of defense, Donald Rumsfeld, chaired the 1997 Commission to Assess the Ballistic Missile Threat to the United States, which concluded that the United States would have little or no warning of threatening ballistic missile deployments and argued that America should develop the means both to deter and defend against hostile acts.[43]

In late 2001, President Bush announced the United States' withdrawal from the ABM Treaty with the former Soviet Union: "I have concluded the ABM Treaty hinders our government's ability to develop ways to protect our people from future terrorist or rogue state missile attacks."[44] While abiding by the ABM Treaty, the United States could not pursue the deployment of land-based missile defenses. Its withdrawal from the treaty made clear to Russia and the world that the United States was committed to developing missile defenses to counter an attack. As long as the ABM Treaty remained in place, it blocked prospects of an effective missile defense for the United States and limited options for defending military forces, allies, and coalition partners stationed overseas.[45]

For President Bush, the benefits of missile defense once again overrode the costs of both TMD and NMD. Like President Reagan, President Bush sought to remove the restriction on deploying such a defense. The United States was willing to seek unilateral options for deterring ballistic missile attacks by creating a credible defense. The full range of missile defense options (including SBMD) became available when the United States withdrew from the ABM Treaty.

The Current Ballistic Missile Defense Architecture

The United States must maintain the technological capability to respond if deterrence fails. Multiple opportunities to intercept an incoming ballistic missile increase the probability of a successful interception. BMD "must provide an active, layered defense that allows multiple engagement opportunities throughout the boost, midcourse, and terminal phases of a missile's flight to negate or defeat an attack as far from the Homeland as possible."[46] Throughout these phases, a BMD could incorporate land-, sea-, air-, and space-based elements, using both kinetic and nonkinetic means to destroy hostile missiles.[47]

The nation's current BMD architecture relies on space components to sense and cue terrestrial interceptors. Space-based sensors can detect the heat of the burning booster during its boost phase and transmit trajectory information to ground stations. Once the booster extinguishes and infrared-sensing satellites lose track of the missile, radars can track it throughout the remaining flight time. These radars cue terrestrially based BMD elements so they can attempt to intercept the missile. Commanders on the ground, in turn, can launch interceptors to destroy it. Currently, the United States possesses land- and sea-based kinetic-kill intercept capabilities but no space-based intercept capability.

The level of support for SBMD capabilities has waned since President Reagan first started SDI, but support for land-and sea-based missile defense has remained stable and even grown. President Reagan supported R&D for missile defense in all mediums (air, land, sea, and space) and provided the funding to back his SDI program. Pres. George H. W. Bush continued President Reagan's initiatives but at a reduced level due to the changing threat environment and declining defense budget. President Clinton favored missile defense, with the exception of SBMD; however, he did not provide enough funding for it, thus limiting the scope of BMD to TMD. Pres. George W. Bush reinvigorated missile defense by extending BMD to incorporate NMD in all mediums except space, where he opened the door, enabling future presidents to cross this threshold.

Benefits of Space-Based Missile Defense

Many characteristics of SBMD could create uncertainty in the minds of potential adversaries about whether or not they could achieve their aims.[48] Space provides access to threats in areas that terrestrial, maritime, and airborne defenses cannot reach. SBMD is capable of destroying ballistic missiles over the enemy's territory before they release multiple reentry vehicles or countermeasures designed to thwart defenses.

The constant forward presence of SBMD could allow the United States to limit its military footprint on foreign soil and support many military operations simultaneously. Land- and sea-based interceptors have to be placed in areas where they can provide credible protection from ballistic missile attacks. Prepositioning infrastructure, supplies, and equipment may shorten response times when hostilities erupt, but they are costly and difficult to sustain. SBMD allows a nonintrusive forward presence because it does not require the prepositioning of assets on other territories.

Furthermore, employing SBMD is not contingent on approval from another nation. The continued presence of US assets on foreign soil depends on the host nation's accepting or approving the mission that those assets support. If defenses are not in position, deterrence is reduced. Stationed in the right orbits in the right quantities, SBMD could deter or defend against attacks around-the-clock, especially if used in concert with other sea- and land-based missile defenses.

Responding to Countermeasures

Potential adversaries may develop countermeasures in response to the US fielding of an SBMD because the latter would make their capabilities ineffective. R&D of countermeasures, which takes time and money, may result in reduced payload and/or range of the missile. These monetary and performance costs may be enough to deter an adversary from attempting countermeasures.

One countermeasure against nonkinetic SBMD capabilities—hardened missiles—could have a reduced payload due to the added weight of the hardening material and additional fuel needed to reach the required distances. The adversary could also field more missiles to saturate the missile defense architecture.[49] The saturation point depends upon the numbers of both space-based and terrestrially based interceptors deployed. Because decoys and countermeasures are deployed after boost phase, SBMD could lighten the load for midcourse and terminal-phase defenses.

The adversary could also shift from ballistic missiles to cruise missiles but would pay a penalty in terms of speed, reach, and destructive potential. These penalties, in combination with existing cruise missile defenses, could make an attack less likely to succeed. Space sensors designed to trigger SBMD could also trigger TMD to intercept cruise missiles.

SBMD could increase the effectiveness of the current BMD architecture even if the adversary employs countermeasures. Credible capabilities have the potential to deny an adversary's objectives and therefore may deter him from employing ballistic missiles altogether. Key political decisions help explain the progress (or lack thereof) made towards exploring and developing the potential of SBMD.

The Way Ahead

SBMD progressed through various programs, such as GPALS, Brilliant Pebbles, Clementine, and SBL, despite dwindling support from presidential administrations following President Reagan's. Pres. George W. Bush paved the way for the next administration to put SBMD on the international agenda. According to *The National Security Strategy of the United States of America* (2006), the United States may need new approaches to deter state and nonstate actors and deny them the objectives of their attacks.[50] Additionally, the *National Strategy to Combat Weapons of Mass Destruction* (2002) states that "today's threats are far more diverse and less predictable than those of the past. States hostile to the United States and to our friends and allies have demonstrated their willingness to take high risks to achieve their goals, and are aggressively pursuing WMD and their means of delivery as critical tools in this effort. As a consequence, we require new methods of deterrence."[51]

Cooperation on missile defense initiatives could increase global stability. By banding together in coalitions, countries can deter war by repelling an attack against any member.[52] States and rogue elements will not be able to strike surreptitiously if they know that the international community could quickly discern the origin of any launch and compute potential impact points. Attempts by a rogue element to destabilize the region through the attribution of attacks to a state may initially promote the rogue elements own agenda. However, data provided by missile defense and other sensors can refute such claims. The shared international ability to identify launch and impact points might deter states and rogue elements from launching in the first place. The more nations cooperate with each other, the more stable the world becomes.

Policy makers need to invest in the development of many different capabilities, including SBMD, to negate missiles in their boost phase and use the information gleaned from these developments to inform decisions. One approach involves bringing a system to the prototype stage for testing and accurately gauging its performance. This approach could let the United States invest in only a limited number of prototypes, thus deferring large-scale production to allow further research, development, and testing. These efforts could decrease the risk of failure during production and deployment.[53] When the need arises, the United States should capitalize on preexisting prototypes as long as the industrial base could support rapid production.

By funding R&D for SBMD, the United States would ensure the viability of these technologies. The DOD cannot expect developments in commercial industry to be available for national security purposes. Competitive pressures force industry to fund near-term R&D programs and choose near-term survival over long-term possibilities.[54] Applied research into SBMD technologies would allow the United States to gain more knowledge about boost-phase defenses. America will get as much R&D in SBMD technologies as it is willing to fund.

The United States may need to examine the standards it applies to the fielding of other BMD systems and adjust expectations for an initial SBMD capability. Henry Kissinger has commented on the standard of perfection applied to missile defense:

> The experts had all the technical arguments on their side, but Reagan had got hold of an elemental political truth: in a

> world of nuclear weapons, leaders who make no effort to protect their peoples against accident, mad opponents, nuclear proliferation, and a whole host of other foreseeable dangers, invite the opprobrium of posterity if disaster ever does occur. That it was not possible at the beginning of a complicated research program to demonstrate SDI's maximum effectiveness was inherent in the complexity of the problem; no weapon would ever have been developed if it first had had to submit to so perfectionist a criterion.[55]

Fielding even imperfect elements of the architecture may deter an adversary, as occurred in Desert Storm when imperfect TMD helped keep Israel out of the war.

The fact that senior leaders and policy makers tend to focus on current issues because they are more tangible puts the United States at risk of not funding research critical to its future defense. America may need to avoid pressures to sacrifice long-term research for the sake of short-term procurement by moving away from having policy determine the technologies pursued and letting feasible technologies inform policies necessary to deter threats.

Conclusion

Credible deterrence depends on technological capability and political will. During the Cold War, the United States relied on the nuclear triad to deter ballistic missile threats emanating from the Soviet Union. These capabilities reinforced the political will expressed through policies such as massive retaliation and assured destruction. We had no defense against ballistic missile attacks. Today, the nuclear triad still deters threats from Russia and China; however, the threat has expanded to include rogue elements and proliferators undeterred by Cold War methods. The current land- and sea-based missile defense architecture provides a limited defense against these threats, but it lacks redundancy and depends on the proper positioning of assets to intercept missiles in their midcourse and terminal phases of flight.

Attaching a monetary figure to SBMD is difficult. A cost/benefit assessment should include potential cost savings in other parts of the missile defense architecture in relation to the benefits, including rapid responsiveness, global power projection, and constant presence. The United States must also consider the cost of expanding current missile defense layers to achieve the added deterrent and protective effect that SBMD could provide. Putting a monetary value on deterrence represents the main difficulty of a comprehensive assessment.

The continued proliferation of ballistic missile technology to states and rogue elements warrants increased research into SBMD. The United States should continue to demonstrate the international will necessary to help deter the proliferation of ballistic missiles while providing the capability to defend against rogue elements should deterrence fail. ✪

Notes

1. Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 12 April 2001 (as amended through 17 March 2009), 161, http://www.dtic.mil/doctrine/jel/new_pubs/jp1_02.pdf.

2. Department of Defense, *Homeland Defense and Civil Support Joint Operating Concept*, 1 October 2007, 42, http://www.dtic.mil/futurejointwarfare/concepts/joc_hld_v20.pdf.

3. Paul Cornish, "Deterrence," in *The Oxford Companion to Military History*, ed. Richard Holmes (New York: Oxford University Press, 2003), 258.

4. Ibid.

5. Ibid.

6. House, *Dr. Keith B. Payne, Professor and Department Head, Graduate Department of Defense and Strategic Studies, Missouri State University, Testimony before the House Armed Services Committee, Subcom-*

mittee on Strategic Forces, 110th Cong., 1st sess., 18 July 2007, http://www.nipp.org/Adobe/7-07%20 testimony-delivered.pdf.

7. JP 3-01, *Countering Air and Missile Threats*, 5 February 2007, xi, http://www.dtic.mil/doctrine/jel/new_pubs/jp3_01.pdf.

8. Curt Weldon, "Charting a New Course on Missile Defense," in *Spacepower for a New Millennium: Space and U.S. National Security*, ed. Peter L. Hays et al. (New York: McGraw-Hill, 2000), 147.

9. JP 3-01, *Countering Air and Missile Threats*, xi.

10. Department of Defense, *Deterrence Operations Joint Operating Concept* (Washington, DC: Department of Defense, December 2006), http://www.dtic.mil/futurejointwarfare/concepts/do_joc_v20.doc. According to this document, there are five major differences between state and nonstate actors that significantly affect deterrence operations:

> 1. It can be far more difficult to identify the decision-makers we seek to deter.
>
> 2. There is generally greater uncertainty as to how these decision-makers perceive the benefits, costs, and consequences of restraint.
>
> 3. State and non-state actors often differ in their susceptibility to our efforts to credibly threaten cost imposition.
>
> 4. They may have different goals/objectives, different values, and they employ different means to achieve them.
>
> 5. In contrast to non-state actors, deterrence of state actors is facilitated by well-established means of communications between states (4–5).

11. Department of Defense, *Homeland Defense and Civil Support*, 51.

12. Department of Defense, *Deterrence Operations Joint Operating Concept*, 18.

13. Ibid., 71.

14. Steven A. Hildreth, *Ballistic Missile Defense: Historical Overview*, CRS Report for Congress, RS22120 (Washington, DC: Congressional Research Service, 9 July 2007), CRS 3–4.

15. Curtis Peebles, *High Frontier: The U.S. Air Force and the Military Space Program* (Washington, DC: Air Force History and Museums Program, 1997), 67.

16. DARPA, *Technology Transition* (Washington, DC: Defense Advanced Research Projects Agency, 1997), 31, http://www.darpa.mil/Docs/transition.pdf (accessed 2 June 2009).

17. Ibid., 32.

18. Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitations of Anti-Ballistic Missile Systems, 3 October 1972, http://www.state.gov/www/global/arms/treaties/abm/abm2.html.

19. Hildreth, *Ballistic Missile Defense*, CRS 3–4.

20. Karl Mueller identifies six perspectives on space weaponization: (1) "Sanctuary idealists oppose the spread of weapons or warfare into any new realm," fearing that weapons will lead to warfare. (2) Sanctuary internationalists are concerned about international stability and the offensive influence of space weapons. (3) Sanctuary nationalists oppose space weapons because they could weaken the power and security of the nation. For sanctuary nationalists, the costs of weaponization outweigh the benefits. (4) Space racers are "reluctant space weaponization advocates, who may accept that sanctuary is desirable in the abstract, but who believe that space weaponization is inevitable, and that this makes it imperative for the United States to lead the way in the development and deployment of space weapons." (5) Space controllers believe the benefits outweigh the costs as determined by comparing future military capabilities with and without the potential space weapons. (6) Space hegemonists argue that space will be the critical battlefield, the "ultimate high ground," and should be weaponized as fast as possible. Karl P. Mueller, *Totem and Taboo: Depolarizing the Space Weaponization Debate* (Santa Monica, CA: RAND, 8 May 2002), 6–13, http://www.gwu.edu/~spi/spaceforum/TotemandTabooGWUpaperRevised%5B1%5D.pdf.

21. MDA Historian's Office, "Missile Defense Timeline, 1944–2004," Missile Defense Agency, http://www.mda.mil/mdalink/html/milstone.html (accessed 7 November 2007).

22. Lester L. Lyles, "Space and Ballistic Missile Defense Programs," in *Spacepower for a New Millennium*, 112.

23. Henry Kissinger, *Diplomacy* (New York: Simon and Schuster, 1994), 782.

24. Lyles, "Space and Ballistic Missile Defense Programs," 114.

25. MDA Historian's Office, "Ballistic Missile Defense: A Brief History," Missile Defense Agency, http://www.mda.mil/mdalink/html/briefhis.html (accessed 7 November 2007).

26. Ibid.; and Lyles, "Space and Ballistic Missile Defense Programs," 114.

27. Lyles, "Space and Ballistic Missile Defense Programs," 130.

28. Henry F. Cooper, "Space Defense: An Idea Whose Time Has Come?" in *Spacepower for a New Millennium*, 130.

29. Lyles, "Space and Ballistic Missile Defense Programs," 123.

30. Robert Preston et al., *Space Weapons, Earth Wars*, RAND Report MR-1209-AF (Santa Monica,

CA: RAND, 2002), xvii, http://www.rand.org/pubs/monograph_reports/MR1209.

31. Ibid.

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