CHAPTER ONE

INTRODUCTION

What future role will space play in warfare? And what should the United States do about it now? These questions have not been the focus of intensive and sustained political debate since the cold war days of the 1980s. In the meantime, technology has changed a great deal; geopolitics has changed even more. This book attempts to answer these broad questions for the context in which military space policy will be made in the early years of the twenty-first century.

Space is already militarized. Indeed, it has been militarized for more than four decades. But satellites played a rather benign role during much of the cold war, when they were most important for preserving strategic stability. Particularly since the cold war ended, however, space assets have been reestablished as competitive military instruments, especially by the United States. This trend has not extended to placing weapons in space or developing weapons for the purpose of threatening objects in space, but that clearly could change in the coming years. And weapons now being developed for other purposes, most notably missile defense, will make low-altitude satellites increasingly vulnerable even if no explicit steps are taken to achieve that end.

The Soviet Union and the United States employed satellites during most of the cold war. They did so largely for purposes of watching each other's nuclear tests, missile launches, and military force deployments. They also used space for communicating with their own global force deployments and operations, weather forecasting, mapping, measuring Earth's gravitational field (largely to improve the accuracy of ballistic missiles), and maintaining exact and uniform time standards for their deployed military forces. Many of these activities ultimately served the nonconfrontational and desirable purposes of maintaining strategic nuclear stability and promoting arms control. But their purposes were still basically quite military—contributing, for example, to the development of nuclear war plans—and hence were competitive as well. Indeed, from the launching of *Sputnik* in October 1957 until 1963, when a series of UN resolutions, implicitly at least, acknowledged and allowed the use of reconnaissance satellites, the Soviet Union struggled with the question of whether to tolerate U.S. satellites over its own territory. Both superpowers ultimately concluded that mutual toleration served their interests. The United States wanted means to tie together its global force deployments and to monitor capabilities in closed societies like the Soviet Union and the People's Republic of China (PRC). The Soviet Union saw its space program as a sign of national prestige and may have found reconnaissance satellites quite useful for watching events in places such as Cuba, China, and Europe.[1]

As time went on, both sides explicitly agreed not to interfere with the operations of each other's satellites in a number of arms control accords, including the 1972 ABM Treaty, the 1974 Threshold Test Ban Treaty, the 1976 Peaceful Nuclear Explosions Treaty, the 1979 SALT II Treaty, the 1990 multilateral CFE Treaty, and the 1991 START accords.[2] (They also signed the 1992 Open Skies Treaty, along with a couple dozen European countries, providing mechanisms for aerial monitoring under specific circumstances.)

Since the cold war, the United States has increasingly used satellite assets for tactical warfighting purposes in wars against Iraq, Serbia, and the Taliban in Afghanistan. Space systems, notably the global positioning system (GPS) satellite constellation, were used to help American soldiers navigate in the featureless desert starting most notably in the 1991 war against Iraq. GPS satellites are employed to synchronize operations in time as well, with remarkable accuracy. They are also increasingly used to pinpoint the locations of enemy targets and help guide precision-strike munitions, such as cruise missiles and the GPS-guided joint direct attack munition (JDAM), to those targets. Hundreds of JDAMs were used in the Kosovo war of 1999. More than 5,000 were employed in the Afghanistan war of 2001–02, striking as close as five meters from their aimpoints, and a comparable number were used in Operation Iraqi Freedom in 2003.[3] GPS devices are also integral to the "blue force" tracking systems that keep tabs on friendly units in a given region to reduce fratricide. Such systems still have only limited capabilities and use, and present challenges for filtering data so that users are not swamped by information they do not need, but they are quite useful nonetheless.[4]

Communications satellites are used for an increasing range of activities as well. While they still carry traditional voice messages, they also transmit real-time imagery taken by cameras and radar on platforms such as unmanned aerial vehicles

(UAVs) and reconnaissance aircraft to individuals far removed from the scene of battle, whether for purposes of data processing or for command and control.[5] They transmit detailed air war targeting plans to commanders and pilots.

As a result, the use of such satellites in war has skyrocketed. In Desert Storm, a total of sixteen military satellites and five commercial satellites provided coalition forces with a maximum possible transmission rate of 200 million bits per second (the equivalent of nearly 40,000 simultaneous telephone calls). Nearly twice as much capacity was available during the Kosovo war eight years later—much of it commercial, however, and hence unhardened against possible enemy action, such as electronic jamming, and unsecured. It was used for purposes that included teleconferencing among commanders.[6] Available capacity doubled again, to close to a billion bits per second, during the Afghan campaign of 2001–02. Again, much of the data flowed through commercial systems.[7] What that means is that, remarkably, a U.S. military operation of some 50,000 troops in 2001–02 used five times as much communications bandwidth as did a war with 500,000 troops a decade earlier—fifty times as much bandwidth per person, on average. In Operation Iraqi Freedom, the military used 2.4 gigabits per second.[8]

But the 2003 Iraq war was less notable for further increases in bandwidth, perhaps, than for several other aspects. More than fifty satellites were used in the war effort; commercial firms, including France's leading satellite services company, provided the majority of communications capacity and a fair amount of imagery as well. Satellite channels in the so-called EHF frequency band gave ships fifty times more bandwidth for secure data transmissions than in the past (128 kilobits per second). And the GPS permitted the United States to drop more than 6,000 satellite-guided JDAMs.[9]

Recognizing what satellites now offer the warfighter, the U.S. military is improving its means for utilizing their services. A space team was established and put on full-time duty in the Persian Gulf in late 2002 to plan operations against Iraq, for example. Among other things, its purpose was to help air planners understand when the greatest number of GPS satellites would be available to help guide bombs to target as accurately as possible.[10]

Space systems may soon be used to maintain a track on ballistic missiles, so that ground-based interceptors can be launched to shoot them down. Further in the future, space-based weapons may be used to destroy the ballistic missiles directly, though this is not necessarily a desirable goal for American policymakers anytime soon, as discussed below.

The increasing militarization of space is not exclusively a superpower story, however. The United States certainly dominates military space spending—accounting for more than 90 percent of the total, by some measures.[11] U.S. space funding over time is reported in table 1-1; the country's military space budget totals exceed $15 billion a year.[12] But other countries besides the United States and Russia have also increasingly sought military satellites, largely for reconnaissance and communications purposes so far, and will surely continue to pursue space capabilities of many types in the future. They may make use of civilian and commercial assets for military purposes as well. They are surely studying American capabilities to find, track, and quickly attack targets using space assets. Some are trying to emulate the United States; some are trying to find vulnerabilities in U.S. space systems so they can challenge them in any future wars. China may be the most notable example of a country that is doing both. Its progress to date is limited, as far as we can tell, and its progress in the coming years is likely to

Table 1-1. U.S. Government Space Funding

Billions of 2002 dollars

Fiscal Year	*NASA*	*Department of Defense*	*Other*	*Total*
1959	1.3	2.4	0.2	4.0
1960	2.3	2.8	0.2	5.3
1961	4.6	4.0	0.3	8.9
1962	8.8	6.3	1.0	16.1
1963	17.5	7.5	1.2	26.2
1964	23.9	7.6	1.0	32.5
1965	24.1	7.4	1.1	32.7
1966	23.4	7.8	1.0	32.2
1967	21.9	7.5	0.9	30.3
1968	19.4	8.4	0.7	28.6
1969	16.2	8.5	0.7	25.4
1970	14.3	6.8	0.6	21.7
1971	11.9	5.8	0.6	18.3
1972	11.2	5.1	0.5	16.9
1973	10.8	5.7	0.5	17.0
1974	9.2	5.9	0.5	15.7
1975	9.1	5.9	0.5	15.5
1976	11.5	6.9	0.6	19.0
1977	8.8	6.2	0.5	15.5
1978	8.9	6.7	0.6	16.2
1979	9.3	7.0	0.6	16.8
1980	10.0	8.2	0.5	18.6
1981	9.8	9.4	0.5	19.6

(continued)

Table 1-1. U.S. Government Space Funding (continued)

Billions of 2002 dollars

Fiscal Year	*NASA*	*Department of Defense*	*Other*	*Total*
1982	9.8	11.9	0.6	22.3
1983	10.5	15.0	0.5	26.1
1984	10.9	16.3	0.6	27.8
1985	10.6	19.6	0.9	31.2
1986	10.7	21.0	0.7	32.4
1987	14.3	23.7	0.7	38.6
1988	11.8	25.0	1.0	37.8
1989	13.8	24.5	0.8	39.1
1990	15.11	20.6	0.7	36.4
1991	16.6	18.0	1.0	35.6
1992	16.1	18.4	1.0	35.5
1993	15.6	16.8	0.9	33.2
1994	15.1	15.3	0.7	31.2
1995	14.3	12.1	0.9	27.3
1996	14.0	12.8	0.9	27.8
1997	13.6	12.8	0.9	27.3
1998	13.2	13.3	0.9	27.4
1999	13.2	14.0	1.0	28.2
2000	13.1	13.5	1.1	27.7
2001	13.6	14.7	1.1	29.4
2002	13.9	15.7	1.2	30.8
Total	568.1	505.1	32.9	1,106.2

Source: Tamar A. Mehuron, "2003 Space Almanac," *Air Force Magazine* (August 2003), p. 28.

be modest as well—but these prognostications may prove wrong, and in any case will not be applicable forever.

Although space is becoming increasingly militarized, it is not yet weaponized—at least as far as we know. That is, no country deploys destructive weapons in space, for use against space or Earth targets, and no country possesses ground-based weapons designed explicitly to damage objects in space. The challenges of weaponizing space should not be overlooked; in the words of one top Air Force specialist, space is a very challenging environment in which to work.[13] It is also a very different medium than the air, as Air Force Chief of Staff General John Jumper emphasized when he discarded the popular term "aerospace" and instead insisted that the Air Force must specialize in both air *and* space operations.[14] On the other hand, trends in technology and the gradual spread of space capabilities to many countries will surely threaten the status quo. Not only the United States but other major western powers, China, and smaller states as well, will have weaponization opportunities within reach.

But space is not a true sanctuary from weapons today. Virtually any country capable of putting a nuclear weapon into low-Earth orbit (LEO) already has a latent, if crude, antisatellite (ASAT) capability (though in many cases such weapons would have to be modified so that the warheads could be detonated by a timer or by remote control). Not only would such a weapon be likely to physically destroy any satellite within tens of kilometers of the point of detonation and to damage or destroy unhardened satellites within line of sight many hundreds of kilometers away (if not even further); it would also populate the Van Allen radiation belts with many more charged particles, which would destroy most low-Earth orbit satellites within about a month.[15]

Nor has space been treated as an inviolable sanctuary in the past. The nuclear superpowers made some progress toward developing antisatellite weapons in fits and starts from the 1950s through the 1980s. For example, the United States had something of an ASAT capability with its Nike Zeus and Thor nuclear-armed interceptor missiles in the 1960s and early 1970s, and with the Spartan program of the 1970s. The Soviets later developed and tested a nonnuclear "co-orbital" ASAT that needed to conduct a couple orbits to gradually approach its target (see table 1-2). Into the 1980s, the United States developed a nonnuclear "direct ascent" ASAT, launched by an F-15, that would reach its target much more promptly and then collide with it.[16] Soviet antiballistic missile (ABM) systems deployed around Moscow probably had ASAT capability as well; given the size of their warheads, they may have been able to damage satellites as distant as hundreds of kilometers from their detonation points.[17] Some of these capabilities may remain warehoused in some form. Still, the ASAT competition was held in check. Likewise, technological constraints made any deployment of space-based ballistic missile defenses impractical, even though the idea of such missile defenses was hotly debated.[18]

Decisions not to deploy ASATs or space-based missile defenses during the cold war did not, however, reflect any permanent commitment to keep space forever free from weaponry. Nor do existing arms control treaties ban such activities. Instead, they ban the deployment or use of nuclear weapons in outer space, prevent colonization of heavenly bodies for military purposes, and protect the rights of countries to use space to verify arms control accords and conduct peaceful activities.[19] In addition, in 2000 the United States and Russia agreed to notify

Table 1-2. Soviet Antisatellite Tests, 1968–82[a]

		Target orbit			Intercept orbit			
Test number and date	*Target*	*Inclination (degrees)*	*Perigee; apogee (km)*	*Inter-ceptor*	*Inclination (degrees)*	*Perigee; apogee (km)*	*Attempted intercept altitude (km)*	*Probable outcome*
Phase I								
1. Oct. 20, 1968	K248	62.25	475; 542	K249	62.23	502; 1,639	525	Failure
2. Nov. 1, 1968	K248	62.25	473; 543	K252	62.34	535?; 1,640?	535	Success
3. Oct. 23, 1970	K373	62.93	473; 543	K374	32.96	530; 1,053	530	Failure
4. Oct. 30, 1970	K373	62.92	466; 555	K375	62.86	565; 994	535	Success
5. Feb. 25, 1971	K394	65.84	572; 614	K397	65.76	575?; 1,000?	585	Success
6. Apr. 4, 1971	K400	65.82	982; 1,006	K404	65.74	802; 1,009	1,005	Success
7. Dec. 3, 1971	K459	65.83	222; 259	K462	65.88	231; 2,654	230	Success
Phase II								
8. Feb. 16, 1976	K803	65.85	547; 621	K804	65.86	561; 618	575	Failure
9. Apr. 13, 1976	K803	65.86	549; 621	K814	65.9?	556?; 615?	590	Success
10. Jul. 21, 1976	K839	65.88	983; 2,097	K843	n.a.	n.a.	1,630?	Failure[b]

11. Dec. 27, 1976	K880	65.85	559; 617	K886	65.85	532; 1,266	570	Failure[c]
12. May 23, 1977	K909	65.87	993; 2,104	K910	65.86	465?; 1,775?	1,710	Failure
13. Jun. 17, 1977	K909	65.87	991; 2,106	K918	65.9?	245?; 1,630?	1,575?	Success[d]
14. Oct. 26, 1977	K959	65.83	144; 834	K961	65.8?	125?; 302?	150	Success
15. Dec. 21, 1977	K967	65.83	963; 1,004	K970	65.85	949; 1,148	995	Failure[c]
16. May 19, 1978	K967	65.83	963; 1,004	K1009	65.87	965; 1,362	985	Failure[c]
17. Apr. 18, 1980	K1171	65.85	966; 1,010	K1174	65.83	362; 1,025	1000	Failure[c]
18. Feb. 2, 1981	K1241	65.82	975; 1,011	K1243	65.82	296; 1,015	1005	Failure[c]
19. Mar. 14, 1981	K1241	65.82	976; 1,011	K1258	65.83	301; 1,024	1005	Success
20. Jun. 18, 1982	K1375	65.84	979; 1,012	K1379	65.84	537; 1,019	1005	Failure[c]

Source: Paul B. Stares, *Space and National Security* (Brookings, 1987), p. 86.
? = Uncertain; n.a. = not available.
a. All missions were of two revolutions, except tests 8, 9, 12, and 13, which were one revolution.
b. Apparently failed to enter intercept orbit.
c. Reportedly used new optical sensor.
d. Conflicting data exist for intercept orbit.

each other in advance of most space launches and ballistic missile tests.[20] Most other matters are still up for grabs. And the concept of space as a sanctuary will be increasingly difficult to defend or justify as space systems are used more and more to assist in the delivery of lethal ordnance on target.[21]

Some scholars, such as Ambassador Jonathan Dean, do argue that the START I, Intermediate-Range Nuclear Forces (INF), and multilateral CFE treaties effectively ban the use of ASATs by one signatory against any and all others, given the protection they provide to satellite verification missions. But these treaties were signed before imaging satellites entered their own as targeting assets for tactical warfighting purposes, raising the legal and political question of whether protection originally provided to a satellite for one, generally nonprovocative and stabilizing mission can be extended to its use in a more adversarial fashion. Moreover, no one argues that these treaties ban the development, testing, production, or deployment of ASATs.[22]

In the late 1980s and 1990s, debates over military space policy became less visible than they had been during the Reagan era and a number of periods during the cold war. Détente, and then the end of the cold war, defused the immediate argument for such systems. Bill Clinton's election in 1992 reinforced these strategic developments, among other things leading to a shift in missile defense efforts from strategic to theater systems, for which weapons based in space did not figure prominently (though some theater missile defense [TMD] systems could have capabilities against low-Earth orbit satellites). Even when Clinton reemphasized national missile defense in mid-decade, his plan called for land-based interceptors. Sensor technology was to be based in space, but other capabilities were not. Clinton also curtailed the development of a kinetic energy, or "hitto-kill," antisatellite system that he inherited from George H. W. Bush, as well as a microsatellite program known as Clementine II, despite the efforts of Senator Robert Smith of New Hampshire and other conservatives.[23]

But Clinton did not stop technology in its tracks. Two of the missile defense systems he promoted steadily, the midcourse national missile defense program and the airborne laser theater missile defense program, continue to this day and have latent capability as ASATs (see chapter 3). Moreover, he allowed the use of the mid-infrared advanced chemical laser (MIRACL) in a test against a target in space, confirming that the United States may have at least a rudimentary capability of using that ground-based high-energy laser in an ASAT mode.[24] (Meanwhile, some work continued more quietly and is ongoing under President Bush. For example, the Army has reportedly been working on laser dazzlers to blind surveillance satellites and jammers to disrupt communications and surveillance satellites.[25] It also, again, has a kinetic energy ASAT program, though funding has been near nil for several years and the Pentagon leadership has decided not to request funding for a flight test in 2004.[26])

The election of George W. Bush as president, and, even more important, his decision to select Donald Rumsfeld as secretary of defense, made it likely that such efforts would accelerate. Just before he became secretary, Rumsfeld chaired a commission on the military uses of space that warned of a possible future "space Pearl Harbor" for the United States unless it took a wide range of defensive and offensive steps to better protect its security interests in the heavens.[27] The worry was that countries such as China and Iran, among others, would gradually get their hands on technologies, such as high-energy lasers or homing microsatellites, that could threaten U.S. space assets. But the secretary's thinking is not strictly defensive. Rumsfeld's major strategic plan as secretary of defense states, "The mission of space control is to ensure the freedom of action in space for the United States and its allies and, when directed, to deny such freedom of action to adversaries."[28]

It is possible to exaggerate the change that occurred in U.S. policy when the Bush administration came into power. During the Clinton era, Air Force leaders increasingly discussed space as a military theater like any other. They envisioned the day when the Air Force would become an air and space force, or even a space and air force.[29] And Rumsfeld's language quoted above resembles official statements on Clinton administration space policy. Consider this excerpt from Space Command's 1998 Long-Range Plan in regard to one option it would eventually wish to develop more fully:

> *Negation* means applying military force to affect an adversary's space capability by targeting ground-support sites, ground-to-space links, or spacecraft. Negation will be executed when prevention fails. High-priority targets include an enemy's ability to hold US and allied space systems at risk. Negation will evolve from current concepts, which emphasize terrestrial attacks on an adversary's ground nodes, to a full range of flexible and discriminate techniques against the most appropriate node. Acting under clear lines of authority and rules of engagement, USCINCSPACE will take actions necessary to meet the National Command Authorities' objectives and defend our nation's vital space interests. Actions will range from temporarily disrupting or denying hostile space systems to degrading or destroying them. Our objectives must consider third-party use, plausi-

ble deniability and how actions will add to debris or otherwise affect the environment.[30]

But in broader context, Rumsfeld's approach indeed seems more assertive than policies under Clinton.[31] To quote Peter B. Teets, undersecretary of the Air Force for acquisition and head of the National Reconnaissance Organization, the nation must develop "ways to get a vehicle rapidly off the pad to any orbit on short notice. . . . It is easy to see how such a responsive capability could be useful for rapid constellation replenishment and sustainment, but I leave it to your imagination . . . to find other ways to employ such a capability to achieve desired warfighting effects."[32] Little imagination is needed if one reads official doctrine, given its emphasis on disrupting, degrading, and, if necessary, destroying enemy space assets in future combat.[33] This approach also seems to have emboldened a number of Air Force officers to make more public statements about the inevitability of weaponizing space.[34] As one example, Brigadier General Pete Worden argues that small launchers could be useful to the U.S. military for, among other reasons, their ability to launch weapons on short notice against targets in space.[35] Certain specific actions have already affected the policy landscape quite directly as well. For example, the Bush administration's decision to withdraw from the ABM Treaty, an action that was publicly announced in December 2001 and officially put into effect in June 2002, opened up the legal possibility of space-based ballistic missile defenses. Eliminating Space Command as one of the country's ten unified commands and placing space functions under Strategic Command may also reflect an inclination to think about space as another theater of combat, rather than as a special, and possibly safeguarded, domain.[36]

Not all policymakers agree with Rumsfeld. For example, Senate Majority Leader Tom Daschle made a strong statement against such activities in 2001 and suggested that most other Democrats also opposed putting weaponry in space.[37] This position is probably rooted, at least in part, in the philosophical view that space should remain a natural preserve of all mankind. As such, it should be devoted to nonmilitary—or at least nonthreatening and nonoffensive—purposes. Beyond that ideological point, opponents of weaponization also make a practical national interest argument: as the world's principal space power today, the United States stands to lose the most from the widespread weaponization of space, since that outcome could jeopardize the communications and reconnaissance systems on which it so disproportionately depends.[38]

Opponents of weaponizing space also point to the world's growing economic dependence on satellites, and the risk of damaging those capabilities should weaponry be based or used above the atmosphere. Worldwide, commercial revenues from space ventures exceeded government spending on space activities in the late 1990s, reaching and then exceeding $50 billion a year. The spread of fiber-optic cable has actually reduced the relative importance of satellites in global telephone services, and global economic conditions caused a downward revision in forecasts for space services.[39] But nonetheless the global satellite business now involves more than 1,000 companies in more than fifty countries.[40]

Non-American opponents of weaponizing space make many of the same arguments. They also worry about a unilateralist America pursuing its own military advantage at the expense of other countries, most of which do not favor putting weapons in space. This dispute has much of its origins and motivation in the history of the ballistic missile defense debate, as well as the

ASAT debate of the 1980s. But it has taken on a new tone in what many view as an era of American unipolarity or hegemony. In recent years, China and Russia have been consistently vocal in their opposition to the weaponization of space and their desire for a treaty banning the testing, deployment, and use of such capabilities.[41] So have a number of U.S. allies, including Canada, which in 1998 proposed that the United Nations convene a committee on outer space in its Conference on Disarmament in Geneva.[42] The UN General Assembly has continued to pass resolutions, for more than twenty straight years, opposing the weaponization of space. In December 2001 it called for negotiations on a treaty to prevent an arms race in outer space at the Geneva Conference. (The vote passed by 156 to 0; the United States, Micronesia, Israel, and Georgia abstained.)[43] In 2001 China presented an incomplete draft treaty banning the weaponization of space, and in 2002 China and Russia jointly presented another draft that included bans on weapons based in space and on any use of weapons against objects in space.[44]

For most defense planners today, by contrast, developing more military applications for outer space is an important imperative. Much thinking about the so-called revolution in military affairs and defense transformation emphasizes space capabilities. Ensuring American military dominance in the coming years—which proponents tend to see as critical for global stability as well—will require that the United States remain well ahead of its potential adversaries technologically. For some defense futurists, the key requirement will be to control space, denying its effective use to U.S. adversaries while preserving the unfettered operation of American satellites that help make up a "reconnaissance-strike complex." Others favor an even more ambitious approach. Given that fixed bases on land and large assets such as ships are increasingly vulnerable to precision-strike weaponry and other enemy capabilities—or to the political opposition of allies such as Turkey, Saudi Arabia, and France, who have sometimes opposed use of their territories or airspaces for military operations—they favor a greater U.S. reliance on long-range strike systems. These include platforms in space.[45]

Advocates of space weaponry also argue that, in effect, space is already weaponized, at least in subtle ways. As noted, most medium-range and long-range rockets capable of carrying nuclear weapons constitute latent ASATs. Likewise, rockets and space-launch vehicles could probably be used to launch small homing satellites equipped with explosives and capable of approaching and then destroying another satellite. Such capabilities may not even require testing, or at least testing easily detectable from Earth. Advocates of weaponization further note that the United States is willing to use weapons to deny other countries wartime use of the atmosphere, oceans, and land, raising the question of why space should be a sanctuary when these other media are not. As Barry Watts put it, "Satellites may have owners and operators, but, in contrast to sailors, they do not have mothers."[46]

Specific military scenarios can bring these more abstract arguments into clearer focus. Consider just one possibility. If in a future Taiwan Strait crisis China could locate and target American aircraft carriers using satellite technology, the case for somehow countering those satellites through direct offensive action would be powerful. If jamming or other means of temporary disruption could not be shown to provide reliable interruption of China's satellite activities, outright destruction would probably be seriously proposed—and would not immediately be unreasonable as an option. Indeed, China may be taking steps in the direction of using satellites for such targeting purposes, for example, with the recent launch of a 155-mile-range antiship cruise missile that may eventually be able to receive navigational updates by satellite communication link.[47] Moreover, despite rhetorical and diplomatic opposition to the weaponization of space, China's military planners have also reportedly given thought to how they might attack U.S. military space systems. That is quite a natural reaction for any defense planner who thinks his country may have to take on the United States someday. But it also underscores the strong pressures toward the weaponization of space, given current trends.[48]

Although technological progress, the absence of arms control regimes banning most military uses of space, and the growing use of space for tactical warfighting purposes suggest that space may ultimately be weaponized, the issue is not a simple yes or no proposition. The nature of the weapons that might ultimately reach space, or affect space assets, is important. So does the timing of weaponization, and the state of great power relations when it occurs. Even if weaponization is indeed inevitable, in other words, when and how it happens may matter a great deal. Accordingly, even if most weapons activities are not banned categorically by treaty, reciprocal restraint by the major powers, together with some limited and formal prohibitions on activities in space, may make sense.

This book is designed to move beyond the ideological debate of whether or not space should be preserved as a nonweaponized sanctuary, and instead to develop and analyze a number of specific proposals for future U.S. space policy.[49] The analysis is technical as well as strategic. It considers military, warfighting issues as well as arms control and political matters. Missile defense is not discussed in detail—numerous studies already exist on that subject—but its linkages to the space weapons debate are central and unavoidable, and thus frequently invoked in these pages.[50]

These questions need to be answered, in part, because there is at present no official U.S. position on most of them. Or, to put it differently, there are various competing positions. The military's publicly stated views are quite assertive, even if its actual programs for moving ahead with the weaponization of space are generally restrained for the moment. Moreover, most possible moves toward weaponization are unconstrained by any arms control accords. The Outer Space Treaty of 1967 only bans a small set of activities—notably, nuclear weapons in space, as well as hostile colonization of the moon and the planets.

Slowing the Weaponization of Space

This book's basic argument is that space should not yet be weaponized by the United States. For a combination of technological and strategic reasons, however, it may not prove practical to sustain this policy indefinitely. Thus the United States should also avoid most types of formal arms control categorically prohibiting the weaponization of space, even as it seeks to delay the arrival of that weaponization indefinitely.

Slowing and delaying the weaponization of space may strike many as an unsatisfying policy. It neither establishes a clear legal and political red line against such activity nor endorses it. Presumably, one might contend, putting weapons in space is either good or bad. If bad, should it not be precluded permanently; and if good on national security grounds, should it not be pursued without guilt or reservation?

In point of fact, space weapons are not inherently good or bad. Unlike biological weapons or many types of land mines, they are not by nature inhumane; yet, unlike the next type of fighter jet or munition, they are not just the natural progression of military modernization. Their political significance is much greater than that of most types of weaponry.

In addition, the United States enjoys a remarkably favorable military position in space today, without suffering much political and strategic fallout for making major use of the heavens for military purposes. It should preserve that situation as long as possible. And it has no need to rush to change current circumstances to maximize its own military capabilities. Some concepts, such as space-based ballistic missile defense, while holding a certain inherent appeal, would be needlessly provocative and exceptionally uneconomical to pursue at present. The satellites of other countries (and private companies) are not yet militarily significant enough to warrant development of destructive antisatellite weapons.

Extreme positions that would either hasten to weaponize space or permanently rule it out are not consistent with technological realities and U.S. security interests. The 2001 report of the Commission on Outer Space, which warned of a possible space "Pearl Harbor" and implied that the United States needed to take many steps—including offensive ones—to address such a purportedly imminent risk, was alarmist. It exaggerated the likely space capabilities of other countries. In fact, only certain classes of satellites are potentially vulnerable to enemy action in the coming years, and it may be some time before that potential vulnerability becomes real. Moreover, the United States can take passive and defensive measures to reduce the associated risks—and to know more clearly if and when it is being challenged in space.

To proceed on the basis of worst-case assumptions and hasten development of ASAT capabilities would be to ignore the serious political and strategic consequences of any U.S. rush to weaponize the heavens. American satellites, so dominant today, could be put at risk by the countervailing actions of other countries more quickly than they would be otherwise. Even more important, relations with Russia and China, which have improved in recent years but remain fragile, could suffer. Even if the United States someday does put weapons in space or develop weapons against objects in space, timing matters in international politics. Witness how the events of September 11, 2001, and the focused personal diplomacy between Presidents George W. Bush and Vladimir Putin preserved good relations between the United States and Russia even after the United States' withdrawal from the ABM Treaty in June 2002—an event that could have seriously damaged bilateral relations if it had occurred only a little earlier. Today, weaponizing space could reinforce the image of a unilateralist United States too quick to reach for the gun and disinclined to heed the counsel of others. Given that almost all countries routinely support an annual UN resolution calling for a treaty outlawing the weaponization of space, and that most currently find the United States too ready to flex its military muscle, any near-term decision to weaponize space would be very bad timing.

By the same token, the dismissive attitude toward any and all space weapons evidenced by large elements of the arms control community is too purist. Space, as noted, is increasingly used for warfighting purposes, so it cannot be viewed as a true sanctuary from military activity even today—and it is not clear that space should be seen as a less appropriate place to fight than Earth. If satellites increasingly become tools of the tactical warfighter rather than linchpins of strategic stability between nuclear-armed powers, it is not clear that they should merit complete protection from attack even as they are used to help kill targets on the ground. Leaving aside philosophical arguments, there are also practical military rationales for keeping a future ASAT option. While the United States might like to preserve its current dominance in space for intelligence, communications, and tactical warfighting purposes, it will not enjoy that luxury forever. Passive steps to defend itself, such as satellite hardening, may not suffice to protect its interests—even in the hypothetical case of an ASAT treaty banning the development, deployment, and use of antisatellite weapons. Too many non-ASAT technologies have potential applications as ASATs, especially in a world of increasingly capable missile defenses and a growing number of satellites and microsatellites. And other countries may learn to use satellites for tactical warfighting, including against the United States.

Some would argue that missile defenses themselves are unwarranted. But in the international enviroment, the demise of the ABM Treaty is quite certainly now permanent, with no prospect of a replacement accord prohibiting such technologies. Even defenses designed against shorter range missiles (often known as theater missile defenses), which have not been controversial in the United States, have certain antisatellite capabilities. Moreover, a number of these technologies are close to realization in the United States. Regardless of whether one thinks it would be desirable, it is simply not feasible to put the horse back in the barn.

That said, the United States should pursue some types of binding arms controls on military space activities and, even more important, show unilateral restraint on its space activities in a number of ways. It should agree to a ban on any tests in space that would create debris (notably, tests of antisatellite weapons that use explosives or collisions to destroy targets). It should publicly declare that it will forgo space tests of any antisatellite system for the foreseeable future. And it should also seriously consider revising its military space doctrine to declare that it will not even develop dedicated ASAT technologies in the coming years. This policy will probably prove temporary, but because the coming years will be critical for the further maturation and improvement of great power relations (especially with Russia and China), improving the prospects for strategic stability in that period is important. If and when the United States needs to change its policy in the future, the danger of strategic fallout may be reduced.

The approach recommended here differs greatly from the early rhetorical position of the incoming Bush administration. It differs less from the de facto approach of the Bush administration since September 11, 2001, when the United States chose to emphasize the need for great power security cooperation against terrorism and to seek accommodation or delay on issues that could impede that priority effort. But even today, the Bush administration retains the aspiration for space-based missile defense and funds programs to that effect; it retains a space policy doctrine emphasizing the possibility of destroying the satellites of potential adversaries; it refuses to negotiate even very limited accords on uses of space that might, for example, prevent the production of more debris in low-Earth orbit; and it establishes no policy roadblocks to the rapid weaponization of space, should it choose to move in that direction in any new budget plan. It should make its de facto restraint more formal in certain areas and reinforce it in several others.

Translating these broad strategic observations and premises into policy terms leads to the set of core recommendations described below. They begin with more straightforward, passive, and nonthreatening actions that the United States could take to ensure its reliable use of military space assets in the future. But they also include options for the weaponization of space, particularly in regard to antisatellite capabilities of various types, should future circumstances so warrant.

Passive and Defensive Measures

—Beyond improving its ground-based space surveillance capabilities as currently planned, the United States could place surveillance assets on individual satellites to identify and report any attacks on them. Most military satellites lack such capabilities today.

—Although details are classified, the United States appears not to have sufficiently hardened its military satellites. It needs to do so not only against natural radiation and nuclear effects, but also against certain other threats; laser attacks against low-Earth orbit satellites are among the most worrisome. Hardening of new military satellites is generally feasible and practical, albeit not cost free.

—A related measure could be to subsidize hardening of commercial satellites (particularly communications systems) on which the United States increasingly depends. Jamming and nuclear-induced atmospheric disturbances are among the more serious threats to guard against. But these steps may not be practical given classification concerns, commercial satellites' emphasis on high-data-rate transmissions, and other factors. Thus the United States needs to continue to emphasize laser satellite communications systems and reduce its dependency on commercial satellites in warfighting environments. In the interim, the U.S. armed forces also need to be able to streamline their insatiable demands for data and bandwidth, because such wide bandwidths may not be reliably available in future conflicts. Specifically, the military needs to prioritize its data needs and develop mechanisms for ensuring that the most important information can continue to flow in combat even if 25 percent, 50 percent, or 75 percent of total desired bandwidth proves at least temporarily unavailable due to enemy action.

—The United States needs to be able to recover if major satellite capabilities, such as low-Earth orbit imaging assets, are damaged or destroyed. Many in the military community favor development of rapid reconstitution capabilities—extra satellites in warehouses, coupled with rockets ready to launch within weeks or even days of a decision to do so. But if satellites on orbit proved vulnerable, a second batch of satellites might be, too. Thus air-breathing capabilities, such as the P-3, EC-135, JSTARS, and various UAV systems need to be retained. The GPS constellation may be sufficiently robust and distributed that most of its satellites will survive any plausible attack, but the signals of current-generation GPS satellites are relatively easy to jam or otherwise disrupt. That may suggest the need for airborne targeting capabilities as a backup to GPS; more likely, it suggests that the United States needs to modernize its GPS system by putting into orbit an improved generation of satellites without further delay.

—The United States should research active defenses for satellites. These would not necessarily have to be general-purpose ASAT weapons; they could instead be short-range self-defense weapons placed on the satellite to be defended and designed to strike only nearby objects. Their kill mechanisms could, for example, be high-powered microwaves or lasers of modest total power.

Antisatellite Technologies

—Partly because the future survivability of its own satellites cannot now be assumed, and partly because the future survivability of adversary satellites may not be tolerable under certain circumstances, the United States should not rule out the possibility of developing ASAT capabilities of its own. It should not hasten to develop, test, or deploy advanced systems for this purpose. Yet nor should it preclude the possibility, either by treaty or by excessive constraints on its basic research and development activities.

—In fact, the United States will soon possess latent ASAT capability. These systems will not be found only in the form of nuclear-tipped intercontinental ballistic missiles (ICBMs) or submarine-launched ballistic missiles (SLBMs), which could be programmed to detonate at a certain time near a certain point in space; nor solely in the form of the MIRACL laser already operational in New Mexico. They will increasingly be found in ballistic missile defense programs as well. In particular, the midcourse intercept system soon to be deployed in Alaska and California surely has at least latent capability against low-Earth orbit satellites, even if it might require software upgrades to accept targeting data from different sensors than would likely be used for missile defense. And the airborne laser (ABL) will soon have similar capabilities. Again, the ABL would need help from external sensors to find and track a satellite, and quite likely would require software upgrades to be able to accept the data from those sensors. These types of software modifications, and actual testing of these weapons in an ASAT mode, should be avoided indefinitely. But their intrinsic ASAT capabilities against most types of lower-Earth orbit satellites appear rather significant.

—The United States should not build dedicated ASATs soon. It has enough advantages in any ASAT competition in the form of its ABL and midcourse ballistic missile defense programs that it need not be first in each and every technology category, including microsat ASATs. The downside of developing microsat ASATs first is that doing so would harm great power strategic relations and help accelerate an ASAT arms race that the United States does not stand to benefit from in the foreseeable future. Similarly, a kinetic energy ASAT is unnecessary, and would be undesirable vis-à-vis other possible ASAT technologies in any event, given the debris it would cause in space.

Missile Defenses and Space-to-Earth Weapons

—The United States should not hasten the development or deployment of space-based missile defenses, which would have inherent ASAT capabilities. They are not needed for missile defense against extremist states with modest arsenals—the only real rationale for ballistic missile defense systems in the foreseeable future—given the variety of ground-based options soon to be available. For purposes of missile defense they would have to be deployed in such numbers (given absentee ratios, due to the movement of satellites above Earth) that they could pose a very serious threat to many satellites simultaneously, as well as being extraordinarily expensive.

—Space-to-Earth weapons are not a promising concept for the foreseeable future. In addition to being politically very provocative, they offer few benefits to a global military power already capable of rapid intercontinental strike. The technologies within reach, such as tungsten rods or a common aero vehicle that could function first as a reentry vehicle and then as a guided aerodynamic device, do not warrant advanced development and deployment. They are either too limited in capabilities, too expensive, or too uninteresting in terms of their limited attributes relative to ground-based systems. Further conceptual exploration and basic research may be warranted; nothing more than that is even desirable in the coming years—and hence budgets need not be substantially increased.