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China's Space Ambitions—And Ours

Jeff Kueter

On January 11, 2007, a missile was launched from Chinese territory. It arced upwards into space to an altitude of about 537 miles, where it slammed directly into its target, an obsolete Chinese weather satellite. The target was destroyed, reportedly producing some 900 trackable pieces of space debris in orbits from 125 miles to about 2,300 miles and resulting in an increase of 10 percent in the total amount of manmade debris in orbit.

This demonstration of an anti-satellite weapon (ASAT) was just the latest in a series of tests of China's space weapons program, and was a warning sign the United States should take very seriously. In the decades after the Soviet Union and the United States first designed and deployed so-called space weapons, some observers came to hope it would be possible to turn back history's pages and preserve space as a sanctuary, a pristine place of peace and international cooperation, where terrestrial disputes could be left behind. If these hopes were ever given credence, they have surely been dispelled by China's recent actions in space: vivid demonstrations that the country could threaten essential satellites both directly, by physically destroying them, and indirectly, employing lasers and other jamming techniques to make them unusable. China is now a military space power and space is once again an undeniably contested arena.

There are several policy courses the United States could take in responding to this new reality. It could assume that China is not a significant threat to American space assets and determine that inaction is preferable to overreaction. But such a do-nothing approach would expose the United States to the dangers of what has been called a "space Pearl Harbor," a surprise attack on U.S. space capabilities with immediate consequences for the American military and for American interests the world over.

Alternatively, American policymakers could conclude that negotiation and diplomacy offer the best path forward. Following this approach, the U.S. would embrace efforts to ban the introduction of weapons into space and negotiate codes of conduct to regulate the behavior of nation-states. But while some good could undoubtedly come from the emergence of international norms and rules, it is unlikely they would be sufficient to preserve security.

Jeff Kueter *is president of the George C. Marshall Institute.* *He would like to thank Dean Cheng of the CNA Corporation for work that contributed to this article.*

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Instead, the United States should adopt an active defensive posture, invigorating the research and technical base needed to defend or replenish space assets. This posture can complement diplomatic efforts by providing important verification and enforcement capabilities. Such an approach will be expensive and will need to overcome bureaucratic inertia as well as domestic and international opposition—but it is the only option that can ensure the security of American space assets.

The Rising Dragon

China's January ASAT demonstration followed years of work on a variety of related weapons. In September 2006, reports surfaced in the press that China had for several years successfully used ground-based lasers to blind U.S. reconnaissance satellites. These blinding tests seem intended to demonstrate the capability to pinpoint, track, and "illuminate" American spy satellites. Blinding a spy satellite's optical and infrared imaging systems could result in either temporary or permanent damage, depending upon the delivered power of the beam and the sensitivity and protections built into the satellite's sensors. (The United States first ran its own such laser tests a decade ago, when the Navy's ground-based Mid-Infrared Advanced Chemical laser was used to illuminate an aging Air Force satellite.)

Strategically, such a capability could, for example, help the Chinese hide military preparations or prevent U.S. forces from responding in a timely fashion to a Chinese move against Taiwan. China's People's Liberation Army (PLA) is apparently developing techniques to jam other kinds of satellites as well. Articles in some PLA journals have discussed how broad-spectrum or narrow-frequency jamming can be used against navigation satellites; others have focused on jamming space-based radar, which is used (although not extensively) by the U.S. for military intelligence.

There are also strong indications that the PLA is developing micro-satellites that could collide with enemy satellites to damage and disable them. When seen in combination with the PLA's express interest in maneuverability and on-orbit rendezvous, the existence of the microsatellite program strongly suggests the Chinese are seriously investigating (and perhaps investing in) space-based ASATs.

In a word, China is now unquestionably a first-tier space power, comparable to the United States and Russia. Not only does China have the capacity to exploit space for its own purposes, but the ASAT test demonstrated a Chinese capability to deny other nations that same capacity. This may be an emerging capability; it may be a limited one; but it is also

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now an actual, rather than potential, capability—and one with distinct diplomatic and political implications.

China's Growing Space Capabilities

To put China's space ambitions into context, it is worth reviewing the history of the country's space program. It began in 1956 as an offshoot of China's missile technology development efforts and was soon considered a priority alongside the country's missile and nuclear programs, together referred to under the rubric *liang dan, yi xing*—"two bombs, one star" (i.e., satellite). On April 24, 1970, China became the fifth country to put a satellite into orbit. Reportedly at Mao Zedong's instructions, that first satellite was both larger and more capable than the first Soviet and American satellites had been.

Under Deng Xiaoping, the Chinese science and technology enterprise shifted to concentrate on projects of economic benefit or of scientific value. Space therefore became a lower priority until 1986, when National Project 863 began. That major high-tech initiative ranked aerospace technology alongside energy research, information technology, and the biological sciences as keystones for future economic development in China. Aerospace projects were highlighted in the regime's subsequent five-year plans.

Those five-year plans offer useful insight into the progress and evolving priorities of China's space program. During each of the two five-year plans that comprised the 1990s, China launched about 10 satellites. But in the next five-year plan, starting in 2001, China placed more than 35 satellites into orbit. A 2006 government white paper on space called for the development of a new generation of satellites; the improvement of launch and satellite manufacturing capabilities; and the expansion of the global competitiveness of China's launch services, satellite services, and ground equipment. The current five-year plan emphasizes China's intentions for lunar exploration. Building on the successful mission of its first astronaut in 2003, China now plans more manned flights in Earth orbit, as well as a number of unmanned missions to the Moon (starting with a lunar orbiter expected to launch in 2007).

China possesses the facilities, satellite technology, mission control centers, and launchers required of a space power. The Long March series of rockets can place payloads into low-Earth, geosynchronous, and polar orbits. Five satellite constellations are used for communications, meteorology, remote sensing, and navigation. In addition, China has shown great interest in small satellites and has developed a dedicated launcher for them.

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The Chinese have also engaged in several international cooperative efforts, such as the Galileo navigation satellite system that Europe is developing as an alternative to America's Global Positioning System (GPS).

For all its advances, it is worth noting that China's space program looks somewhat different from the American or old Soviet space programs. In their early years, those space programs emphasized reconnaissance, nuclear detonation detection, and missile warning. But China hasn't concentrated on reconnaissance and warning satellites. Whereas the U.S. and Soviet space programs were built with military intelligence in mind, the Chinese space program has decidedly more twenty-first-century motivations.

The New Strategic High Ground

Why, then, has China been aggressively pursuing new capabilities in space and building space-weapons systems? One obvious reason is that the country's space program is a source of both tremendous international prestige and domestic patriotic pride. It is a dramatic illustration of China's technical prowess and achievement, and a reflection of the country's emergence as a great power. While the space program has economic and technical benefits that themselves contribute to China's reputation, the program's very existence boosts the country's standing in a way that supports its larger foreign policy objectives.

And as a matter of pride for the people, it is an important consideration for the regime. The space program is "promoting China's economic, scientific, and national defense capabilities as well as its *national cohesiveness*," says the head of the National People's Congress; space achievements "inspire greater patriotic passion, national pride and *cohesion*," says the head of the country's manned space program; it increases "China's international prestige and the *cohesive power* of the Chinese nation," says a leading Chinese scientist; when the first Chinese astronaut was launched, television advertisements called for "patriotic fervor and national *cohesion*" (emphases added). The Chinese regime clearly believes the space program helps to unify the country—not unlike the upcoming Beijing Olympics.

A more important motivation for China's investment in civil and military space is of course the country's perception of its security environment and its understanding of the evolution of modern warfare. The Chinese have concluded from observing recent wars—including Operation Desert Storm, NATO operations in the Balkans, and the present wars in Afghanistan and Iraq—that "the PLA's past approach to wars,

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which relied heavily on mass mobilization and preparation for all-out warfare, are frankly no longer appropriate," according to China scholar Dean Cheng of the Center for Naval Analyses.

Chinese analysts have reached several conclusions about the characteristics of future wars. They will extend from operations on the land, at sea, and in the air to the electromagnetic spectrum and into outer space. They will demand widely spread forces, operating over large geographic areas, demonstrating precise operational coordination and timing, and requiring multiple military services working together. Future wars will be characterized by long-range operations, involve the decisive use of precision-strike weapons, and require much higher rates of expenditure of munitions. Operations will occur more rapidly and conflicts will conclude more quickly. American strategists have reached similar conclusions, as is reflected in the doctrines of the U.S. military services, embodied in the annual U.S. defense budgets, and written into recent Quadrennial Defense Reviews.

These conclusions have shaped China's overall military modernization efforts as well as its outer-space ambitions. As a 2006 study from the Center for Strategic and International Studies and the Institute for International Economics puts it, China has recognized

> the increasing importance of information technology in modern warfare. China's leaders have no illusions that the People's Liberation Army is a match for the U.S. military. What China does seek are niche capabilities to exploit U.S. vulnerabilities in order to deter, complicate, and delay, if not defeat, U.S. (or other) intervention in a Taiwan scenario.

Among the niche capabilities of particular interest to China, according to a 2006 report from the U.S.-China Economic and Security Review Commission, is the ability

> to disrupt [an] adversary's C4ISR [Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance] advantages through such means as attacking its computer and communications systems. Accordingly, the PLA is establishing information warfare units and capacities, and developing anti-satellite capabilities [and] space warfare weapons.

Chinese military scholars often refer to space as the new strategic high ground; they recognize the importance of achieving *space dominance* in a conflict so as to protect Chinese space systems and to deny opponents

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access to their own space systems. "The same information technologies and improved sensor systems that make modern weapons much more destructive effectively make outer space a key battleground," Cheng says. "Without control of space, at least at the local level, PLA authors suggest it is virtually impossible to gain or maintain air or naval dominance, which in turn then makes winning a war much more problematic."

China clearly recognizes that the transformation in modern warfare, driven by information technology and dependent upon space, represents both a significant challenge and an opportunity for its security. The challenge is that space dominance confers tremendous military advantages in terms of speed, lethality, accuracy, and reach. In this understanding, whoever gains space dominance will be able to influence and control other battlefields; a combatant without space dominance is likely to lose the initiative. The control of space is thus simultaneously a *goal* of and an essential *enabler* of military operations; it will be both a means and an end for future warfare. The opportunity is that the United States can be challenged by a nation possessing China's space capabilities.

New Strengths, New Vulnerabilities

The Chinese military comprehends just how reliant the United States has come to be on its satellites. "Space capabilities are inextricably woven into the fabric of American security, scientific, and economic activities," Lieutenant General C. Robert Kehler, the deputy commander of U.S. Strategic Command, told a congressional subcommittee in 2006. From television to shipping to weather reports to airplane navigation, most Americans interact indirectly with satellites every day.

Beyond those obvious civilian applications, satellites have had a profound effect on the U.S. military. America's military space systems serve five broad missions: communications; position, navigation, and timing; integrated tactical warning and attack assessment; intelligence, surveillance, and reconnaissance; and environmental and weather monitoring. Taken together, those space-based functions have transformed the American conduct of war on land, at sea, and in the air. By integrating those space-based functions into operations, we can use precision strikes from a distance to put fewer U.S. forces in harm's way, and we can improve coordination and reduce confusion when we must put boots on the ground. American space-based assets have enhanced military logistics and have made it possible to collect and rapidly disseminate intelligence almost in real-time. They make our military more effective and lethal,

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while simultaneously reducing unintended casualties and improving the safety of our forces.

This is a remarkable change from the Cold War days, when the principal national security function of space was reconnaissance. Satellites brought a degree of transparency and stability to the U.S.-Soviet "balance of terror." Under the prevailing doctrines of massive retaliation and mutual assured destruction, the ability to quickly detect one another's missile launches ensured that either side could launch its own missiles before they were destroyed, thus precluding the possibility of a winnable nuclear exchange and discouraging launches in the first place. Today, though, the United States uses space in a fundamentally different way. Space assets no longer just tell us where our enemies are and what they are doing; they are integrated with the weapon systems used to target and destroy.

This new capability, however, also creates a new potential vulnerability. "Far more than any other country, the U.S. depends on space for national and tactical intelligence, military operations, and civil and commercial benefits," as Robert L. Butterworth, president of the space consultancy Aries Analytics, recently put it. This "provides a clear incentive for attacking American spacecraft." Such an attack on American satellites would not have to be very extensive to be devastating—as long as it were well-planned. "Even a small-scale anti-satellite attack in a crisis against fifty U.S. satellites (assuming a mix of targeted military reconnaissance, navigation satellites, and communication satellites) could have a catastrophic effect not only on U.S. military forces, but [on] the U.S. civilian economy," according to a recent report by China analyst Michael Pillsbury.

There are numerous ways our space assets could be disabled or destroyed. One likely threat to U.S. space assets resides in a very terrestrial environment: strikes against ground stations and launch systems. Such attacks could constrain the usefulness of our existing satellites or reduce our ability to put new satellites into orbit.

But such ground attacks would probably, at worst, only diminish our ability to use our space assets, since the data transmitted from orbiting satellites could in most cases be rerouted to other receiving stations on the ground, and since our launch systems are (somewhat) redundant. Of more concern is the possibility of attacks that directly destroy or damage satellites, since they cannot at present be replaced quickly, easily, or cheaply. Without a reorientation of the way it acquires space hardware, the United States faces substantial barriers to repairing or replacing damaged satellites.

The Chinese test in January demonstrated what is known as a direct ascent anti-satellite capability, wherein an object, presumably a missile, is

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launched from Earth or from an airplane in flight at a target overhead in space. The missile slams into the targeted satellite and the energy created by the collision of two fast-moving objects destroys both. Such "kinetic kill" interceptions are well understood, were demonstrated by both the United States and the Soviet Union during the Cold War, and now underpin the U.S. ballistic missile defense program.

Another technique to destroy satellites involves co-orbital ASATs, which are placed into orbit where they wait for a period of time before they are sent to destroy their target. The Soviet Union built and tested a co-orbital ASAT system in the 1970s and early 1980s. While the PLA's apparent interest in microsatellites could imply some such capabilities, it is unclear how far Chinese research in this area may have progressed. Other space-based ASATs could, in theory, disable satellites from a distance using directed-energy weapons—lasers, particle beams, or high-energy radio-frequency weapons—although none of these has yet been deployed on platforms in space.

Another type of threat to space assets is high-altitude nuclear detonation. An enemy could arm a missile with a nuclear warhead, launch it, and explode the warhead in space. All satellites within the line of sight of the explosion would be destroyed or rendered ineffective immediately, with the effects dissipating with distance from the explosion. What's more, the radiation released by a single low-yield, high-altitude nuclear explosion "could disable—in weeks to months—*all* low-Earth orbit satellites not specifically hardened to withstand the radiation generated by that explosion," according to the Defense Threat Reduction Agency. Most U.S. satellites—including those commercial satellites that are used extensively for defense communications—are not hardened to withstand such an attack, and they lack the maneuvering capabilities needed to "get out of the way" of the attacking missile, the explosion, or the radioactive effects. China certainly has the missile and nuclear capabilities required to conduct such an attack. (So, too, do the United States, Russia, the United Kingdom, France, and possibly Israel, India, and Pakistan. North Korea apparently lacks the missile competence, and Iran probably does not have either the missile or nuclear know-how—as of this writing.) Needless to say, this most extreme measure would likely be attempted only in times of acute international crisis.

But even aside from destroying or damaging satellites, there is a multiplicity of ways space systems can be disrupted so as to preclude their use. The electromagnetic transmissions between satellites and the ground can be jammed (that is, blocked or drowned out) or spoofed (that is, imitated with fake signals that appear legitimate). Military and commercial

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satellite users have ways to prevent some jamming attacks, and encryption can protect against spoofing, but these remain realistic concerns. As General Kehler told Congress last year, "GPS jamming has occurred, as has jamming of commercial telecommunications satellites.... Open-source reporting has cited examples of incidents, both intentional and unintentional, that have impacted space capabilities." Well-publicized instances include the jamming of a Chinese TV satellite by the Falun Gong religious movement in 2002; Iran's jamming of various satellites starting at least in 2003; and Libya's jamming of various communications satellites in 2005. "While none of these incidents proved catastrophic," as General Kehler said, "our enemies clearly understand the reliance we place in our space capabilities and we should expect the level and sophistication of efforts to deny us the advantages of space to increase in future conflicts."

Parchment Barriers

The debate over what to do about security challenges in space is both old and new. Begun during the Cold War when both the United States and Soviet Union considered deploying ASAT capabilities and missile-defense systems, the argument receded for much of the 1990s. It has returned in the months since President George W. Bush reopened the possibility of space-based missile defenses and issued a new national space policy, and since the Air Force began discussing broader uses of space for military purposes. The Chinese ASAT test has further galvanized the debate.

Any serious discussion of policy options must begin by moving beyond a tired lexical dispute. Discussions about space security are cluttered with commentators and advocates fretting about the potential implications of "militarizing" and "weaponizing" space. But it is too late: space is already militarized and weaponized. The militarization of space—the use of space for military purposes—began with the launches of the first American and Soviet military satellites nearly five decades ago. The weaponization of space, too, has already happened. While there are currently no orbiting anti-satellite or missile-defense systems (in part because arms control activists for years prevented the development of either), there are satellites in space that are an integral part of weapons systems here on Earth. For that matter, all the long-range ballistic missiles in the world, as well as ASATs like the one China demonstrated this year, are really "space weapons" because even though they may not be launched *from* space, they can be fired *into* space and they transit *through* space to their targets. In a looser sense, even tools for jamming satellite transmissions or bombs used

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in wholly terrestrial attacks against ground stations could be counted as "space weapons" since they would serve to disrupt space assets—that is, they unquestionably *bring war to space*.

Setting aside such semantic quibbling, the real challenge now facing the United States is how best to deter, deny, and dissuade the Chinese, and other emerging space powers, from hostile actions in space. One approach would involve diplomacy and international discussions. For some time, arms-control advocates have been pushing for agreements to ban weapons in space. More recently, in light of the changed circumstances brought on by China's tests, the focus has shifted to securing "codes of conduct" and devising "rules of the road" to regulate how nation-states behave in space. Sympathetically interpreting China's recent tests as an understandable reaction to U.S. policies, arms-control advocates have characterized American actions in space as dangerous and provocative, and have condemned the United States for refusing to enter into international negotiations. Only a treaty, they argue, can restrain the Americans' aggressive tendencies. As one arms-control advocate told the *Washington Post*, the Chinese were responding to U.S. space policies and sending a signal to the Pentagon: "We can play this game, too, and we can play it dirtier than you." Representative Edward Markey, a Democrat from Massachusetts, told the *Post* that the United States must initiate "an international agreement to ban the development, testing, and deployment of space weapons and anti-satellite systems." This attitude—blaming America for other countries' actions and demanding that the United States preemptively disarm itself—is reminiscent of the old Cold War debates over nuclear weapons.

Also strikingly familiar to students of the Cold War is Beijing's hypocritical hand-wringing over the specter of an arms race in, and the weaponization of, outer space. As Michael Pillsbury has pointed out, "While China has publicly assumed a leadership position in international activities to ban space weapons, there is an active group within China not only advocating the weaponization of space but also putting forth specific proposals for implementation of a Chinese space-based weapons program." Even while the PLA was successfully executing at least two anti-satellite tests, the Chinese diplomatic corps was raging against the supposed weaponization of space by the United States. At a U.N. conference on space in 2006, a Chinese Foreign Ministry official, Tang Guoqiang, complained about actions in space that could "cause serious consequences":

> The policy of a certain country [i.e., the United States] to test, deploy and use weapons and weapon systems in outer space [is] discon-

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> certing. Outer space is the common heritage of mankind and [the] weaponization of outer space is bound to trigger off [an] arms race in outer space, thus rendering outer space a new arena for military confrontation.

Even after the January 2007 ASAT test, a Chinese Foreign Ministry official insisted that countries "opposed to the weaponization of space" should "join hands to realize this goal."

Existing treaties allow actions to protect and defend national interests in space. Article IV of the Outer Space Treaty forbids signatories (including the United States and China) from placing nuclear or other weapons of mass destruction in orbit or on the Moon, and prohibits the testing of weapons, conduct of maneuvers, or construction of fortifications on the Moon and other celestial bodies. Since October 1967, when the treaty went into force, nearly every U.S. president has interpreted its requirements in such a way as to explicitly allow the development, operation, and maintenance of the space-control capabilities needed to ensure freedom of action in space and to deny such freedom of action to adversaries. During successive administrations of both political parties, the National Security Council has interpreted the treaty as not barring the deployment of space-based missile defenses or other systems to perform space-control missions.

Work to draft new treaties continues apace. China and Russia have been spearheading international efforts to construct a framework to govern space. The Prevention of an Arms Race in Outer Space (PAROS) process at the U.N. Conference on Disarmament calls for formal negotiations to prohibit the placement of weapons in orbit or on celestial bodies. But whatever shreds of credibility this international process had were destroyed by the recent Chinese tests.

Another diplomatic tack contemplated by those opposed to "weaponizing space" is the adoption of multilateral codes of conduct. To a certain extent, such norms will develop organically on their own, as the growing interdependence between economic and security interests forces government and commercial satellite operators to cooperate, and as Washington increasingly coordinates its space activities with military and civil space authorities in allied and friendly nations. Over time, new norms for shared space situational awareness, debris mitigation, and orbital traffic management may emerge among responsible space-faring nations.

But such norms make no sense if the parties have not first built up trust. And if such norms are externally imposed, they will be nothing

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more than unverifiable arms control agreements in camouflage. Absent the ability to ascertain or enforce compliance, a code-of-conduct rule regime will be weak and, more likely than not, ineffectual. A rules system for space between potential adversaries that relies on voluntary compliance and lacks viable punitive measures will be a hollow one. (Nor, for that matter, would an international treaty "banning" anti-satellite testing be enforceable or verifiable; the ignominious record of enforcing and verifying treaties prohibiting activities on Earth should be proof enough of that.)

The chief failing of the diplomatic approach to dealing with the new reality of space weapons is that it is blind to the reason a potential adversary like China would seek access to space in the first place—namely, the desire to be able to inflict a crippling blow against U.S. military and economic might by decapitating its surveillance and communications abilities. Those pushing for a new treaty or a code of conduct have yet to explain why China would abandon capabilities that threaten the "soft underbelly" of American military power. The Chinese regime clearly aspires to develop such capabilities; there is little reason to believe it would negotiate them away. The United States should resist calls for such futile diplomatic efforts.

An Active Defense

A better approach to coping with the new realities of space security, some analysts argue, would be for the United States to develop the means to quickly react against any other nation deploying weapons to space. But this approach greatly overestimates the ease of putting systems into space. Space is a challenging environment, and the design and production of new systems is complicated, expensive, and subject to frequent reversals. The industrial and academic base on which U.S. space prowess depends is not currently capable of surging production of existing systems or developing new ones to meet such demands. And even if it were, such a reactive course would still leave U.S. assets *already in space* vulnerable, opening the possibility of blackmail, coercion, or worse.

The United States should instead adopt an active defensive posture, beginning by expanding and invigorating the research and technical base needed to defend or replenish space assets. In the absence of defensive systems, the United States government would do well to invest in small satellite development and rapid launch capabilities. The combination of the two, once achieved, changes the strategic calculations of prospec-

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tive adversaries. Instead of achieving strategic surprise by decapitating America's critical space-enabled weapons, an adversary would only have attained a momentary advantage. Unfortunately, the Air Force and Department of Defense budgets show little intention of investing in these areas.

Another important component of an active defensive posture is presidential rhetoric that fits the times. In October 2006, the Bush administration issued a new national space policy that reiterates America's fifty-year commitment to preserving peaceful uses of space, safeguards freedom of action for all nations, reserves the right to protect and defend U.S. space systems, and expresses antipathy toward additional international agreements. But that policy appears only to have added to the uncertainty in some quarters regarding U.S. intentions in space. If space security is to be a national priority, then President Bush or his successor should make public remarks explaining how America will defend its vital interests in space. A clear statement of the U.S. position on anti-satellite weapons and space-based missile defense is called for. These positions will not win universal endorsement, just as President Reagan's call for research on missile defense initially drew intense criticism from a Democratic Congress and the Soviet Union. However, Reagan's ultimate success in moving away from a strategy of mutual assured destruction shows that clear statements, backed up by a careful declassification of intelligence on emerging threats, will help both domestic and international audiences know what the U.S. actually stands for and the consequences of inaction.

It may also be necessary to realign the government bureaucracy. Today, bureaucratic inaction afflicts space security policy. Tension between intelligence gatherers and warfighters over primary control of the space enterprise has created conflicts over budgets and turf. Within the military community more broadly, while there is lip-service recognition of the vital significance of space to the American warfighter, there is little real appreciation for the complexity of the challenge of defending and maintaining those systems. The 2005 decision to designate the Air Force Undersecretary as the Department of Defense's "Executive Agent for Space" was supposed to have clarified this situation, but it did not: While the Undersecretary is regularly held accountable for the failures of flawed acquisition strategies of past administrations, the Executive Agent exerts only secondary influence over the Pentagon's processes for space policy or budgeting.

In any event, none of these Pentagon offices have any meaningful influence over the classified "black" (that is, secret) activities of the

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National Reconnaissance Office (NRO), which is now dominated by career civilian bureaucrats. This segregation flies in the face of nearly two decades of increasing interdependence between the "black" and "white" space communities. The inevitable inefficiencies resulting from separate space-sensor efforts are less worrisome than the potential complacency regarding growing threats to the intelligence community's programmatic empires. Although Donald Kerr, the director of NRO, told the press last year that evidence of Chinese ASAT development "makes us think," it is unclear when such thought will become action within the intelligence community.

For the near term, the agency best positioned to take the lead on space security is U.S. Strategic Command, which serves as the lead combatant command for space. In the long run, new organizational structures may be needed, perhaps even an independent space corps.

The legislative branch has an important role to play, too. Congress must focus its oversight on the specific actions and bureaucratic reforms needed to ensure space security, and when deliberating on the administration's space budget requests, should prioritize promising initiatives that would enhance our military's space situational awareness, maximize the use of commercial space assets, and make it possible to respond to evolving threats to U.S. and allied interests.

An active defensive posture on space security would not ignore diplomacy altogether: It is essential for the United States to work closely with its allies in Europe and the Pacific Rim to develop coordinated approaches for responding to emerging threats, especially as China, India, and other nations deploy increasingly sophisticated satellite and anti-satellite capabilities. Just as persistent diplomacy across the Reagan and two Bush administrations helped to transform the international discussion on missile defense, allowing the U.S. to develop systems that both reassured allies and dissuaded rivals from reckless behavior, so too will international consultation be critically important in shaping the way the world thinks about space security. We should begin with frank dialogue with America's closest allies, Australia and the United Kingdom, whose silence in response to the Bush space policy speaks volumes. A frank discourse with Canada is also necessary, given the growing contradictions between its North American Aerospace Defense Command obligations on space surveillance and its vocal diplomatic support for new multilateral treaties. Also, the United States should propose a space planning group be formed within NATO to develop a common appreciation of the threats, discuss potential responses, and consult on the formulation of alliance policy and

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plans to deter and defend against threats from space. Only with extensive prior consultation, planning, and appropriate exercises will the United States have the cooperation it would need in a crisis.

Protecting the Final Frontier

Ironically, the Chinese ASAT test could boost the prospects for space-based missile defense. If the international community is truly worried about the debris-generating effects of ASAT weapons, then it ought to embrace—indeed demand—the development and deployment of boost-phase missile defenses capable of intercepting missiles carrying ASATs long before they reach their satellite targets. A constellation of orbital interceptors could build upon capabilities developed in a precursor system of rapid-replenishment satellites. Combined with a new emphasis on satellite protection and replenishment capabilities, space-based missile defenses could frustrate any attempts to block the peaceful use of space by America and its allies.

Despite the current U.S. lead in space activities, there are serious causes for concern about America's ability to sustain the quantity and quality of its space activities. Nearly every U.S. space program faces budget overruns and schedule slippages. This is indicative of systemic management concerns, changing requirements, and the complexity of the tasks at hand. Two important indicators—federal R&D dollars spent on space activities and the size of the aerospace workforce and its related academic cohort—are flat or falling, suggesting a perceived lack of priority or faith in the future of these industries and activities. According to the National Science Foundation, federal support for space activities ranged between $7.1 billion and $8.5 billion per year in the 1990s, but fell to between $5.3 billion and $7.1 billion in 2000-2006. This drop ran counter to the overall trend: total federal R&D has jumped from $78 billion to $113 billion since 2000. (All figures are adjusted for inflation.) Meanwhile, the Aerospace Commission, the National Science Board, and many others have voiced concerns about the health of the human capital base of the aerospace industry. The workforce is aging, employment in missiles and space-related fields has dropped precipitously since the end of the Cold War, and the number of U.S. citizens pursuing advanced technical degrees in related fields is outpaced by their foreign colleagues. In a 2005 examination of U.S. space policy, George Abbey and Neal Lane, both of Rice University, concluded, "Over the past few years, the aerospace industry has been unable to develop the experienced workforce that they had dur-

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ing the 1960s due to consolidations and the absence of new programs." In short, there are questions about the innovative capacity of the U.S. to sustain its present advantages. Only leadership, commitment, prioritization, and investment can reverse those trends.

The United States today is in a unique position to take steps to ensure the defense of its interests in space, and to ensure the basic principles of free passage and access for all. Such basic defensive actions are not incompatible with the maintenance of peace and stability; indeed, they are essential to it.

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