Chapter 4

Safe Heavens: Military Strategy and Space Sanctuary

David W. Zeigler

> *Undoubtedly the most provocative subject in any discussion of the future of space is the subject of space weapons and the likelihood of their use. Here I am referring to the broadest categories: space-based lasers to shoot down hostile intercontinental ballistic missiles, space weapons that attack other satellites, or weapons released from space platforms that destroy terrestrial targets. Today these kinds of systems clearly break the current thresholds of acceptability and introduce Anti-Ballistic Missile Treaty issues, as well as social and political reservations. But the 21st century could well see a change.*
>
> —Gen Thomas S. Moorman Jr.

Today, as they have since the 1950s, American leaders are debating the efficacy of US space weapons. In military circles these discussions frequently gravitate to issues of technology, legality, cost, and the military employment of the weapons themselves. Such a focus—one that predominantly concerns itself with how space weapons can be deployed—inevitably overshadows the question of what happens if they are deployed. This result jeopardizes the foundation of knowledge from which Americans will judge the merits of space weapons. Decision makers may be forced to act without a complete and rigorous analysis of the compatibility of space weapons with national strategy.

When Basil H. Liddell Hart succinctly defined strategy as "the art of distributing and applying military means to fulfill

This work was accomplished in partial fulfillment of the master's degree requirements of the School of Advanced Airpower Studies, Air University, Maxwell AFB, Ala., 1997.
Advisor: Maj Bruce DeBlois, PhD
Reader: Dr Karl Mueller

the ends of policy," he correctly subordinated a nation's force structure and doctrine to its national policy objectives—they are inextricably linked.[1] As a result, militarily promising weapons and doctrines can still prove incompatible with higher policy objectives. Three historical examples illustrate this idea, beginning with the Allies' choice of weapons against Germany in the Second World War.

During World War II, the Allies developed proximity-fuzed antiaircraft shells used with great success against German V-1 missiles. Undoubtedly these same weapons would have brought the Allies better performance against the Luftwaffe in combat over France and Germany. Allied commanders banned the weapon from that region, however, fearing that if the Germans manufactured their own from a captured specimen they might use it with devastating effectiveness against Allied bombers in the crucial combined bomber offensive (CBO).[2] Although deploying the shells to continental Europe offered military advantages, those advantages were incompatible with the CBO's central role in Allied strategy.

President James Earl "Jimmy" Carter's rejection of the neutron bomb offers an example of higher national policy ruling out a promising weapon system still in the conceptual stage. The president's complete repudiation of these weapons rested not with their ineffectiveness—they were well-suited for stopping a Soviet offensive while preserving Europe's infrastructure—but rather with the incompatibility of the bombs with broader American strategy. That strategy motivated the United States to internationally maintain the moral high ground, preserve the North Atlantic Treaty Organization (NATO) coalition, and promote arms control.

American deliberations over chemical weapons provide the most contemporary illustration of the potential clash between military expediency and national policy objectives. In April 1997 the US Senate formally ratified the Chemical Weapons Convention by obligating America to forsake future development, production, acquisition, transfer, stockpiling, and use of chemical agents. The treaty was controversial in that such historical American adversaries as Russia, Libya, and Iraq refused to sign it.[3] Treaty critics preferred, instead, to preserve

America's freedom to retaliate with chemical weapons against adversaries who used such weapons against American troops. They accurately asserted that lacking such freedom weakened the ability of the United States to control conflict escalation. As with the case of the neutron bomb, however, the United States elected to forgo the military benefits of a chemical deterrent in deference to higher political objectives. US leaders calculated that America's reputation as a responsible superpower and its commitment to arms control were better served by formally renouncing the American chemical arsenal.

Military policy makers for space find themselves treading similar waters. Today, space weapons are becoming increasingly practical in terms of military promise and associated costs. Yet in the context of higher military and national strategy, the decision to deploy them is complicated by related social, political, economic, and diplomatic factors. As in the past, military missions like "space control" and "space force application" cannot be decoupled from broader national strategy. Though they may promise military advantages, space weapons are desirable only if they prove to be compatible with policy at the national level.

There is no question that Department of Defense (DOD) officials fully appreciate the subordination of military space operations to America's civilian-led national strategy. In February 1997 the commander in chief, US Space Command (CINC USSPACECOM), Gen Howell M. Estes III, emphasized that decisions to develop space-based weaponry are not made by the military. "We . . . support whatever decisions our elected leadership may arrive at with regard to space control and the weapon systems required," he remarked.[4]

As the elected leadership moves closer to these decisions, military strategists should work now to consider the issue of space weapons from every angle, including potential arguments against their development. A quick review of today's defense literature, however, reveals that this is not happening. While there is much written in support of space weapons and their attendant missions, attempts to understand the counterarguments against deploying space weapons are scarce. Few strategists, if any, are testing the conventional wisdom of

space weapon proponents with any rigor. For example, military planners and strategists are silent on the evidence of some 40 years of American cold war space policy—a history that shows US national interests ultimately being served by preserving a space sanctuary relatively free of American space weapons. This should not be the case. There must be a disciplined consideration of why cold war space operations developed the way they did and the relevance (or irrelevance) they have today. Instead, some advocates for space weapons continue to see sanctuary thought as a form of "unstrategy," viewing its proponents as "making head-in-the-sand plans."[5] This perspective only serves to undermine useful debate. It leads to a situation in which everybody interprets the universe of possible strategies to include only those they are already predisposed to. As a result, even the most ardent space weapon advocates find themselves at a disadvantage when crafting strategy. They compromise their ability to implement a weapons program that still incorporates, to the extent possible, useful features of sanctuary thought. They forfeit the opportunities, afforded by another point of view, to fairly appraise and ameliorate any weaknesses associated with space weapons.

Regardless of their initial convictions, strategists must strive for totally objective thought. They should take apart every conviction and recast it to optimally fit the current situation. They must explore all avenues of approach to a problem and ranges of possible solutions. Hence the purpose of this study. It endeavors to develop a better understanding of the arguments against space weapons by asking the question: Could pursuing a space sanctuary in the near future benefit the national interest? The product—the space sanctuary argument articulated here in the strongest reasonable terms—offers military strategists a counterpoint to round out the pro-weapons literature on their shelves. Since its purpose is to challenge mentally and not to persuade, the question of whether space should or should not be weaponized is left unanswered. Instead, strategists are invited to put the sanctuary perspective in their cognitive "toolboxes" as but one of many tools required to decide the future of space weapons.

In laying out the sanctuary perspective, basic concepts essential to any discussion of sanctuary thought are first clarified. An underlying premise is emphasized: that US military strategy—especially one associated with space—cannot be divorced from broader national strategy. Since that is true, President William Jefferson "Bill" Clinton's 1996 US national security strategy is used to give the phrase "national strategy" greater substance. The clarification of basic concepts concludes with definitions for "space weaponization" and "space sanctuary."

Having established a framework for discussion, the study turns to America's history with space weapons. Any treatment of contemporary military space policy must at least consider where the nation has been in the past. Although most of America's space history is indelibly colored by the cold war—a geopolitical environment far different from that of 1997—it nevertheless bears some relevance for policy today. The restrained manner in which the United States pursued antisatellites (ASAT) through the end of the 1980s is a classic example of sanctuary concepts in action.

Contemporary American space policy remains relatively consistent with that of the cold war. Domestic support for operational space weapons is growing, however. After transitioning from the past to the present, fundamental convictions driving the arguments of American space weapon advocates today are explored. These convictions are then challenged with sanctuary counterarguments. The case for a sanctuary policy is further bolstered with rationale independent from the convictions of weapon advocates. No attempt is made to critique the weaknesses of the sanctuary argument presented—further acknowledgment that this study merely aims to give sanctuary thought its full day in court. It is left to the reader to balance the space weapon and space sanctuary perspectives.

With the sanctuary argument complete, the conclusion calls upon military strategists to embrace the complex debate over national military space strategy. It encourages strategists to consider military space policy from every perspective in search of the very best strategy. Strategists are also challenged to disregard the idea that sanctuary thought leads to a passive national strategy. Instead, examples illustrate how sanctuary

tenets demand coordinated action of all national instruments of power. They also show how sanctuary thought remains relevant even if there is an eventual US decision to deploy space weapons.

Definitions

The United States is a spacefaring nation—it operates some two hundred military and civilian satellites with a combined value of $100 billion.[6] As impressive as these statistics appear, they do not reflect the additional billions of dollars and millions of American lives influenced every day by space communication, navigation, weather, environment, and national security satellites. Space is big business and is inseparable from US economic strength. It attracts international attention and therefore diplomatic power. It is absolutely crucial to American military operations. Since the "high frontier" underpins almost every facet of US national power, American strategists must consider space from a perspective broader than pure military concerns. To do so, however, they must define "broader perspective." In that regard, *A National Security Strategy of Engagement and Enlargement* (February 1996) provides a solid point of departure and conveys the president's priorities for formulating and conducting national policy. "The nature of our response must depend on what best serves our own long-term national interests. Those interests are ultimately defined by our security requirements. Such requirements start with our physical defense and economic well-being. They also include environmental security as well as the security of our values achieved through expansion of the community of democratic nations."[7] Subsequent use of "national interests" in this study is meant to connote the four most basic security requirements arranged by the White House: physical defense, economic well-being, environmental security, and the expansion of the community of democratic nations.

The rudimentary framework provided by the 1996 publication prompts military strategists to evaluate space strategies across the full spectrum of national interests. Before that occurs, how-

ever, strategists must clearly understand the space strategies themselves. Therefore, the specific ideas conveyed by “space weapon” and “space sanctuary” must be explicitly defined.

A space weapon is defined as any system that directly works to defeat space assets from terrestrial- or space-based locations or terrestrial-based targets from space. Space weaponization is distinct from the extensive militarization of space that began in the late 1950s. Since that decade, nations have launched thousands of military satellites into space to support surveillance, reconnaissance, communications, navigation, and military research.[8] Today, these satellites make important but indirect contributions to the final defeat of targets. Space weapons, if ever employed, will directly attack and defeat targets via mechanisms ranging from physical destruction to spoofing.

Significantly, the definition adopted for space weapons leaves out two categories of weapon systems that routinely operate in space—ballistic missiles and antiballistic missiles (ABM). Although ballistic missiles traverse space en route to their targets, they are more accurately appraised as surface-to-surface systems. In addition ballistic missiles are well established in strategic thought and provide national security with a deterrent function that has long since been accepted. Considering ballistic missiles as space weapons, then, would inordinately complicate the debate with no apparent gain.

The same is true of the second notable exclusion from the definition for space weapons, the ground-launched ABMs. Including ABM systems in the context of the space sanctuary debate would cloud the central issues related to weapons that attack targets in space and weapons that attack targets from space. Note, however, that ABM systems modified to perform ASAT missions are not excluded. In that event, the modified system clearly becomes a space weapon.[9]

Understanding what is implied by the concept *space sanctuary* is as important as defining space weapons. In the strictest sense, space is a sanctuary when it is completely unthreatened by terrestrial- or space-based weapons. This definition, however, is impractical on two counts. First, such a sanctuary has not existed for decades and realistically never will again. It therefore becomes a rather inflexible construct

for a serious policy discussion. Second, even when a nation sincerely believes a sanctuary exists, other nations may disagree. Consider that starting in 1981 the Soviets strenuously objected to the American space shuttle as an ASAT because of its capability to "snatch" satellites from space.

A second, more flexible, definition for space sanctuary might see it in light of national intentions. By this reckoning, a space sanctuary would exist even where nations possessed space weapons, so long as they truly intended never to use them. Again, however, the construct becomes problematic. Good intentions notwithstanding, no nation as a practical matter can accept an armada of adversarial space weapons on the faith they would never be used. Instead of continuing to search for a conceptual definition of space sanctuary in absolute terms, then, this study seeks a more pragmatic approach linked to current realities.

Today, the number of operational space weapons is unchanged from that of a decade ago. In fact the number is actually down from cold war peaks discussed in the next section. The international community, therefore, lives with a degree of space weapons that is stable. Nations are not fielding new weapon systems and the operational systems that already exist are extremely limited in capability. As support builds for American space weapons, however, US decision makers are rapidly approaching a crossroads—a point of decision. This study asserts that any US strategy advocates a space sanctuary if it endeavors to cap the current level of space weaponization *where it stands today*. In other words, a sanctuary exists today given the present equilibrium.

Introducing new space weapons would violate that sanctuary. If the threshold for viewing space as a sanctuary is set at current levels of weaponization, then the strategist ought to know the history that generated those levels. The next section describes past space weapons and elucidates the drivers behind America's space weapons policy during the last 50 years.

Space Weapons and the American Experience

The cold war was a tense affair. For 40 years, two global superpowers stood toe-to-toe, eye-to-eye poised for a war that promised devastation for both. Amidst this tension, the impetus for superiority was so strong and the level of mutual distrust so powerful, that America's nuclear arsenals were built to levels far beyond what some assert were ever useful. The global confrontation also drove innovation and modernization of American conventional forces. United States policy makers never deliberately allowed the Soviets to achieve favorable asymmetries in major weapon systems except antisatellite weapons. Many caution that the cold war fostered geopolitical conditions so unlike today's that its lessons are totally irrelevant. In her book *Rational Choice in an Uncertain World,* Robyn Dawes notes that "a great deal of thinking is associational, and it is very difficult indeed to ignore experience that is associationally relevant, but logically irrelevant."[10] Correspondingly, one might assert that while today's weapon races appear to be comparable to those of the cold war, the unique bipolar tension of the cold war makes any comparison of the two logically flawed—what worked in the cold war may fail in today's multipolar world. That hypothesis, however, is more true for some weapon systems than it is for others. In the case of space weapons it is suspect.

The American cold war experience with space weapons presents a bit of a conundrum. Despite the pressure for relative military parity, if not US superiority, the Soviets finished the cold war with an operational ASAT while the United States possessed none. Significantly, this asymmetry cannot be traced to greater Soviet technological prowess. Instead, its roots lie with American restraint. Unilateral arms restraint during the cold war, however, runs counter to the prevailing sentiments of that period. If the United States did in fact deliberately opt against pursuing an aggressive ASAT program, it must have been to advance interests beyond simple military effectiveness.

American cold war space policy, therefore, is highly relevant for space sanctuary advocates in 1997. The sanctuary argument proposes the very restraint observed in that era. It sug-

gests that broader national strategies can preempt even the strongest justifications for space weapons just as occurred during the cold war maelstrom. For this reason, the argument for a space sanctuary strategy should consider the history of cold war space weapons.

Two Historical Themes

This section briefly describes America's historical experience with space weapons. From the 1950s to the start of the 1990s, two general themes emerge.

First, although space weapon technologies matured over the years, any long-term US commitment to a vigorous space weapons program was constrained by perceived American vulnerabilities in space. When operational US ASATs did appear, they were in direct response to the Soviet threat of orbiting nuclear weapons. Second, in spite of their reluctance to develop space weapons, US policy makers consistently "hedged their bets" with the technological insurance of space weapons research.

Protecting American Vulnerabilities through Restraint

Historical US space policy consistently embraced American restraint in the deployment of space weapons. Policy makers were motivated to legitimize and protect other US space missions from attack. On two occasions, US policy makers ordered ASAT systems to go operational. In both cases, the systems were motivated by Soviet involvement with orbiting nuclear weapons.

By the mid-1950s, the United States was engaged in a cold war of atomic proportions. The perceived adversary was a monolithic Communist movement adroitly led by the Soviet Union—a conviction reinforced by the confrontation with the Soviets over the blockade of Berlin, the 1950 Sino-Soviet Pact, and the Korean War. The technology was nuclear and the introduction of relatively lightweight hydrogen bombs now meant intercontinental ballistic missile (ICBM)-launched warheads were feasible.[11] Assessing the situation in 1954, President Dwight D. Eisenhower observed that "modern weapons

have made it easier for a hostile nation with a closed society to plan an attack in secrecy and thus gain an advantage denied to the nation with an open society."[12] His observation hastened the first military space program, Project Feedback, a study recommending that the United States develop satellite reconnaissance as a matter of "vital strategic interest to the United States."[13] By July 1954 Program WS-117L (advanced reconnaissance system) was approved.[14] It was the first step in a long-term American commitment to satellite reconnaissance.

The first serious US discussions of space weapons were prompted by the Soviet launch of sputnik in October 1957. Already that year, Gen Bernard A. Schriever, US Air Force, had stressed the need for "space superiority," predicting that in decades to come the decisive battles would be fought in space.[15] Sputnik inflamed such convictions—even the public soon shared the concern over a perceived "space weapons gap" with the Soviets.[16] This public climate led defense officials to be more specific in their calls for American space weapons. Gen James Gavin, US Army, urgently recommended that Americans "acquire at least a capability of denying Soviet overflight—that we develop a satellite interceptor."[17] In November 1957 his service proposed two ASAT solutions: a modified Nike Zeus ABM and a "homing satellite" carrying a destructive charge.[18]

Despite the mounting pressure to weaponize space, President Eisenhower resisted. He believed it was more imperative that the international community embrace the legitimacy of the satellite reconnaissance mission.[19] In his estimation, jumping out to a lead in ASATs would undermine the credibility of America's efforts to promote space for "peaceful" purposes and encourage the Soviets to redouble their own ASAT efforts. By 1958 Eisenhower articulated this policy in National Security Council (NSC) 5814/1, stating the United States should "in anticipation of the availability of reconnaissance satellites, seek urgently a political framework which will place the uses of U.S. reconnaissance satellites in political and psychological context favorable to the United States."[20]

By the early 1960s, President John F. Kennedy was forced to reassess Eisenhower's sanctuary strategy when Soviet statements and actions indicated they might develop orbiting

nuclear bombs. Kennedy feared such weapons could blackmail Americans in a crisis and knew waiting to counter the threat, after it appeared, might embarrass his administration later.[21] So in May 1962, Secretary of Defense (SECDEF) Robert S. McNamara ordered the Army to modify the Nike Zeus ABM for a future ASAT role. The modified system, Program 505, was based at Kwajalein Atoll in the Marshall Islands. Each missile carried a nuclear warhead capable of destroying satellite targets.[22]

As evidence of Soviet efforts to deploy orbital bombs continued to mount, so did pressure for a long-range American ASAT. In 1963 President Kennedy approved Program 437—a ground-launched ASAT system based on the Thor intermediate-range ballistic missile (IRBM)—stating that the United States should "develop an active antisatellite capability at the earliest practicable time, nuclear and non-nuclear."[23] Program 437 was eventually based at Johnston Island in the Pacific. Like Program 505 it carried a nuclear warhead.[24]

Both Programs 505 and 437 went operational in May 1964.[25] Program 505 was quickly phased out by May 1966 in deference to Program 437's longer range.[26] Four factors indicate that these programs were simply emergency stopgaps against a specific nuclear threat and did not signal an American priority to deploy a general-purpose ASAT against other types of satellites. First, after the United States conducted the Starfish Prime series of space nuclear tests in 1962, American policy makers clearly understood that nuclear ASAT detonations would cripple friendly satellites as well as hostile ones.[27] Second, any use of Programs 505 and 437 would have violated the Partial Test Ban Treaty signed only one day before President Kennedy approved Program 437.[28] Third, both systems were hamstrung by their single remote bases. Operating from fixed locations severely limited the number of satellites vulnerable to each system. Satellites that were periodically vulnerable would often be out of view for days.[29] Finally, more flexible systems for targeting general purpose satellites across the spectrum of conflict—nonnuclear ASATs—were never produced despite President Kennedy's directive. DOD considered several projects, but each failed to win administration endorsement.[30]

President Lyndon B. Johnson's administration completed the ASAT programs started by Kennedy, sharing the view that any US ASAT program was principally a hedge against Soviet orbital weapons. An administration report stated that "an anti-satellite capability (probably earth to space) will be needed for defense of the United States. . . . Current high priority efforts should be continued and extended as necessary in the future."[31] Significantly, that same report considered using American ASATs against "space targets in time of war whether or not the orbital nuclear delivery vehicles were introduced." It also proposed that US ASATs could "enforce the principle of noninterference in space."[32] When it came to these additional missions, however, the Johnson administration reiterated Eisenhower's conclusions—targeting Soviet satellites invited retaliation and the United States was more dependent on its space assets. As the report stated, "the usefulness to the United States of observation [satellites] . . . as a means of penetrating Soviet secretiveness is obvious. The value to the USSR may be less clear; indeed, the value is probably much lower."[33] As a result, the Johnson administration proved ambivalent to ASATs, and little was done to replace the limited capabilities of Program 437.[34] That decision was complemented by Johnson's broader space policy: "We should continue to stand on the general principle of freedom of space. We should actively seek arms control arrangements which enhance national security. We should pursue vigorously the development and use of appropriate and necessary military activities in space, while seeking to prevent extension of the arms race into space."[35] President Johnson's policy was another example of America's traditional inclination for sanctuary thought and a key contributor to international acceptance of the 1967 Outer Space Treaty. The treaty's signatories agreed "not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner."[36] America's ASAT posture and policy remained rooted in the sanctuary perspective through 1977. As a case in point, Program 437 was terminated on 1 April 1975, leaving the United

States with no operational ASAT capability.[37] This termination is particularly striking in light of the Soviet involvement with ASATs during the same period.

The Soviets began testing their co-orbital ASAT in 1967.[38] The tests' prevailing pattern involved the launch of a target satellite followed by the launch of a "killer satellite" boosted into a coplanar orbit. Typically within two orbital revolutions, the killer satellite would be maneuvered to detonate near the target satellite, destroying it in a cloud of shrapnel.[39] Although these tests often failed, when the initial series of Soviet tests ended in December 1971, they had demonstrated the ability to intercept US photoreconnaissance, electronic intelligence, weather, and TRANSIT NNSS (US Navy navigation satellite system).[40]

President Richard M. Nixon's national security advisor, Henry A. Kissinger, reacted to the Soviet ASAT tests by calling for a "quick study" of possible US responses in 1970.[41] Remarkably, the lack of urgency was such that the report was not submitted until 1973. By that time détente, including the Strategic Arms Limitation Talks (SALT) I treaty and the Soviet hiatus in ASAT testing, had diverted interest from the subject of ASATs.[42]

Détente aside, the report's findings are further indication of US reluctance to deploy space weapons—even when provoked. It recommended steps to reduce the vulnerability of US satellites to attack but explicitly argued against a US ASAT program in response. The rationale was reminiscent of previous administrations. A US ASAT was "not an area where deterrence works very well because of dissimilarities in value between US and Soviet space systems."[43]

By 1977, however, three developments gave new impetus for a renewed US ASAT effort. The first was a series of government panels expressing concern over the growing vulnerability of US satellites. The second was the blinding of US satellites over the Union of Soviet Socialist Republics (USSR) and the resumption of Soviet ASAT testing. The third was a president concerned about the obvious cold war asymmetry in ASAT capability.

In 1975 President Gerald R. Ford's advisors convened the Slichter Panel to review the military applications of space. The panel focused on satellite reconnaissance and tactical communications concluding that "the US dependence on satellites was growing and that these satellites were largely defenseless and extremely soft to countermeasures."[44] This warning was the catalyst for a second panel convened to specifically analyze these vulnerabilities and consider the need for an American ASAT program.[45] The Buchsbaum Panel determined that an ASAT would not enhance the survivability of other US satellites—deterrence was ineffective given the heavy American dependency on space. The Buchsbaum Panel did recognize, however, that while the United States was more dependent on space than the Soviets, the Soviet dependency was increasing. In this regard, the panel believed an American ASAT possessed at least some utility against Soviet intelligence and radar ocean reconnaissance satellites. This utility could also strengthen ASATs as a negotiation chip in future arms control discussions.[46]

Anxiety over the vulnerability of US satellites was heightened by the blinding of US satellites over the USSR and the resumption of Soviet ASAT testing. On three occasions in 1975, US satellites were saturated with intense radiation from sources in the Soviet Union.[47] These incidents reinforced reports that the Soviets were rapidly progressing in directed energy weapon technologies.[48] To aggravate matters further, the Soviets resumed testing of the co-orbital ASAT. In 1976 alone, there were four such orbital tests.[49] The net effect of these developments was a subtle shift in US ASAT policy presaged at the end of 1976 by comments from the Director of Defense Research and Engineering Malcolm Currie. "The Soviets have developed and tested a potential war-fighting antisatellite capability. They have thereby seized the initiative in an area which we hoped would be left untapped. They have opened the specter of space as a new dimension for warfare, with all that this implies. I would warn them that they have started down a dangerous road. Restraint on their part will be matched by our own restraint, but we should not permit them to develop an asymmetry in space."[50]

Subsequent policy statements continued to emphasize restraint and space as a medium for nonaggressive purposes, but in January 1977 President Ford released National Security Decision Memorandum (NSDM) 345 ordering DOD to develop an operational ASAT.[51]

President Carter inherited Ford's NSDM 345 weeks after it was signed. Elected on a platform of arms control and reduced military spending, however, Carter returned the nation to its tradition of working to stabilize space as a sanctuary. He continued with the ASAT initiative principally on the grounds that it would strengthen arms negotiations as a bargaining chip. If arms control succeeded, the American ASAT would never become operational. President Carter's 1978 Presidential Directive on Space Policy stated that "the United States finds itself under increasing pressure to field an antisatellite capability of its own in response to Soviet activities in this area. By exercising mutual restraint, the United States and the Soviet Union have an opportunity at this early juncture to stop an unhealthy arms competition in space before the competition develops a momentum of its own."[52] In line with this policy, the Carter administration opened ASAT arms control talks with the Soviets in June 1978.[53] The negotiations stalled over a number of issues, however, and finally collapsed with the Soviet invasion of Afghanistan in December 1979.[54]

By the time President Ronald W. Reagan assumed office in 1981, America's ASAT program was in an advanced stage of development.[55] Specifically, the miniature homing vehicle (MHV) ASAT—a direct ascent, air-launched missile designed to home in on and collide with satellites—was approaching the point of operational testing.[56] In contrast with Carter's perspective on space weapons, Reagan unabashedly accelerated the program stating at the beginning of his first term "the United States will proceed with development of an antisatellite (ASAT capability), with operational deployment as a goal. The primary purposes of a United States ASAT capability are to deter threats to space systems of the United States and its allies and, within such limits imposed by international law, to deny any adversary the use of space-based systems that provide support to hostile military forces."[57]

In further contrast to his predecessor, Reagan pressed on with the MHV ASAT effort even as the Soviets called for a space weapons treaty. In 1983 Foreign Minister Andrey A. Gromyko proposed to supplement the Outer Space Treaty so as to outlaw the use of force in space to include a prohibition on "any space based weapons intended to hit targets on the Earth, in the atmosphere, or in space." Significantly, the Soviets underscored the sincerity of their calls by imposing a unilateral moratorium on their own ASAT testing in the same year.[58] Nevertheless, Reagan categorically rejected all Soviet offers citing various weaknesses in the proposed treaty drafts.[59]

In spite of President Reagan's strong support, the MHV ASAT program faced congressional opposition. The Soviet overtures for a space weapons treaty were well received by legislators and many viewed the MHV as an unnecessary start to an arms race in space.[60] As a result, Congress passed a law in 1984 that banned further US ASAT testing. Only a short lapse between this ban and its successor permitted a September 1985 test to occur. On 13 September 1985, an F-15 launched an MHV ASAT at a US satellite collecting scientific data in space. Seconds later, the MHV struck the satellite shattering it into several hundred pieces.[61] The success belied the program's future. In March 1988 congressional test restrictions and budgetary limitations killed the ASAT program before it went operational.[62]

Although President George W. Bush was handed a dead ASAT program in 1989, Reagan's Strategic Defense Initiative (SDI) remained very much alive. Ironically, the Bush administration deemphasized any push for an operational US ASAT effort because of SDI. The administration believed ASATs were destabilizing and above all a threat to the sophisticated ballistic missile defense satellites planned for the future. Addressing the question of stability, President Bush's National Security Advisor Brent Scowcroft observed that "all scenarios involving the use of ASATs, especially those surrounding crises, increase the risks of accident, misperception, and inadvertent escalation."[63]

The vulnerability of the expensive SDI space architecture to ASATs was also recognized early in its development. The govern-

ment's Defensive Technologies Study Team found in 1984 that "survivability is potentially a serious problem for the space-based components. The most likely threats to the components of a defense system are direct-ascent antisatellite weapons; ground- or air-based lasers; orbital antisatellites, both conventional and directed energy; space mines; and fragment clouds."[64] The technologists designing the SDI architecture would echo the same thoughts in subsequent years. According to the director of the Lawrence Livermore National Laboratory in 1986, "if extensive strategic defenses are deployed, the ASAT and counter ASAT picture changes completely. This is particularly true if space-based weapons are developed and deployed. Under such circumstances, all space assets, whether needed for defense or offense, for warning or other purpose, would have to operate in a very hostile environment."[65]

President Bush, then, returned the nation to a familiar ASAT policy. President Eisenhower had rejected operational ASATs because of the US's dependency on reconnaissance satellites. Subsequent administrations rejected operational ASATs because of the US's growing dependency on satellites of all types. President Bush rejected operational ASATs, in part, because of a predicted US dependency on ballistic missile defense satellites.

The fact that Bush elected not to deploy an operational ASAT does not mean he dismissed ASAT work altogether. In 1989, a year after the MHV was canceled, all three military services remained engaged in ASAT research.[66] This approach to ASATs is patently American and represents a second consistency in the history of US space weapons. US policy makers have consistently "hedged their bets" with the technological insurance of space weapons research and development (R&D) programs.

Technological Insurance through ASAT Research

As the first president to adopt a sanctuary policy for space, Eisenhower nevertheless authorized the Advanced Research Projects Agency (ARPA) and all three of the military services to conduct space weapon research. NSC 5802/1 called for a "vigorous research and development program" to consider weapons against "satellites and space vehicles."[67] Consistent with his

broader policy, however, Eisenhower disapproved the services' requests for more advanced stages of system development.[68] A B-47-launched ASAT missile tested in the Bold Orion program and the satellite interceptor (SAINT) program were two notable R&D efforts during Eisenhower's presidency.[69]

In the course of congressional hearings in 1962, Director of Defense Research and Engineering Dr. Harold Brown acknowledged that the Kennedy administration would follow Eisenhower's precedent of pursuing ASAT R&D as insurance. Brown stated that "we must, therefore, engage in a broad program covering basic building blocks which will develop technological capabilities to meet many possible contingencies. In this way, we will provide necessary insurance against military surprise in space by advancing our knowledge as a systematic basis so as to permit the shortest possible time lag in undertaking full-scale development programs as specific needs are identified."[70]

Technology associated with the X-20 Dynasoar, a manned hypersonic space glider, is perhaps the most well recognized military space R&D program during this era.[71] That program, as well as the Manned Orbiting Laboratory, lasted well into the Johnson years.[72] The United States continued to consider vigorous R&D as sufficient insurance against future space weapons threats even as the Soviets demonstrated their co-orbital ASAT. President Nixon's NSC recommended that the United States respond to the Soviet demonstrations with an R&D effort aggressive enough to permit quick turnaround of an operational ASAT system.[73] The MHV ASAT program eventually fulfilled this R&D requirement for both the Ford and Carter administrations.

Measuring national commitment to ASAT R&D after 1983 is very difficult due to President Reagan's SDI. The line between ASAT and ballistic missile defense (BMD) weapons is so blurred as to often make it impossible to distinguish between the two. Indeed, some opponents regarded SDI as little more than cover for a "bloated ASAT development effort."[74] While that assertion is undoubtedly inaccurate, it correctly appreciates that defensive capabilities against ballistic missiles can equate to offensive capabilities against satellites. Since this is

so, it is reasonable to assert that the United States continued to pursue ASAT technologies through the R&D associated with SDI and President Bush's subsequent global protection against limited strikes (GPALS).

In the two years after President Reagan's Star Wars speech in 1983, SDI became the Pentagon's largest single R&D program.[75] Reagan's planned SDI architecture included space-based missile warning satellites, traditional ground-based ABMs with conventional warheads, and constellations of space-based interceptors—hundreds of satellites, each equipped with small rockets to destroy ICBMs. Over the long-term, SDI intended to replace this architecture with various directed-energy weapons deployed on the ground, in the air, and in space.[76]

The 1972 ABM Treaty clearly influenced SDI's research and test methodology. Since the traditional interpretation of that treaty only allowed for testing of sanctioned ground-based ABM systems and their components, the Reagan administration declined to conduct SDI space experiments in the ABM mode.[77] As a result, active space experiments were always conducted against other "space objects," not missile components, underscoring the tenuous distinction between BMD and ASAT R&D.

With the end of the cold war, President Bush reoriented SDI to GPALS. Since the Soviet threat was now replaced by that of rogue nations with rapidly developing ballistic missile programs, GPALS emphasized more mature technologies suitable for theater and tactical defenses.[78] In addition to the traditional warning satellite and ground-based ABMs, Brilliant Pebbles—an improved space-based interceptor—became the critical space weapon in GPALS. Brilliant Pebbles would consist of hundreds of small interceptors deployed in orbits 400 kilometers above the earth. These interceptors would maneuver to collide with any detected ballistic missiles.[79]

Although the concepts for SDI and GPALS never matured to operational systems, they fostered significant advances in space weapon technologies. For example, ground ABM tests showed significantly improved probabilities for intercepting ballistic missiles from long ranges;[80] a high-intensity particle

beam irradiated a miniature reentry vehicle in 1986;[81] space experiments collected data on target signatures in space;[82] a neutral particle beam was fired in space from a satellite;[83] and in 1991, SDI Office officials unveiled a chemical laser with practical potential to be an effective space-based weapon.[84]

Conclusions Regarding the Historical Trend

In summary US space policy has a strong sanctuary tradition behind it. Since the 1950s and through eight US presidential administrations, Americans significantly restrained their deployment of space weapons. Policy makers recognized that acting otherwise invited international countereforts that, in turn, would jeopardize satellites viewed as essential to American national security. In place of operational space weapons, US decision makers opted for research designed to maintain technological parity in space weapons in case production was required to meet new threats. History shows the US government deployed operational ASATs only when the Soviets directly threatened the continental United States with nuclear space weapons, and the utility of these ASATs was quite limited.

Undoubtedly, the United States's sanctuary policies were instrumental in limiting the degree to which space weapons proliferated. Today, space remains relatively unweaponized—defying more than 40 years of a superpower arms race in land, sea, and air weapons. It would be impossible to guess with any precision how things might have turned out had the United States opted to aggressively weaponize space.

Are US space policies of the past relevant for today's decision makers? That question has no simple answer because historical contexts never precisely repeat themselves. Nevertheless, history provides a powerful case study of space sanctuary policy. Understanding the sanctuary perspective in its strongest form requires one to fully appreciate the implications of the historical record. If contemporary US leaders elect to weaponize space today, that decision will stand in marked contrast to almost all US space policies of the past. It would be viewed, domestically and internationally, as a significant discontinuity in US national strategy.

Contemporary US Policy on Space Weapons

> *The United States is committed to the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all humanity. "Peaceful purposes" allow defense and intelligence-related activities in pursuit of national security and other goals. The United States rejects any claims to sovereignty by any nation over outer space or celestial bodies, or any portion thereof, and rejects any limitations on the fundamental right of sovereign nations to acquire data from space. The United States considers the space systems of any nation to be national property with the right of passage through and operations in space without interference. Purposeful interference with space systems shall be viewed as an infringement on sovereign rights.*
>
> —President Clinton's National Space Policy
> 19 September 1996

Today, US space policy continues to reflect the sanctuary tradition of the past. Like so many of his predecessors, President Clinton opposes aggressive weaponization of space.

President Clinton is being challenged by space weapon advocates around the defense community and in Congress. As that debate unfolds, the United States persists with a familiar course of action—space weapons research and development to a point short of operational deployment.

Space Weapons and the Clinton Administration

While President Clinton tacitly accepts the military missions of space force application (the projection of firepower against surface targets from space) and space control, he clearly has reservations about space weapons. The White House's National Space Policy directs the DOD to "maintain the capability to execute the mission areas of space support, force enhancement, space control, and force application."[85] A more pointed statement remarks later on that "consistent with treaty obligations, the United States will develop, operate, and maintain space control capabilities to ensure freedom of action in space, and, if directed, deny such freedom of action to adversaries."[86]

These policy statements cannot be construed to mean President Clinton emphatically endorses space weapons. His administration has consistently demonstrated an aversion to such systems.

When President Clinton assumed office in 1993, he acted to prune space weapons from two high-profile defense initiatives. First, he redirected the Ballistic Missile Defense Office's agenda to emphasize local theater missile defense (TMD) at the expense of a more global national missile defense architecture.[87] Reflecting a stricter adherence to traditional interpretations of the 1972 ABM Treaty, this new approach to ballistic missile defense substituted ground-based defenses for space-based weapon systems.[88] Specifically, the Brilliant Pebbles interceptors central to President Bush's global protection against limited strikes was conceptually replaced by the Patriot advanced capability, the upgraded Aegis radar, and the theater high-altitude area defense (THAAD)—all ground-based ABM systems. The only space systems to survive the rearchitecture were satellites designed for passive surveillance.[89]

President Clinton's aversion to space weapons is communicated in his ASAT policy, as well. After his inauguration, he marked for termination President Bush's kinetic energy (KE) ASAT initiative.[90] He has yet to propose a budget with funding for that system.[91]

The Convictions of American Space Weapon Advocates

Growing elements of Congress and the defense community are resisting the president's position, however. Since 1994 the Senate has sustained the KE ASAT program with unrequested funds.[92] In the fiscal year 1997 budget, for example, Congress unilaterally added $50 million to develop this antisatellite system.[93] An analyst for the Congressional Research Service notes that on the subject of ASATs, "the current Congress is certainly more supportive than the last several congresses."[94]

Congress, supported by senior defense leaders, believes its actions are consistent with national security requirements. Their case is built around two basic convictions. First, proponents believe space is too central to America's power to remain unprotected. They view the US space infrastructure as a cen-

ter of gravity. Soon after assuming command of the US Space Command, Gen Howell M. Estes III, noted that, "we are the world's most successful space-faring nation . . . , one of the major reasons the United States holds its current position in today's league of nations. But, we are also the world's most space-dependent nation, thereby making us vulnerable to hostile groups or powers seeking to disrupt our access to, and use of, space. For this reason, it is vital to our national security that we protect and safeguard our interests in space.[95] The ability of our potential adversaries to affect our advantage in space is growing. We, in military space, are just now beginning to consider and deal with these threats."[96]

Senior DOD leaders particularly highlight America's growing dependence on space systems for economic and military prowess. In February 1997, the Deputy Under Secretary of Defense for Space Robert V. Davis underscored the economic vulnerability of satellites that pass extensive electronic commerce through space.[97] That same month, CINC USSPACECOM cautioned that DOD space systems also present adversaries with lucrative targets. He observed that "in purely military terms, the national dependence on space-based systems equates to a vulnerability. History shows that vulnerabilities are eventually exploited by adversaries, so the United States must be prepared to defend these systems."[98] Recognizing these vulnerabilities, many policy makers see space combat and weapons as inevitable. "The United States will . . . eventually fight from space and into space," remarked Gen Joseph W. Ashy, CINC USSPACECOM at the time of interview.[99] "We are developing direct-force applicators," he emphasized on another occasion. "They can be delivered by terrestrial [means], as well as from aircraft, shooting [targets] in the air or in space."[100] Secretary of the Air Force Sheila Widnall allowed that these direct-force applicators might range from shooting down satellites to less obtrusive interference with an adversary's signals.[101]

As a second basic conviction, US space weapon proponents believe that adversaries will unilaterally develop space systems in pursuit of greater relative power. Proponents are concerned about hostile space intelligence surveillance, and reconnaissance, information (ISR) satellites, as well as hostile

space weapons. They recommend the deployment of US space weapons to counter these international developments.

US advocates of space weapons decry the improving ISR space posture of our potential adversaries. At the end of 1995, some 31 nations or international ventures had at least one such satellite payload in orbit.[102] Gen Robert S. Dickman, the DOD's space architect, predicts that in the next decade more than 20 nations will field space systems that "will have some ability to influence the battlefield."[103] Such systems will put US soldiers at risk, as adversaries take advantage of the force multiplication offered by their own satellites. In the words of the deputy undersecretary of defense for space, the United States must begin to prepare for adversaries that "will be able to use space to [their] advantage the same way we use it for ours. . . . I guarantee, in the near future, that threat will emerge; it's only a matter of time."[104] Vice Chief of Staff of the Air Force Gen Thomas S. Moorman Jr. sees this development as unacceptable. "Just as it would be unthinkable in a future conflict to permit an adversary to use an aircraft to reconnoiter our battle lines for intelligence and targeting, so is it equally unacceptable to allow enemy reconnaissance satellites free and unhindered flight over US military positions. An operational ASAT capability designed to eliminate an adversary's space capabilities must be considered an integral part of this country's force structure."[105]

General Moorman's message is winning support on Capitol Hill, where some lawmakers worry about enemy reconnaissance satellites and commercial satellites. "There is concern in this Congress over the proliferation of imagery" from commercial satellites that can be used for military purposes, said a Congressional Research Service policy analyst. The DOD is sensitive to similar concerns. In March 1997, for the first time, the Army publicly linked its eight-year-old ASAT development with the threat of foreign space-based remote sensing. Specifically, the Army Space and Strategic Defense Command acknowledged it needs rapid development of an ASAT to combat the growing "spread of space-based photography" that has led to concerns that "hostile reconnaissance could be used against the United States and allied military forces in the future."[106]

In addition to the threat posed by proliferating ISR satellites around the globe, advocates of space weapons are wary of foreign ASATs. Senior DOD officials acknowledge that the facilities and launch pad for Russia's co-orbital ASAT are still in place.[107] Many strategists also point to the likelihood that others will follow suit. One such strategist logically points out the attractiveness of ASATs to America's competition. "We should expect interest in anti-satellite weapons (ASATs) to proliferate. . . . ASATs may represent a particularly attractive weapon, because the problems posed by a hostile satellite may be most effectively banished by attacking a single target in space rather than numerous and dispersed Earth-bound targets. The United States has concentrated its space functions on a small number of satellites, meaning that the loss of one or more systems in the midst of hostilities could have fatal repercussions."[108]

Motivated by convictions that space is a US center of gravity and that foreign military competitors will exploit space systems of their own, weapon proponents are successfully impacting today's plans and budgets. For the first time since President Reagan's SDI, a draft National Security Space Master Plan endorses the creation of an offensive space capability against "surface, space, and airborne targets" as US national policy.[109] Consistent with this master plan, the Pentagon is requesting some $84 million for RTD&E under budget lines for "space and electronics warfare," "advanced materials for weapons systems," "advanced weapons technology," and the "DOD high-energy laser facility."[110] This money would be in addition to the congressional funding for a KE ASAT.

Thoughts on Departing the Traditional Sanctuary

In summary, while President Clinton resists deployment of space weapons, other senior policy makers continue to argue for their utility. These policy makers see space weapons as inevitable guardians of US access to space—access fundamental to national power. In addition, advocates promote space weapons as a counter to proliferating foreign ISR and ASAT technologies.

It is interesting that these convictions were just as true during the cold war as they are today, if not more so. Then,

US leaders also recognized that space played a central role in US national security. The threat posed by Soviet ISR satellites and ASATs was considerable during the cold war. In fact, both the threat and its implications were arguably far graver than those posed by potential adversaries today. Yet, US officials restrained themselves from more than token weaponization of space during that conflict.

How contemporary US decision makers would distinguish their situation from that of cold war strategists is a lengthy debate in itself. Perhaps today's looser association of space with the nuclear "sword of Damocles" permits greater freedom to act aggressively there. Then again, perhaps technology has matured to the point where cost-effective weapon concepts are feasible. The proliferation of ballistic missiles to the third world and a heightened US sensitivity to casualties might make those cost-effective space weapons particularly attractive.

Whatever the differences between the eras, some US decision makers believe those differences now make space weapons necessary. Indeed, they may be absolutely correct—this study in no way attempts to belittle their concerns. Nevertheless, decisions addressing space weapons should be postponed until strategists seek out and understand all sides of the debate. This is the goal of the next section. It seeks to round out the debate by articulating a contemporary argument against space weapons today.

The Sanctuary Argument

This section strives to articulate the strongest possible case against weaponizing space further in the immediate future. It works to capture the essence of what sanctuary advocates might argue given their "day in court." The basic premise of this sanctuary argument is that US interests are better served by preserving the present equilibrium in space weapons. It cannot be overemphasized that the case presented here does not propose that the United States should *never* introduce space weapons, but rather that it should *postpone* weaponization until current conditions change.

No attempt is made here to rebut the sanctuary argument. Rather, this section aims to present space weapon advocates with a counterargument to round out the debate. Indeed, the section will be written with a parochial edge to emphasize that counterargument.

The sanctuary argument is presented in two parts. First, it challenges the two basic convictions of space weapon advocates previously summarized. In some cases, that means asserting the basic convictions are incorrect. Where the convictions are incontestable, it means offering policy alternatives to space weapons. Second, the argument makes a positive case for a contemporary sanctuary strategy independent of the two basic convictions—with the goal of connecting such a strategy to broader national interests.

Challenging Weapon Advocates' Basic Convictions

As a first conviction, weapon advocates propose that space is central to US power and must be protected as a center of gravity (COG). This conviction rests on the fundamental assumption that in guarding against exploitation of a presumed US space Achilles' heel there is no alternative but to protect it with space weapons. Military history offers many examples of similar dilemmas solved by eliminating the COG rather than protecting it. In the 1960s, US military credibility rested heavily on bombers and land-based ICBMs. These systems constituted a friendly COG. Improved Soviet nuclear strike capabilities eventually rendered these COGs vulnerable. The principal US response was not to protect their land-based forces by active defenses designed to defeat inbound Soviet missiles. Instead, the United States mitigated its vulnerability by reducing the extent to which the ICBMs and bombers themselves were COGs. The development of submarine-launched ballistic missiles devolved part of the nuclear mission to a third medium—the sea. US strategic vulnerability was reduced. A similar approach is open to policy makers concerned about the exposure of US space assets.

Strategists must recognize that space communication, surveillance, reconnaissance, and navigation systems are not COGs because they are in space; they are COGs because they

are centralized communication, surveillance, reconnaissance, and navigation systems. Options exist, however, to share these missions with other terrestrial systems and pursue a widely distributed space architecture. This decentralization would not only reduce US vulnerability in space but might do so without degradation of mission performance. Significantly, as the vulnerability is reduced, the case for space weapons weakens. Protection is accomplished through decentralization and diversification rather than through active defenses.

Current technology hints that this approach to national security is reasonable. Unfortunately, the possibility is masked by the past successes of centralized space assets. Operations such as Desert Storm continue to foster a paradigm that space is now and must always be the principal medium for DOD command, control, communications, computers, and intelligence (C^4I) systems. An overwhelming 90 percent of the coalition's intertheater communications and 60 percent of their intratheater communications were carried by satellites in that conflict. These statistics downplay the fact that 40 percent of the intratheater communications were successfully carried through terrestrial communication links. Microwave, tropospheric, and switched network communications quickly established operational connectivity and began to replace point-to-point satellite communications at both the intertheater and intratheater levels.[111]

The statistics from Desert Storm also understate the vulnerability of satellite communications (SATCOM) to jamming, interception, monitoring, and spoofing. The Iraqis were known to have at least four Soviet-made ultrahigh frequency jammers capable of shutting down up to 95 percent of the wartime communications to and from the US Navy.[112] Such vulnerability led the cochair of a Defense Communication Agency review of the Gulf War to emphasize the need for alternatives to SATCOM.[113] Some of the more promising alternatives that permit this are maturing at a blistering pace.

Fiber-optic technology is one example and is already routinely used by the commercial sector. A single optic fiber exceeds the entire carrying capacity of current satellite designs. In fact, the international demand for fiber-optic paths has

prompted trans-Atlantic cables boasting 60,000 channels each. The performance and cost-effectiveness of fiber optics presages its rapid growth in the future.[114] In addition to fiber optics, technologies employing microwave, millimeter wave frequency, infrared, and laser communications also offer enormous broadband capabilities.[115]

General Dickman, the DOD space architect, recently advanced another alternative to present SATCOM architectures. Citing that one of his biggest challenges was getting the military and national security space communities to accept "a different way of looking at space," Dickman proposed communication packages be carried aboard unmanned aerial vehicles (UAV).[116] The military is on the verge of being able to field such a capability. For example, by the end of 1997, the United States was scheduled to build two Global Hawk UAVs capable of line-of-sight data link communications. These vehicles can be launched from ranges up to three thousand nautical miles and still loiter over a target area for 24 hours at altitudes greater than 60,000 feet.[117] With launch bases closer to the theater, loiter times approach 48 hours. The communications payload built for the Global Hawk is equally impressive. It essentially equals the communications capacity of a defense satellite communication system (DSCS) satellite, making the Global Hawk a viable and extremely cost-effective satellite surrogate.[118] The current DOD contract fixes the average unit price of the Global Hawk at $10 million.[119] This contrasts dramatically with the $140-million price tag of a DSCS satellite and its $86-million Atlas booster.[120]

In addition to their contributions to communications, systems such as the Global Hawk are strong candidates to perform reconnaissance and surveillance missions traditionally dominated by satellite platforms. The Global Hawk carries an advanced suite of ISR capabilities. The data from these sensors is processed by the equivalent of an onboard supercomputer before downlink—a system that allows coverage of a geographic area the size of Illinois in just 24 hours at three-foot resolution.[121] It is also capable of spot images with one-foot resolution.[122] No wonder a summary of UAV contributions reads like that of satellites: "responsive and sustained data

from anywhere within enemy territory, day or night, regardless of weather, as the needs of the warfighter dictate."[123] Significantly, the UAV provides these capabilities within an architecture that is easily reconstituted. It is less expensive and far simpler to replace a downed UAV than a satellite lost on orbit. The last major satellite mission area is that of navigation. No discussion of the Gulf War can overlook the significant contribution of the global positioning system (GPS). By the end of the war, close to 10,000 receivers guided ships, aircraft, tanks, and infantry soldiers through deserts with no distinguishable landmarks.[124] GPS is even more valuable today. DOD is basing the guidance of a new generation of precision-guided munitions on space-based data. This trend leads advocates of space weapons to posit that GPS satellites warrant protection from attack or interference. Nevertheless, the better solution might be to shift navigation capability back to terrestrial systems. Inertial navigation systems, for example, free navigation from external data links and are rapidly improving. Not only are inertial navigation systems becoming more accurate, they are also becoming more portable, as the military recognizes. Between 1996 and 1999 the Pentagon plans to triple its investment in micromechanical systems with an emphasis on miniaturized inertial measurement, distributed sensing, and information technology.[125] A concerted emphasis on these kinds of technologies could not only build a military relatively insensitive to attack on its space navigation assets or jamming of its signals but also might allow the United States to deny less-developed adversaries access to free GPS data when the shooting starts.

Shifting space missions to terrestrial mediums is one way to minimize US vulnerabilities in space. Another way is to evolve today's centralized space architecture to one that is more distributed and decentralized. Not only would this further mitigate the potential US vulnerability in space but system performance might actually improve. Lt Col Christian C. Daehnick, in the previous chapter of this book, determined that a space architecture with smaller, distributed satellites "more directly responds to the needs of today's primary users and can adapt more readily to changes in both requirements

or technological opportunity."[126] Others are reaching the same conclusions.

The National Reconnaissance Office (NRO) revealed it will downsize its national security satellites to a maximum of "½ their current size, and in some cases ¼ of the current weight," while making them more capable than today's spacecraft.[127] Similarly, the Air Force's improved space and missile tracking system will eventually launch 12 to 24 681-kilogram satellites into a distributed constellation.[128] In the future, the space community may consider even these satellites overly large and centralized. The Phillips Laboratory will begin space-based testing of miniaturized components that could lead to grapefruit-sized smart satellites within a decade.[129]

As US space assets shrink in size and weight, "clouds" of small satellites will foster survivability by eliminating single point failures in mission capability. The smaller satellites also enhance survivability by allowing more economical launch systems to replenish satellite constellations. In anticipation of this, the US Air Force is considering a reusable launch vehicle (RLV). The RLV technology, developed in the National Aeronautics and Space Administration (NASA) programs, promises to reduce today's $4,500-per-kilogram costs for low Earth orbit payloads to some $450 per kilogram. NASA administrator Daniel Goldin predicts the RLV will also bring a tenfold improvement in launch reliability.[130]

In summary, advocates of space weapons are correct in their diagnosis, but misguided in their cure. The degree to which the United States has centralized its communication, surveillance, reconnaissance, and navigation systems in space translates to a potentially serious US vulnerability. Rather than introduce weapons to defend these assets, however, the systems themselves could be decentralized and diversified across the air, land, and sea mediums. In this way, the American COG in space could be defended by eliminating it. Note that this does *not* mean the United States should work to abandon space. Instead, it means finding a balance between reliance on space and terrestrial systems, between centralization and decentralization, so as to mitigate the value of US

space assets as a COG and obviate the requirement for space weapons for defense.

As a second conviction, space weapon advocates postulate that the US's international competitors will unilaterally move to exploit and control space. More specifically, this conviction assumes that adversaries will develop effective ISR space platforms. Next, it presumes that adversaries will not stop with ISR space systems but will strive to weaponize space as early as possible––with or without provocation from similar US actions. The significance of the first assumption and the accuracy of the second are debatable. For the first, it is disputable whether foreign ISR satellites should significantly alter US military effectiveness. Even if they did, the United States would find it very difficult to target them without recrimination. The commercial and international character of satellites present the targeteer with troublesome sensitivities. Evidence against the second assumption asserts that, unless provoked by extensive US space weaponization, the US's adversaries will not be inclined to pursue space weapons.

Some proponents of space weapons believe foreign ISR satellites—particularly reconnaissance—warrant weapons for preemptive strikes. There are other ways to defeat ISR systems without incurring the costs and risks associated with space weapons. Consider that an opponent being as "blind" as the Iraqis were during the Gulf War is a historical anomaly and not a prerequisite for victory. In World War II, for example, the United States prevailed over adversaries who possessed ISR assets nearly equal to those of the Allies. Allied techniques like concealment, communications security, deception, and operations security proved to be effective countermeasures to enemy ISR capabilities. In this respect, Americans would do well to recall the effectiveness with which the North Koreans, Chinese, North Vietnamese, and Afghani mujahideen operated against superpower militaries. These superpowers possessed space and air superiority—accessing at will any spot in the theater with ISR capabilities. Repeatedly the superpowers were frustrated by their opponents' low-tech countermeasures. December 1950 offers one telling example. In that month, a surprise Chinese offensive drove the US Eighth

Army back into southern Korea. To support the Eighth Army, the Fifth Air Force was ordered to locate precisely the Chinese forces on the other side of the front. Robert F. Futrell notes that 10 days of unspared aerial reconnaissance and 27,643 reconnaissance photographs revealed nothing in front of the Eighth Army's position. What the all-out reconnaissance effort missed were 177,018 troops of the Chinese Fourth Field Army—true masters of camouflage and operations security.[131]

Although US countermeasures will not render enemy ISR satellites totally benign, US military effectiveness is far from lost. Seeing US forces is one thing, attacking them is another. The United States employs a formidable array of defensive technologies designed to prevent enemy penetrations of all types. Even the troublesome ballistic missile threat is well on its way to being thwarted by maturing US theater ballistic missile defense systems. The United States also possesses the world's most effective offensive forces, capable of destroying an enemy's terrestrial links to ISR satellites. So while the adversary's satellite may not be blind, the data is nevertheless lost. For example, during the 1991 Gulf War, Iraqi access to Arabsat telecommunication satellites was severed when a coalition air attack destroyed the Arabsat earth station in Baghdad.[132]

In summary, then, the United States is neither compelled nor limited to countering enemy ISR satellites with space weapons. US military effectiveness can be preserved through operational security, defensive technologies, and attacks on the key terrestrial nodes supporting the enemy space systems.

US strategists still bent on augmenting passive countermeasures with preemptive attacks on foreign ISR satellites face the challenging task of distinguishing between military and commercial systems. Writing from the Centre for Defence Studies and Space Policy Research Unit in Great Britain, Alasdair McLean notes that "all remote sensing satellites relay data on the area of the earth's surface they observe. If, within that area, lie sites of military interest, the data thus obtained is of military value. Likewise, communications satellites, even if not specifically dedicated to military use, can be used for such purposes, whether by normal commercial contracts, or by special agreement in time of crisis or conflict."[133]

The Meteosat-4 satellite, operated by the European Space Agency, illustrates McLean's contention. That satellite transmits signals every 30 minutes to any user with proper receiving equipment. During the Gulf War, a Plymouth College professor built his own homemade receiver and was surprised to see that he could detect troop concentrations in the Gulf area from the weather imagery. Clearly this shows the "undoubted military potential of the most innocent civilian satellite."[134] The high-resolution imaging capabilities of the French *Systeme Probatoire pour l'Observation de la Terre* (SPOT) made it less innocent in the context of the Gulf War. Fortunately for the United States, SPOT Image agreed not to sell its photoreconnaissance outside the coalition. During the same conflict, however, the US-based company that operates Landsat insisted on selling imagery to noncoalition countries, arguing it had a legal obligation to do so.[135] Such uncooperative civilian and commercial systems present military planners with dubious if not provocative targets. Aggressors against these systems must carefully balance military necessity with collateral damage. They must also recognize that allies may be users of the targeted systems. This is precisely what happened in the Gulf War. Iraq had access to civilian-run Intelsat, Inmarsat, and two regional Arabsat telecommunications satellites.[136] Such arrangements will immeasurably complicate future efforts to attack satellites.

Whereas foreign ISR satellites are a reality, foreign space weapons are not. Today there is little to suggest that another nation with the economic, technological, and space expertise required to pursue space weapons is inclined to do so. This includes Russia, Europe, Japan, and China.

Except for the United States, Russia is the only nation to have demonstrated any historical interest in ASAT technologies. In November 1991, the Russians announced that their co-orbital ASAT remains "operational" today. Although this Russian ASAT does threaten certain US space assets, its effectiveness should be kept in context. First, in 29 tests of the system between October 1968 and June 1982, there were 12 failures.[137] Second, the most recent test was conducted 12 years ago.[138] Third, tests were only conducted across orbital inclinations of

62 to 66 degrees and altitudes of six hundred to 1,000 miles.[139] Most of the US's satellites are at altitudes greater than 1,000 miles and well outside the tested inclinations. The performance of the Russian co-orbital ASAT is limited by other operational constraints as well. Days are often required to achieve the orbital conditions that allow a successful launch and intercept. In addition, the nature of the co-orbital intercept provides advance warning of hostile intentions, thus allowing evasive actions on the part of the target. In David Lupton's words: "US terrestrial assets are more vulnerable to numerous threats (including terrorist acts) than are space systems threatened by the Soviet ASAT."[140] Reportedly the Russians have also experimented with other forms of ASAT weaponry. Starting in the 1970s, Russia extensively pursued high-powered, ground-based lasers and microwave weapons. A more conventional ASAT program, very similar to the US F-15 air-launched ASAT, was also kicked off in the late 1980s.[141] Although it is unclear what these efforts finally achieved, there are no indications that any of the concepts matured to become operational systems. Nor is it likely any of the concepts will do so, given the current fiscal condition of the Russian space program. In January 1997, Russian Space Agency (RSA) Director Yuri Koptev warned that without increased funding, Russia would be unable to maintain even a skeleton space program. He acknowledged that of 20 nations active in space research and satellite launches, Russia ranked second to last. Only India spent less. In 1996 this meant that only 11 of the RSA's 27 planned civil missions were actually launched. The RSA's woes are affecting its personnel, as well. Since 1989 half the engineers and technicians have left the RSA as Russian spending on space programs fell each of the previous eight years.[142] Money is so scarce that Russia risks losing its place in the highly visible international space station program. Vice President Albert Gore warned in 1997 that Russian participation would be jeopardized if Russia failed to release millions of rubles withheld from time-critical contracts.[143]

Less information is available on Russia's annual military space budget, but requests for 1995 reveal planned expendi-

tures roughly equal those of the RSA.[144] This indication of dramatically reduced spending on military space systems is corroborated by other evidence. In 1996 there were no Global Navigation Satellite System (GLONASS) navigation satellite launches despite the fact that three GLONASS satellites stopped transmitting signals in that year.[145] Consider also that between 1962 and 1994, the Russians averaged more than two photoreconnaissance spacecraft on orbit. During that same period, there was never a gap in coverage.[146] Today, although it had planned to keep at least one imaging system operational, Russia has no imaging reconnaissance satellites in orbit—a Russian first that stands in stark contrast to the five imaging satellites the United States currently has aloft.[147] As yet another example of deep spending cutbacks, the Russians postponed the December 1996 launch of a new missile warning satellite "to conserve carrier and spacecraft."[148] In light of this and the other operational and fiscal constraints noted above, a concerted Russian effort to develop space weapons appears unlikely in the near future.

While Russia struggles to regain its footing in space, Europe is pursuing strategies for cooperation in the civilian sector. Joint European endeavors in military programs like the Helios reconnaissance satellite are clearly the exception and not the rule.[149] Consistent with this position, European nations continue to rebuff US initiatives to cooperate in ballistic missile defense technology developments. Hence, Alasdair McLean's conclusions on Europe and space weapons: "no evidence exists for any real enthusiasm for European nations to develop active space-based weapon systems."[150]

Any analysis of Japanese ambitions to weaponize space must ultimately consider Japan's constitutional prohibition against offensive military capabilities. Since 1945, Japan has severely constrained its defense expenditures in deference to public support for that prohibition and the military security already provided by US forces.[151] Japan's national sentiment fosters budget woes for the Japanese Defense Agency. Plans for a missile warning satellite were scrapped in favor of the short-term solution of buying US airborne warning and control system (AWACS) aircraft instead.[152] On a related note,

Japan recently declined to participate in a joint venture to develop an operational theater missile defense. This evidence indicates that Japan is not inclined to weaponize space.

In terms of space programs, China is Asia's most visible nation. Recently, however, Chinese energy has been devoted to securing the cooperation of the United States and Europe in aerospace ventures. New Chinese initiatives into the next century include an improved booster, technology work geared to a Chinese manned space presence, new imaging spacecraft, and many new communication satellites. Analysts see the Chinese willingness to cooperate as China's admission that it is falling behind its Asian neighbors, such as India and Japan, which are already cooperating with the West.[153] A series of booster failures confirms that there may be cause for Chinese concern. The August 1996 explosion of a Long March 3 rocket pushed China's launch failure rate to more than 30 percent and is the sixth failure in less than four years.[154] In contrast, the January 1997 failure of a US Delta 2 at Cape Canaveral represents an anomaly for a program that enjoys a 98 percent success rate even after the accident.[155] In total, then, it is reasonable to conclude that the Chinese desire to encourage cooperation with the West and the Chinese struggle for reliable space technology will discourage near-term pursuit of advanced space weapons—as long as they do not feel threatened.

In summary, any assertion that the United States should aggressively pursue weaponization to beat adversaries already rushing in that direction is questionable. While it is true that potential adversaries continue to perfect ISR spacecraft, US responses are not limited to shooting those spacecraft down. Time-tested techniques with passive countermeasures and attack of terrestrial choke points offer alternative solutions. Since these options remain effective, the United States should shun provoking potential adversaries by unilaterally employing space weapons. In addition, a close examination of the principal actors in space today indicates that the nations pursuing ISR spacecraft do not appear to be inclined to weaponize space. A depolarizing world headed toward widespread democracy, tight military budgets, mission failures, and flat out disinterest in weapons currently motivate these principal actors to put aside

space weapons development. Therefore, contrary to the view of a world racing to weaponize space, the world seems poised to follow the US lead. Today, foreign interest in space weapons may hinge entirely on US restraint or weaponization.

Independent Arguments for a Sanctuary Strategy

Simply refuting the basic convictions of space weapon advocates shortchanges the strongest possible argument for a sanctuary strategy. Sanctuary strategists should also attempt to prove their concepts best serve US national interests on other grounds. These interests are broader than the military objectives that support them. White House policy makers clearly convey these broader interests in the 1996 National security strategy. That document states that "the nature of our response must depend on what best serves our own long-term national interests. Those interests are ultimately defined by our security requirements. Such requirements start with our physical defense and economic well-being. They also include environmental security as well as the security of our values achieved through expansion of the community of democratic nations."[156]

As a starting point to extending the sanctuary argument, it is reasonable to postulate that physical security, economic well-being, and democratic expansion depend on the quality of American international relations. If that is accepted, the value of weaponizing space should, in part, be judged by its effect on those relations. It is quite possible that weaponizing space may turn out to be unacceptably provocative—particularly in the post-cold-war world—leading to global instability and deteriorating US foreign relations.

Space weapons are provocative because they inherently possess offensive utility. Consider that war in space is much like the infamous shoot-out at the OK Corral. In that gunfight, armed men constituted an enduring offensive threat to all other gunslingers. There were no defensive shots, and at all times anybody was a potential target. Space is similar. The laws of astrodynamics routinely give space weapons (ground- and space-based) clear line of sight to the satellites or territories of other nations. Such weapons could be fired instantane-

ously and without warning. Significantly, these circumstances encourage future space combatants to preempt adversaries by shooting first. This destabilizing result is discussed below in more detail.

Even if space weapons could be understood as defensive, the US's current treaty obligations make it likely that steps toward weaponizing space will strain its international relations. The 1972 ABM Treaty, for example, bans development, testing, and deployment of space-based ABM systems or components. The treaty also limits the United States and Russia each to a single ABM site with no more than one hundred missiles.[157] Except for the protection of National Technical Means of Verification granted in Article XII of the same treaty, international law is ambiguous if not silent on the subject of ASATs.[158] The traditional international precedent of "that which is not prohibited is permitted" would seem to remove ASATs from treaty constraints. The difficulty in distinguishing between ASATs and ABMs makes this problematic since a powerful ASAT weapon also threatens ballistic missiles. Therefore, a concerted US effort to develop any weapons that project destructive force into or from space will foster protest from those sensitive to violations of the 1972 ABM Treaty. Objections from the Russians are particularly worrisome since they have clearly linked both Strategic Arms Reduction Talks (START) treaties to continued US compliance with the ABM Treaty. Under these accords, thousands of missiles will be destroyed by the United States and Russia. Clearly, preserving these accords is well within the US's national interest. In the words of one of the ABM Treaty negotiators, "A missile scrapped is a missile that does not have to be shot down."[159]

If space weapons are indeed offensive by nature and if they unavoidably challenge international law, then US actions to weaponize space could easily aggravate the security dilemma that fosters arms races. Nations exist in a setting where no diplomatic sovereign arbitrates international conflicts. Each must ultimately rely on its own strength for protection and constantly look for shifts in relative power.[160] This preoccupation with relative position means that even arms acquisitions intended purely for self-protection are destined to menace

one's global neighbors.[161] "What one state views as insurance, the adversary will see as encirclement."[162] In this way, US initiatives to strengthen its relative posture in space could drive other nations to follow suit—even if each is motivated by what it sees as peaceful goals. It is the classic prisoner's dilemma: each state pursuing its own self-interests in space only to find in the end that all are worse off than if they had cooperated.[163] Those familiar with game theory know the opportunity to break this cycle occurs when a principal player risks compromising immediate self-interests for the longer-term good of all. Since the United States undoubtedly leads the world in space weapon technology, the question becomes: Will America lead the world toward cooperation or conflict?

The traditional view of space power as a symbol of international prestige is another force driving nations to keep pace with US technology. In their book *The Prestige Trap*, Roger B. Handberg and Joan Johnson-Freese study what motivated the US, European, and Japanese space programs. They specifically address the question of why these nations made serious resource commitments to exploiting a medium that promised little in the way of immediate return.[164] The answer, in all three cases, was primarily prestige and national pride (with a dash of scientific curiosity).[165] While acknowledging that these early space efforts were often civilian in character, the authors note that "civilian space policy has clear links to the military-industrial policies within most societies. The technologies and technical skills involved in civilian space endeavors in many cases have clear and ready applications to military technology . . . the boundary is thin and easily breached."[166] On either side of this boundary, US strategists should expect their international competitors to keep pace with US developments.

Some strategists might remain relatively unfazed by competition from staunch allies like the Europeans and Japanese. They should pause to reflect, however, because the introduction of space weapons might jeopardize those alliances. From his study of contemporary history, Stephen M. Walt concluded that nations are far more likely to ally against dominant threats than they are to bandwagon with them.[167] This balancing behavior occurs because nations recognize their odds for

survival are improved by confronting a rising hegemon before it becomes too strong to resist. Since allying with a hegemon entails the gamble of trusting it, the safer strategy is to join forces with other less threatening nations.[168] The factors that incite this reaction to an emerging hegemon are the hegemon's aggregate power, proximity, offensive capability, and offensive intentions.[169] Nations will be more prone to balance as the threat gets stronger, closer, more offensively capable, and more hostile. This framework poses problems for US strategists planning to weaponize space. Space weapons increase US power with systems already noted as inherently offensive. In his paper on the implications of space weapons, Dr. Karl Mueller postulates that space weapons will also "increase the effective proximity of the United States to previously distant states."[170] The net effect of these changes might well foster an international perception that a new and different US threat is emerging. This perception could lead nations presently friendly or neutral toward the United States to balance against it when US space weapons are deployed. At a minimum, nations may at least become less willing to cooperate with the United States.[171] Such was Germany's fate when Admiral Tirpitz built a formidable battle fleet as a means of coaxing Britain's alliance. Instead, the British redoubled their own shipbuilding and moved diplomatically closer to France and Russia.[172]

In general, the United States tends to underestimate how its actions affect the security dilemma and international balancing. The United States sincerely believes its actions are categorically peaceful and are perceived as such by other nations. However, this is not the way the rest of the world—including allies—always views the United States. In a multipolar world, the United States is the single most powerful competitor. This distinction naturally impels other nations to observe the United States with at least some suspicion. As an illustration, US Space Command acknowledged that it officially "predicts when selected satellites will be in position to perform intelligence collection against US forces and military/military-related installations, and makes these predictions available to installation commanders." Most Americans would clearly cast

this statement in a benign light. They would view such a capability as defensive—the inherent right of US forces to remain aware of when they are being observed. There are reportedly some in the international community who have a different interpretation, however. They link this US Space Command mission with US Army statements that justify the KE ASAT program as fulfilling a requirement to deny hostile remote sensing and reconnaissance capabilities. According to *Military Space*, that "potential linkage . . . generated some uneasiness, especially among foreign space officials."[173]

Whatever the reaction of the international community, the introduction of weapons into space would be strategically destabilizing. Robert Jervis postulates that the military stability of the international system resides in two variables: first, whether defensive weapons can be distinguished from offensive ones and second, whether defensive or offensive weapons are superior.[174] Since space weapons were shown earlier to be inherently offensive, the question of international stability ultimately depends on whether one believes space weapons are superior. Certainly, the US Air Force suspects that they are. The new Air Force strategic vision, approved at the 1996 Corona meetings, states, "We are now transitioning from an Air Force into an air and space force, on an evolving path to a space and air force."[175] What Air Force leaders have apparently concluded is that space is becoming a dominant medium of the future. If they are right, Jervis's framework predicts that space weapons will tend to destabilize the international order. Such weapons favor the side that strikes first and penalize the side that hesitates. In warning, Thomas C. Schelling wrote, "The whole idea of accidental or inadvertent war, of a war that is not entirely premeditated, rests in a crucial premise—that there is such an advantage, in the event of war, in being the one to start it."[176] The US Congress Office of Technology Assessment echoed similar thoughts years later: "Pre-emptive attack would be an attractive countermeasure to space-based ASAT weapons. If each side feared that only a pre-emptive attack could counter the risk of being defeated by enemy pre-emption, then a crisis situation could be extremely unstable."[177] This particular congressional assessment, and that of

Jervis and Schelling, invite US caution with space weapons. The United States may weaponize space only to fight a war that otherwise need not have occurred.

If the future does in fact find the United States in a war featuring space combat, advocates of space weapons assume the United States will prevail. They believe that US technological prowess and industrial power will preserve space superiority. There is no guarantee, however, that the United States will indefinitely possess space superiority—a grave reality since pursuing it may mean forfeiture of the US's hard-won and tentative superiority in the air, land, and sea arenas. Consider the implications of space weapons for US defense spending.

From fiscal year 1996 through fiscal year 2002, defense budgets projected by Congress and the president are expected to decline an average of 20 percent from fiscal year 1995 spending. The Congressional Budget Office reports that the administration remains about $101 billion short of the money required for a fully modernized Bottom-Up Review force.[178] Those shortfalls are further exacerbated by the continuing pattern of diverting procurement funds to pay for operations and maintenance (O&M) costs associated with US peace enforcement forces abroad.[179]

In this budget-constrained environment, funding for space weapons could only come at the expense of other US defense forces. These forces are constantly challenged by global competitors for technological and operational superiority. So far, the United States has done well to preserve its advantage through relentless modernization of its systems. Those modernizations are expensive and today are stretched out beyond the life cycle of the systems they replace. While acknowledging that today's force can handle today's threats, the current chief of staff of the Air Force recognizes that resources are not available to modernize everything at once. His acquisition plan, therefore, calls for just-in-time modernization. F-22s are phased in to replace today's fighters just as those fighters are made obsolete by foreign developments. The C-17 is delivered just as C-141s retire. "We are phasing in the capabilities so that they arrive when we need them," he states, but "delays in the modernization will create vulnerabilities very soon."[180] Why

start an arms buildup in space when budget limitations already threaten essential programs like the joint strike fighter and the evolved expendable launch vehicle? Funds allocated to space weapons undermine the budget upon which the US services' just-in-time modernization is predicated. It gambles that investing in space superiority is worth the resulting decline in relative advantage in the other mediums.

Just as there is no guarantee that the United States will maintain air, land, and sea superiority if it shifts significant funds to space programs, there is also no guarantee that the United States will emerge the winner in the space weapons race itself. It is entirely possible that another nation could beat the United States or "leapfrog" past US accomplishments late in the race. It is widely recognized that several European and Asian nations are rapidly advancing technologically. In fact, the United States no longer leads the world in some sectors. Twenty years ago, for example, the United States launched 80 to 90 percent of all commercial satellites in the world. Today, that figure stands at 27 percent and continues to drop as the Russians, Chinese, and French make inroads.[181] The French alone own more than 50 percent of the launch market share.[182] These statistics and other examples challenge the assumption that the United States could never be bested in a technology that proves to be crucial to war fighting in space. It might be somebody else who first develops some concept as revolutionary as British radar in the Battle of Britain, the German blitzkrieg in the Battle of France, or the Russian sputnik during the cold war.

Not only is it possible that foreign know-how might overpower the United States in some key technology sector, but US know-how might work against the United States in a race for space superiority. Dr. Mueller cites nuclear history as an example of this. Today, an early US nuclear monopoly continues to erode with every additional nation that acquires nuclear weapons. It cannot be ignored that the growing US vulnerability to such weapons is in part compliments of the United States. It was the United States that demonstrated the feasibility of nuclear weapons and paid the tremendous nonrecurring development costs to do so. It was from the United

States that atomic secrets leaked to its chief adversary. In general, the growing fraternity of nuclear powers benefited from US hindsight and experience. It ought to be expected that the same thing could be repeated should the United States accelerate development of advanced space weapons.[183]

So far, independent arguments for a sanctuary strategy suggest that weaponizing space in no way guarantees the United States is better postured to meet security challenges. In fact, a practical requirement to cut other US defense expenditures to pay for space weapons may actually make the United States less secure. This could happen if the US's military advantages in space weapons were offset by new disadvantages in the air, land, and sea mediums or if potential adversaries won the contest for space superiority. Even if the United States were to successfully establish an enduring superiority in all mediums, it might prove so provocative as to isolate the United States from the international community. This isolation would undercut the US's stated national interests in physical security, economic well-being, and expansion of democratic values. In addition to the potential impacts on these interests, weaponizing space also jeopardizes US interests in the environment and domestic programs.

US policy makers are growing increasingly concerned that space debris will begin to impede peaceful commercial exploitation of space. This concern dates back to 1967 when the United States signed the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space. Article IX of that treaty requires parties to "conduct exploration . . . so as to avoid their [space and celestial bodies] harmful contamination."[184] In 1996 the president of the United States directed that "the United States will seek to minimize the creation of space debris. . . . The design and operation of space tests, experiments, and systems will minimize or reduce accumulation of space debris consistent with mission requirements and cost-effectiveness. It is in the interest of the US Government to ensure that space debris minimization practices are applied by other spacefaring nations and international organizations. The US government will take a leadership role in international fora to adopt policies and practices aimed

at debris minimization."[185] This environmental concern is real and must be factored into the decision to weaponize space. Space combat is potentially very messy—recall that a single test of the US's miniature homing vehicle ASAT produced fragments by the hundreds.[186] Combat of this sort could easily come at the expense of commercial exploitation of space. Driving that point home, the French satellite Cerise was crippled in a collision during 1996. It was destroyed by a fragment of an Ariane booster upper stage.[187] Less than a year later, on 15 February 1997, the space shuttle *Discovery* was forced to dodge a Pegasus upper stage fragment.[188]

US space weapons not only jeopardize the environment, they also threaten US budget deficit reduction and domestic spending. It is not unrealistic to expect that weaponizing space, especially if it occurs in the context of an arms race, could be one of the United States's most expensive military undertakings to date.

Since 1984, SDI and BMD researchers have spent $39 billion and the Congressional Budget Office estimates that an effective space-based missile defense, alone, will cost another $60 billion through 2010.[189] Notably, these estimates assume a benign space environment controlled and exploited by the United States. They do not consider foreign challengers in space nor do they consider future military space operations other than ballistic missile defense. Both considerations promise to hike costs further.

These spending estimates come amidst strident calls to reduce the US national debt—calls that political leaders are slowly heeding. Experts project the US's debt at $5,457 trillion after fiscal year 1997. At the end of the same fiscal year, the annual federal deficit, having narrowed roughly $200 billion from 1992 to 1996, is predicted to widen back to $125.7 billion.[190] Remedying these fiscal conditions could well constitute a national interest more compelling than unilateral US action to accelerate the weaponization of space.

Allocating the nation's scarce dollars to important domestic programs may better serve US interests, as well. In 1996 an estimated 555,000 Americans died of cancer—215,000 more than in 1971. Current trends indicate that by the year 2000,

cancer will overtake heart disease as the US's number one killer.[191] Researchers studying cancer are funded from a slice of the National Institutes of Health $12-billion annual budget.[192] In 1994 Congress comprehensively reviewed that budget and the fight against cancer in total. The ensuing report concluded that current research funding is inadequate to "capitalize on unprecedented opportunities in basic science research."[193] Future funding, however, stands in direct competition with that for space weapons. It is a compelling assertion, however, that researchers attacking a disease that every year kills 10 times the number of US combatants lost in Vietnam deserve higher priority than insurance against hypothetical space threats. Consider, also, that cancer research is but one of hundreds of domestic programs in similar circumstances.

In summary, developing space weapons may not serve US national interests. Weaponizing space brings opportunity costs that fundamentally challenge US security interests as defined by the national security strategy. These opportunity costs are steep, and while they may be justified in scenarios where the United States is clearly threatened from space, they appear dubious given the superiority the US military enjoys today.

Summarizing the Independent Argument for Space Sanctuary

In 1996 the Joint Warfighting Center (JWFC) conducted a series of war games to simulate the effectiveness of forces proposed for 2010. In two of the games, US and "red team" forces faced each other with highly capable space weapons in their orders of battle. In both cases, the games opened with what one observer referred to as a "space Armageddon." The flag officers, having quickly discovered that space weapons severely curtailed operational freedom of their air, land, and sea forces, were forced to win total space superiority before proceeding with their terrestrial campaigns.[194]

Advocates of space weapons would be quick to point out that the JWFC war games prove their point—the United States must move *now* to control space or risk losing it in future conflicts.

This section, however, indicates that space weapon proponents should look deeper into the issues motivating them to support weaponizing space *now*. It asks them to carefully differentiate the question of *if* space should be weaponized from the question of *when* space should be weaponized. Today, the United States may have better alternatives with which to reduce the vulnerability of US space systems, as well as better alternatives with which to reduce the exposure of US terrestrial forces to enemy space ISR. In addition, strategists should continue to debate the proposition that weaponizing the high ground unquestionably optimizes US national interests. US space weapons, even if advertised as defensive systems, may unacceptably undercut broader US interests related to international relations, global arms stability, military superiority, and domestic concerns. Finally, it is possible that other nations currently have neither the inclination nor the resources to start their own weaponization programs in space. They could well discover that inclination, however, if the United States proceeds with a space weapons program of its own.

Conclusions

> *Strategy . . . is concentrated upon achieving victory over a specific enemy under a specific set of political and geographic circumstances. But strategy must also anticipate the trials of war, and by anticipation to seek where possible to increase one's advantage without unduly jeopardizing the maintenance of peace or the pursuit of other values.*
>
> —Bernard Brodie

Four years after World War II, Bernard Brodie called upon military strategists to make their thinking broader and more sophisticated. Brodie believed uniformed officers well versed in the military links to political, social, economic, and international dynamics were essential to formulating the best US security policies.[195] The nuclear age that followed his comments made this requirement more important as well as more challenging. Clemenceau's assertion that war was too important to be left to generals foreshadowed the predominant role civilians would play in formulating US defense policy after the

introduction of nuclear weapons. Civilians like Brodie, Herman Kahn, Schelling, and Albert Wohlstetter were responsible for most of the truly groundbreaking work underpinning the United States's fledgling nuclear strategy—a result fostered as much by military disinterest in strategic policy as it was by civilian interest in the same.

While the value of civilian contributions should never go unappreciated, the absence of substantive military nuclear theorists should never pass as acceptable. Surely US nuclear strategy would have been improved had bright military officers asserted themselves in matters other than execution of policy. Such officers, if properly prepared, might have brought the invaluable perspective of military professionals schooled in the complexities of national and international power.

Today, national strategists debate space weapons in a policy climate not unlike the early days of nuclear strategy. The subject of space weapons also attracts strong civilian intervention and has done so since the 1950s. As was the case with nuclear policy immediately after World War II, there is still no comprehensive theory or strategy for space power. In fact, even the most rudimentary ideas about space power remain undeveloped. One thing is certain. The United States will develop a space theory and strategy in the future. The question is who will develop it. Will military strategists distinguish themselves and be included this time around?

Bearing this question in mind, the 1997 USSPACECOM effort to draft a military space theory and doctrine was an encouraging development.[196] That effort will succeed if those involved strive to see space power in the broadest of terms. Theorists and strategists alike must consider far more than weapon technologies, principles of war, and campaign planning. They must consider, from every angle, the contributions of space to a nation's power and the means by which a state's actions in space do or do not influence other nations. Strategists should recommend courses of action in matters like space weapons only after rigorously considering all perspectives.

The previous section examined the issue of weaponizing space from one such perspective—that of a sanctuary advocate arguing the strongest possible case against further

weaponization of space at this time. Since a basic purpose of this study is to give military space thinkers something with which to mentally wrestle on their own, the sanctuary argument was offered without criticizing it. That is left for strategists to do within the context of their specific problems. In addition, the logic behind the convictions of weapon advocates was treated only to the point of establishing the framework upon which to build the sanctuary discussion. No doubt the case for space weapons today could have been articulated in more depth and with greater sophistication. That too was beyond the basic purpose and is also left for future strategists.

There are two final points which are important for strategists who are judging the merits and shortcomings of the sanctuary argument. First, the sanctuary position should never be construed as a passive national strategy. Second, strategists who conclude that US national interests are indeed served by introducing space weapons will still find the sanctuary perspective invaluable to their planning.

It is incorrect to see the sanctuary strategy as passive or to believe that it requires policy makers to stand idly by while competitors seize the initiative. Instead, the sanctuary strategy replaces US investments in space weapons with action through other national avenues. Any deliberate decision to pursue a sanctuary space strategy warrants aggressive diplomatic, informational, military, and economic support. As an illustration, US diplomats might seize the initiative by denouncing space weapons in international forums. In turn, international cooperation in space could be fostered through treaties and agreements. Any sanctuary strategy would undoubtedly require strong investments in national and military systems capable of recognizing treaty violations. Economic trade might be conditionally linked to nations demonstrating “good faith” in space treaty matters. Finally, and consistent with their military tradition, the United States would be wise to maintain a technological posture that always protects its ability to accelerate weapons development to meet threats. This posture recognizes that the conditions conducive to a sanctuary strategy can change over time to favor a weapons-oriented strategy instead.

It is equally mistaken to dismiss the sanctuary perspective as irrelevant if the United States does set out on a strategy to weaponize space. Weaponization occurs in degrees, and at any given time the strategist must carefully balance the merits of further weaponization with the value of preserving the sanctuary which still remains. The best strategy will rarely discount one entirely in favor of the other. There will normally be an optimum point somewhere between the extremes of total weaponization and a complete sanctuary.

Indeed, the United States's first steps toward any hypothetical weaponization of space might be heavily influenced by sanctuary thought. Weapon systems might remain ground-based so as to minimize any provocation associated with space-based weapons. Weaponizing covertly could further defuse the risk of provocation, and sharing key technologies with staunch allies might help assuage their suspicions and fears. Mindful of tentative superiority of American air, land, and sea forces, US strategists might opt to field technologies for space control missions but not for force application. This would minimize the risk of potential adversaries hitchhiking on US force application technologies to undermine our advantage in terrestrial military strength. International and national concerns over space debris might lead the United States to field systems that kill without fragmentation. The possible permutations are numerous and strategists must determine which ones best suit their situations.

The sanctuary perspective helps identify the space infrastructure that will support space weapons in the same way it helps the strategist to tailor the specific nature of the space weapons themselves. Consider space launch systems. The requirement for quick, cost-effective, and reliable access to space is well understood by the military space community. It recognizes that without it, satellite forces become more expensive and prone to gaps in coverage. Sanctuary thought, however, leads space strategists and acquisition decision makers to strengthen the justification for responsive launch beyond the force "push" that it provides.

Earlier, the sanctuary perspective proposed that space weapons were inherently offensive and therefore destabilizing in a crisis. Responsive launch systems, however, help reestab-

lish stability. They permit strategists to create a protected second-strike capability by retaining a significant portion of their space weapons on the ground, hence reducing incentives for preemptive attacks against space systems in orbit. In this way, launch reconstitution plays a stabilizing role similar to the submarine leg of the nuclear triad. Here, then, is a patent case where the sanctuary perspective should lead even a weapons proponent to modify strategy for the better. There are certainly more such cases.

In conclusion, the sanctuary argument broadens the understanding of US strategists wrestling with the question of space weapons. The argument exposes domestic and international issues that might otherwise be overlooked. It allows military strategists to more completely weigh alternatives, thereby strengthening the military's contribution to US space defense policy.

Henry IV once remarked, "I never suffer my mind to be so wedded to any opinions as to refuse to listen to better ones when they are suggested to me."[197] The wisdom of the sixteenth-century king's approach is timeless. Contemporary decision makers should approach any decision on space weapons with a good deal of listening. They should understand the sanctuary perspective not because they are comfortable with its conclusions, but because they are uncomfortable if they never hear it. There is, after all, a lot at stake for the United States.

Notes

1. Basil H. Liddell Hart, *Strategy*, 2d ed. rev. (New York: Meridian, 1991), 321.

2. Russell F. Weigley, *Eisenhower's Lieutenants: The Campaign of France and Germany, 1944–1945* (Bloomington, Ind.: Indiana University Press, 1981), 377.

3. Tim Zimmerman, "Chemical Weapons: Senate Skeptics Ratify a Treaty," *U.S. News & World Report*, 5 May 1997, 44.

4. Warren Ferster, "U.S. Military Develops Plan to Protect Satellites," *Space News* 8, no. 7 (17–24 February 1997): 6.

5. Steven Lambakis, "Space Control in Desert Storm and Beyond," *Orbis*, Summer 1995, 428.

6. Ferster, 26.

7. The White House, *A National Security Strategy of Engagement and Enlargement* (Washington, D.C.: Government Printing Office, February 1996), 11.

8. Statistics on the number, type, and national origins of satellites since 1957 are updated annually by *Air Force Magazine.* See also Tamar A. Mehuron, "Space Almanac," *Air Force Magazine,* August 1996, 38–40. For more details on modern international space activities, see USAF Phillips Laboratory, *Europe and Asia in Space: 1993–1994* (Colorado Springs, Colo.: Kalman Sciences Corp., 1994), 347.

9. On US ABM programs, see B. Bruce-Riggs, *The Shield of Faith* (New York: Simon and Schuster, 1988); and Ernest J. Yanarella, *The Missile Defense Controversy* (Lexington: University of Kentucky Press, 1977).

10. Robyn M. Dawes, *Rational Choice in an Uncertain World* (Orlando, Fla.: Harcourt Brace College Publishers, 1988), 103.

11. Curtis Peebles, *Battle for Space* (New York: Beaufort Books, 1983), 51.

12. Curtis Peebles, *High Frontier: The U.S. Air Force and the Military Space Program,* Air Force History and Museums Program (Washington, D.C.: Government Printing Office, 1997), 4.

13. Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945–1984* (Ithaca, N.Y.: Cornell University Press, 1985), 30.

14. Ibid., 30.

15. Ibid., 48.

16. Ibid., 47–48.

17. Ibid., 49.

18. Ibid.

19. Ibid., 51.

20. Ibid., 55.

21. Ibid., 75.

22. Peebles, *Battle for Space,* 83–85.

23. Stares, 80–81.

24. Peebles, *Battle for Space,* 89–90.

25. Stares, 119; and Peebles, *Battle for Space,* 90.

26. Peebles, 85.

27. Ibid., 92.

28. Stares, 81. The Partial Test Ban Treaty of 1963 prohibited nuclear test explosions in all mediums including space.

29. Ibid., 127.

30. Ibid., 128–29.

31. Ibid., 93.

32. Ibid., 94.

33. Ibid.

34. Ibid., 97.

35. Ibid., 93.

36. Ibid., 103. The Outer Space Treaty also reserved the moon and other celestial bodies exclusively for peaceful purposes, and forbids the testing of

any type of weapon, the establishment of military bases, and the conduct of military maneuvers on the moon or other celestial bodies. This is another illustration of the sanctuary paradigm in action.

37. Peebles, *Battle for Space*, 94.
38. Ibid., 103.
39. Ibid., 105.
40. Ibid., 103.
41. Stares, 162–63.
42. Ibid., 165.
43. Ibid., 164.
44. Ibid., 169.
45. Ibid., 170.
46. Ibid.
47. Ibid., 146.
48. Ibid., 145.
49. Peebles, *Battle for Space*, 112.
50. Stares, 174.
51. Ibid., 171.
52. Ibid., 185.
53. Peebles, *Battle for Space*, 111.
54. Ibid., 113–14.
55. Stares, 116.
56. Peebles, *Battle for Space*, 122.
57. Stares, 218.
58. Ibid., 231.
59. Ibid., 232.
60. Peebles, *High Frontier,* 67.
61. AU-18, *Space Handbook: A Warfighter's Guide to Space*, vol. 1 (Maxwell Air Force Base [AFB], Ala.: Air University Press, December 1993), 43.
62. Peebles, *High Frontier,* 67.
63. Edward Reiss, *The Strategic Defense Initiative* (Cambridge, Mass.: Cambridge University Press, 1992), 145.
64. *Star Wars Quotes* (Washington, D.C.: Arms Control Association, July 1986), 115.
65. Ibid., 36.
66. Charles A. Monfort, "ASATs: Star Wars on the Cheap," *Bulletin of Atomic Scientists*, April 1989, 10.
67. Stares, 49.
68. Ibid., 50.
69. Ibid., 109 and 112.
70. Ibid., 76.
71. Peebles, *Battle for Space*, 53–54.
72. Stares, 98.
73. Ibid., 164–65.
74. Monfort, 10.
75. Reiss, 51.

76. Peebles, *High Frontier,* 67–68.

77. Reiss, 91.

78. Ibid., 186–88.

79. General Accounting Office, *Report to the Chairman on Armed Services, U.S. Senate. Strategic Defense Initiative: Estimates of Brilliant Pebbles' Effectiveness Are Based on Many Unproven Assumptions* (Washington, D.C.: Government Accounting Office (GAO), March 1992), 2.

80. Reiss, 56, 88.

81. Ibid., 88.

82. Ibid.

83. Patricia A. Gilmartin, "Successful Neutral Particle Beam Firing Paves Way for More Ambitious SDI Test," *Aviation Week & Space Technology*, 24 July 1989, 31–32.

84. Michael A. Dornheim, "Alpha Chemical Laser Tests Affirm Design of Space-Based Weapon," *Aviation Week & Space Technology,* 1 July 1991, 26.

85. White House, *Fact Sheet: National Space Policy,* 19 September 1996, 5.

86. Ibid., 6.

87. David Mosher and Raymond Hall, "The Clinton Plan for Theater Missile Defenses: Costs and Alternatives," *Arms Control Today,* September 1994, 15.

88. Elizabeth A. Palmer, "Clinton Hews to Narrow View on ABM Treaty," *Congressional Quarterly,* 17 July 1993, 1894.

89. Mosher and Hall, 15–16.

90. Pat Cooper, "ASAT Funds Boosted in Senate," *Space News,* 27 May–2 June 1996, 6.

91. Pat Cooper, "U.S. Political Battles Threaten Antisatellite Project," *Space News,* 24–30 June 1996, 7.

92. Pat Cooper, "ASAT Funds," 6.

93. Pat Towell, "Clinton Signs Republicans' Fortified Defense Bill," *Congressional Quarterly,* 12 October 1996, 2931.

94. Cooper, "U.S. Air Force Considers Antisatellite Weapons," *Space News,* 26 February–3 March 1996, 4.

95. Gen Howell M. Estes III, CINC US Space Command, speech to the Air Force Association Annual Symposium, Beverly Hills Hilton, Los Angeles, Calif., 18 October 1996.

96. Ferster, 26.

97. Ibid., 6.

98. Jennifer Heronema, "A.F. Space Chief Calls War in Space Inevitable," *Space News,* 12–18 August 1996, 4.

99. William B. Scott, "USSC Prepares for Future Combat Missions in Space," *Aviation Week & Space Technology*, 5 August 1996, 51.

100. Steve Weber, "ASAT Proponents Fail to Reverse White House Policy," *Space News,* 19–25 September 1994, 7.

101. Mehuron, 40.

102. "Space Control Study Looks at Shielding Assets," *Military Space,* 30 September 1996, 7.

103. William B. Scott, "New Milspace Doctrine 'Vital,'" *Aviation Week & Space Technology,* 22 April 1996, 26.

104. Lt Gen Thomas S. Moorman Jr., "Space: A New Strategic Frontier," *Airpower Journal,* Spring 1992, 22.

105. Cooper, "ASAT Funds," 6.

106. "SSDC: ASAT Needed for Denial of Sat Recon," *Military Space,* 3 March 1997, 1.

107. "Space Control Study Looks at Shielding Assets," 7.

108. Steven Lambakis, "The United States in Lilliput: The Tragedy of Fleeting Space Power," *Strategic Review,* Winter 1996, 35–36.

109. "Second DOD Forum: 'Guide Stars' and Hail, Farewell," *Military Space,* 17 February 1997, 3.

110. "National Security Space Master Plan Finished," *Military Space,* 17 February 1997, 5.

111. Joseph S. Toma, "Desert Storm Communications," in *The First Information War,* ed. Alan D. Campen (Fairfax, Va.: AFCEA International Press, October 1992), 3.

112. Alan D. Campen, "Iraqi Command and Control: The Information Differential," in *The First Information War,* 175.

113. Larry K. Wentz, "Communications Support for the High Technology Battlefield," in *The First Information War,* 21.

114. Gordon R. W. MacLean, "Will Fiber Optics Threaten Satellite Communications?" *Space Policy,* (May 1995): 95–99.

115. Dr. Joseph N. Pelton, "Why Nicholas Negroponte Is Wrong about the Future of Telecommunications," *Telecommunications,* January 1993, 38.

116. "First Space Architecture Is Released, Others Delayed," *Military Space,* 16 September 1996, 1–3.

117. Maj Gen Kenneth Israel, "High Altitude Endurance Unmanned Aerial Vehicle," DARPA Tactical Technology Office, 13 January 1997, n.p. Online, Internet, 13 January 1997. Available from http://www.arpa.mil/asto/hae.html.

118. Capt Mike Evans, Headquarters C4A, Scott AFB, Ill., telephone interview with author, 10 December 1996.

119. Colin Clark, "Global Hawk Rolls Out; First Flight By Fall," *Defense Week,* 24 February 1997, 7.

120. "EELV, SBIRS Tops Space," *Military Spaces 17 February 1997, 8.*

121. "Global Hawk: Tier II Plus High Altitude Endurance Unmanned Aerial Reconnaissance System," commercial brochure from Teledyne Ryan Aeronautical.

122. Clark, 7.

123. Israel.

124. Gen Thomas S. Moorman Jr., "The Future of United States Air Force Space Operations: The National Security Dimension," address to the National Security Section, Commonwealth Club, San Francisco, Calif., 1 December 1993, *Vital Speeches,* 60 (15 March 1994): 326.

125. Anne Eisele, "Phillips Moves toward Light, Tiny Satellites," *Space News,* 13–19 January 1997, 17.

126. Christian C. Daehnick, "Blueprints for the Future: Comparing National Security Space Architectures" (master's thesis, School of Advanced Airpower Studies [SAAS], June 1995), 3.

127. "NRO Satellites to Shrink in Size, Technology Director Says," *Space Business News,* 19 February 1997, 8; and "NRO Plans for Smaller Satellites," *Space News,* 17–23 February 1997, 23.

128. "LM Eyes A2100 for SBIRS High," *Military Space,* 20 January 1997, 7.

129. Anne Eisele, "Lower Costs Drive Development in Europe, Japan, and the United States," *Space News,* 17–23 February 1997, 17.

130. Ibid., 8.

131. Robert F. Futrell, *The United States Air Force in Korea, 1950–1953* (Washington, D. C.: Office of Air Force History, 1983), 272–73. On Vietnam and Afghanistan, see Mark Clodfelter, *The Limits of Airpower: The American Bombing of North Vietnam* (New York: Free Press, 1989); and Edward B. Westermann, "The Limits of Soviet Airpower: The Bear versus the Mujahideen in Afghanistan, 1979–1989" (master's thesis, SAAS, June 1997).

132. Sir Peter Anson and Dennis Cummings, "The First Space War: The Contribution of Satellites to the Gulf War," in *The First Information War,* 122.

133. Alasdair McLean, *Western European Military Space Policy* (Aldershot, England: Dartmouth Publishing Co., 1992), 101.

134. Ibid.

135. Lambakis, 421.

136. For a precise accounting of what nations use Intelsat, Inmarsat, and Arabsat, see Andrew Wilson, ed., *Jane's Space Directory: 1996–97,* 12th ed. (Alexandria, Va.: Jane's Information Group, 1996), 289, 297. The situation with Arabsat in the Gulf War is particularly interesting. Arabsat is headquartered in Saudi Arabia and plays a vital role in Middle East communications. Its 21 members include Egypt, Iraq, Kuwait, Qatar, Saudi Arabia, and Syria.

137. David E. Lupton, *On Space Warfare: A Space Power Doctrine* (Maxwell AFB, Ala.: Air University Press, 1988), 69.

138. USAF Phillips Laboratory, *Europe and Asia in Space: 1993–1994* (Colorado Springs, Colo.: Kaman Sciences Corp., 1994), 347.

139. Lupton, 68.

140. Ibid., 69.

141. USAF Phillips Laboratory, 348.

142. Nicolay Novichkov, "Russian Space Chief Voices Dire Warnings," *Aviation Week & Space Technology,* 6 January 1997, 26.

143. "Mission Control," *Military Space,* 17 February 1997, 3.

144. USAF Phillips Laboratory, 20.

145. "Mission Control," 3.

146. USAF Phillips Laboratory, 334.

147. Craig Covault, "Advanced KH-11 Broadens United States Recon Capability," *Aviation Week & Space Technology*, 6 January 1997, 24.

148. Ibid., 24.

149. McLean, 127.

150. Ibid., 119.

151. Joseph P. Keddell Jr., *The Politics of Defense in Japan: Managing Internal and External Pressures* (Armonk, N.Y.: M. E. Sharpe, 1993), xiii, 8.

152. "Increases Seen in Space Early Warning," *Military Space*, 2 September 1996, 7.

153. Craig Covault, "China Seeks Cooperation, Airs New Space Strategy," *Aviation Week & Space Technology*, 14 October 1996, 29–32.

154. Simon Fluendy, "Up in Smoke: Latest Launch Failure Could Cost China Dearly," *Far Eastern Economic Review*, 5 September 1996, 69; and Mark Ward, "China's Exploding Space Program," *World Press Review*, June 1996, 36.

155. Craig Covault, "Delta Explosion Halts $1 Billion in Launches," *Aviation Week & Space Technology*, 27 January 1997, 33.

156. The White House, *A National Security Strategy of Engagement and Enlargement* (Washington, D.C.: Government Printing Office, February 1996), 11.

157. McLean, 179.

158. Ibid., 177.

159. Sidney N. Graybeal and Daniel O. Graham, "Should the United States Build a Space-Based Missile Defense?" *Insight*, 11 September 1995, 19.

160. Robert Jervis, *Perception and Misperception in International Politics* (Princeton, N.J.: Princeton University Press, 1976), 62.

161. Ibid., 63.

162. Ibid., 64.

163. Ibid., 67.

164. Roger B. Handberg and Joan Johnson-Freese, *The Prestige Trap: A Comparative Study of the United States, European, and Japanese Space Programs* (Dubuque, Iowa: Kendall/Hunt Publishing Co., 1994), 212.

165. Ibid.

166. Ibid., 3.

167. Stephen M. Walt, "Alliance Formation and the Balance of World Power," *International Security* 9, no. 4 (Spring 1985), as reprinted in *The Perils of Anarchy: Contemporary Realism and International Security*, ed. Michael Brown, Sean M. Lynn-Jones, and Steven E. Miller (Cambridge, Mass.: MIT Press, 1995), 238.

168. Ibid., 210.

169. Ibid., 214.

170. Karl Mueller, "Why Building Space Weapons Would Threaten U.S. Security: The Perils of Occupying the High Frontier" (paper, SAAS, Maxwell AFB, Ala., 1997), 6.

171. Ibid.

172. Walt, 216.

173. "Project SATRAN Warns of Hostile Recon from Space," *Military Space,* 14 April 1997, 7.

174. Robert Jervis, "Cooperation under the Security Dilemma," *World Politics* 30, no. 2, (January 1978): 187–214.

175. "Global Engagement: A Vision for the 21st Century Air Force," Headquarters USAF, 25 November 1996, n.p. On-line, Internet. 25 November 1996. Available from http://www.af-future.hq.af.mil/21/logi/mist.htm.

176. Thomas C. Schelling, *Arms and Influence* (New Haven, Conn.: Yale University Press, 1966), 227.

177. Reiss, 145.

178. "AIA's Fuqua: Aerospace Recovery Under Way," *Military Space,* 8 January 1996, 7.

179. "QDR Sets Pace, Questions," *Military Space,* 17 February 1997, 6.

180. Johan Benson, "Conversations with General Ronald Fogleman," *Aerospace America,* July 1996, 16.

181. Moorman, 328.

182. Pierre Sparaco, "Arianespace Seeks Non-European Allies," *Aviation Week & Space Technology,*27 January 1997, 62.

183. Mueller, 9.

184. William J. Burke and Rita C. Sagalyn, "Active Space Experiments Affect Treaty Obligations," *Signal,* June 1990, 74.

185. The White House, "National Space Policy Fact Sheet," September 1996, 14.

186. AU-18, *Space Handbook: A Warfighter's Guide to Space,* vol. 1 (Maxwell AFB, Ala.: Air University Press, December 1993), 43.

187. Leonard David, "Severity of Orbital Debris Questionable," *Space News,* 24 February–2 March 1997, 4.

188. "Shuttle Avoids Collision with Pegasus Debris," *Space News,* 24 February–2 March 1997, 2.

189. Stan Crock, "Star Wars Junior: Will It Fly?" *Business Week,* 15 July 1996, 89.

190. Council of Economic Advisers, "Economic Indicators" (Washington, D.C.: Government Printing Office, December 1996), 32.

191. Rita Rubin, "Special Report: The War on Cancer," *U.S. News & World Report,* 5 February 1996, 54.

192. Gary S. Becker, "The Painful Truth about Medical Research," *Business Week,* 29 July 1996, 18.

193. "Better Coordination, More Funds for Cancer Research Urged," *Chemical and Engineering News,* 10 October 1994, 20.

194. Lt Col Ed Felker, Chief, Joint Vision 2010 Concepts Branch, Joint Warfighting Center, interview with author, 13 January 1997.

195. Bernard Brodie, "Strategy as a Science," *World Politics* 1, no. 4 (July 1949): 499.

196. Gen Howell M. Estes III, CINC USSPACECOM, directed his command to complete a space theory and doctrine by May 1998. In an interview

dated 24 March 1997, the general highlighted the lack of such a work as the single largest obstacle to astute space policy making in the future.

197. Peter G. Tsouras, *Warriors' Words: A Quotation Book* (London, England: Arms and Armour Press, 1992), 289.