Chapter Five

ON SPACE CONTROL AND SPACE FORCE APPLICATION

Until now, the Air Force has largely been limited in its space involvement to the two most basic mission areas of (1) space support, the launching of satellites and day-to-day management of on-orbit assets that underpin military space operations, and (2) space force enhancement, a broader mission category that includes all space operations aimed at increasing the effectiveness of terrestrial military operations.[1] These two mission categories have traditionally been politically benign, with no sensitivities attached other than cost considerations. Most would acknowledge that the Air Force has done commendably well at developing them in the nation's interest since the 1950s.

The space support mission, which makes all other space operations possible, has now matured to the point of considering acquisition of the Evolved Expendable Launch Vehicle (EELV) and pursuing single-stage-to-orbit technologies, in both cases with a view toward eventually driving down overall launch costs. The EELV, an Air Force partnership with industry, seeks to reduce the cost of space launch by at least 25 percent and to make access to space a more standard,

[1]The latter operations include satellite communications, space-based navigation, and a wide range of ISR functions that provide commanders and operators with information about weather, geodesy, terrain, and enemy forces, including real-time warning of ballistic missile launches. The most notable aspect of space force enhancement in recent years has been the steady tendency toward the use of space systems for directly enabling, rather than merely enhancing, terrestrial military operations, as attested by the increasing reliance by the Air Force and Navy on Global Positioning System (GPS) signals for guiding near-precision aerial munitions.

repeatable, and reliable process.[2] The space force enhancement mission is overdue for a concurrent replacement of entire constellations of existing space-based C4/ISR (command, control, communications, computers, information, surveillance, and reconnaissance) assets now entering block obsolescence. It also will eventually see a migration of such key air surveillance systems as the E-8 joint surveillance target attack radar system (Joint STARS) and E-3 airborne warning and control system (AWACS) to space. Such major replacement programs will be costly and will be hotly debated on need and affordability grounds. But they do not entail higher-level strategy and policy sensitivities.

That has not been the case for the two space mission areas of space control and space force application. The first involves ensuring that friendly forces can use space unmolested while denying the use of space, as circumstances warrant, to potential opponents. The second aims at directly striking terrestrial targets by means of space-based weapons.[3] Because the latter two mission categories envisage direct space combat functions, they have long been hobbled not just by cost considerations but also by a pronounced national ambivalence concerning space as an arena of warfare.

This was not a serious concern in years past because, despite a small number of nascent antisatellite (ASAT) and space defense programs, the Air Force's main interest in space was then directed largely toward developing the mission areas of routinely accessing space and using the satellites placed on orbit to support the national leadership and combatant commanders worldwide. It also was not a great preoccupation for the Air Force because threats to U.S. on-orbit assets were minimal to nonexistent and because technologies for potential use in both ground-to-space and space-to-earth combat were either in their infancy or altogether undeveloped.

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[2]Statement by the Honorable Peter B. Teets, Under Secretary of the Air Force, to the Commission on the Future of the U.S. Aerospace Industry, Washington, D.C., May 14, 2002, p. 6.

[3]These four space mission areas (space support, force enhancement, space control, and force application) were first articulated and defined by AFSPC in its November 1983 Space Plan and were formally endorsed by the Department of Defense in 1987.

That is no longer the case today. Having been active in space operations for more than four decades now, the United States is more heavily invested than ever in space, both militarily and commercially, and potential opponents are increasingly closer to being able to threaten our space-based assets by means ranging from harassment to neutralization—and even outright destruction. Technologies offering promise for attacking near-earth orbital systems are no longer science fiction but now lie well within the realm of validation and exploitation, not only by the United States but also by potential adversaries. These developments have increasingly forced the American leadership to come face to face with the long-simmering question of whether it should continue treating space as though it were still a sanctuary from the use of force or accept instead that the time has finally come for the United States to seize the initiative in a measured way before others preempt us by aggressively testing the vulnerability of our most vital space systems.

WHY SPACE CONTROL NOW?

The most compelling reason for moving forward with dispatch toward acquiring at least the essential elements of a serious space control capability is that the United States is now unprecedentedly invested in and dependent on on-orbit capabilities, both military and commercial. Since these equities can only be expected to grow in sunk cost and importance over time, it is fair to presume that they will eventually be challenged by potential opponents. In 1997, then-CINCSPACE General Howell M. Estes III pointed out that with more than 525 satellites then on orbit (including more than 200 U.S. satellites) and with more than $250 billion likely to be invested by 46 nations in space assets by 2000, space had indisputably become an economic center of gravity and, hence, a major vulnerability of the United States and its allies.[4]

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[4]For an argument that space in the coming century "will increasingly take on the lead role in international trade that sea-borne commerce has in centuries past," see Brigadier General Simon Peter Worden, USAF, "Space Control for the 21st Century: A Space 'Navy' Protecting the Commercial Basis of America's Wealth," in Peter L. Hays et al., eds, *Spacepower for a New Millennium: Space and U.S. National Security,* New York: McGraw Hill, 2000, pp. 225–237.

Some have questioned whether this aggregation of assets in space truly constitutes an economic center of gravity, even though there may be a thousand American satellites on orbit within ten years at a half-trillion-dollar investment. These skeptics counter that because satellites involve the movement of information rather than goods, they are not strictly comparable to the commercial ships that were plundered during the bygone era of rampant piracy on the high seas. On this point, it may well be, as Barry Watts has suggested, that we have not yet "found the right metaphors and historical analogies for thinking about the military use of near-earth space."[5] Yet what matters is that those satellites represent a tremendous U.S. dependency. It is thus entirely plausible that as the United States deploys ever more satellites and relies ever more on them for military applications, it will only be a matter of time before our adversaries are tempted to challenge our freedom of operation in space. In the security realm in particular, as two RAND colleagues have pointed out, a prospective opponent "will understandably view any space capability contributing to the opposing military as part of the forces arrayed against it in a theater. When the space capabilities represent an easier target than other critical nodes, we should expect interference with them. The natural consequence of space integration into military activity is a more hostile environment for space."[6]

Prompted by this concern, the U.S. Army, U.S. Strategic Command, and other joint agencies conducted a succession of high-level war games in recent years that focused expressly on the susceptibility of various U.S. space systems to disruption, denial, degradation, deception, and destruction. By one account, those experiences gave land, sea, and air commanders "a new appreciation for how dependent on space resources their operations have become."[7] In one Army-sponsored game, a scenario set in the year 2020 involving an invasion of Ukraine by "a neighboring state" featured the early neu-

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[5]Barry D. Watts, *The Military Use of Space: A Diagnostic Assessment*, Washington, D.C.: Center for Strategic and Budgetary Assessments, February 2001, pp. 31–32.

[6]Bob Preston and John Baker, "Space Challenges," in Zalmay Khalilzad and Jeremy Shapiro, eds., *Strategic Appraisal: United States Air and Space Power in the 21st Century*, Santa Monica, Calif.: RAND, MR-1314-AF, 2002, pp. 155–156.

[7]William B. Scott, "Wargames Underscore Value of Space Assets for Military Ops," *Aviation Week and Space Technology*, April 28, 1997, p. 60.

tralization of many U.S. satellites by detonations of nuclear weapons on orbit aimed at disrupting intelligence and communications channels and at inhibiting any Western intervention. As one game participant later said of this gambit, "they took out most of our space-based capabilities. Our military forces just ground to a halt."[8]

Concern for the vulnerability of U.S. space-based assets was expressed with even greater urgency in the Space Commission's finding of a "virtual certainty" that a material threat to vital U.S. space equities will eventually arise. That finding led the commissioners to warn that the United States "is an attractive candidate for a 'space Pearl Harbor'" and must accordingly begin hedging now against hostile acts in and from space by developing and deploying what they called "superior space capabilities."[9] That conclusion was later echoed by Army Lieutenant General Edward G. Anderson III, the deputy CINCSPACE, who argued that "space is so critical now that if we don't do something about [our vulnerability] . . . we're going to have a 'space Pearl Harbor' and we'll deserve what we get."[10] Stressing the need to "ensure our continued access to space [and] deny space to others, if necessary," Anderson told the House Armed Services Committee that the nation runs "the very real risk of a 'space Pearl Harbor'" if this is not attended to in a timely manner.[11]

Such testimony raised an important question as to what a "space Pearl Harbor" might entail for the United States. At the darker end of the spectrum, it could occur frontally and as a stunningly rude surprise. The gravest threat in the near term would be a large number of U.S. and allied satellites being debilitated or destroyed by a major electromagnetic pulse (EMP) event or series of events staged by hostile forces in orbital space by means of nuclear weapon detonations. We already know something of the phenomenology of such a possible occurrence. In July 1962, Project Starfish Prime detonated

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[8]Ibid.

[9]*Report of the Commission to Assess United States National Security Space Management and Organization*, Washington, D.C., January 11, 2001, hereinafter referred to as *Space Commission Report*, p. 100.

[10]William B. Scott, "Commission Lays Foundation for Future Military Space Corps," *Aviation Week and Space Technology*, January 15, 2001, p. 433.

[11]Walter Pincus, "U.S. Satellites Vulnerable to Attack, Officer Warns," *Washington Post*, June 21, 2001.

a 1.4-megaton thermonuclear weapon over Johnston Island in the Pacific Ocean at an altitude of 250 miles to test the effects of EMP on radio communications and radar. That event set off burglar alarms and burned out street lights in Oahu and further generated high-energy electrons that were trapped by the earth's magnetic field, producing an artificial radiation belt that damaged weather and observation satellites and destroyed seven satellites in seven months. The residual effects persisted until the early 1970s.[12] For years, the conventional wisdom among space optimists held that out of enlightened self-interest, if nothing else, no opponent would be so craven as to occasion such an omnidirectional and indiscriminate "scorched-space" cataclysm. The enormity of the terrorist attacks against the United States on September 11, 2001, however, coupled with the dawning realization of what the perpetrators of those attacks might have done had they been in possession of a nuclear device, went far toward discrediting that complacent counsel by confirming that at least some avowed mortal enemies of the United States are completely unbound by any such inclinations toward self-restraint.

At a lower level of potential destructiveness, a notional "space Pearl Harbor" might come in the form of a surprise hostile meddling with U.S. satellites by, for example, a ground-based laser attack that would cause irreparable damage to vital assets or otherwise interfere in some consequential way with an ongoing U.S. military operation. A disturbing hint of such a possibility was a 1997 Army test that temporarily blinded a U.S. satellite with a laser. In that test, a low-powered laser with little more wattage than a refrigerator lightbulb was fired at an Air Force MSTI-3 satellite on orbit 300 miles high. Pressed into service when the controversial million-watt Mid-Infrared Advanced Chemical Laser (MIRACL) melted one of its parts during an earlier test, the far weaker laser beam hit the satellite on three successive nights, suffusing the pixels on a focal plane array for several seconds.[13] That may not have been the first instance of such an event, moreover. Some people think that in October and

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[12]R. C. Webb, "Implications of Low-Yield High Altitude Nuclear Detonation," Defense Special Weapons Agency (DSWA) presentation to an OSD/Net Assessment workshop on nuclear weapons and the revolution in military affairs, September 16–17, 1997, cited in Watts, p. 19.

[13]John Donnelly, "Laser of 30 Watts Blinded Satellite 300 Miles High," *Defense Week*, December 8, 1997, p. 1. MSTI stands for Miniature Sensor Technology Integration.

November 1975 the Soviets intentionally used intense radiation beams to interfere with three American satellites, although the U.S. government later publicly explained away the resultant degradation of those satellites as having been caused by natural phenomena.[14]

A particularly glaring U.S. space vulnerability is the constellation of Global Positioning System (GPS) satellites, thanks to our extraordinary dependence on that system. Although there is no public evidence that hostile jamming or other interference attempts have yet been made against GPS, it nonetheless presents a uniquely attractive target not only because of the extent of our reliance on it, but also because the GPS signal is faint and highly susceptible to jamming. Almost every high-end weapon in the U.S. military inventory relies on it for navigation and near-precision targeting, including the GBU-31 Joint Direct Attack Munition (JDAM), the powered GBU-15 electro-optically guided munition, unmanned aerial vehicles (UAVs), and certain Army ballistic missiles, among numerous others.[15] As strategist Colin Gray has cautioned, "people today who are easily impressed with the apparent difficulty a U.S. adversary would face in seeking to take down [GPS] should be exposed to the history of air power. . . . The technical-tactical challenges . . . eventually are overcome."[16]

Perhaps the most probable initial attempts against U.S. space-based assets will be made at the margins and incrementally, starting with a determined electronic "hacking" of those assets. At present, the United States is poorly equipped to deal even with the problem of accurately characterizing an attack in the event of such an attempt. There are proposals on the books for installing threat-warning sensors on future U.S. satellites to detect, identify, and classify attacks of various sorts. Most producers of commercial satellites, however, remain unconcerned about such potential threats to their products and are disinclined to spend the considerable sums that would be

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[14]Paul B. Stares, *The Militarization of Space: U.S. Policy, 1945–1984*, Ithaca, N.Y.: Cornell University Press, 1985, p. 146.

[15]See John A. Hancock and Robin M. Pettit, "Global Positioning System—Our Achilles' Heel?" *Proceedings*, U.S. Naval Institute, January 2002, pp. 85–87.

[16]Colin S. Gray and John B. Sheldon, "Spacepower and the Revolution in Military Affairs: A Glass Half-Full," in Peter L. Hays et al., eds., *Spacepower for a New Millennium,* p. 244.

required to install threat-warning systems on their satellites.[17] As matters now stand, a satellite failure could be the result of natural radiation, a technical malfunction, a collision with space debris, or a deliberate attack, whether physical or electronic. To cite but one example, the U.S. Galaxy IV satellite in geostationary orbit above the United States began to roll aimlessly on May 19, 1998, leaving 35 million personal pagers in the United States dead and many self-service gasoline pumps unable to accept credit cards for nearly a day. It was the worst failure in space communications history up to that point. Fortunately, it proved to have been the result of a processor error and was eventually fixed. But it could just as easily have been the work of a mischievous hacker or a more malevolent agent.[18]

No military or commercial satellites are yet known to carry sensors to detect an attack by lasers, electromagnetic energy, or a kinetic-kill device. At present, the United States relies solely on passive measures for protecting its on-orbit assets against such threats. These measures include hardening and shielding against radiation, orbital maneuvering capabilities to evade attacks, and the use of such means as data encryption and antijamming provisions. Hardening of satellites and other onboard protection means offer an interim defense against potential threats. However, those measures are expensive and can be countered by a determined attacker. That is why CINCSPACE General Ralph E. Eberhart remarked that space control is "still at idle," referring to an aircraft's lowest throttle position, and that "it's time to move that up."[19] He also commented that even though the mere mention of "space control" leads many people's thoughts to turn instantly to "weapons in space," the pillars of space control "start with space surveillance." Beyond that, Eberhart added, with respect to the active denial of enemy space capabilities, there are multiple ways of doing the job without actually

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[17]During the Schriever 2000 wargames, a satellite company executive said to Major General Lance Smith: "Protection? That's what insurance is for." (Quoted in Major M. V. Smith, USAF, "Ten Propositions Regarding Spacepower," M.A. thesis, School of Advanced Airpower Studies, Maxwell AFB, Alabama, June 2001, p. 24.) In fairness to industry here, the U.S. government has shown equally little inclination to pay for even modest electronic hardening of commercial satellites.

[18]John T. Correll, "Destiny in Space," *Air Force Magazine*, August 1998, p. 2.

[19]"World News Roundup," *Aviation Week and Space Technology*, February 25, 2002, p. 24.

destroying equipment on orbit: "There are lots of things you can do. You can use nonkinetic means." Most important of all in his view, however, is getting beyond the time not so long ago when "we couldn't [even] talk about it," a self-imposed restriction which he saw as "terribly naïve."[20]

UNDERSTANDING THE SPACE CONTROL MISSION

There is nothing particularly exotic about space control as a mission area. Conceptually, it is analogous to the long-familiar notions of sea and air control, both of which likewise involve ensuring friendly access and denying enemy access to those mediums. Viewed purely from a technical perspective, there is no difference in principle between defensive and offensive space control operations and operations conducted in any other medium of warfare. It is simply a matter of technical feasibility, desirability in principle, and cost-effectiveness for the payoff being sought. Yet the idea of space control has been slow to take root in the United States ever since the earliest days of the space age. The reason has long been a pervasive lack of government and popular consensus as to whether actual combat, as opposed to passive surveillance and other terrestrial enabling functions, should be allowed to migrate to space and thus violate the status of space as a weapons-free sanctuary, quite apart from the more practical question of whether preparing for space combat is even needed yet at this still-embryonic stage of space weapons development.[21]

To be sure, high-level leadership declarations have repeatedly acknowledged that the nation's space capabilities will routinely support U.S. military operations as feasible and appropriate. That has been the case with each successive U.S. National Space Policy since

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[20]Quoted in Peter Grier, "The Combination That Worked," *Air Force Magazine*, April 2002, p. 32.

[21]The core issue here, it bears emphasizing, is not the "militarization" of space, even though this has long been a favorite whipping boy of critics. In fact, space has been "militarized" ever since the late 1950s by the constant presence of Soviet and American intelligence-gathering satellites on orbit. Rather, the sensitivity that attaches to the space control and, even more so, space force application missions has to do with their implied prospect of actually putting munitions in space and thereby migrating armed conflict itself into space.

1958, as well as with other national security documents that have periodically emanated from the White House and the Office of the Secretary of Defense and with the various service and joint vision statements of more recent years. All of these documents have repeatedly and consistently underscored the criticality of space for providing services geared to maintaining and exercising the nation's military core competencies to the fullest.

Yet these declarations have typically paid only lip service at best to the goal of ensuring U.S. freedom of operations in space. Not only that, they have been repeatedly belied by a sustained record of inaction on hard investments in space control mission development. Little has changed in this respect since the late 1950s. High-level military space guidance remains much the same today as it was when the Eisenhower administration endorsed the first national space policy in 1958. The principal unifying theme of that guidance has long been promoting the use of space for "peaceful purposes," while granting in principle that such use also includes defense and intelligence-related R&D and operations. Yet in practice, service programs proposed for actually developing and testing systems for possible space control applications have typically been resisted both within and outside the government.

By the same token, efforts to address space control needs programmatically have typically been either delayed or canceled outright as a result of a widespread determination to treat space as inviolate, irrespective of the nation's verbal commitment to space control. Most recently in this regard, then–Secretary of Defense William S. Cohen noted in a memorandum to U.S. military leaders accompanying the new Department of Defense Space Policy in July 1999 that "purposeful interference with U.S. space systems will be viewed as an infringement on our sovereign rights."[22] That document, in effect, declared that space control was an essential precondition for the United States to maintain information dominance. Yet the same Clinton administration of which Cohen was a key member two years earlier used the line-item veto to kill the Air Force's spaceplane proposal, as well as a kinetic-energy Army ASAT program, both of which

[22]John Donnelly, "Cohen: Attack on U.S. Satellite Is Attack on United States," *Defense Week*, July 26, 1999, p. 2.

were expressly geared to offering first-generation approaches toward enforcing space control.[23]

Accordingly, the space control mission area remains almost completely undeveloped in any operationally meaningful way. True enough, the coalition's air attacks against Iraqi satellite ground stations during the 1991 Gulf War could be rightly construed in hindsight as having entailed a successful first-generation attempt at conducting offensive space control because their intent was to deny Iraq access to the product of commercial satellite systems. Apart from that, however, no true space control systems have yet been deployed by the United States. About all we can do today to deny an enemy access to the data stream flowing from space is to jam or physically destroy satellite ground-control stations with aircraft or special operations forces or to use ground-based lasers in a crude effort to disrupt satellites that might be used against us. To all intents and purposes, as space-power advocate Steven Lambakis has pointed out, any security the United States may enjoy in space today—apart from that incurred as a happenstance by-product of deterrence—has been "by default, not because there is a deliberate policy framework and well-resourced, organized, and strategically guided military force to guard national space interests."[24]

In large part out of its growing appreciation of that fact, the Air Force leadership in recent years has been at the forefront of measured advocacy of more determined investment in space control. During his incumbency as CINCSPACE, General Estes pressed especially hard for aggressively pursuing concrete space control measures, declaring that "the writing is on the wall. If we don't [devote] some attention to

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[23]That use of the line-item veto was interpreted by then-CINCSPACE General Howell M. Estes III as an effort by President Clinton to send a message to Russia's President Boris Yeltsin that the United States was not interested in starting a new arms race in space. Estes added that in his personal opinion, the vetoes were meant "to try to send a signal back to Russia in a public way that we were not going to develop systems for space control in terms of not creating systems to put their sensors at risk." He further suggested that those vetoes were but "a little bump in the road" on the way to space control because, given the "importance of the space control mission to this country's national security, we will continue to move down this road." See "Estes Sees Need for Continued ASAT Planning," *Aerospace Daily*, December 4, 1997, p. 1.

[24]Steven Lambakis, *On the Edge of Earth: The Future of American Space Power*, Lexington, Ky.: University of Kentucky Press, 2001, p. 1.

[space control] now, when the time comes, we'll wish we had—because it'll be a crisis that causes a huge government reaction. I want [us] to start working on it now, in a measured way, so we don't find ourselves in a crisis [where] chances are greater that we'll make the wrong decision."[25] More recently, General Eberhart similarly insisted that the Air Force and the nation need to embrace the space control mission more seriously: "I don't think we would be good stewards of space capabilities if we only thought about 'integration.' We should also be spending resources and intellectual capital on space control and space superiority." Eberhart repeated the increasingly heard refrain that space control will become ever more important "as our economy becomes more reliant on space." He further declared: "If we only look at space in terms of 'integration,' in my view, we'll fall into the same trap we fell into with the airplane. We [initially] thought of it in terms of intelligence, surveillance, reconnaissance, communication, and weather [support]. If we only think of space in these ways, [it's just] a 'higher hill' as opposed to a center of gravity."[26]

This insistence by the Air Force leadership, aided in considerable part by a worsening security situation in recent years, has been accompanied by encouraging signs that further progress toward serious space control mission development may finally be at hand. The Space Commission clearly backed the space control mission in its January 2001 report by noting that "the loss of space systems that support military operations or collect intelligence would dramatically affect the way U.S. forces would fight," indicating a "need [for them] to be defended to ensure their survivability."[27] The commissioners further noted that the threat to U.S. freedom of operation in space "does not command the attention it merits from the departments and agencies of the U.S. government." They went on to warn that a continued "failure to develop credible threat analyses could have serious consequences for the United States." They flatly con-

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[25]William B. Scott, "CINCSPACE Wants Attack Detectors on Satellites," *Aviation Week and Space Technology*, August 10, 1998, p. 22.

[26]Ibid.

[27]*Space Commission Report,* p. 32.

cluded that because "we know from history that every medium . . . has seen conflict, reality indicates that space will be no different."[28]

Seemingly accepting this counsel, the George W. Bush administration's Quadrennial Defense Review (QDR) for 2001 noted not long afterward that the emergence of space and information operations as the predominant aspect of the nation's commercial and military space involvement had raised "the possibility that space control—the exploitation of space and the denial of the use of space to adversaries—will become a key objective in future military operations."[29] The QDR added that "future adversaries will . . . likely seek to deny U.S. forces unimpeded access to space." It further noted that such counterspace alternatives as space surveillance, ground-based lasers, space jamming capabilities, and proximity microsatellites are becoming increasingly available to potential U.S. opponents, making it an "essential objective" of U.S. defense transformation "not only to ensure the U.S. ability to exploit space for military purposes, but also, as required, to deny an adversary's ability to do so."[30] Consequently, the QDR declared, the Department of Defense "will pursue modernization of the aging space surveillance infrastructure, enhance the command and control structure, and evolve the system from a cataloguing and tracking capability to a system of providing space situational awareness."[31] Although these expressions fell short of promising hard funding for such mission needs, they nevertheless were important bellwethers of administration concern and intent.

SOME INITIAL SPACE CONTROL ALTERNATIVES

The first point that bears emphasizing in any consideration of next steps toward space control is that the initial requirement for developing such a capability is simply better space surveillance, the sine qua non of any would-be space control regime. A ready availability of functioning ground- and space-based systems to

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[28]Ibid., pp. 18, 22.

[29]The Honorable Donald H. Rumsfeld, *Quadrennial Defense Review Report*, Washington, D.C., Office of the Secretary of Defense, 2001, p. 7.

[30]Ibid., p. 31.

[31]Ibid., p. 45.

monitor what is on orbit, where those items are at any given moment, and what they are capable of doing is a precondition for *any* significant space control capability. The Space Commission did the cause of space control a favor by reminding readers of its report that the need to come to better grips with the space surveillance challenge does not contravene the argument of successive administrations that the United States should endeavor to preserve the space weapons regime established by the Outer Space Treaty concerning the "traditional interpretation of the Treaty's 'peaceful purposes' language to mean that both self-defense and non-aggressive military use of space are allowed."[32]

At present, the United States enjoys only a modicum of real-time space situation awareness, since it only tracks objects that are already known to be on orbit. The next step toward acquiring the essential elements of a space control capability will be securing the ability to search space in short order so that U.S. space monitors can better know what is being put into orbit and by whom. Such a capability will probably be based initially on improved ground- and space-based optics, supplemented by better and more proliferated ground-based radar "fences" which will detect anything that transits their field of regard.[33]

Beyond improved surveillance and situation awareness, much more can be done to develop an operational space-control repertoire merely by using existing ISR and strike assets to engage a potential enemy's most immediately accessible and exposed space system nodes, such as ground-based satellite uplinks and downlinks. As for follow-on measures toward acquiring a more active space control capability, those who would seek the benefits of such a capability without transgressing the taboo against migrating armed combat into space have proposed a mode of operations called "flexible negation" in lieu of direct attack. Flexible negation involves such measures as jamming, spoofing, and blinding enemy satellites and disabling enemy ground support stations. The underlying idea is to temporarily disable a satellite rather than to damage or destroy it,

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[32]*Space Commission Report*, p. 37.

[33]William B. Scott, "CINCSPACE: Focus More on Space Control," *Aviation Week and Space Technology*, November 13, 2001, p. 80.

and to do so in a manner that might provide the attacker a fair amount of deniability. It is an inescapable fact that any use of kinetic-kill alternatives would create a host of associated problems, not only because a direct attack on a satellite could be construed as an act of war but also because any physical destruction of a hostile satellite would create a severe on-orbit debris problem that could badly backfire on the United States and its allies by strewing low orbital space with potentially lethal shrapnel. As two Air Force space professionals soberly observed, "satellites that die an explosive death become a lot of space debris. Space debris is fundamentally an unguided, hypervelocity kinetic-energy weapon" and, at a minimum, a hazard to space navigation.[34]

Primarily for that reason, "flexible negation" was the preferred approach of the Clinton administration to space control, emphasizing relatively benign, nonlethal, and reversible imposition options. As then–Deputy Secretary of Defense John Hamre explained the concept: "We fully believe that 'negation' in space—preventing the bad guys from using space against us—is fully authorized under international law. But we do want to take steps and actions that don't create instability in the world. This [space control] area is, frankly, on the edge, and we do not want to take steps that are precipitous and that could create greater problems for the U.S." Hamre added: "There is a range of things we can do. It isn't simply blowing up satellites in space." The latter, he said, would make it "much, much harder for us to get international cooperation" on such important matters as frequency and orbital slot allocation. "We could spend an enormous amount of money on space destruction capabilities that our leaders would never authorize us to use, for fear of international [backlash] and the problems it might create. So our preference is that we design a negation program around tactical denial of capability, not permanent destruction."[35] Representative examples of such a tactic might

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[34]Lieutenant General Roger G. DeKok and Bob Preston, "Acquisition of Space Power for a New Millennium," in Peter L. Hays et al., eds., *Spacepower for a New Millennium*, p. 85.

[35]William B. Scott, "U.S. Adopts 'Tactical' Space Control Policy," *Aviation Week and Space Technology*, March 29, 1999, p. 35. It should be noted here that the United States is hardly a newcomer to the space situation awareness business. As far back as the early 1960s, the Ballistic Missile Early Warning System (BMEWS) fenced the Arctic, the

include the selective jamming of an enemy's satellite data stream and denying an enemy the use of GPS signals in a localized zone.

Beyond these nonintrusive flexible negation alternatives, a more direct and aggressive approach being explored for disrupting enemy on-orbit assets might feature the use of "micropaint" satellites, which could rendezvous with those assets and fire paintball-like material at them to blind them. Yet another option might entail small, highly maneuverable microsatellites that could rendezvous with enemy satellites and negate them by blocking their field of view, spot-jamming their transmissions, or burning out their wiring with lasers. Once developed, such space control activities will be dominated by both passive and active space defense capabilities, which will be natural extensions of today's multisensory tracking systems, antisatellite weapons, and embryonic decoy and deception technologies and concepts.

FORCE APPLICATION AND THE ISSUE OF WEAPONIZATION

Space force application, an area of interest farther down the list of priorities than the more pressing matter of space control (leaving aside the related but separate case of ballistic missile defense), is rightly regarded as representing the ultimate use of space for military purposes. Among other things, it envisages the use of space-based directed-energy and kinetic-energy weapons against missile targets, kinetic-energy weapons against ground targets, and conventional weapons against ground targets. A recent RAND study defined space weapons as "things intended to cause harm that are based in space or that have an essential element based in space," with the degree of

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Navy Space Surveillance System (NAVSPASUR) fenced the continental United States, and Baker-Nunn cameras and imaging radar provided fairly prompt space object identification. All this was triggered by Defense Support Program (DSP) launch detections and was augmented by additional phased-array and mechanical tracking radars in the space surveillance network. Once this capability had matured, neither the Soviets nor the Chinese launched anything that U.S. sensors did not detect, track, identify, and catalog within about 20 minutes. The fact that the United States needs to get better and faster at the space situation awareness game should not be taken to suggest that it neglected that mission area during the first four decades of the space age. I am indebted to Lieutenant Colonel Forrest Morgan, USAF, for reminding me of this important piece of Air Force space history.

sought-after harm ranging from temporary disruption to permanent neutralization or disruption.[36]

U.S. space systems do not currently have any ability to employ direct force against an opponent. Once such an ability becomes economically, technically, and politically feasible, however, the development of the force application mission, often referred to more colloquially as the "weaponization of space," will complete the nation's transition to a true military space power.[37] It could ultimately lead to the use of such exotic technologies as space-based lasers to intercept ballistic missiles and destroy or neutralize other satellites. It may also involve the use of space-based nonnuclear hyperkinetic weapons against terrestrial targets, ranging from hardened bunkers, munitions storage depots, underground command posts, and other heavily defended objects to surface naval vessels and possibly even armored vehicles and other ground targets of interest.

Numerous force application concepts have been seriously proposed and considered. The first national-level war game dedicated primarily to military space operations—Schriever 2001, conducted by the Air Force Space Command's Space Warfare Center—sought to explore a range of operational requirements for space force application. One alternative considered was the use of so-called common aerospace vehicles against ground-based lasers situated deep within enemy territory, with the intent of engaging a class of targets that must be serviced very quickly, something the United States currently lacks an ability to do with its existing nonnuclear projection forces.[38] (The extended distances involved would preclude the effective use of

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[36]Bob Preston, Dana J. Johnson, Sean J. A. Edwards, Michael Miller, and Calvin Shipbaugh, *Space Weapons, Earth Wars*, Santa Monica, Calif.: RAND, MR-1209-AF, 2002, p. 23. This well-informed primer on space weapon concepts currently being considered describes their attributes, categorizes and compares them, and explores the political implications of their possible acquisition and deployment—all at an unclassified level.

[37]Lest there be unintended confusion here, it bears stressing that many defensive and offensive space control functions could also involve "weaponization" of various sorts. The difference at issue is between weaponization against enemy space systems and weaponization against more classic terrestrial targets of independent strategic, operational, or tactical interest.

[38]William B. Scott, "Wargames Zero In on Knotty Milspace Issues," *Aviation Week and Space Technology*, January 21, 2001, pp. 53–54.

bombers and cruise missiles to prevent enemy lasers from negating U.S. satellites.)

In a similar spirit, Air Force officials have reported that they could launch a demonstration space-based laser by 2010. It would permit the downing of an in-flight ballistic missile within about 18 months, at a projected cost of around $4 billion. A constellation of six such satellites, using technology similar to that on the Air Force's airborne laser currently in advanced development, would be needed to make the system operationally effective. The projected cost would be $70 billion to $80 billion.[39] To cite but one more of the numerous weapons concepts that have been considered, the Defense Science Board has urged the initiation of a demonstration project to validate the feasibility of deploying highly accurate hypervelocity rods made of heavy material to engage ground targets through the atmosphere from space.[40]

As in the case of space control, the issues associated with space force application are fairly simple and straightforward from a narrow military viewpoint and largely entail matters of technical feasibility, strategic desirability, and cost. Apart from their political dimensions, the importance of which cannot be overstated, decisions about the merits of developing and deploying space-to-earth weapons could be based simply on a trade-off assessment of the operational efficiencies of space-based weapons and their terrestrial counterparts. The advantages and disadvantages of space-to-earth weapons will, of course, depend on the specific characteristics of the systems in question. In most cases, however, the comparisons will turn on a weighing of differences in such familiar variables as speed, range, lethality, flexibility, vulnerability, and acquisition and sustainment costs.

The overarching problem connected with this mission area, however, is that—at least today—far greater political sensitivities attach to it than those associated with the less provocative notion of space con-

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[39]Peter Pae, "Doubts Trail 'Son of Star Wars' Proposal," *Los Angeles Times*, May 23, 2001.

[40]Defense Science Board, *Joint Operations Superiority in the 21st Century: Integrating Capabilities Underwriting Joint Vision 2010 and Beyond*, Washington, D.C., Office of the Under Secretary of Defense for Acquisition and Technology, October 1998.

trol. It is revealing that media representatives in attendance at Secretary of Defense Rumsfeld's May 2001 press conference (called to discuss the bureaucratics of military space reorganization in response to the Space Commission's recommendations) seemed to want to discuss only the hot-button issue of space "weaponization." To preempt any possible media charges of hidden administration weaponization intent, Rumsfeld came forearmed with the space policy statement issued in 1996 by the Clinton administration, which declared that the Department of Defense would "maintain space control capabilities to ensure freedom of action in space and, if directed, deny such freedom to adversaries."[41] Rumsfeld further emphasized that his proposals had "nothing to do" with weaponization, but rather concerned organizational arrangements within the Department of Defense "that put a focus on the important issues relating to space, which [hitherto] have been spread throughout the department in a way that has made it difficult to get the right kind of focus and the right kind of emphasis."[42] Yet many simply refused to accept that message. Opined one critic with a predisposition to presume the worst, even though Rumsfeld admittedly claimed that his proposed reforms "had nothing to do with any intention to deploy antisatellite systems or weapons, such protestations were cold comfort to the very countries that the United States seeks to assuage about its missile defense program."[43]

As baseless and unfair as that particular charge and others like it may have been, the fact remains that there is no more fundamental or more unresolved a military space issue in the United States today than the long-festering question of whether space should be kept free of weapons at every reasonable cost or actively exploited to the fullest extent of its ability to underwrite the nation's security. From a purely operational viewpoint, there is no difference between combat functions that would be carried out from space and those that al-

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[41]John Diamond, "Rumsfeld Hedges on Space Arms," *Chicago Tribune*, May 9, 2001.

[42]Quoted in Amy Butler, "Air and Space Ops Chief Refutes Accusations of Political Subversion," *Inside the Air Force*, May 18, 2001, p. 1. Later, in a press interview, Rumsfeld bridled at the media's effort to portray his reorganization briefing as a weapons-in-space briefing: "I couldn't believe it. I had to spend the whole dadburn press conference trying to dig out from that." (Thomas E. Ricks, "Post Interview with Defense Secretary Donald H. Rumsfeld," *Washington Post*, May 20, 2001.)

[43]Paul B. Stares, "Making Enemies in Space," *New York Times*, May 15, 2001.

ready occur routinely in the land, naval, and air environments. The *technical* differences between attacking land, naval, or aerial targets with terrestrially based weapons and doing the same with weapons delivered from space are, by and large, distinctions solely involving tactics, techniques, and procedures.[44] Yet the American political establishment and its elected leaders have not yet made up their collective minds as to whether space should be deemed just another operating domain like the more familiar, air, land, and maritime environments or instead should somehow be treated as "different" and protected from conversion into yet another potential battle arena.

To summarize the arguments regarding space weaponization briefly: What might be called the "sanctuary school" continues to insist that because the United States is the country most dependent on space both militarily and commercially, it has the most to lose by rushing to weaponize before a clear need for doing so has been established. Among other things, this school bases its case on an asserted absence of imminent threats to U.S. freedom of space operations and a belief that weaponization could appear aggressive to others and accordingly could trigger a space arms race and other destabilizing consequences—such as inducing others to take asymmetric responses like acquiring nuclear weapons. At bottom, it holds that a premature deployment of space force application systems not only would provide the United States with few security gains to offset these penalties but might have implications that could be highly unwelcome, especially should the United States seek a truly hegemonic space-based force application capability.[45]

Opposed to this argument is the school of thought whose proponents actively seek the weaponization of space at the earliest opportunity, with more than a few already busy at work laying the doctrinal and

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[44]This is not meant by any means to trivialize the *political* salience of putting offensive space-to-ground weapons on continuous station in earth orbit. As noted in Chapter Three, enemies and allies alike would understandably have every reason to perceive American space-based offensive weapons orbiting constantly overhead as no different in principle than armed American bombers routinely transiting their airspace. There is no prima facie reason to believe that most countries would readily countenance our doing with space-based weapons in normal peacetime conditions something we would never presume to do with air-delivered weapons.

[45]I am indebted to my colleague Karl Mueller for the framing of this characterization of sanctuary thinking.

technology foundations for such a development. At the root of this thinking is an implicit belief that timely and effective space weaponization would naturally be a good thing for the Air Force and for the larger interests of U.S. security. Among those of this persuasion both in and out of uniform, some would undoubtedly concede that although space weaponization is probably undesirable in principle, it also is ultimately bound to happen, since those who are inimical to the United States will sooner or later come to view space weapons as offering an attractive and lucrative means for threatening U.S. interests.

Others would argue more matter-of-factly that the United States should prepare *now* not only to deny the use of space to potential enemies for military purposes, but also to make whatever offensive use of space as may be advantageous, on the premise that continued U.S. unilateral restraint would do little to dissuade present and potential rivals from pursuing weaponization options of their own whenever it seemed feasible and suited their purposes. At bottom, the most extreme of the would-be space weaponizers argue that the United States should press ahead with acquiring space force application capabilities as soon and as extensively as practicable while time remains. Their reasoning is that if we prepare in a timely and effective way not only to control who uses space and how, but also to exploit it offensively in support of U.S. strategy, no potential challenger will ever be able to catch up with us.

IS SPACE WEAPONIZATION INEVITABLE?

The foregoing discussion raises the important yet ultimately intractable question of whether the migration of combat operations to orbital space is bound to take place sooner or later out of sheer inexorability. Many regard such an eventual development simply as a given. As former Air Force General Joseph Ashy declared during his incumbency as CINCSPACE, "it's politically sensitive, but it's going to happen. Some people don't want to hear this, and it sure isn't in vogue . . . but—absolutely—we're going to fight *in* space. We're going to fight *from* space, and we're going to fight *into* space when [U.S.

and allied assets on orbit] become so precious that it's in our national interest."[46]

This widespread belief in the eventual inevitability of space weaponization stems in part from air analogies and, in particular, from a conviction that the space experience will naturally repeat the air experience. As General Estes, for example, argued while serving as CINCSPACE, "the potential of aircraft was not recognized immediately. Their initial use was confined to observation . . . until one day the full advantage of applying force from the air was realized, and the rest is history. So too [will it be] with the business of space."[47]

In fact, the United States possesses the essential wherewithal in principle to begin weaponizing space today. Reduced to basics, it is only a question of leadership choice, societal acceptance, and which particular force-employment alternatives to pursue first. Yet it also is true that the United States retains the power of the initiative in this respect and has at least some basis for guardedly hoping that if it continues to show restraint, others may also. The unanswerable question concerns when—not whether—our opponents will decide to become militarily proactive in space to counter U.S. dominance.

Regarding this issue, the United States faces a difficult policy conundrum. As the world's leading democratic country, its leadership is bound by an understandable obligation to do everything reasonable to maintain the moral high ground. Yet that leadership cannot afford to remain so passive as to allow itself to be caught by a "space Pearl Harbor" surprise. An important question thus entails whether proceeding to lay down at least the essential wherewithal for moving, as need be, to weaponize space sooner would risk incurring fewer downside consequences than waiting until later. The deputy commander-in-chief of U.S. Space Command, General Anderson, recently put the dilemma this way: "Right now there is no need to deploy weapons in space, but . . . we are tasked with the responsibility for examining force application. It is reasonable that we should do that. . . . This is not easy technology. It is something that does take

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[46]William B. Scott, "USSC Prepares for Future Combat Missions in Space," *Aviation Week and Space Technology,* August 5, 1996, p. 51.

[47]General Howell M. Estes III, USAF, address to the Air Force Association annual symposium, Los Angeles, October 18, 1996.

time. You can't wait until you decide you need it and then not have it. It seems to me we would be failing our obligations to the nation."[48]

Most would agree that space weaponization is not inevitable in the *near term*. Indeed, there is scant observable evidence to suggest that the military use of near-earth space will be substantially different in 2020–2025 than it is today, at least regarding the development and fielding of new technologies and systems that would broaden the use of our on-orbit assets from force enhancement to force application—unless, of course, some unforeseen trigger event occurred to provoke it. It naturally follows that any U.S. space weaponization that eventually occurs, whether preemptive or reactive, will most likely be threat-driven rather than as a result of prior unprovoked choice. Former Air Force chief of staff General Michael Ryan suggested as much when he stated: "I don't think you'll see us moving real fast until some threat occurs—a huge threat, a threat that makes a big dollar difference. Then you'll see a shift in policy."[49]

For the time being, the idea of placing offensive weapons in space for use against terrestrial targets remains contrary to declared national policy, and there is no indication that the nation is anywhere near the threshold of deciding to weaponize space. Any truly serious steps toward acquiring a space force application capability will involve a momentous political decision that the nation's leadership has not yet shown itself ready to make. As the Air Force's former deputy chief of staff for air and space operations, then–Lieutenant General Robert Foglesong, noted, "if the policy decision is made to take our guns into space, that will be decided by our civilian leadership."[50] Until that threshold is reached, any talk of space weaponization will remain not only politically moot but needlessly provocative, and military space activity will remain limited to enhancing terrestrial operations and controlling the ultimate high ground.

Yet to say that space weaponization is not around the corner is scarcely to say that it is out of the question altogether. As Colin Gray

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[48]"Interview with U.S. Army Lieutenant General Edward Anderson," *Jane's Defence Weekly*, July 11, 2001, p. 32.

[49]William Matthews, "To Military Planners, Space Is 'The Ultimate High Ground,'" *Air Force Times,* May 18, 1998, p. 12.

[50]"If Ordered, AF Ready to Arm Space," *San Antonio Express-News*, May 11, 2001.

has pointed out, such a development "may be slow to arrive, but slow to arrive is a light year removed from impracticable. . . . Speculation about the efficacy of seapower in the 17th or early 18th century could have pointed to problems entirely comparable to those which [skeptics of weaponization cite] to suggest that spacecraft will enjoy a continuing sanctuary status in orbit."[51] In a similar reflection of what might be called space weaponization fatalism, General Estes likewise observed that "some day in the not so distant future, space will have evolved to the point where the movement of terrestrial forces will be accomplished only at the pleasure of space forces, much in the same way that the movement of land and sea forces today can only be accomplished at the pleasure of air forces."[52] By this logic, the eventual weaponization of space is only a matter of time—albeit a span of time that is, at least to a degree, within the power of the United States to control by its near-term conduct and by the character and pacing of its eventual actions.[53]

NEAR-TERM IMPLICATIONS FOR THE AIR FORCE

It is now widely accepted within the Air Force and among other observers of the space scene that if the Air Force intends to evolve into an "air and space force" worthy of the name, it will soon need to start acquiring at least the beginnings of a serious space control capability, just as it did in the realm of counterair operations during the formative years of air power's development. Fortunately, the climate for taking the next steps toward space control has become increasingly favorable. The nation's leadership, by numerous indications (including the Space Commission's recommendations and the most recent QDR), finally seems disposed to lend a receptive ear toward that end. Moreover, the terrorist attacks against the United States on

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[51]Gray and Sheldon, in Hays et al., eds., *Spacepower for a New Millennium*, p. 243.

[52]Quoted in Correll, "Destiny in Space," p. 2.

[53]To note one conceivable possibility in this respect, the distinction between space force enhancement and space force application could become increasingly blurred over time when one considers that the GPS satellites, for example, which already guide a JDAM to its target, are, in fact, participating very directly in the application of force, much like a strike aircraft's laser designating a target upon which it is dropping a laser-guided bomb. Whether a system like GPS is considered part of a weapon or a mere force enhancer is partly a matter of perception, which will be greatly affected by how the United States elects to characterize it. I am grateful to Karl Mueller for this insight.

September 11, 2001 irreversibly altered the conventional wisdom about the character of the external threats the nation faces. Those attacks confirmed beyond doubt that America's enemies, especially fanatically hostile nonstate enemies, possess the will, if not yet the means, to go to any achievable lengths to harm the most vital U.S. interests. As a result, the long-standing popular reluctance to migrate even defensive force-employment functions to space under any conditions may be gradually losing its former tenacity.

True enough, with the end of the cold war now more than a decade behind us, the United States still lacks a peer opponent of sufficient technological virtuosity to warrant our proceeding aggressively toward offensive space weaponization today. That said, several state actors in President George W. Bush's declared "axis of evil" are working diligently toward acquiring the means for accessing space in a spoiler role. While deterrable to a point, they also possess both the motive and the determination to exploit any such means to the hilt at the earliest opportunity. It follows that the Air Force, now more than ever, needs a measured approach toward moving systematically beyond space support and space force enhancement to further developing and ultimately mastering the space control mission. To do this successfully will require being more careful than ever to avoid projecting any appearance of prematurely overreaching with respect to space "weaponization" and instead concentrating unswervingly on laying down the essential building blocks for realistically enforceable and credible space control, while deferring any active involvement in force application initiatives until a clear justification for them has arisen and the associated enabling technology and political will have matured to a point where their time has arguably come.

Some Air Force commentary in recent years on the would-be virtues of space weaponization has seemed surprisingly oblivious of the real sensitivities that still attach to the idea of combat operations from space in many quarters, as well as of the no-less-real political costs and potential consequences for our national interests that could accrue from making space force application a premature goal of U.S. strategy.[54] One such example was the space applications volume of

[54]See Karl Mueller, "Space Weapons and U.S. Security: Why and How to Avert a Dangerous Potential Revolution," unpublished paper, School of Advanced Airpower Studies, Maxwell AFB, Alabama, September 28, 1997.

the Air Force Scientific Advisory Board's widely publicized *New World Vistas* study of 1995. This study categorically stated that the Air Force should "broaden the use of space to include direct force projection against surface, airborne, and space targets," without the least apparent consideration of possible political or strategic ramifications.[55] Fortunately, those in positions of higher Air Force leadership have been more measured and discreet when it comes to this most touchy of space issues. General Estes, for example, in stressing the need for moving ahead smartly in the space control arena, was keenly mindful of the issue's political delicacy when he candidly admitted: "We've got to be real careful how we do this. It's a sensitive issue. . . . I don't know how else to tell you . . . because we're talking about doing things in space that upset people."[56] He also took studious care to decouple space control from space force application, to emphasize that the first does *not* automatically imply the second, and to highlight the importance of attending to first things first: "We [also] have to be able to surveil, protect, and negate under this space control mission. . . . I believe it's obvious to all—*short of deciding we're going to weaponize space*—that we understand we must be committed to space control, that we must be able to prevent [adversaries'] use of space and protect our use of space. And if protection goes to negation, then we need to be prepared to do that."[57]

Most of all, the Air Force should recognize that although the nation may indeed be nearing a tectonic shift in public attitudes with respect to migrating combat functions into space, it will take astute leadership, both civilian and military, to ensure the necessary transition toward a robust American space control capability in a seemly way. That will not occur until that leadership first forges a new national consensus on the still-sensitive issue. As John Logsdon, a re-

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[55]*New World Vistas: Air and Space Power for the 21st Century,* Space Applications Volume, Washington, D.C., USAF Scientific Advisory Board, 1995, p. 164.

[56]John Donnelly, "Commander: Clinton's Vetoes Won't Halt Space Weapons," *Defense Week,* December 15, 1997, p. 3.

[57]Ibid., emphasis added. A spokesman for AFSPC's directorate of plans and programs conceded candidly, however, that in order to pursue space control seriously, "seventeen consecutive miracles are going to have to happen to get us there," since Air Force space activity has to compete for funds not only with the other services but also within the Air Force. "Air Force Space Command Developing Strategies for Satellite Protection, Warfare Advances," *Florida Today*, June 22, 2001. AFSPC currently spends $12 to $15 million of its $8.8 billion annual budget researching space control concepts.

spected space scholar at George Washington University, aptly observed in this respect, "it may well be that the time has come to accept the reality that the situation of the past half-century, during which outer space has been seen not only as a global commons but also a sanctuary free from armed conflict, is coming to an end. But decisions about how the United States should proceed to develop its space power capabilities and under what political and legal conditions are of such importance that they should be made only after the full range of concerned interests have engaged in thoughtful analysis and discussion."[58]

In light of that, an important challenge facing the Air Force entails helping to inform such analysis and discussion by taking the lead in articulating the issues authoritatively, while disavowing any immediate programmatic commitment to space force application and, at the same time, keeping the argument for space control unswervingly fixed in its public message as the nation's most pressing priority for expanded space mission development. The Air Force's executive agent for military space, the Honorable Peter Teets, set a helpful precedent in that respect when he suggested that the time may have arrived for the Department of Defense to consider developing space-based weapons, at least to protect its on-orbit equities. "Given the dependence of U.S. military forces on space-based assets, illustrated every day over Afghanistan," he said, "it is critical that the Pentagon find ways to protect those assets. I believe that weapons will go into space. It's a question of time. And we need to be at the forefront of that."[59]

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[58]Quoted in Butler, "Air and Space Ops Chief Refutes Accusations of Political Subversion," May 18, 2001, p. 1.

[59]"Defense Department Should Consider Developing Space-Based Weapons, Teets Says," *Aerospace Daily*, March 7, 2002.