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Is the Weaponization of Space Inevitable?

Is the weaponization of space inevitable? If other states are bound and determined to develop, test, and deploy antisatellite (ASAT) weapons, or weapons in space that can attack objects on earth, why should the United States exercise forbearance? Indeed, a commission headed by the soon-to-be-appointed Secretary of Defense, Donald H. Rumsfeld, argued precisely this case in January 2001. The congressionally mandated Commission to Assess United States National Security Space Management and Organization concluded that space warfare was "a virtual certainty." This report concluded that the lessons of history demonstrated that "every medium—air, land, and sea—has seen conflict. Reality indicates that space will be no different." In order to avoid a "Space Pearl Harbor," this report called for the United States to develop "superior" capabilities for "power projection in, from, and through space" in order to "negate the hostile use of space against U.S. interests."[1]

If war-fighting in or from space is inevitable, it then follows that the United States should have the panoply of military capabilities not just to deter warfare in the heavens, but also to actively defend satellites in orbit that are essential for the conduct of U.S. military operations on the ground. "Space control," however, is a far more demanding pursuit. It requires the protection of satellites against attacks in space, as well as the ability to carry out offensive strikes, whether from platforms orbiting the earth or from those on the ground, sea, and air. Moreover, if the weaponization of space is a virtual certainty, it also follows that arms control efforts, whether broadly or narrowly defined, to foreclose this competition are without merit. If such a competition is foreordained, America should compete to win.

Historical inevitability is a heavily freighted and much contested concept. History can certainly repeat itself, at least in thematic terms. Consequently, knowledge of history can be a useful reference for policy formulation. But every historical chapter also contains its unique passages that are read and weighted differently by historians. Moreover, the "historical record" usually contains many blank pages reflecting unanswered questions. Even heavily

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[1] "Executive Summary," in *Report of the Commission to Assess United States National Security Space Management and Organization* (Washington, DC: Commission to Assess United States National Security Space, January 11, 2001), pp. vii–xxxv.

studied episodes, such as the Cuban missile crisis, yield new insights with the release of additional interviews and archival material. We also know that historical parallels can be forced and made to conform to policy preferences. Those committed to the study of history, and thus keenly aware of its intricacies, tend to shy away from arguments that begin with the words, "History teaches." Policy advocates who employ this line of argument usually majored in other subjects. Historical determinism can therefore be a flawed and dangerous enterprise. As Bernard Brodie has noted, "History is at best an imperfect guide to the future, but when imperfectly understood and interpreted it is a menace to sound judgment."[2]

WHAT CONSTITUTES WEAPONIZATION?

This inquiry into the weaponization of space begins not with an assumption of historical inevitability, but with a working definition of "weaponization." Those who wish to seize the high ground of space find it useful to blur the distinction between the militarization and weaponization of space. Steven Lambakis posits that weaponization started in September 1944, "when the first German V-2 missile came rocketing down from the edge of space and exploded on the residents and buildings of London."[3] Surely, this constitutes too expansive a definition of weaponization, since the missiles in question were launched from the ground and were designed to demoralize city dwellers. This is also true for modern-day ballistic missiles. The few minutes these military instruments traverse through the heavens hardly constitute the weaponization of space, since the ballistic trajectories begin and end on the earth's surface, where psychological or military impacts are designed to be felt.

The militarization of space has proceeded steadily and inexorably since the launch of *Sputnik* in October 1957. Subsequently, many satellites have been launched to assist, enhance, or empower ground, sea, and air forces. These satellites provide targeting and weather information, as well as communication support for war fighters. The use of satellites to assist military operations is, however, far different from the flight-testing and deployment of platforms specifically designed to fight a war in or from space, or military capabilities on the ground specifically designed to kill satellites in space. Surely, these military activities would constitute space weaponization by any reasonable definition.

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[2] "War in the Atomic Age," in Bernard Brodie (ed.), *The Absolute Weapon, Atomic Power and World Order* (New York: Harcourt, Brace and Company, 1946), p. 28.

[3] Lambakis, "Putting Military Uses of Space in Context," in James Clay Moltz (ed.), *Future Security in Space: Commercial, Military, and Arms Control Trade-Offs*, Occasional Paper No. 10 (Monterey, CA: Monterey Institute of International Studies, Center for Nonproliferation Studies and University of Southhampton, Mountbatten Centre for International Studies, July 2002), pp. 23–24.

Advocates of maintaining space as a sanctuary against war-fighting view the distinction between militarization and weaponization as vital, even if the precise crossover point remains a contentious subject.

During the Cold War, the Soviet Union advanced a most peculiar and self-serving definition of space weaponization. Beginning in 1981, the Kremlin proposed a ban on stationing weapons in space, while permitting terrestrially based ASAT weapons. The active pursuit of space warfare capabilities by the Reagan administration persuaded the Kremlin to endorse more expansive constraints on weaponization.[4] Efforts by non-governmental groups to prevent the weaponization of space during this period focused on activities to be banned, rather than on specific types of weapons. Prohibited activities included deploying weapons for "destroying, damaging, rendering inoperable, or changing the flight trajectory of space objects" as well as deploying weapons in space that could damage objects in the atmosphere or on the ground.[5]

A more recent definition of a space weapon, offered by the Canadian Government, is "any device designed or modified to inflict physical or operational damage to an object in space through the projection of mass or energy."[6] This definition is certainly serviceable, as it helps to differentiate between "dedicated" weapons for space warfare that are specially designed to do harm to objects in space, as opposed to weapons or platforms designed for other purposes, such as intercontinental ballistic missiles or ballistic missile defense interceptors, that could be put to such use *in extremis*.

Designing arms control approaches that capture all such "residual" space warfare capabilities is not feasible as this would require the complete abolition of, among other things, medium- and long-range ballistic missiles, advanced missile defense interceptors, space launch capabilities for peaceful purposes and space exploration, as well as the space shuttle. At the same time, a narrow-banded approach that focuses solely on dedicated space weapons may be insufficient, if restraint in deploying dedicated ASATs is accompanied by the avid pursuit of such capabilities under other guises.

The absence of a singular, commonly accepted definition clearly suggests that space weaponization exists along a continuum, with the power projection

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[4] Office of Technology Assessment, US Congress, *Anti-Satellite Weapons, Countermeasures, and Arms Control* (Washington, DC: GPO, September 1985), p. 97.

[5] See "Appendix B: A Treaty Limiting Anti-Satellite Weapons," in John Tirman (ed.), *The Fallacy of Star Wars* (New York: Vintage Books, October 1984), pp. 280–284. In particular, see articles I and II of the proposed treaty text.

[6] "Food for Thought, The Non-Weaponization of Outer Space," Canadian non-paper, May 1, 2002, p. 5 (mimeo).

capabilities deemed necessary by the Rumsfeld Commission constituting one end of this spectrum. Some actions, such as wartime attacks on an adversary's satellites, or the destruction of targets on the ground by weapons deployed in space, clearly constitute weaponization. The initial building blocks for such capabilities, in the form of episodic, limited, and rudimentary testing of ASAT capabilities, were laid during the Cold War. The last such reported test by the Soviet Union occurred in June 1982.[7] The last reported ASAT test by the United States was in September 1985.[8] The information gleaned from these tests presumably remains accessible, and it is possible that mothballed capabilities could be reconstituted. Nonetheless, the conduct of a few ASAT tests two decades ago cannot reasonably be presumed to have constituted an irreversible watershed that cannot henceforth be dammed. Indeed, advocates of U.S. space weaponry predicate their proposals on the insufficiency of prior efforts.

Similarly, the testing to date of lasers to gauge their destructive or disabling capabilities against satellites, as well as to test the ability of satellites to withstand attack by lasers, has so far been of the most minimal kind, contrary to fears expressed during the Cold War. Soviet concerns over the potential use of U.S. directed energy weapons during the Cold War were quite pronounced after President Ronald Reagan's proposed Strategic Defense Initiative, but the technical challenges, architectural dilemmas, cost consequences, and political constraints associated with these efforts proved to be insurmountable barriers at the time.

Likewise, Reagan administration and U.S. intelligence community officials expressed serious concern over Soviet directed energy programs, predicting that,

> In the late 1980s, [the Soviets] could have prototype space-based laser weapons for use against satellites. In addition, ongoing Soviet programs have progressed to the point where they could include construction of ground-based laser antisatellite (ASAT) facilities at operational sites. These could be available by the end of the 1980s and would greatly increase the Soviets' laser ASAT capability… They may deploy operational systems of space-based lasers for antisatellite purposes in the 1990s, if their technology developments prove successful, and they can be expected to pursue development of space-based laser systems for ballistic missile defense for possible deployment after the year 2000.[9]

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[7] Michael Getler, "Soviet Missile Test: Scenario for War," *Washington Post* (June 21, 1982).

[8] Bill Keller, "Air Force Missile Strikes Satellite in First U.S. Test," *New York Times* (September 14, 1985).

[9] Department of Defense, *Soviet Military Power,* 5th ed. (Washington, DC: Government Printing Office,

These dire predictions turned out to be vastly exaggerated. The Soviet Union dissolved at about the time the Kremlin was predicted to be able to seize the high ground of space.

The reported testing to date of U.S. laser capabilities has been of a rather pedestrian kind, carried out by a laser prototype developed in the early 1980s. Originally developed as part of the Navy's SeaLite program, the Mid-Infrared Advanced Chemical Laser, or MIRACL, was considered to be of possible use in protecting aircraft carriers. This laser has a reported power output of 2 megawatts and can potentially be used to disable conveniently positioned satellites or destroy their on-board sensors. After the Congress decided there were cheaper and less technologically difficult ways to protect carriers, the MIRACL was moved to the White Sands Missile Range in New Mexico where it has been used in a variety of missile defense-related experiments. In October 1997, the Army Space and Missile Defense Command used the MIRACL to illuminate an aging Air Force satellite in the hope of gaining useful information on the vulnerability of satellites to ground-based lasers.[10] Additional, unpublicized tests to gauge the durability of U.S. satellites to directed energy attacks might subsequently have been carried out.

Considerable time and distance remain before new space warfare capabilities by means of lasers or by other directed energy weapons can be deployed. The strongest testimony as to the extent of this distance comes from frustrated proponents of the development and testing of such capabilities. The same hurdles that bedeviled directed energy programs during the Reagan administration continue in place.

The Inevitability of Militarization, Not Weaponization

At present, the crucial distinction between the militarization and weaponization of space remains in place. The militarization of space was certainly inevitable during the Cold War, because both superpowers needed satellites to observe each other's strategic capabilities and to enhance the

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1985), p. 44.

[10] Federation of American Scientists, "Mid-Infrared Advanced Chemical Laser (MIRACL)," available online at http://www.fas.org/spp/military/program/asat/miracl.htm; "Conference Urges Laser Program Termination," *Aviation Week and Space Technology* (August 15, 1983), p. 21; Michael A. Dornheim, "Laser Engages Satellite, With Questionable Results," *Aviation Week and Space Technology* (October 27, 1997), p. 27.

effectiveness of their terrestrial war-fighting capabilities.[11] Both nations orbited satellites to glean targeting information, to learn of meteorological conditions in theaters of combat, and to communicate with widely dispersed forces. Navigation satellites, although not nearly as accurate as the global positioning system (GPS) of today, were crucial for improving the accuracy of ballistic missiles. And space systems were indispensable for obscure but necessary functions like geodesic surveying, which facilitated ballistic missile accuracy by measuring perturbations in the earth's gravitational field. Satellites provided early warning of missile launches and detection of nuclear detonations. In other words, over the course of the Cold War, space became an essential adjunct for war-fighting on the ground, without becoming another theater of combat. While the militarization of space proceeded apace, the weaponization of space was avoided.

The continuum to characterize space warfare capabilities employed by the Joint Staff of the Office of the Joint Chiefs of Staff provides a useful typology in this regard. Within the domain of space operations, the Joint Staff define four primary mission areas: space control, force enhancement, space support, and force application.

> Space control operations provide freedom of action in space for friendly forces while, when directed, denying it to an adversary, and include the broad aspect of protection of U.S. and U.S. allied space systems and negation of enemy adversary space systems. Space control operations encompass all elements of the space defense mission and include offensive and defensive operations by friendly forces to gain and maintain space superiority and situational awareness if events impact space operations.
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> Space force enhancement operations multiply joint force effectiveness by enhancing battlespace awareness and providing needed warfighter support. There are five force enhancement functions: intelligence, surveillance, and reconnaissance; integrated tactical warning and attack assessment; environmental monitoring; communications; and position, velocity, time, and navigation.

[11] See Ashton Carter, "The Current and Future Military Uses of Space," in Joseph Nye, Jr. and James Schear (eds.), *Seeking Stability in Space: Anti-Satellite Weapons and the Evolving Space Regime* (Lanham, MD: University Press of America, 1987), pp. 29–69; Paul Stares, "Space and U.S. National Security," in William Durch (ed.), *National Interest and the Military Use of Space* (Cambridge, MA: Ballinger Publishing Co., 1984), pp. 35–59. For a more recent survey see, Barry Watts, "The Current American Advantage in the Military Use of Near-Earth Space," in *The Military Use of Space: A Diagnostic Assessment* (Washington, DC: Center for Strategic and Budgetary Assessments, February 2001), pp. 33–46.

> Space support operations consist of operations that launch, deploy, augment, maintain, sustain, replenish, deorbit, and recover space forces, including the command and control network configuration for space operations. Support operations consist of spacelift, satellite operations, and deorbiting and recovering space vehicles, if required.
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> Space force application operations consist of attacks against terrestrial-based targets carried out by military weapons systems operating in or through space. Currently, there are no space force application assets operating in space.[12]

This typology can be condensed further into three fairly distinct categories:

1. Activities that involve the direct application of force either from space, within space, or directed against objects in space from the earth's surface or atmosphere. Space force application and much of space control fall into this category.
2. Activities that clearly involve no use of force, primarily space support activities.
3. Activities that do not involve the direct application of force but that can support and enhance other activities that destroy or disable an adversary's capabilities in space, on the earth's surface, or in the atmosphere.

Clearly, category 1 activities involving space force application would constitute the weaponization of space. Additionally, space control activities resulting in the denial or negation of an adversary's spacecraft would also constitute weaponization. Included in this definition of weaponization are dedicated ASAT weapons, "defensive" weapons carried on satellites or other space objects that could be used for offensive purposes, and attacks against terrestrial-based targets carried out by military weapon systems operating in or from space. Excluded in this definition are military and civilian capabilities such as long-range ballistic missiles, space launch vehicles, and the space shuttle, which could be used as ASATs but which have clearly been designed to carry out other missions. Also excluded from this definition are category 2 and 3 activities listed above.

This construct of space weaponization falls between overly broad definitions that are unhelpful and overly narrow definitions that are insufficient. Several nations now have the capability to do significant damage to satellites in orbit, perhaps by utilizing ocean-spanning ballistic missiles, or long-range

[12] Joint Chiefs of Staff, U.S. Department of Defense, *Joint Doctrine for Space Operations,* Joint Publication 3-14 (August 9, 2002), pp. ix–x.

missile defense interceptors, or space-launch vehicles to detonate nuclear weapons above the earth's atmosphere. Space assets face other threats. The U.S. space shuttle was designed to repair and refurbish satellites, not to purposefully damage them. But it has this inherent capability. Commercially available communications equipment can be used to jam satellite uplinks and downlinks. The U.S. Air Force's Space Aggressor Squadron, which "red teams" the possible behavior of potential adversaries, assembled a satellite jamming device for $7,500 using readily available equipment. Space warfare need not take place in space, since satellite ground-control stations are susceptible to hacking and to direct attacks by air power, ground forces, and commando operations.[13]

In other words, space-faring nations or consortiums, as well as states possessing long-range missile capabilities have long possessed the capability to create havoc in space by reorienting weapon systems designed for other purposes. The deployment of advanced missile defense interceptors and the airborne laser could provide additional capabilities against satellites. These residual capabilities do not, however, constitute the weaponization of space because they have not been used for this purpose. The acquisition of new military capabilities that could be applied to space warfare increases the necessity to prevent their flight-testing in "an ASAT mode," if the distinction between militarization and weaponization is to be maintained. Cooperative monitoring arrangements are essential for this purpose.

Put another way, because it is not possible to ban military technologies and capabilities that could be used for space warfare does not mean that the weaponization of space has already occurred. This barrier remains intact as long as versatile military technologies are not used against objects in space. The existence of versatile technologies and military capabilities means that any state using them against U.S. satellites can reasonably expect retaliation in kind or other unwanted consequences. Rather than constituting an insuperable problem, residual ASAT capabilities can help deter ASAT use. Residual ASAT capabilities also can help states to conclude that they do not need to pursue dedicated ASATs in order to deter space warfare.

The essential distinction between the militarization and weaponization of space currently remains in place. Dedicated ASAT capabilities of Cold War vintage are not now deployed. Newer models are presumably in research and development behind closed doors, but flight tests of new "kinetic kill" ASATs or space mines have not been reported. And dedicated platforms for offensive

[13] *Report of the Commission to Assess United States National Security Space Management and Organization*, pp. 19–22; William B. Scott, "Innovation Is Currency Of USAF Space Battlelab," *Aviation Week and Space Technology* (April 3, 2000), p. 52.

military operations from space remain closer to gestation than to adolescence. The Pentagon has affirmed that there are no U.S. "force application" assets now operating in space, and there are no reported weapons in space orbited by other nations. The absence of flight tests and deployments of instruments of space warfare affirm that we have not yet crossed critical thresholds associated with the weaponization of space.

COLD WAR CAUTION IN SPACE

Based on the evidence to date, a healthy degree of skepticism is warranted concerning the future inevitability of space weaponization. The strongest counter-factual argument to this deterministic hypothesis is that space weaponization has yet to occur, notwithstanding U.S. and Soviet capabilities to do so during the Cold War. During these decades, both superpowers competed intensely on military technologies that were perceived to offer significant payoffs. Unstinting efforts were devoted to the flight-testing, production, and deployment of weapon systems that had a bearing on the strategic balance. In a typical year during the Cold War, the United States and the Soviet Union conducted, on average, over 30 nuclear tests. They averaged even more missile flight tests annually. Each superpower typically produced hundreds of these missiles every year.[14] Money was not a serious constraining factor in this competition. One new nuclear warhead design followed the next, and new generations of missiles (or considerably improved variants of existing missiles) typically appeared every decade. During this intense competition for strategic advantage—or to avoid being placed at a strategic disadvantage—the United States and the Soviet Union produced approximately 125,000 nuclear weapons.[15]

In contrast, the United States and the Soviet Union proceeded with great caution to avoid the weaponization of space. The United States deployed 1,000 intercontinental ballistic missile launchers for most of the Cold War's duration. Between 1964 and 1975, Washington deployed exactly two ASAT interceptors on Johnston Island in the Pacific. During the Cold War, both superpowers tested nuclear weapons over 1,700 times. In contrast, they tested rudimentary

[14] Throughout the Cold War, the USSR conducted 715 nuclear tests, compared to 1,015 by the United States, which equates to one nuclear test every three weeks during the Cold War. See "NRDC's Nuclear Data – Table of Known Nuclear Tests Worldwide, 1945–1996," available online at http://www.nrdc.org/nuclear/nudb/datab15.asp. For missile-related data see "NRDC's Nuclear Data - Table of US ICBM Forces from 1959–1996," available online at http://www.nrdc.org/nuclear/nudb/datab3.asp and "NRDC's Nuclear Data - Table of USSR/Russian ICBM Forces, 1960–1996," available online at http://www.nrdc.org/nuclear/nudb/datab4.asp.

[15] "NRDC Nuclear Notebook: Global Nuclear Stockpiles, 1945–2002," *Bulletin of the Atomic Scientists* 58, No. 6 (November–December 2002), pp. 103–104.

ASAT weapons 53 times, with U.S. tests mostly confined to between 1963 and 1970 (with one test of the air-launched miniature homing vehicle in 1985). Soviet flight-testing of ASATs was confined to two periods, 1968–1971 and 1976–1982.[16] ASAT capabilities remained rudimentary, at best, a pale shadow of military advances in other spheres.

Rather than elevate the superpower competition into space, Moscow and Washington tread lightly in this domain. Both superpowers deployed a total of more than four thousand satellites, but neither is known to have parked satellite killers in orbit.[17] Instead, Washington and Moscow chose to limit their competition in space by means of tacit and formal agreements. The 1963 Partial Test Ban Treaty prohibited signatories, led by the United States and the Soviet Union, from carrying out nuclear tests in the atmosphere and outer space. The 1967 Outer Space Treaty banned the placement of weapons of mass destruction in space or on celestial bodies. A 1968 multilateral agreement attended to the rescue and return of astronauts. A 1971 bilateral agreement called for notification of signs of interference with early warning systems and related communication systems associated with missile launches. Many of these critical nodes resided in space. The 1971 Hotline modernization accord predicated improved superpower communication on the protection of satellites. The 1972 Anti-Ballistic Missile Treaty expressly prohibited interference with monitoring satellites.

These accords, negotiated during a period of intense superpower competition, as well as other agreements that followed in due course, reflected deliberate decisions to refrain from turning space into a battlefield. At the same time, U.S. national space policy from the administration of President Dwight David Eisenhower through the presidency of William Jefferson Clinton, prepared for the possibility of space warfare and refused to accept U.S. disadvantages in such a competition. With the exception of the first Reagan administration, however, U.S. preferences clearly lay on the side of protecting space from warfare.

Many reasons can be deduced for such uncommon restraint amidst an intense Cold War military-technical competition in other environments. To begin with, satellites during the Cold War were primarily viewed and widely

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[16] Paul Stares, *The Militarization of Space: U.S. Policy, 1945–1984* (Ithaca, NY: Cornell University Press, 1985), pp. 117–129; Bill Keller, "Air Force Missile Strikes Satellite in First U.S. Test," *New York Times* (September 14, 1985).

[17] From 1957 to 2000, Moscow placed 3,718 payloads into orbit. The corresponding figure for the United States was 980. This disparity is not quite as stark as it may seem since Soviet satellites were designed to last for shorter time periods and hence had to be replaced with far greater regularity. See "2001 Space Almanac," *Air Force Magazine* (August 2001), available online at http://www.afa.org/magazine/space/0801alm.pdf.

understood to be closely linked to nuclear deterrence. They provided early warning of missile launches, and thus constituted the first line of defense against strategic surprise. Satellites also provided targeting information, communication, and weather data associated with nuclear war plans, and they monitored observance of nuclear arms control treaties. To blind, disable, or destroy these satellites could signal the onset of a nuclear war in which escalation was unlikely to be controlled. The nuclear force postures of both superpowers were primed to launch massive attacks quickly, so as not to be severely disadvantaged by a surprise attack. Under these circumstances, adopting first-strike postures for space warfare in the form of deployed ASAT systems to accompany first-strike postures for nuclear forces would have compounded risks for political and military leaders. Widespread, instinctual public opposition to the weaponization of space reinforced caution.

In addition, space warfare capabilities during the Cold War appeared to be either far too crude or too futuristic. One crude approach would be to detonate nuclear weapons in space. This could unquestionably create havoc with enemy satellites, but it could also create havoc with friendly satellites as well as manned space flight, as was evident with U.S. and Soviet atmospheric nuclear test programs prior to the 1963 Partial Test Ban Treaty.

Other elementary, but more discriminating, means to kill satellites were also achievable, involving direct ascent or co-orbital maneuver of dedicated ASATs, followed by a direct collision or a nearby explosion to destroy an adversary's satellite. During the Cold War, these means were demonstrated sufficiently to clarify capability, but there was little technically "sweet" or militarily efficient about them. Instead, their mission profile was entirely without subterfuge. Even limited attacks by such means, whose point of origin could not be mistaken, could open up a Pandora's Box of unintended escalation. In the time within which a successful satellite intercept could take place—if not minutes afterward—terrible retribution might be expected. In addition, satellite collisions or explosions would produce a field of debris that would be unhelpful, to say the least, to other satellites operating in a similar orbital space or path.

Technically advanced options involving space-based lasers, particle beam weapons, and other futuristic concepts did not, at least on paper, face these same roadblocks. In theory, attacks by means of futuristic, space-based technologies could be carried out quickly, without signaling hours in advance that strike preparations were underway. In addition, attacks by directed energy weapons could, in theory, effectively disable opposing satellites without creating large debris fields within orbits. However, the transfer of these concepts from paper to the laboratory and from the laboratory to the field presented significant obstacles. The cost of lifting weighty objects into space and figuring out how to

defend them once they got there presented serious challenges. The technical barriers to developing directed energy weapon systems in space were quite considerable, as were problems of maintenance in the event that these challenges could be surmounted.

In addition, domestic and international political barriers against the pursuit of advanced war-fighting concepts in space were quite high. The Anti-Ballistic Missile Treaty stood in the way of testing and deployment of advanced concepts. The Treaty either needed to be artfully reinterpreted, renegotiated, or abrogated before the unfettered pursuit of these technologies could proceed. The first approach was tried during the presidency of Ronald Reagan, without success. Indeed, the Reagan administration's attempt to reinterpret the ABM Treaty to permit space-based testing and deployments of futuristic war-fighting concepts only reinforced the views of strict constructionists on Capitol Hill. Treaty renegotiation or "clarification" was effectively pursued for far less contentious matters, but was not in the cards for military options that would fundamentally nullify the treaty's core commitments. The third alternative approach—treaty abrogation or withdrawal—was not deemed feasible in a Cold War context. To do so would presumably open the sluice gates for an even more intensified strategic competition that both superpowers appeared unwilling to pursue.

Consequently, during the Cold War, advanced concepts were funded sufficiently to clarify the technical challenges involved and to generate strenuous blocking strategies. Both superpowers pursued research and development of advanced space war-fighting concepts, but these necessarily took the form of hedges rather than deployable weapons. The technologies, financial costs, and political constraints involved were too daunting to make technically advanced space warfare options realizable in a divided world dominated by two superpowers. Throughout this period, satellite vulnerability was great, but the dictates of deterrence were greater.

THEN VS. NOW

Because the weaponization of space was avoided during the Cold War, it does not necessarily follow that weaponization will continue to be avoided in a new era of asymmetric warfare. Indeed, the "virtual certainty" of space weaponization predicted by the Rumsfeld Commission report and by advocates of U.S. space dominance is presumed to be a consequence of disproportionate and growing U.S. military power. In this view, space will become another arena of asymmetric warfare because U.S. vulnerabilities and dependency on space are pronounced, both with respect to space-dependent military operations, and the vast increase in global commerce that depends upon transmissions to, in, or from

space. Weaker states might therefore be sorely tempted to develop and employ space warfare capabilities in order to neutralize or degrade U.S. military advantages.

Asymmetric warfare is, of course, a two-way street. The United States could also be sorely tempted to exploit its advantages in military and space technology to accentuate terrestrial military superiority, to further reduce prospective casualties in combat, and to protect and extend U.S. advantages in space-dependent commerce. Space warfare capabilities could also be used for preemptive attack, complementing U.S. terrestrial military doctrine.

The Rumsfeld Commission's report did not dwell on, or even mention, these possibilities. Instead, it focused on foreign threats while citing historical examples and future projections. One keen analyst of U.S. space policy, Karl Mueller of the RAND Corporation, argues that the Commission's conclusion that space warfare was virtually inevitable is "based on a smattering of evidence and logic, extrapolated into facile overgeneralizations that are well-suited for television talk-show punditry but which are a poor basis for national policymaking." In this view, human nature has not filled every vacuum with weapons or warfare, with some environments and regions escaping this fate entirely. Nor is the postulate that warfare follows commerce correct in all cases. Indeed, air warfare preceded commercial aviation.[18]

The use of space to enhance military operations on Earth has, without question, accelerated since the demise of the Soviet Union. The military benefits of utilizing space have been quite lop-sided, however. By any measure, during the past decade, America's utilization of space to assist military operations has increased many fold.[19] For example, during the 1991 military campaign against Saddam Hussein, none of the U.S. air-delivered munitions were guided to their target by satellite. By the time of U.S. operations in Kosovo, they constituted 3 percent of all such munitions. That figure jumped to 32 percent by the time of operations against the Taliban and Al Qaeda in Afghanistan.[20] According to the RAND Corporation, during Operation Desert

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[18] Karl P. Mueller, "Is the Weaponization of Space Inevitable?" Paper delivered at the International Studies Association Annual Convention, March 27, 2002, p. 4ff.

[19] As Barry Watts has noted, this quantitative increase was brought about by a qualitative change in how space systems are used: "Whereas U.S. space efforts had concentrated on *pre-conflict* aspects of central nuclear war and the military competition in central Europe during 1957–91, over the last decade the U.S. military has sought to redirect space efforts toward the *real-time* enhancement of ongoing, nonnuclear military operations within the earth's atmosphere [emphasis in original]." *The Military Use of Space*, p. 1, emphasis in original. Paul B. Stares forecast such a shift in *The Militarization of Space*, pp. 242–3

[20] Peter Hays, "Current and Future Military Uses of Space," presentation at Outer Space and Global Security Workshop (Geneva: November 26, 2002); also see "Defense Watch," *Defense Daily* (August 19, 2002).

Storm, the U.S. armed forces used approximately 100 megabits per second of capacity. Today, estimates of the demand for a major regional conflict range from 1.25 to 10 gigabits per second, in other words, somewhere between 10 to 100 times the amount used during the 1991 Gulf War.[21] More and more of these data will be traveling over commercial networks. During the Kosovo campaign, for example, 80 percent of the space-borne data traveled on commercial systems.[22] There is every reason to believe that assets in space will continue to help the United States to refine and accentuate its conventional war-fighting capabilities, and that other states will lag behind, seeking to utilize space to a far lesser degree for similar ends.

Given this growing disparity in utilizing space to enhance conventional war-fighting capabilities, it would not be surprising if weaker space powers were covertly developing ASAT programs. A staff background paper to the Rumsfeld Commission prominently featured a *Xinhua* news agency report on how China's military plans on defeating the U.S. military in a future conflict. The *Xinhua* article noted, "For countries that could never win a war by using the method of tanks and planes, attacking the U.S. space system may be an irresistible and most tempting choice."[23] In January 2000, the *Sing Tao* newspaper based in Hong Kong quoted Chinese sources saying that China was developing a "parasitic satellite" to be used in an ASAT mode**.** This article reported that ground testing was complete and planning had already begun to test the system in space.[24] Russia has far more ASAT capability than China, having benefited from research and development into the co-orbital interceptor during the 1960s and 1970s. Russia also pursued development of an air-launched ASAT in the late 1980s and early 1990s.[25] Both Russia and China

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[21] Daniel Gonzales, *The Changing Role of the U.S. Military in Space* (Santa Monica, CA: Rand, 1999), pp. 18–23.

[22] Watts, *The Military Use of Space*, p. 41.

[23] Al Santoli, "Beijing Describes How to Defeat U.S. in High-Tech War," *China Reform Monitor* No. 331 (September 12, 2000), available online at http://www.afpc.org/crm/crm331.htm cited in Tom Wilson, *Threats to United States Space Capabilities* (Washington, DC: Prepared for the Commission to Assess United States National Security Space Management and Organization, 2001), p. 5.

[24] Cheng Ho, "China Eyes Anti-Satellite System," *Space Daily*, January 8, 2000. In January 2001, two additional articles in the Hong Kong press discussed development and testing of "parasitic" or "piggyback" ASATs. See Philip Saunders, et al, "China's Space Capabilities and the Strategic Logic of Anti-Satellite Weapons," Center for Nonproliferation Studies, Monterey Institute of International Studies (July 22, 2002), available online at http://cns.miis.edu/pubs/week/020722.htm.

[25] "Russians Alter MiG-31 For ASAT Carrier Role," *Aviation Week and Space Technology* (August 17, 1992), p. 63.

presumably are exploring directed energy weapons technology, but significant time and resources will need to be invested to field useful weapon systems.[26]

The Bush administration is also working on ASAT programs, according to published reports. The FY2004 budget request contains $14.7 million for research and development on "space control" and $82.6 million for "counterspace technologies."[27] The Defense Advanced Research Projects Agency is reportedly working on "microsatellites" that could be used in an ASAT role.[28] These circumstances, which are alarming to some and woefully insufficient to others, do not yet suggest that the weaponization of space is a virtual certainty. Indeed, the advocacy of space "dominators" and the blocking strategies of their critics have barely begun.

Ongoing research and development programs related to space warfare also suggest a continuation of hedging strategies, not unlike those adopted by the United States and the Soviet Union during the Cold War. That is, selected countries are working on research and development programs behind closed doors, either to exploit the offensive potential of space warfare, or to avoid being placed at a disadvantage by ASAT flight tests carried out by a potential adversary. In the absence of newly tested, dedicated space warfare systems, these states can continue to fall back on space warfare capabilities that are inherent in weapon systems designed for other military missions.

Contemporary circumstances are, however, significantly different from Cold War hedging strategies. Back then, over fifty ASAT tests were carried out. Since the demise of the Soviet Union, no ASAT flight tests have been reported. During segments of the Cold War, rudimentary, dedicated ASATs were overtly deployed or they were reported to be covertly deployed. At present, dedicated ASAT deployments, whether overt or covert, have not been reported. Judging by these yardsticks, space warfare is less of a virtual certainty now than during the Cold War.

Who Benefits from Asymmetric Warfare in Space?

While the conditions under which space weaponization might now occur are quite different than during the Cold War, basic questions regarding cost, benefit, and risk remain unchanged. A Reagan-era study of U.S. space policy

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[26] Robert Wall, "Directed-Energy Threat Inches Forward," *Aviation Week and Space Technology* (October 30, 2000), p. 70.

[27] The FY2004 research and development budget request is available online at http://www.dod.mil/comptroller/defbudget/fy2004/fy2004_r1.pdf.

[28] "DARPA Initiative Exploring Micro-Satellites," *Aviation Week and Space Technology* (July 29, 2002), p. 23.

options highlighted one of the fundamental questions bearing on our inquiry: Do we value the safety of our own satellites more than we value the ability to destroy satellites belonging to others?[29] Put another way, would the perceived benefits of a dominant U.S. war-fighting posture in space be durable, and would they exceed downside risks? Would military gains outweigh diplomatic, commercial, and national security losses?

After a decade of tentative multilateralism during the 1990s, it has become fashionable in some quarters to take pride in defining national security in more narrow terms. From this perspective, the first and foremost question is whether a particular course of action advances U.S. national security interests. U.S. leadership, in this view, will generate followers. How, then, does the world's sole remaining superpower wish to lead in space?

Space leadership in the past has resulted from national endeavors. But the leadership initiatives that have captured popular imagination have mostly been outside the military realm, most notably the moon landings undertaken by the United States. National leadership of this kind has not precluded multinational cooperation. Indeed, in the vast expanse of space, far more than on earth, multilateral approaches have produced strikingly successful results. The scientific exploration of space is a shared endeavor, exemplified by the International Space Station. The International Telecommunications Union has established mechanisms to allocate slots and frequencies for communication satellites, while the more *ad hoc* Inter-Agency Space Debris Coordination Committee has led the way in establishing "best practices" to mitigate the potential danger from orbiting space debris.[30]

Those who are drawn to space for exploration, science, and commerce tend to reject narrow conceptions of national interest in this domain. Non-military pursuits in space are, by their nature, inclusive as well as expansive enterprises. Indeed, Article II of the 1967 Outer Space Treaty explicitly rejects the proposition that outer space is "subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means." A balanced assessment of the net effects of space weaponization requires a broad-angle view of what national security means, and how the attempted

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[29] Office of Technology Assessment, *Arms Control in Space, Workshop Proceedings,* OTA-BP-ISC-28 (Washington, D.C.: U.S. Congress, Office of Technology Assessment, May 1984), p. 4.

[30] For a discussion of the International Telecommunications Union, see Peter Hays, *United States Military Space Into the Twenty-First Century,* INSS Occasional Paper 42 (Maxwell Air Force Base, Alabama: Air University Press, 2002), pp. 62–64. For a discussion of space debris and coordination efforts, see Nicholas L. Johnson, "Space Debris: Its Causes and Management," Presentation for the Center for Non-Proliferation Studies, Monterey Institute of International Studies (Washington, DC: July 24, 2002).

appropriation of space for warfare relates to on-going and prospective non-military pursuits that enrich our daily lives.

Others think differently. Proponents of space weaponization argue in the narrowest of terms, focusing on possible threats without evaluating their probability and keying on potential military benefits without weighing these benefits against the probable consequences of their favored pursuit.[31]

The necessity to weaponize space in order to extend U.S. military superiority on the ground, sea, and air is well worth questioning. If terrestrial military superiority can continue to be extended without taking the lead in weaponizing space, is the latter warranted? And might it be possible that U.S. terrestrial military dominance could be greatly and unnecessarily complicated by weaponizing space? Put another way, how much dominance is enough?

Basic questions also need to be asked regarding the interconnections of space weaponization and space-dependent commerce. The process of globalization and its positive distributed effects have been far more evident in space than on earth. The commercial utilization of space has been central to communications, navigation, remote sensing, timekeeping, and direct broadcasting. U.S. Space Command projects that by 2003, the Global Positioning System alone will generate $16 billion per year in revenues. In 2001, during the downturn in the telecommunications sector, the worldwide satellite industry still earned $85 billion in revenues. Before the downturn, some observers, such as space policy expert James Oberg, expected that by 2010, the cumulative U.S. investment in space could reach $500 billion to $600 billion—equaling the value of all current U.S. investments in Europe.[32]

Is the flight-testing and deployment of space warfare capabilities the best way to protect and expand these investments? Would we think the same way about protecting the banking system, telephone landlines, fiber-optic cables, electrical grids, or stock markets? Common sense suggests that the flight-testing and deployment of space warfare capabilities would not be conducive to commerce that depends on the unhindered utilization of space. Instead,

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[31] Colin Gray and John Sheldon shrug off costs, arguing that while they are debatable, they are largely irrelevant for making strategic decisions. See "Space Power and the Revolution in Military Affairs: A Glass Half Full?" *Airpower Journal* 13, no. 3 (Fall 1999), 23–38. For an example of a "capabilities-based" approach to planning, see Wilson, *Threats to United States Space Capabilities*.

[32] Also, see the testimony of General Richard B. Myers before the Subcommittee on Strategic Forces of the Senate Armed Services Committee (March 22, 1999); Satellite Industry Assocation, "Satellite Industry Indicators Survey, 2001–2002," prepared by the Futron Corporation, available online at http://www.sia.org/papers/Satellite%20Industry%20Indicators%20Survey-02.pdf; James Oberg, *Space Power Theory* (Washington, DC: GPO, 1999), pp. 15–16 available online at http://www.jamesoberg.com/books/spt/spt.hml.

insurance rates for satellite launches would likely rise, and investors in space commerce would likely become more leery.

The drive toward space weaponization would have percussive effects on space commerce. Since the vulnerabilities of commercial satellites are very great and the costs of protective measures are open-ended, cost-benefit calculations of commercial investments in space would become more problematic. Space commerce requires the minimization of space debris. The growth of commerce in space therefore requires a peaceful environment. This environment has been nurtured over the past decade by the absence of space weapons' flight-testing and deployment. Is the nurturing and expansion of space commerce now to proceed on an entirely different premise? How would proponents of the flight-testing and deployment of U.S. space warfare capabilities propose to assure commercial markets?

The United States has become so dominant militarily that any threat it faces is, *ipso facto*, asymmetric in nature. It follows that neither the United States nor its future adversaries seek or expect a level playing field. Washington will continue to utilize its military dominance to deter, defend, and defeat adversaries, while weaker foes, whether nations or terrorist cells, will seek to catch the United States off balance, either at home or at its foreign outposts. Consequently, asymmetric warfare now constitutes the basis for military strategy, whether in Afghanistan, Iraq, Aden harbor, or other outposts and symbols of American power at home and abroad.

The very nature of American power and its extraordinary extension, here on Earth as well as in space, offers a wide range of targets for adversaries. An open society whose power is built upon advanced technology networks and whose defenders maintain forward posts in dangerous neighborhoods present multiple targets that are extremely hard to defend. The potential targets for attack are so varied and numerous that priorities must be set for their protection. Where do U.S. space assets fit within this "target rich" environment for asymmetric attack? What are the most effective as well as cost-effective ways to foreclose such attacks? If preventive diplomacy and deterrence strategies fail, what are the best insurance policies to minimize adverse consequences? And where do space weapons fit within strategies to deter, defend, and defeat adversaries that engage in asymmetric warfare?

The Rumsfeld Commission's assumption that the "relative dependence of the U.S. on space makes its space systems potentially attractive targets" is not contestable.[33] Cell phones, pagers, ATM and other banking transactions, and

[33] "Executive Summary," in *Report of the Commission to Assess United States National Security Space Management and Organization*, p. viii.

the need for precise position location information have been transformed from luxuries to basic necessities for a growing number of American citizens, thanks to satellite operations. Effective and swift military operational success with a minimum of casualties and collateral damage also rest, to an unprecedented degree, on information provided by satellites. Disrupting satellite operations therefore offers adversaries multiple opportunities to generate mass inconvenience or complications in the conduct of U.S. military operations. Proponents of space weaponization argue that weaker nations unable to compete militarily with the United States on land, sea, and air, might in the future choose to do so in space.

It does not necessarily follow, however, that future adversaries will place a high priority on attacking or disrupting satellites. In the event they might, it is essential to adopt measures to increase "situational awareness" of possible threats to U.S. satellites, and to lessen U.S. vulnerabilities in space or at ground stations servicing space. These central elements of a space assurance posture can help detect and deter attacks in space on U.S. assets. They are essential to guard against disabling single-point failures and over-dependency on individual communication nodes and satellites.

If the United States adopts sensible insurance policies, most would agree that asymmetric attacks on U.S. satellites would become less likely and less successful. If, however, the United States unwisely fails to adopt these insurance policies, would asymmetric warfare in space necessarily become more likely? Whether or not these sensible measures are undertaken, other vulnerabilities and targets will continue to present themselves to U.S. adversaries. Our cities remain vulnerable, as are our ports, mass transit centers, and airports. Our computer networks continue to invite hackers. Adding to this list requires little imagination. These terrestrial targets are far more accessible to adversaries than satellites orbiting the earth. Moreover, if the object of terrorist attacks is the United States, why would an attacking country or terrorist group choose a distant target that provides services to many nations, rather than focusing on a distinctly American target?

Conventional explosives, which account for the greatest number of victims resulting from asymmetric warfare, are far easier to acquire than ASAT capabilities. Fissile material, combined with conventional explosives, can cause longer lasting disruption than acts to interfere with satellite signals. The use of a radiological weapon or a "dirty" bomb in a U.S. city center is likely to cause more profound psychological injury than the covert, temporary disruption of pagers or cell phones.[34] In other words, close-to-home scenarios of asymmetric

[34] See Michael Levi and Henry Kelly, "Weapons of Mass Disruption," *Scientific American* (November 2002), pp. 76–81; and Charles Ferguson, Tahseen Kazi, and Judith Perera, *Commercial Radioactive Sources:*

attack are far more likely to occur, and are thus likely to be far more consequential than space warfare against U.S. assets. It is also easier in most cases for the perpetrator to remain anonymous if the attack is on the ground rather than in space. And why would an adversary plan an attack in space when there are so many "soft" targets nearby?

Space warfare initiated by a far weaker adversary offers the prospect of mass disruption, whereas terrestrial attacks offer the prospect of mass disruption and mass casualties. Is poking a much stronger foe in the eye, ear, cell phone, or pager a particularly compelling strategy for those who wish to harm the United States? Terrorists and their state sponsors have chosen far different categories of targets in the past, with disturbingly successful results. Have efforts to counter terrorist designs been so successful that sworn foes would need to move from terrestrial to space warfare? It stretches credulity to argue that asymmetric warfare in space is a virtual certainty by the weak against the strong when the powerful have better means to compensate for vulnerabilities in space than on Earth.

The prioritization of threats facing the United States and U.S. friends and allies is essential for developing appropriate countermeasures. A wide spectrum of asymmetric threats continues to plague U.S. citizens and preoccupy the U.S. armed forces. These threats and appropriate responses are not in the heavens; they are thoroughly terrestrial.

Space Warfare and Regional Military Contingencies

Let us assume that a maverick leader who is a sworn foe of the United States has acquired satellite disruption or destruction capabilities. Might such a foe, fearing a U.S. invasion, initiate covert space warfare to degrade U.S. military capabilities and to signal readiness to defend supreme national interests? Let us also presume that a maverick leader possessed a nuclear weapon and a long-range missile. Might this leader detonate a nuclear weapon in low earth orbit to disable observation satellites and to greatly interfere with other U.S. military support functions?[35]

In the event of covert attacks on satellites, the perpetrator would have the choice of directing the attacks solely against U.S. space assets or disrupting

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Surveying the Security Risks, CNS Occasional Paper No. 11 (Monterey, CA: Monterey Institute of International Studies, January 2003).

[35] See Advanced Systems and Concepts Office, Defense Threat Reduction Agency, Department of Defense, *High Altitude Nuclear Detonations (HAND) Against Low Earth Orbit Satellites ("HALEOS")* (Defense Threat Reduction Agency, April 2001). Also Dennis Papadopolous , "Satellite Threat Due to High Altitude Nuclear Detonations," presentation for the Center for Nonproliferation Studies, Monterey Institute of International Studies (July 24, 2002).

multinational satellite operations, as well, either in an attempt to mask the real purpose of the attack, or in recognition that the United States would turn to other satellites for data in the event that U.S. satellites were harmed. If the first path were chosen, it would greatly narrow the list of suspect nations. The international political context in which the attacks were undertaken would provide further clues, and if the U.S. intelligence community were doing its job properly, it would be able to sift through collected data to identify the culprit. If the second path were chosen, there would be even more data points to identify the perpetrator of preemptive space warfare. The perpetrator would find little sympathy from the international community when U.S. retribution began. While these scenarios cannot be rejected out of hand, they lack plausibility because the attacker has little to gain and much to lose by attempting covert, preemptive space attacks against the United States.

There is even less to be gained and far more to lose if a maverick leader carries out preemptive space warfare by means of one or more nuclear detonations. Again, this scenario cannot be completely discounted, in part because insurance policies to protect satellites in such circumstances, such as satellite redundancy, hardening, and prompt launch capabilities, are nullified if space is purposefully irradiated in this fashion. But the "logic" behind this extremely dangerous scenario rests on the premise that it is somehow "safer" to kill satellites than to kill soldiers. As Barry Watts has noted, "Satellites may have owners and operators, but, in contrast to sailors, they do not have mothers." Killing satellites, unlike killing many American soldiers or civilians, might therefore not generate a strenuous U.S. response, or so this line of reasoning goes.[36]

In these scenarios, the distinction between killing satellites and soldiers is without practical meaning. To begin with, by killing U.S. satellites, the perpetrator would also be seeking to kill U.S. military personnel, who would be deprived of satellite-derived information in battle. Moreover, the perpetrator would cross two critically important international thresholds: the initiation of space warfare and the initiation of nuclear warfare. It is inconceivable that in these circumstances the severity of the resulting conflict would be lessened.

Proponents of testing and deploying space warfare capabilities would argue that the above, much-abbreviated analysis is far too rational and analytical.

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[36] Watts, *The Military Use of Space*, p. 29. A similar point was made by Paul Stares: "Destroying the satellite ensures denial of the benefits it gives and may be seen as less escalatory and more attractive than attacking the ground segment, because the destruction would not involve the loss of life" ("Nuclear Operations and Antisatellites," in *Managing Nuclear Operations*, p. 692). It should be noted, however, that neither observer argues that the use of nuclear weapons in space is likely. Watts argues that the costs of using a nuclear weapon in space probably outweigh the benefits for most potential adversaries (Watts, *The Military Use of Space,* p. 102).

They would argue that rational analysis does not apply to "irrational" actors who are dismissive of the reasoned dictates of deterrence theory. Two rebuttals might be offered in response. The record of maverick leaders to date suggests that they are, indeed, capable of surprising steps but, above all, they are keenly interested in maintaining power. To initiate space warfare against the United States is not a good way to maintain power. But if irrationality rules behavior, and if a maverick leader were intent on using a nuclear weapon in a losing cause, why would that leader target satellites instead of an invading army?

Asymmetric warfare in space does not favor the weak against the strong. The strong have greater means to reduce their weaknesses in space and to exploit the weaknesses of others. Moreover, weaker states have a greater chance of causing harm to the United States on the ground than in space. Attacks by weaker states against U.S. satellites would complicate and perhaps extend somewhat the Pentagon's military campaigns, but they would not change the outcome of warfare, given the dominating and growing power projection capabilities enjoyed by the United States.

Nor would attacks in space by a far weaker foe serve to protect that which the initiator of space warfare holds dear on the ground. Acts of warfare initiated in space do not grant to the perpetrator greater dispensation or relief from retaliatory strikes. Moreover, the perpetrator would find it hard to conceal his handiwork; if concealment were essential, some forms of terrestrial covert attack would offer better prospects of plausible deniability than the initiation of space warfare. In addition, attacks in space against U.S. assets are likely to prompt a fierce and devastating response, especially if the means of attack were one or more nuclear detonations.

The use of nuclear weapons in space warfare would be a widely reviled act. It would break the taboo against nuclear warfare that has withstood almost six decades of extended and costly regional warfare, including grueling land wars in Korea and Vietnam, and more than 150 lesser military engagements.[37] Nuclear testing in the atmosphere was stopped four decades ago against the backdrop of public revulsion generated by increased radiation levels. A "Space Pearl Harbor," whether or not it involves nuclear detonations in space, would leave the attacker with little international protection to face a near-term, devastating military response.

Current preoccupations about sneak attacks in space revolve less around nuclear detonations than on covert, small satellites that could serve as space mines. These satellites could be maneuvered to "park" nearby U.S. satellites,

[37] James Ciment (ed.), *The Encyclopedia of Conflicts Since World War II* (Armonk, NY: M.E. Sharpe, 1999), p. 105.

where they could be detonated on command. Alternatively, an adversary could have the means to launch, maneuver, and attach "parasitic" ASATs to U.S. platforms in space. The military effectiveness of satellite attacks by conventional means would be a function of the number and type of satellites harmed. The greater the ambitions of an adversary to harm U.S. space assets, the easier it becomes to identify the attacker. Alternatively, disabling attacks could be carried out in a more limited, covert, and plausibly deniable fashion. However, the more limited the attack, the less militarily effective it is likely to be.

None of these scenarios can be dismissed out of hand, but all appear to be far less plausible than a wide variety of asymmetric attacks that could cause widespread disruption or death by covert means here on Earth. Attacks by a weaker adversary in space would not yield military gains, except perhaps for the most temporary kind. A "Space Pearl Harbor" could, however, increase U.S. casualties on the battlefield, which would prompt a more ferocious response with superior U.S. conventional military capabilities. To further reduce the likelihood of a weaker adversary initiating space warfare against the United States, the executive and legislative branches could invest in space assurance policies that reduce U.S. vulnerabilities and risks. These insurance policies, such as improved U.S. situational awareness in space and initiatives to increase redundancy for space assets, are discussed in Chapter 3.

The possibility of a space attack by the weak against the strong warrants hedging strategies; the improbability of such an attack does not warrant the initiation of flight-testing and deployment of space weaponry. Asymmetric warfare is far more probable and worrisome on Earth than in space. The remote possibility of a "Space Pearl Harbor" should not serve as the basis for a national policy that calls for the weaponization of space.

Asymmetric Space Warfare and Preemption

Asymmetric warfare in space by the weak against the strong might temporarily complicate the attacking plans of a more powerful foe, but it would not alter the devastating result of such a contest. In contrast, asymmetric warfare in space by the strong against the weak offers the prospect of even more devastating and quicker results. As Karl Mueller has rightly noted, "[T]he only argument [for space weaponization] that can plausibly stand on its own" relates to military utility.[38] The argument of historical inevitability is too slippery a concept for space warriors to advance their agenda, and resting one's case on the vulnerability of space assets is problematic, since this implies the insufficiency

[38] Mueller, "Is the Weaponization of Space Inevitable?" p. 10.

of deterrence and ameliorative measures. The diplomatic, political, and financial costs of vigorously pursuing space weaponization can only be justified by the unvarnished magnification of U.S. military dominance.

After canvassing the arguments of proponents for space warfare capabilities, a recent RAND study cited four presumed advantages of space weapons: an ability to attack inaccessible targets, a rapid response capability, a long-range attack capability from protected distances, and a high likelihood of assured kills.[39] These capabilities could prove especially useful, in the view of advocates, in targeting hardened, underground bunkers far distant from U.S. power projection capabilities. In addition, Simon Worden and others have argued that precision, space-based weapons could provide the basis for a new deterrence strategy built on space and information dominance, thereby avoiding dilemmas associated with nuclear deterrence.[40] Might these presumed benefits against weaker foes warrant space weaponization?

These presumed benefits have already been demonstrated by U.S. power projection capabilities featuring conventional munitions of increasing range and lethality. Further advances can be expected, so advocates of U.S. space warfare capabilities have the added burden of explaining why these terrestrial advances are insufficient to support a dominant U.S. military capability, and what added value would accrue from even greater increases in lethality, promptness, and reach from space. Moreover, further improvements in the range, promptness, and lethality of terrestrial weapons are likely to come far sooner, and at a fraction of the diplomatic, political, and financial cost, than the advent of "space strike" capabilities.

Are space weapons needed to destroy hardened, underground bunkers? Existing or improved conventional weapons can serve to deny access to such facilities, thereby rendering the weapons inside unusable. The nullification of such threats could thereby be accomplished at a small fraction of the multiple costs associated with flight-testing and deploying space warfare capabilities. For the same reasons, the rationale for "improved" nuclear weapons designed for this purpose is deeply suspect.

The presumed additional deterrent value of U.S. space weapons is also questionable. If existing U.S. conventional military and nuclear superiority prove insufficient to deter, it is doubtful that the addition of space warfare capabilities would make an appreciable difference in an adversary's calculus of

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[39] Bob Preston, Dana J. Johnson, Sean Edwards, Michael Miller, and Calvin Shipbaugh, *Space Weapons Earth War* (Santa Monica, CA: RAND, 2002), pp. xx, 48.

[40] Simon P. Worden and Martin E.B. France, "Towards an Evolving Deterrence Strategy: Space and Information Dominance," *Comparative Strategy* 20, no. 5 (October–December 2001), pp. 453–466.

decision. The search to strengthen or supplant nuclear deterrence by means of space warfare capabilities will therefore appear to many as a quest to escape from, rather than "enhance," deterrence. When viewed though this lens, the pursuit of space weapons appears designed less for strengthening deterrence and more for negating the deterrents of potential adversaries.

To the extent that this perception holds, the flight-testing and deployment of space weapons is unlikely to raise the nuclear threshold, as proponents claim. To the contrary, the use of conventionally armed "space-strike" weapons could prompt unwanted escalation by threatening the nuclear forces of a weaker foe. In this event, the United States will receive little or no applause of the choice of weaponry used in preemptive strikes.

Common sense suggests that these risks be avoided and that the presumed military advantages of space warfare be pursued at far lesser cost by other war-fighting means. Dissatisfaction with Cold War era concepts of deterrence and containment appears to provide the subtext for breaking down barriers against space warfare. In this view, space weapons could help place at risk an adversary's deterrent, or help compel an adversary not to use weapons of mass destruction in the event of a military confrontation with the United States. Space-based weapons could reinforce a military posture that places importance on preventive war and preemptive strikes. Space weapons could amplify U.S. military dominance on the ground, at sea, or in the air, reducing U.S. and allied casualties in regional military contingencies against a weaker foe.

These rationales for space warfare capabilities are politically sensitive. They are not mentioned in the Bush administration's national security strategy document which elevated preemption from an option to a core element of U.S. military doctrine. Instead, the administration's national security strategy pointedly but elliptically declares that, "as a matter of common sense and self-defense, America will act against such emerging threats before they are fully formed."[41] Bush administration officials have certainly not excluded space warfare from the logic of preventative war and preemption.

Space Warfare and the Taiwan Scenario

More definition can be provided to these abstractions by analyzing the scenario of a possible crisis between the United States and China over the future of Taiwan.[42] If China possessed imaging satellites capable of locating forward-

[41] *The National Security Strategy of the United States of America* (September 2002), p. iv, available online at http://www.whitehouse.gov/nsc/nss.pdf.

[42] This discussion draws heavily from discussions with Michael O'Hanlon, a working group member and senior fellow at the Brookings Institution, who does not exclude the possible utility of ASAT use by the United States in this contingency.

deployed U.S. aircraft carriers, this targeting information could then be relayed to platforms carrying long-range, anti-ship missiles. As a consequence, U.S. aircraft carriers could be placed at acute risk. Heavy U.S. casualties could result, and depending on the status of forces in the theater, China might initially secure some military gains against Taiwan. Based on this scenario, a U.S. ASAT capability might be viewed as necessary to protect carrier operations in high-threat environments along China's periphery. By extension, just as surface combatants and submarines provide a defensive screen for carriers on the high seas, ASAT capabilities might provide a defensive screen in space. In this view, the United States might be willing to tolerate an ASAT arms competition in which its own satellites were placed at greater risk in order to ensure incapacitation of the potential enemy's ability to strike high-value American targets at sea.

To be sure, China might not need satellite capabilities in order to identify the location of U.S. carriers during a crisis over Taiwan. Indeed, satellite capabilities would provide only the most infrequent location information regarding the whereabouts of U.S. aircraft carriers, and only then, if the satellites were cued where to look by other means. In addition, the stipulated assumption of carrier vulnerability in high-threat regions is not new, since it was a staple of the Cold War. What is new in this regard is the assumption that U.S. carriers would be vulnerable to attack by China.

In this scenario, preemption, like asymmetric warfare, is a two-way street. While China could seek to carry out preemptive strikes against U.S. carriers, thereby seeking to facilitate war objectives regarding Taiwan, the United States could seek to carry out preemptive strikes against Chinese satellite capabilities and trailing ships, thereby foiling China's war plans and limiting U.S. casualties. If China were to strike preemptively against U.S. carriers, it would incur devastating retaliation by U.S. military forces, swiftly by U.S. air power, and subsequently by U.S. sea power. If China were able to secure beachheads on Taiwan, these would be pummeled unmercifully. There can be no doubt but that, in the event of a Chinese attack against U.S. naval forces in the Pacific, Washington would undertake a fearsome military response, and China would need to contemplate the prospect of Taiwan becoming independent.

In this scenario, the potential benefits of space warfare are far greater when initiated by the stronger adversary than by the weaker foe. A preemptive U.S. strike against Chinese satellites could increase the prospect of a decisive military victory with minimum casualties. A preemptive U.S. strike limited to Chinese space assets would, however, leave much to chance. If the United States were serious about limiting casualties and pursuing damage limitation in the event of a war with China across the Taiwan Strait, preemptive strikes would need to

extend to other Chinese targets that could do harm to American military forces and the U.S. homeland. These strikes could also be executed from space, as well as by terrestrial means.

SATELLITE WARFARE AND ESCALATION CONTROL

The inherent escalatory potential of satellite warfare between the United States and a major power such as China is exposed by such anodyne calculations. Any analysis of this scenario for preemptive attacks on space assets—whether initiated by the United States or by China—cannot assume that strikes would be confined to satellites. Moreover, escalation control in this scenario must be considered a highly dubious proposition. After all, the purpose of attacking objects in space, or attacking terrestrial targets from space, is to affect the conduct of military operations on Earth. It is therefore exceedingly hard to envision warfare in space that does not spread elsewhere, whether by asymmetric, conventional, or unconventional means. The resulting combat is likely to be less discriminating and proportional, and far more lethal, either because the stronger party has lost satellites used for targeting and precision guidance, or because the weaker party is unlikely to be concerned about collateral damage.

Concepts of limited warfare and escalation control that were intimately associated with nuclear deterrence during the Cold War have not been propounded by U.S. advocates of space warfare. To engage in tit-for-tat, controlled warfare against satellites would suggest that the first kill of a satellite in the history of armed conflict would reflect a mere quest for balance or a novel form of message sending. The rationales provided by proponents of space control are notably different. The object of acquiring space warfare capabilities is to win, not to tie. In other words, U.S. advocates of space warfare capabilities are less interested in deterrence than in dominance and compellance.

Unlike nuclear weapons, ASAT capabilities have been tested infrequently and deployed (using a generous definition of deployment) minimally. Nuclear deterrence was based on large numbers of overt deployments of lethal capabilities regularly demonstrated at nuclear test sites that made the earth shake. ASAT capabilities, in contrast, are mostly inferential. The basic message of deterrence of space warfare during the Cold War—the prospect of mutual loss exceeding potential gains—was therefore accomplished without the heavy encumbrances and trappings of nuclear deterrence. Library shelves groan under the amount of intellectual effort devoted to deterrence theory written during the Cold War, but there has been little application of these concepts to space warfare. With respect to escalation control, however, nuclear deterrence and space warfare had, and continue to have, much in common: Both rely on

threats that leave something to chance. Escalation control becomes very problematic once the threat is used.

The quest for preemptive space warfare capabilities alongside dominant conventional military capabilities is therefore bound to be viewed in worrisome terms by potential adversaries. The flight-testing and deployment of space weaponry is thus likely to generate low-cost blocking action, comparable to the countermeasures likely to be employed by states fearing the viability of prospective U.S. missile defenses. Space weaponry, like missile defenses, can be designed and sized for the limited purpose of dealing with maverick leaders. Both need not be confined to specific locations; they can go where directed. Additional deployments can be added rather quickly from covert stocks. Moreover, the goal sought by advocates of U.S. space weaponry, as well as missile defenses, is not deterrence but dominance.

Space weapons have another thing in common with missile defenses: They are both vulnerable to countermeasures. The deployment of dominating, yet vulnerable, capabilities by one state will not go unanswered by potential adversaries with access to space. Therefore, the deployment by the United States of satellite killers or battle stations in space would naturally generate company in the form of space mines or other countermeasures. Space would thus become a mixed venue, populated by satellites and satellite killers. Because of their presumed military value and because of trailing space mines, deployed space weapons would require considerable protection against attack, like the screening by surface combatants and submarines that accompany aircraft carriers at sea. An alternative to this expensive panoply of defensive measures could be to attack preemptively space mines before their deployment, but this would not only constitute the "appropriation of space" that is prohibited by international law and customary practice, it would also constitute an act of warfare against a space-faring nation or consortium claiming to exercise legitimate rights protected—or at least not prohibited—by international law.

Space warfare capabilities and preemption strategies are therefore linked, as well as inferentially advertised by the Bush administration's national security strategy. Because the prospective military utility of preemptive strikes from space, added to U.S. terrestrial strategic capabilities and prospective missile defenses, is sufficiently great to threaten the viability of the Chinese and perhaps the Russian nuclear deterrents, countermeasures could be expected. Preemption capabilities would thus become a two-way street in space. The weaker adversary would be able to gain only temporary advantage by the first use of ASAT weapons, but this would be better than ceding all advantage to the side with stronger space and terrestrial warfare capabilities. The hair trigger that characterized nuclear deterrence during the Cold War would be elevated to the

heavens through the deployment of ASAT weapons. As one close observer of U.S. space policy, Bruce DeBlois of the Council on Foreign Relations, has asked, "Will this generation's legacy be to provide a constant threat of space weapons, just as the constant threat of nuclear weapons has diminished?"[43]

PROSPECTS FOR RESTRAINT

The exercise of restraint by the United States in the flight-testing and deployment of space warfare capabilities is critical for space assurance. With U.S. restraint, prospects for avoiding the elevation of a hair trigger into space grow appreciably. Conversely, by initiating the flight-testing and deployment of space warfare capabilities, or by testing military capabilities designed for other purposes in an "ASAT mode," the United States would do much to make the weaponization of space an accomplished fact.

Prospects for restraint are enhanced because the United States does not require preemptive strike options in space alongside similar terrestrial capabilities. To argue otherwise, one must believe that considerable added benefits derive from first strike options in space, and that these benefits override downside risks. Advocates of space strike capabilities must explain why such options are required atop U.S. conventional and nuclear superiority, as well as why they have confidence in the U.S. ability to control escalation and prevent significant damage to the U.S. homeland after engaging in space warfare. In the case of the Taiwan Strait scenario discussed above, advocates must explain how prospective escalation is to be controlled, and why the alternative U.S. means to negate Chinese satellite capabilities—such as by destroying satellite ground stations or by disrupting satellite transmissions—are insufficient. And if the China threat does not constitute a sound basis for taking the lead in testing and deploying space weapons, why would lesser regional contingencies constitute a more compelling rationale for "seizing" the high ground of space?

American restraint in the flight-testing and deployment of space warfare capabilities is possible because of unchallenged U.S. military dominance. While superior U.S. conventional military capabilities provide ample grounds for weaker states to hedge their bets by conducting research and development on space warfare capabilities, the U.S. ability to compete effectively in space makes it most unwise for weaker states to trigger a competition. The distinction between hedging one's bets and demonstrating capabilities through flight-testing and deployments remains crucial and maintainable with wise U.S. leadership.

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[43] Bruce DeBlois, "Space Sanctuary: A Viable National Strategy," *Airpower Journal* 12, No. 4 (Winter 1998), p. 50.

Put another way, the dominant position of the United States provides agenda-setting powers in space. The flight-testing and deployment of space warfare capabilities is surely inevitable if the United States takes the lead in this pursuit, but not if Washington maintains prudent hedges against unwelcome developments in the form of a readiness to respond in kind to any flight tests or deployments of space weapons by weaker states. These hedges, as discussed in Chapter 3, should be sufficiently persuasive to foreclose such a competition, unless weaker space-faring nations make very unwise choices.

While a hedging strategy is necessary, it is also insufficient. Hedges against the flight-testing and deployment of space warfare capabilities need to be accompanied by initiatives that underscore the positive and affirming uses of space for the benefit of humankind. Space assurance, broadly defined, also requires the reaffirmation of existing norms against the weaponization of space.