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Rumsfeld Aims for the Stars

An Arms Control Alternative to the Pentagon's Plans in Space

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In 1998, the United States Space Command (SPACECOM) released a long-range plan that outlined a new operational concept. "Global Engagement (GE) is the combination of global surveillance of the Earth (see anything, anytime), worldwide missile defense, and the potential ability to apply force from space," the *Space Command Long Range Plan* explained. "At present, the notion of weapons in space is not consistent with national policy. GE provides a plan that will provide alternatives to civilian leaders if a decision is made that this capability is in the national interest."[1]

That decision may be about to happen. Warning of a "Space Pearl Harbor," the *Commission to Assess United States National Security Space Management and Organization*, chaired by Donald Rumsfeld until his nomination as secretary of defense, advocated the acquisition of capabilities for "power projection in, from, and through space." The nominal explanation for this sudden support for expanding the military's role in space is the United States's increasing dependence on satellites. "Space, you're well aware, is increasingly at the center of our national and economic security," argued current chairman of the Joint Chiefs of Staff Richard Myers in 1999. "We have a deliberate, balanced, measured approach in mind to deal with these issues. You'll find it all outlined in [SPACECOM's] long range plan..."[2]

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The SPACECOM approach rests on the questionable premise that space dominance can protect U.S. satellites. Although the United States may be able to deny other countries access to space, defending its own satellites against the unrestrained development of anti-satellite weapons is impossible. Arms control, however, could constrain offensive capabilities, giving satellites a sporting chance. Although the Pentagon believes that anti-satellite programs among potential adversaries are inevitable, China—the Pentagon's usual suspect for a peer competitor—has linked its anti-satellite efforts to U.S. plans to deploy missile defenses. Policymakers now have to decide whether satellites are best protected by technology or arms control.

U.S. Reliance on Satellites.

About 600 operational satellites currently orbit the earth, representing an investment of several hundred billion dollars. The plurality these of satellites belongs to either the U.S. government or U.S. commercial interests. Overall, the Federal Aviation Administration estimates that the commercial space industry contributes more than $61 billion to the U.S. economy each year.

The U.S. military relies heavily on satellites to perform many missions, including communications, navigation, weather monitoring, reconnaissance, and missile guidance. Vice Admiral Herbert Browne, deputy commander in chief of U.S. Space Command, estimates that 60 percent of routine Department of Defense communications are carried on commercial satellites. During Operation Allied Force, nearly 40 percent of U.S. munitions relied on satellite guidance.

In addition to supporting critical military operations, satellites perform strategic missions such as verifying arms control agreements, monitoring troop build-ups, and detecting missile launches. These functions stabilize international crises by providing assurances that neither side is about to launch a surprise attack. Soviet intelligence gaps during the 1983 "war scare" contributed to planning for worst case scenarios in the Kremlin that brought the superpowers much closer to nuclear war than Washington realised for many months.[3]

Since each side tends to assume the worst about the other in the absence of contrary information, the data provided by satellites usually reassures antagonists and reduces pressures to escalate a conflict. The United States shared satellite data with India and Pakistan during a 1991 crisis over Kashmir to demonstrate that neither side was mobilizing for war. Former CIA director Robert Gates later noted that the revelation eased tensions, containing a crisis that otherwise might have spun out of control.

Although satellites provide substantial support to military operations, it is worth noting what activities are not conducted in space. Satellites are not currently capable of attacking targets on the ground or other satellites in space, beyond the sort of traffic accident that could occur in the event of a collision. Moreover, no country currently deploys dedicated "anti-satellite" systems based on earth. The rough distinction in practice is that although space has been used extensively for military purposes, it has largely been spared the presence of weapons.

Satellites Are Increasingly Vulnerable. As satellites have become increasingly important to U.S. economic and military prowess, they have become more attractive targets. The principles of orbital dynamics make satellites easy prey. A satellite travels through a completely transparent environment in a fixed orbit at a constant velocity. A network of amateur satellite-observers already tracks and predicts the locations of even classified U.S. spy satellites using telescopes and high school mathematics, often guessing sensitive details about the satellites based on their behavior in orbit.

The vulnerability of satellites did not escape notice during the Cold War. The Soviet Union tested a "co-orbital" anti-satellite (ASAT) weapon, essentially a satellite that maneuvered next to its target before exploding. The United States tested "direct ascent" weapons that could be fired from the ground or an F-15 fighter aircraft, ascending directly to a point in space to collide with an arriving satellite. Neither system was designed to intercept targets beyond low earth orbit (LEO)—between 500 and 2,000 kilometers above the Earth's surface. Consideration was also given to exotic devices such as "space mines," which would linger in space near a target, and ground-based lasers that could permanently disable an orbiting satellite.

The United States and the Soviet Union sporadically tested these systems until the close of the Cold War sent both programs into hibernation. The test records of both the co-orbital interceptor and the direct ascent system were uninspiring. Although neither side committed large resources to developing ASATs for a variety of political and budgetary reasons, both sides could have developed effective systems. The technical challenges of destroying a satellite are relatively simple—especially compared to the physically similar, but more demanding, task of intercepting ballistic missiles.

The proliferation of ballistic missiles, space launch capabilities, and air-defense missiles may allow new players to enter the ASAT game. In addition to the five permanent members of the UN Security Council, more than a dozen states either have or are developing ballistic missiles. Some of these states also have dedicated space launch capabilities that could be modified to execute a co-orbital intercept or place a space mine. States could even acquire Soviet-era surface-to-air missiles, such as the S-300, that could be modified to directly ascend to the lower reaches of space.

With some investment, potential U.S. adversaries may be able to target satellites as the most vulnerable point in many military systems. To take but one example, Chinese academics have already suggested that building anti-satellite weapons targeted at space-based sensors might defeat U.S. missile defenses, obviating a costly modernization of the country's strategic forces. It is alleged that China is already developing small "parasitic" satellites and lasers that could blind U.S. imaging satellites.

The Rumsfeld Commission. The growing importance and vulnerability of U.S. assets in space led Congress in 1999 to empanel the *Commission to Assess*

United States National Security Space Management and Organization. After concluding that space was "a top national security priority," the Rumsfeld Commission recommended organizational changes in the administration of U.S. national security space policy. Upon his confirmation as secretary of defense, Rumsfeld moved to implement many of these changes, including designating the Air Force as "executive agent" for national security space policy.

In addition to seemingly benign organizational changes, the Rumsfeld Commission recommended that the United States develop the technical capabilities to ensure U.S. access to space while denying that access to U.S. opponents in the event of conflict. "In order to extend its deterrence concepts and defense capabilities to space," the Commission wrote, "the U.S. will require development of new military capabilities for operations to, from, in and through space."[1]

Although the Rumsfeld Commission stopped short of advocating the pursuit of specific weapons systems, several Commission members testified before the Senate Armed Services Committee that they believed the logic of the report dictated the presence of some weapons in orbit. ASATs, for example, would be the principal means to deter attacks on U.S. satellites and, if necessary, destroy an opponent's space capabilities. The Rumsfeld Commission rejected suggestions that these "space dominance" missions would spur potential adversaries to acquire ASATs of their own, asserting that potential adversaries would develop anti-satellite weapons in any case.

The Commission did not consider arms control options that might also mitigate that threat, except to warn against "agreements intended for one purpose that, when added to a larger web of treaties or regulations, may have the unintended consequences of restricting future activities in space." During his testimony, retired U.S. Air Force general Ronald Fogelman drew a sharp distinction between arms control and the solutions supported by the Commission. "We, as a commission, believe very strongly that one of the biggest threats to future space capability may be the unintended consequences of well-intentioned people signing up to certain treaties and restrictions today that in and of themselves seem to be very innocent," Fogelman noted. "And as you go down the road, they could end up tying our hands in ways that would very much limit our ability to continue to be dominant."[1]

Technological Solutions. Executing the vision outlined in the Rumsfeld Commission recommendations requires a range of new capabilities to defend and deter attacks against U.S. satellites. The reality, however, may be less encouraging, for there are good reasons to believe that it will usually be easier to attack satellites than it will be to defend them.

Leaving deterrence aside for the moment, defending satellites against unrestrained development of anti-satellite weapons may be an impossible task. Although an array of passive defenses can be constructed, such as making satellites more robust and maneuverable, the economics and engineering challenges of satellite design and launch, as well as the principles of orbital dynamics, favor the offense in space.

As already noted, satellites begin at a considerable disadvantage because of the properties of their orbits. The predictability enables opponents to perform what the Department of Defense calls "scheduling"—intercepting a satellite at a predetermined time and place.

ASATs enjoy the advantage of specialization. Although satellites designers must balance trade-offs between defenses and the primary mission of the spacecraft, ASAT designers build satellite killers for a single mission. For example, maneuverability of a satellite is dependent merely on the ratio of its engine and fuel to its payload—a ratio that will always favor anti-satellite interceptors that rely on just a few pounds of explosive or buckshot to be effective. Making satellites more maneuverable or robust means adding weight—an expensive proposition at $20,000 per kilogram placed in orbit on an expendable launch vehicle.

The lopsided exchange ratios are magnified by another disadvantage to defense. Since the attacker selects the mode of attack, satellites must be defended against all choices available to the attacker. Many satellite defenses, however, compete with one another. For example, defeating a co-orbital interceptor requires hardening a satellite and adding fuel. This will add size, making the satellite a larger target for direct ascent weapons that are too fast and destructive to be defeated by hardening or maneuverability. Miniaturizing satellites and distributing functions across a network requires that the constellation fly in formation, compromising maneuverability.

The Pentagon could also enhance national satellite production and launch capabilities to quickly "re-constitute" lost satellites. This would require prior acquisition of many spare satellites and a significant enhancement of U.S. space launch capabilities. Even if the United States could reconstitute downed satellite constellations with little delay, the economics of exchanging satellites for a salvo of anti-satellite interceptors does not seem promising.

Faced with the daunting challenge of employing passive defenses, space weapons proponents argue for active defenses—"anti-anti-satellite" weapons, for those keeping score at home. Technological innovations of this sort, without accompanying organizational and doctrinal changes, are rarely decisive.[5] Instead, the types of functions installed in "space guards" are likely to lead to the deployment of large numbers of countermeasures and increased lethality.

Technology alone cannot protect our assets in space.

The prospects for successfully extending U.S. deterrence into space are equally discouraging. The unprecedented dependence on satellites by the U.S. Armed Forces leaves the United States with more to lose from the loss of space assets than its opponents. Moreover, the military satellites orbited by other countries tend to have shorter-life spans, representing a less serious investment. Not only would the Chinese military be willing to trade meager Chinese space assets for U.S. ones, it seems reasonable that they would prefer a situation where neither side had space assets to one where both did. This preference would be more pronounced for countries like Iran—countries with no satellites but plenty of ballistic missiles.

This is not to say that we should forgo defensive measures, but rather that technology alone cannot protect our assets in space. Defensive deployments will need help. As one participant in a conference sponsored by the now-defunct Office of Technology Assessment noted, "If the United States is truly and genuinely that dependent on a few satellites, I'd just like to know what the hell DOD [Department of Defense] plans on doing about it, because in the absence of any ASAT arms control, the problems are only worse."

Arms Control Solutions. If defensive deployments in space cannot keep pace with offensive developments on the ground, then some measure of restraining offensive capabilities needs to be found to even the playing field. The most obvious mechanism for restraint is a ban on the destruction of satellites, supported by bans on the testing and the deployment of space-based weapons and ground-based ASATs. Such an agreement might also include separation requirements or "keep-out zones" to prevent the deployment of space mines, as well as protocols for on-orbit inspections and confidence-building measures.

During the 1980s, several groups, including the Union of Concerned Scientists, prepared similar draft treaties that outlined these basic principles. Currently, the government of the People's Republic of China is circulating a working paper outlining elements of an agreement concerning the "prevention of an arms race in outer space" (PAROS) at the Conference on Disarmament (CD) in Geneva.

Opponents of arms control argue that these treaties cannot be verified because surface-to-air missiles, manned capsules, and even the space shuttle all have some residual anti-satellite capability. Although true in a strict sense, opponents of such a ban seldom differentiate the threat posed by the residual capability of these systems and past ASAT tests from the threat posed by unrestricted development of anti-satellite weapons.

The residual threat posed by existing systems is quite limited. First, the existing ASATs were designed and tested only in low earth orbit. Although many important satellites are located in low earth orbit, many other important systems are safely out of range in medium earth orbit and geo-synchronous orbit. Some systems in low earth orbit might be moved to slightly higher orbits as imaging and electronic intelligence capabilities improve.

The need to clandestinely conduct illicit anti-satellite programs would impose substantial constraints on the functionality of the systems. Adversaries would have little confidence in ASATs that have not been tested, given the abysmal record of Soviet and U.S. ASAT tests. The most basic ASAT systems need to be distributed in multiple locations to attack satellites in different orbital planes—but too many interceptor sites would increase the risk of detection.

The ASATs easiest to develop in secret would also be the most easily defeated by simple defensive measures. For example, if China were to attempt to use its Shenshou space capsule to ram a U.S. satellite, the attack would be constrained by the limited window for launch of a co-orbital intercept and the slow ascent of the capsule. These constraints would give a target ample time to take evasive action.

Although defensive deployments will have difficulty keeping up with unrestrained offensive developments, under the constraints imposed by arms control measures, the United States could deploy sufficient defenses to defeat these sorts of "cheap shots." Moreover, such an agreement would enhance U.S. deterrence in space because the United States would retain the most capable break-out capability of any country.

Ballistic Missile Defenses and Space Weapons. So what's the catch? In this case, the catch in the Chinese PAROS proposal is missile defense. The Chinese draft bans "subsystems that [are] directly and indispensably involved in accomplishing battle missions"—a veiled reference to U.S. missile defense plans. Any arms control agreement on weapons in space will also require some resolution of the question of national missile defense (NMD).

Beijing fears that missile defenses could enable the United States to conduct a disarming first strike—offering Washington substantial leverage in a crisis over Taiwan. "China is facing the risk of pre-emptive nuclear attack," one Chinese government official observed. "Since [China's] nuclear revenge capability is based on the scenario that there are not any nationwide missile defense systems among nuclear states, if the United States deploys NMD, no matter a limited or full-scale one, it will, in effect, render China [sic] second-strike capability impotent."[illegible]

China's strategic posture—a minimum nuclear deterrent designed to sneak just a few missiles through any nuclear attack—is particularly vulnerable to missile defenses. "Without the backdrop of NMD, the Americans would always worry about the Chinese retaliation with a few Chinese nuclear weapons that are missed out in the first U.S. nuclear strike against China," contends Li Bin, director of the Beijing-based Institute of Science and Public Affairs. "The deployment of a [sic] NMD system would provide the American public with an illusion that the several surviving retaliatory Chinese ICBMs would be intercepted by the NMD system [as declared and designed]. If the Americans tended to believe that a first nuclear strike plus a [sic] NMD system would be able to disarm the Chinese nuclear retaliatory capability, the U.S. could become incautious in risking nuclear exchanges with China in a crisis."[illegible] U.S. negotiators in Geneva have dismissed Chinese attempts to raise negotiations on the "prevention of an arms race in outer space" in the CD as cynical and obstructionist. Although U.S. negotiators are particularly unreceptive to Chinese efforts to link NMD and PAROS, the two issues are inherently connected.

First, states that are threatened by U.S. missile defenses view ASATs as a principle means to defeat the system. The Space Based Infrared System (SBIRS) is essential to provide global coverage for NMD, as well as high-resolution discrimination to distinguish decoys. Consequently, "ASAT approaches might also be tempting" to defeat NMD, as one prominent Chinese academic admitted.[illegible]

Second, other countries expect the United States to eventually expand missile defense deployments into space. The U.S. administration clearly states that the current deployment architecture is only preliminary. Although "ground-based NMD is the appropriate way to start," explains Gregory Canavan, a scientist at Los Alamos National Laboratory, "its intrinsic weakness to decoys, nuclear effects, and submunitions could be exploited by sophisticated threats, even in the hands of unsophisticated rogues."[illegible]

From a technical perspective, Canavan concludes, a successful boost-phase missile defense system "implies a mix of basing modes with ground-based interceptors stationed near the known threats and a thin space-based layer." Space-based ballistic missile interceptors would be excellent anti-satellite weapons, as well as obvious targets for potential adversaries.

Finally, the NMD ground-based interceptor will provide the U.S. Army with an effective anti-satellite weapon against adversary space assets in LEO. The NMD exo-atmospheric kill vehicle and the army's kinetic energy anti-satellite weapon are so similar that Boeing's program manager for national missile defense told the Senate Armed Services Committee that ASAT and NMD tests ought to be counted together because "that's the same type of vehicle, same type of intercept velocities."[31] The current missile defense architecture would enable intercepts at altitudes between 200 km and at least 1,100 km—high enough to reach most satellites in low earth orbit.

The inextricable link between NMD and ASATs will force the United States to consider constraints on the deployment of missile defenses if it desires meaningful restrictions on the deployment of weapons in space. An assessment of the advantages and dangers posed by deploying progressively more capable missile defense systems exceeds the scope of this essay. But one may notice that the themes dominating this discussion of the weaponization of space—the choice between relying on technology or treaties, the balance of offense and defense, and so on—also dominate the missile defense debate. In missile defense, as well as space policy, decision-makers have a choice to make between technology and arms control.

Conclusion. The Rumsfeld Commission and SPACECOM represent a distinct approach to defending assets in space with U.S. military might. Nevertheless, given the advantage accorded to the attacker in space, this approach is shortsighted. Arms control can play a critical role in ameliorating the disadvantages suffered by the defense.

The Chinese PAROS proposal in Geneva is a good place to start negotiations. Skeptics will suggest that the Chinese proposal on PAROS is insincere. The possibility exists that the Chinese government is merely seeking to undermine U.S. deterrence in space, obstruct negotiations in Geneva, or indefinitely delay the development of missile defenses.

Opening PAROS negotiations in Geneva, however, will reveal these motivations at little cost to the United States. The CD has been deadlocked for years, while the SBIRS program is behind schedule and plagued with technical problems. The United States has a surfeit of time to discuss "rules of the road" for the military use of space.

The Bush administration has, at least publicly, expressed an interest in calming foreign fears about missile defense and gaining Chinese and Russian acquiescence to U.S. missile defense deployments. Support from Beijing and Moscow may prove vital to gaining the support of some of our allies, such as Denmark, who host early warning radars and ground-relay stations. The Danish foreign minister has already conditioned Danish support for NMD on approval by Russia and China.

The Bush administration will have to discuss PAROS with China to achieve these goals. Washington may be able to entice China to accept a limited NMD that employs space-based sensors in exchange for restrictions on future deployments in space, access to missile defense technology, or shared early-warning information.

Of course, the United States may also fail to forge a consensus in the CD that includes China. But if the United States fails, it will be no worse for the effort. If it succeeds in negotiating an acceptable and verifiable agreement, the United States will enjoy a political solution to the vulnerability of U.S. space assets that is far more secure than the technological solutions advanced by SPACECOM. In a final irony, such an agreement, by enhancing protection of U.S. satellites, would greatly benefit any future missile defense system that relies on space-based sensors.

NOTES

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4 "Report of the Commission to Assess United States National Security, Space Management and Organization", (2001): 17.

5 "U.S. Senator Wayne Allard (R-CO) Holds Hearing On National Security Space Management And Organization," *FDCH Political Transcripts* (28 March 2001): np.

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