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Space and the Joint Fight

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Key Points

- Technology has extended space progressively deeper into warfare, while potential adversaries are working to extend warfare further into space. The former calls for new arrangements to provide tactical space reconnaissance; the latter demands recognizing where and how space is essential to the emerging joint fight.
- The measure of merit for military space is enhanced combat capability. Military space must evolve to the assured provision of uniquely essential space capabilities designed, acquired, and operated to enable combat effects that bring success on the battlefield.
- Planning for tactical space reconnaissance largely reflects the efforts of previous decades to extract warfighting support from systems designed for other purposes and operated by another community. Substantial analytic work is needed to shape effective responses both to foreign threats (soon) and to budget exigencies (sooner).

The world first saw the power of space to transform warfare in the 1991 Gulf War. In the years since, the U.S. military has come to depend heavily on space throughout its peacetime and combat operations. Satellites acquired by the Department of Defense (DOD) principally provide protected communications; data for position and timing, terrestrial and space weather, missile launch warning and tracking, and space situational awareness; and experiments and other research and development activities. Satellites for reconnaissance and surveillance are the domain of the National Reconnaissance Office (NRO), under the Director of National Intelligence (DNI).

Today's capabilities emerged over five decades of changing technologies and threats, factors that are now forcing earlier plans for legacy systems to be reconsidered. Technology has extended space progressively deeper into warfare, while potential adversaries are developing capabilities that could extend warfare into space. The former demands finding new arrangements to provide tactical space reconnaissance; the latter demands seeing more clearly how space is essential to the emerging joint fight. Exploiting the advances in technology calls for new capabilities, authorities, and processes; countering the advances in threats calls for assessing architectures, plans, and options to set priorities for mission assurance.

Mission Assurance

The mission that needs to be assured depends on what is needed for the joint fight, and is not necessarily a space system.[1] Some satellites enable terrestrial capabilities; some are integral components of those capabilities; some may protect those capabilities by denying enemy use of space; some may be important at first contact, while others contribute later. But, in every case, the measure of military merit and the significance of space is the contribution to the joint fight. The importance of space systems, like the importance of fighters, tanks, or submarines, derives from their role in winning the war—what General James P.

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Mullins, USAF (Ret.), called “the only truly meaningful measure of merit, enhanced combat capability.”[2]

This measure establishes priorities for investment and protection. It also corrects the common but misleading demand that we build and maintain a space force “second to none,” or “the best in the world.” What is wanted, more precisely, is a military capability that can assure national interests against any and all attackers. Space can be essential to that capability, and what the space force needs to do is determined by how the U.S. military plans to fight the war, not by what other countries might build and launch. Whether that would also include war in space depends on the military context and how U.S. commanders plan to defeat the plans and capabilities of others.

That said, in practice, military space programs have been planned and acquired somewhat apart from the planning for future combat forces. For varied technical, programmatic, and bureaucratic reasons, they do not fit conveniently into the procedures by which conventional force acquisition plans are adjusted by anticipated resources. At any given time, therefore, there is likely to be only a rough synchronicity between development programs for space and those for other force capabilities. Particularly when reduced budgets bring program cancellations and stretch-outs, there are likely to be some space programs in which there is too much investment, others in which there is too little, and perhaps one or two that may be superfluous relative to the force development programs they are intended to support.

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Deciding which space programs to cut, delay, or accelerate is not simply a matter of mirroring budgetary developments for major weapons programs. Space systems almost never serve a single need or customer, and they have often provided capabilities and met needs that were unanticipated when they were designed and launched.[3] Prudent decisionmakers must consider space not only as a component of existing capabilities but as an integrative enabler of the future joint fight. Cyber and drone technologies today, for example, are defining new military options that may supplant some legacy space functions, create needs for new ones, and compel new operational interfaces.

Because the mission to be assured is a joint fight capability, both mission assurers and potential attackers face the challenge of determining what the loss of a particular satellite would mean in combat. Links between specific space systems and specific combat support functions can be difficult to trace, and so can the terrestrial consequences of losing a satellite. Few satellites are single function, and their military role depends not only on the capabilities of the satellite but on the chain of ground stations, command and control nodes, and data processing and dissemination systems that make the satellite’s capabilities relevant to the warfighter. Those capabilities can also sometimes increase, as when new ground processing techniques create new applications for existing sensors in orbit. Finding reliable alternatives to space can also be difficult; options that were initially expected to serve as substitutes for a space capability can be difficult to test and, in times of stress, may be quickly oversubscribed or prove to depend on other satellite links that are themselves vulnerable.

Synchronicity questions notwithstanding, military space is characterized by what the space systems can do in responding to military requirements to meet military needs under military exigencies in times of peace, crisis, and war. Consequently, the military needs assurance that those space systems providing uniquely essential help to the joint fight will be able to do so as long as needed, despite risks in the environment (collision, bursts of intense radiation), in design and fabrication, and from hostile action. Risk mitigation for environmental and engineering risks seems generally well understood (though problems still arise). Mission assurance is more heavily driven by developments in potential threats of hostile action. The military importance of space to U.S. forces makes space systems part of the enemy's target set. In recent years, potential adversaries have demonstrated antisatellite capabilities, including jamming, laser probing, and direct-ascent kinetic intercepts. Preparations for cyber assaults are certainly underway, and the longstanding possibility of scorched-space nuclear bursts cannot be ruled out.

When mission assurance does call for protecting space-based capabilities, the options today are the same four that were formulated by Amrom Katz almost 50 years ago: make them invulnerable, make them replaceable, make them invisible, or prepare them to shoot back.[4] The "invulnerable" approach can include hardening satellite subsystems and components against thermal and electronic interference and attack, but it also refers to constellations that can remain functionally capable despite the loss of some constituent satellites. Military space architecture could, for example, hedge the risks of satellite failure by deploying constellations of systems that provide redundancy for combat-critical functions. The architecture might be able to make use of satellites operated by other governments and commercial entities in a "virtual armada," involving the use of satellite data from allied and other government systems, preferably going beyond formal requests for copies of imagery to obtaining direct combat support in time of need.[5] Some military sensors might become "hosted payloads" on commercial or foreign government satellites.[6]

The "replaceable" approach pursues the same goal, seeking to reduce the strategic advantage an adversary might gain from attacking specific satellites. The concept includes augmentation and may aim to provide substitutes or surrogates for particular functions, rather than entire satellites. One of the intentions behind the Operationally Responsive Space program (though not part of the program as executed) was to provide options for the rapid launch of militarily essential capabilities to augment, replace, or sustain peacetime systems.

Both of the other two options, "invisibility" and "shootback," are undeniably appealing for special applications and situations.[7] But mission assurance for combat support seems sure to require relatively extensive deployments of satellites in various orbits, which argues against either of these options becoming the preferred approach. Shootback would require deployment of additional capability for space situational awareness and command and control, while invisibility is not a viable option due to considerations of technology, cost, and utility.

In sum, lest dependence become a vulnerability, military space must evolve to the assured provision of uniquely essential space capabilities designed, acquired, and operated to enable combat effects that bring success on the battlefield. To find those requirements, planning for space will have to become closely integrated with force development planning overall, both internally within DOD and across the national security space enterprise.

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Tactical Reconnaissance

New demands for mission assurance are one kind of strong pressure, forcing changes in planning for legacy systems; another pressure for change arises from advances in technology that can bring space-based reconnaissance and surveillance to the foxhole. These advances permit developing a capability that for present purposes can be called tactical reconnaissance—essentially "that kind of reconnaissance performed during combat (during the period of actual hostilities) in support of military activities which are neither those of the cold war nor those of the all-out central thermonuclear war."[8] The great challenge for mission assurance is threat assessment; the great challenges for tactical reconnaissance are organizations and authorities.

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From the very early days, space-based reconnaissance and surveillance have been the purview of the National Reconnaissance Office, which was created to develop, acquire, and operate the Nation's "spy satellites." Conceived as a partnership between the Central Intelligence Agency (CIA) and DOD, the NRO's mission emphasized national intelligence programs—that is, topics of interest and concern to the President (and later, Congress). At the outset, top priority was given to collecting data for strategic intelligence, such as indications and warning of attack, foreign research and development efforts, weapons capabilities, and major force movements, and the technologies available at the time best suited those topics. Though there was hot competition between the CIA part of the NRO ("Program B") and the Air Force part ("Program A"),[9] their struggle concerned alternative management and programmatic options for accomplishing the NRO's mission, not the mission itself. Outside the national reconnaissance arena, the Navy and Air Force pursued space programs providing other military support (principally communications and weather).

By the early 1970s, advances in space reconnaissance technology led DOD to fund adjuncts and modifications that would make the national reconnaissance systems increasingly useful for tactical military operations. *Desert Storm* military operations against Iraq in 1991 made plain the success of those efforts.[10] Commanders quickly demanded more and better support from space, including broader and more frequent coverage, and more responsive command and control. The NRO, together with DOD and the Director of Central Intelligence (DCI), worked hard to address these and other military needs during the mid- to late-1990s, holding innumerable interagency meetings to set and review requirements, including validation by DOD's Joint Requirements Oversight Council. Still, the NRO, charged with meeting requirements established by the national intelligence community and also with providing military support, controlled the acquisition process, making the difficult "factory floor" decisions about sacrificing some promised performance goals to meet schedules and budgets. Those decisions seldom provided all the capability desired by defense interests.

To be sure, national intelligence priorities included support to military operations. Like spies and other intelligence assets, the national reconnaissance systems could and did provide data important to military planners and operators. But they were not themselves military capabilities, and the differences become acute in the tactical arena. An NRO satellite and a military satellite might collect the same data from the same target, but the data would be used by different customers for different purposes.[11] The military, for example, needs systems that can address multiple targets in strategic depth and that are resistant to enemy interference. National intelligence users often can be more patient and more selectively focused, and can depend on secrecy for both access and protection. While the complementarity can be extensive, the timeliness of data collection and the efficiency with which raw data are converted to actionable information are typically more important in military operations, while intelligence systems often need higher resolution. A representative problem for national intelligence users is collecting data that can help assess the plans, capabilities, and economic capacity of potential adversaries. A representative problem for military users is tracking enemy forces and determining fire control solutions. These different needs and priorities lead to different investment decisions, operational procedures, and designs for satellites and constellations.[12]

Even as technology advanced and offered more support for tactical military operations, authority to use that technology moved more under the DCI's control. In 1965, the NRO director reported to a three-person executive committee: the DCI; the President's scientific advisor; and the Secretary of Defense, as chairman. Each of these members could appeal directly to the White House for redress for any particular decision. A decade later, the NRO director reported to a foreign intelligence committee chaired by the DCI. Another 10 years found the DCI overruling the technical decisions of the NRO director about the design of new programs. Moreover, the mid-1990s brought tighter budgetary control by the intelligence community staff, following the "forward funding" exposé triggered by construction of the new headquarters of the NRO.[13]

Tensions between national intelligence and tactical military needs have prompted several high-level reviews over the past 40 years, and each time the result has been what it is today: management rather than resolution, in the hope that "compromise and innovation" will continue to bridge the differences of view and perspectives. In 2001, the congressionally mandated "Rumsfeld Commission" recommended that "a successful approach to the organization and management [of national security space] must . . . [p]rovide methods for resolving the inevitable issues between the defense and intelligence sectors on the priority, funding and control of space programs."[14] Secretary of Defense Donald Rumsfeld's efforts to provide those methods, however, tried to reverse the tides of both technology and authority. Rather than trying to manage these long-recognized differences and trends through compromise and improvisation, Rumsfeld and staff set out to integrate fully the defense and national reconnaissance space programs. This leap into the past went nowhere beyond Pentagon press releases—DOD never fully integrated its own space programs, and the Intelligence Community simply said "no."

The NRO did, however, participate heavily in DOD's successive efforts to design a major new program: a radar satellite that would serve both national and tactical reconnaissance needs. Unable to overcome essential differences in shaping the first "Space-Based Radar" program, the Air Force renamed the effort and tried again with the "Space Radar" program. Both efforts collapsed, unable to find the technology that could integrate the incompatible military and intelligence requirements into a single program. The entire "black-white integration" effort, which sought to fuse the management of the national intelligence space programs under the NRO (the "black") with the military space programs of DOD (the "white"), then collapsed as well. This ironically proved what many supporters of the Space-Based Radar program had said earlier: the program "in fact, could become the poster child of horizontal integration development," that is, of black-white integration.[15] In 2005, a new director of the NRO was appointed, and, for the first time ever, the NRO director was not also appointed to be an Under or Assistant Secretary of the Air Force. Finally, in 2011, a new agreement between the Secretary of Defense and DNI, characterized as an "amicable divorce," further registered and formalized the distance between DOD and Intelligence Community space programs.[16]

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These differences and divisions are thus not "management" problems, and management reforms cannot resolve them. Nor can they be obviated by reciting the solecisms of net-centricity.[17] They are rooted instead in the advance and expansion of space technologies in the service of two communities with core mission needs that diverge sharply. Yes, the national and tactical space reconnaissance systems can collaborate in many areas—national systems, for example, can help provide early information about enemy capabilities and dispositions, target selection, and battle damage assessment, while military space systems can support national reconnaissance and track potential threats (environmental and hostile).

space systems are essential to virtually all military deployments and operations—particularly combat

But what they have not been able to do, and cannot do now, is field a single space system that meets the divergent operational needs of two communities with different core missions. For over 40 years, military leaders complained about having too little influence on the design and operation of the national reconnaissance space architecture. Their complaints were met with important but essentially marginal improvements. Now, after 50 years of national security space, the need is indisputable. Space systems are essential to virtually all military deployments and operations—particularly combat—and the earlier dedication to fielding only unitary programs under NRO control has reached an impasse.

Recognition of these differences and divisions was long resisted with solemn warnings that the Nation could not afford separate space programs for defense and intelligence. Lack of evidence never dinted the popularity of this bromide, but once space had become more fully integrated with military operations, it became clear that the Nation would pay a high price to keep pruning military needs to suit intelligence capabilities. As the Space (Based) Radar effort showed, forced union now could prove barren and impose costs in the most expensive terms: forgone military capability.

For strategic planning, weapons development, overseas basing and deployments, international negotiations, and the like, the space systems serving military needs may be identical to those built for the national reconnaissance program. But what the military needs for combat is different from what the intelligence collector needs. The distinction is similar in some ways to that between a spy and a soldier—the spy's job typically requires remaining undetected and avoiding or escaping from shootouts, while the soldier's job may well require overt identification and the ability to win shootouts.

The realignment of responsibilities envisioned in the 2011 Memorandum of Agreement (DOD Directive 5105.23) might benefit both the spy and the soldier. The agreement does not balance defense and intelligence authorities; the NRO director remains the principal advisor to the Secretary of Defense on space matters, and authority for space matters within DOD remains fractionated and fractious (the primary aspirants may meet in a defense space operations council, which includes the NRO director; the council may make recommendations to the Deputy's Advisory Working Group, which in turn may make recommendations to the Deputy Secretary of Defense). But the new agreement might inspire military planners to develop a variety of space-based systems, stimulating competition in innovation and production and yielding advanced field capabilities enabled by less vulnerable satellites that were produced more efficiently, thereby enriching the space techno-industrial base that supports the national security community overall.

Yet the new arrangements seem unplanned, in these terms, and so could prove counterproductive. There is at present no visible initiative at the national level to ensure that sensible opportunities for cooperation and collaboration are pursued across the national space enterprise, that the consequences of particular decisions for other programs are taken into consideration, that timely action is taken to address emerging threats, and that the space programs collectively constitute a coherent contribution to the overall national security strategy. Parochialism could transform productive competition into useless duplication. Decentralization could encourage individual budget decisions that impose higher costs on the overall enterprise. Distributed authority could delay common action against common threats. Individual priorities could supplant national ones.

Proposals for collective management are probably not far away, if only because their absence presents a vacuum that Congress will naturally move to fill. To be expected are renewed calls for an executive committee similar to that of the 1960s, for joint committees and councils on research and common functional areas, for separate monolithic controls within the defense and intelligence space programs, for a national space council and/or strategy, for a Blue Ribbon review commission, and for special reports to Congress. Still, none of these procedural mechanisms promises a clear path to resolving the complex substantive issues at hand.

Acquiring capabilities to address the differences between national intelligence and military space systems, however, promises to be more than a bit complicated. Some desired attributes have long been evident in the shortcomings of the national systems "apps." Combat forces need to train and exercise with the systems they will need in combat; to share data across units and functional activities, including allies and other coalition partners, from which to draw a user-defined operating picture; and to know when and how well their requests for space support will be satisfied. How can the capabilities of advanced intelligence satellites be protected if the same technologies are providing tactical reconnaissance? In addition, tactical reconnaissance will increasingly have to include space itself, as potential adversaries develop counterspace capabilities. Broadly speaking, the extension of military competition to space will compel extensive development of two new architectures: one to provide intelligence preparation of the space battleground and continuing tactical reconnaissance of it, and another to provide the command and control systems to make use of the improved "space situational awareness."

Here again, as with mission assurance, planning for military space must become far more tightly integrated with other elements of force development, both internally to DOD and across the national security space enterprise.

Forces-based Planning

However the authorities and processes for military space are finally arranged, and while management options are being explored, DOD's space programs will be called on to show their military value to the future joint fight. At present, there seems to be no process within DOD that develops space requirements as part of planning the future joint fight, incorporates space as an integral part of development planning for combat forces, determines the space capabilities U.S. military forces would need to create the effects they would want to achieve, and reflects integrated plans for tactical operations, intelligence, technology, and space systems. Such a process would assess how space systems might address problems and deficiencies in the joint fight, or how planned systems might be made more effective through new applications or integration of space data, or the cross-domain trades among new systems and technologies that might reduce dependence on space.

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To start determining operational requirements, one might look back to the time between the World Wars, a period defined by rapid change in military technologies when the basis for operational requirements could not be distilled from experience of a major war. During those years, U.S. forces conducted several experiments to determine doctrine, organizations, and force structure, including the Navy's fleet experiments (how to use aircraft carriers), Mitchell's ship bombing, and the Army's Louisiana Maneuvers (mobility, how to use tanks). A series of experiments[18] or demonstrations or explorations might be undertaken today to help planners better understand several important operational issues. It seems reasonable, for example, to expect that different types of sensors would be important at different phases of conflict (zero through five, as well as subdivisions of each).[19] Presumably the need for and approach to mission assurance, including satellite protection, will change similarly. Perhaps, too, different approaches to command and control of the platform, the payload, data processing, and information dissemination might be better suited to different conflict phases and different space missions. Different sensor technologies, together with the nature of the mission, might affect the relative desirability of "direct downlink"—delivering sensor data directly to the warfighter—or of downlinking data to a central facility for processing and filtering before it is sent on to the warfighter. Experiments could also be used to check whether there might be some elasticity in initial data requirements (resolution, area coverage, frequency of revisit, and the like).

space systems enabled a revolution in American military affairs; the military now needs a revolution in military space planning

Another approach to determining some requirements is participation in combat "lessons learned" activities, and this approach could be used right away. The Center for Army Lessons Learned at Fort Leavenworth, for example, studies cases in which circumstances went badly for ground forces in Iraq and Afghanistan, with a view to recommending changes in tactics, techniques, and procedures (and sometimes more). Including space sensor and systems design engineers in this work might suggest different ways to get better combat outcomes by using different space systems, or different applications of current ones.[20] The intent here is not to evaluate the current activities but instead to involve space experts with specialists in tactical terrestrial operations.

Leadership for these activities seems best suited to U.S. Strategic Command. As the supporting command for regional wars being fought by geographic combatant commanders, it is well positioned to ensure a "joint fight first" approach to determining future space requirements. As the supported warfighting command for space and cyber, it already confronts the challenges of determining what cyberwar and space warfare might require, and how the powerful integration of space and cyber capabilities should be shaped.

In addition, organizational devolution and the increased specialization of space applications will require some mechanism in the national framework to foster collaborative as well as cooperative independent initiatives. At present there is no mechanism to integrate the planning and investment in satellite reconnaissance between the intelligence and defense communities across the national security enterprise. Moving toward an organizational resolution should probably wait until processes and programs for military space are further developed. But a manageable option to start now would be a national-level advisory board that has no formal authority but that has considerable influence and that reports to the Oval Office—a "President's Foreign Intelligence Advisory Board" for space. This group would examine space issues on its own initiative, perhaps to see whether important opportunities were being missed, and could also respond to government agencies' requests for help with difficult technical or bureaucratic issues.[21]

Conclusion

Space systems enabled a revolution in American military affairs; the military now needs a revolution in military space planning. What should a warfighting space architecture involve? Do military demands on space systems change in different phases of conflict? What functions must be maintained in wartime, and are they specific to particular satellites? If so, should the approach be to protect those satellites or to augment or replace them with new launches or with orbiting "silent spares"? What is the architecture that can ensure that data collected separately from intelligence and defense platforms will be shared to meet both intelligence and military needs? Furthermore, how can the coordination of availability and tasking be similarly ensured across both intelligence and defense platforms and needs? What steps should be taken first, and what resources will be needed?

For combat, the military space architecture needs to function in "real time" as part of a kill chain as well as to support intelligence preparation of the battlefield. It needs redundancy and resiliency to assure critical mission capabilities despite mishap or hostile action. It needs to be used in training, exercises, and coalition activities. Its design must therefore be rooted in the operations and development planning of the fighting forces, and it likely will require different satellites and architectures, an acquisition system that is responsive to the strategy, and new relationships among service, departmental, and national organizations. Achieving this will require developing methods to evaluate alternatives (for example, supplemental satellites vs. national reconnaissance components vs. remotely piloted aircraft vs. piloted aircraft) in terms of overall combat effectiveness. Making a military space architecture work effectively will require procedures and standards to ensure cooperative interfaces between military and other national security space systems and activities.

The military perspective, however, is still seriously underdeveloped. Mission assurance has been a constant concern, beginning with the earliest Corona launches. But deciding how to protect which assets against which threats has become highly complex because of the variety of potential threats today, the enormous challenge to earlier thinking presented by cyber warfare, the difficulty of tracing satellite functions to combat capabilities, and the perceived plethora of work-arounds and alternatives to space support. Tactical reconnaissance is similarly unformed: space programs for military reconnaissance and surveillance have largely entailed efforts to extract warfighting support from systems designed for other purposes and operated by another community, and so to date they have been ancillary to force development plans and programs, even where the space contribution was important.

Three years ago the commander of Air Force Space Command called on the defense and intelligence space communities to shift from the "one size fits all" approach—"to shift from a suboptimized 'satellite, reconnaissance, intelligence, and warfighting, one each' approach—to a new architecture that accommodates the needs of both, with platforms that are purpose-designed for specific war fighter or national intelligence needs, and, in my view, that makes individual satellites more affordable and easier to produce."[22]

Answering this call is even more urgent today as national leaders look for ways to reduce budgets without sacrificing near-term military strength. Budget cutters can find space programs to be irresistibly attractive targets. Terminating or delaying these programs offers disproportionately large near-term savings compared with other major programs because so much of their lifecycle cost occurs during initial acquisition. Doing so is also appealing because it may have little or no effect on near-term military capabilities; acquisition of major new satellites can take years. Meanwhile, most legacy systems in orbit continue operating well beyond their expected design lives.

What makes space systems most vulnerable to budget sacrifice, however, is analytic vacuity—a continuing inability to explain military space in terms of enhancements to joint fight performance. Yes, the military space capability envisioned in this paper will require DOD to do more for mission assurance and tactical reconnaissance. Whether it will cost more than continuation of the legacy programs will depend on the results of future detailed assessments of space and the joint fight. But the first step is analysis, not procurement, and it is needed now. A continuing inability to explain military space in terms of enhancements to joint fight performance can only dim the prospects for military space systems and for making future combat forces as strong as they should be.

Notes

[1] The National Space Policy 2010 issued by the White House embodied this approach to mission assurance, emphasizing the maintenance of mission-essential functions. See "National Space Policy of the United States of America," The White House, June 28, 2010, 9. The Defense Department and Intelligence Community's subsequent National Security Space Strategy (unclassified summary, January 2011) does not, however, and simply treats all space capabilities as equally important.

[2] James P. Mullins, *The Defense Matrix: National Preparedness and the Military-Industrial Complex* (San Diego, CA: Avant Books, 1986), 93.

[3] E.C. "Pete" Aldridge, while Under Secretary of the Air Force and Director of the National Reconnaissance Office, frequently responded to allegations that spy satellites were "gold plated" with the fact that "we have never flown capability that was not needed."

[4] Amrom H. Katz, "Preliminary Thoughts on Crises: More Questions Than Answers," mimeo., March 1972, 7.

[5] Beyond technical compatibility and operational familiarity, work on problems of legal, institutional, and domestic political relations at home and abroad would be needed at the outset.

[6] Indeed, government "departments and agencies" are directed to "work jointly to acquire space launch services and hosted payloads arrangements that are reliable, responsive to United States Government needs, and cost-effective" ("National Space Policy," 5). Geosynchronous commercial communications satellites might be useful as platforms for situational awareness, selected communications, research and development testing, or other purposes, depending on corporate business plans and fears of extortion. Better understanding of liability, technical compatibility, security, and related issues is needed. The Defense Department moved ahead with hosted payloads soon after the space policy was released (Turner Brinton, "U.S. Military Wants to Streamline Hosted Payload Process," *Space News*, September 24, 2010) and issued a solicitation for "Commercial Flight of DoD Space Test Program (STP) Hosted Payloads (HPs)," Solicitation Number BAA-SMC-SD-011, on November 23, 2011. Meanwhile, the Air Force completed work on the CHIRP (Commercially Hosted InfraRed Payload) and launched it in September 2011 (see, for example, "SES-2 satellite with USAF hosted CHIRP completes testing," December 22, 2011, available at <www.airforce-technology.com/news/newsses-2-satellite-with-usaf-hosted-chirp-completes-testing>). The continued interest in military hosted payloads was emphasized in the keynote address to the hosted payload summit delivered by Deputy Assistant Secretary Greg Schulte on October 4, 2011 ("Hosted payloads are one of the ways to assure space capabilities . . . [and] are one way the U.S. government might address impending budget constraints." Other agencies, of course, are pursuing these options as well; see, for example, "Hosted Payloads," in the *Space Commerce* publication of the National Oceanographic and Atmospheric Administration, Department of Commerce, available at <www.space.commerce.gov/general/commercialpurchase/hostedpayloads.shtml>.

[7] Even then, they can do virtually nothing against a total space negation attack. The United States has far more to lose than any other country if space becomes unusable; satellites and their products have become central to civil, scientific, and commercial activities, while providing critical force multipliers for military operations. A "scorched space" attack, not so unthinkable after the attacks of 9/11, would hurt the United States more than any other country.

[8] Amrom H. Katz, "Some Ramblings and Musings on Tactical Reconnaissance," (Santa Monica, CA: RAND, March 1963), 1. As Katz went on: "If anyone wants to argue with this definition, let him write his own paper." The distinction between reconnaissance and surveillance is without effect on the subject of the present paper, and so references to space-based reconnaissance or tactical reconnaissance are intended to include surveillance functions as well. The distinctions are presented clearly in the Air University space handbook; see Brian Crothers et al., "U.S. Space-Based Intelligence, Surveillance, and Reconnaissance," chapter 13 of the *AU–18 Space Primer* 2d ed. (Maxwell Air Force Base, AL: Air University Press, 2009), available at <http://space.au.af.mil/au-18-2009/au-18_chap13.pdf>.

[9] Robert Perry, *Management of the National Reconnaissance Program*, 1960–1965 (Chantilly, VA: National Reconnaissance Office History Office, Second Printing, 2001).

[10] See remarks by then–Lt. Gen. Thomas S. Moorman, Jr., quoted in "The JDW Interview: Lt. Gen. Thomas S. Moorman, Jr.," *Jane's Defense Weekly*, February 9, 1991, 200. See also Robert L. Butterworth, "Space Systems and the Military Geography of Future Regional Conflicts," Report No. 14 (Center for National Security Studies, Los Alamos National Laboratory, January 1992).

[11] The GRAB and Poppy programs, while perhaps appearing initially to be exceptions, illustrate the point. For example, "Intelligence derived from the GRAB and Poppy systems supported a wide range of applications during the Cold War. It provided clues to locations and capabilities of Soviet radar sites, characteristics and locations of Soviet air defense equipment, ocean surveillance information for Navy commanders, and a more complete picture of the actual Soviet military threat." Crothers et al., "U.S. Space-Based Intelligence, Surveillance, and Reconnaissance," 175. Also see Dwayne A. Day, "A flower in the polar sky: the POPPY signals intelligence satellite and ocean surveillance," *The Space Review*, April 28, 2008, available at <www.thespacereview.com/article/1115/1>.

[12] "The important factor to recognize in this relationship [between strategic and tactical surveillance and reconnaissance operations] is that the function being supported determines if it is strategic or tactical, not the command that performs the mission or trains the crews. Neither is it the department nor agency that funds the platform." And later: "While the Air Force is satisfying the surveillance and reconnaissance needs of the Army, it must also do the same for its own forces and possibly for the National Command Authorities and strategic planners. Some of the information will be of use to all organizations, but it is a mistake to believe there is a high degree of overlap. The fine detail required for targeting weapons is unnecessary for strategic planning. The technical information required to satisfy a research and development question may go far beyond the needs of a combat soldier or airman who only needs to know what is where, when, and how many." See George E. Daniels, "An Approach to Reconnaissance Doctrine," *Air University Review* (March–April 1982), available at <www.airpower.au.af.mil/airchronicles/aureview_toc/AUReview1982/AUReview1982Mar-Apr.htm>.

[13] A former deputy director of the National Reconnaissance Office (NRO) summarized the event this way: "In 1995 the NRO had a funding crisis. The NRO was found to have accumulated $3.8 billion in forward funding (i.e., unused margin) across all NRO programs. The timing could not have been worse. The U.S. was involved militarily in Bosnia during a period of declining defense budgets. The discovery that a government agency had amassed $3.8 billion was greeted in Congress with both outrage and a sense of relief. There was outrage that the funds had been accumulated, but there was a sense of relief these newly identified funds could be reallocated to solve a funding gap related to ongoing military operations in Bosnia. At the same time, Director of Central Intelligence (DCI), John Deutch, publicly fired the incumbent NRO Director and Deputy Director

(DNRO and DDNRO), and installed Keith Hall as the New DNRO with a mandate to get the NRO back on firm financial footing;" Dennis Fitzgerald, "Commentary on: Kohler's 'Recapturing What Made the NRO Great—Updated Observations on "The Decline of the NRO,"'" *National Reconnaissance: Journal of the Discipline and Practice* (2005), 59.

[14] Report of the Commission to Assess United States Space Security Management and Organization ("Rumsfeld Commission"), January 11, 2001, 79.

[15] "[Space-based radar], in fact, could become the poster child of horizontal integration development. The Air Force is grinding away on a concept of operations for space radar, and officials say they will get it right, with major implications for combat operations. 'The same radar wave front that is collected for intelligence information can be vitally important to the warfighter,' said [Under Secretary of the Air Force and Director of National Reconnaissance Office] Peter B. Teets." Robert S. Dudney and Peter Grier, "New Orbit for American Space Power," *Air Force Magazine*, February 2004, 43–44.

[16] Amy Butler, "USAF Eyes 'Disaggregation' for Future Sats," *Aviation Week and Space Technology*, April 25, 2011. The formal document is DOD Directive 5105.23, signed on June 28, 2011, by Secretary of Defense Robert M. Gates.

[17] As argued by, for example, then–Brigadier General Katherine E. Roberts, "Reflections on the Integration of Black and White Space," *High Frontier* 4, no. 4 (August 2008), 17–19.

[18] "If there is only one outcome, or if there are multiple outcomes but they are indistinguishable, the event is a demonstration, not an experiment. If the meaning of the outcome is determined only after the experiment is over, then it is an exploration, not an experiment." Brian McCue, "Wotan's Workshop: Military Experiments Before the Second World War," Occasional Paper, (Alexandria, VA: Center for Naval Analyses, October 2002), 4–5. Of similar interest is McCue, "The Practice of Military Experimentation" (Alexandria, VA: Center for Naval Analyses, February 2003), 5. An exercise is different still, and would be used for example to test the effectiveness or readiness of an operational force.

[19] The current lexicon includes six phases of conflict: shape, deter, seize initiative, dominate, stabilize, and enable civil authority. See Chapter III, Part C, of Joint Publication 5–0, *Joint Operation Planning*, August 11, 2011.

[20] One well-known example of improving space support is the Air Force initiative to mitigate the "sky-challenged" terrain in Afghanistan by providing quick access to more accurate GPS data, which significantly improved accuracy for the Small Diameter Bomb. See the account of Talon Namath by Brig. Gen. Jay Raymond, available at <www.marshall.org/pdf/materials/763.pdf>.

[21] This board of outside luminaries would be quite different from the Overhead Reconnaissance Advisory Group mentioned in the recent defense/intelligence memorandum, though the two certainly need not be incompatible. The Group as of mid-November had not yet held its first meeting.

[22] General C. Robert Kehler, commander, Air Force Space Command, notes for keynote address to GEOINT 2008 Symposium in Nashville, Tennessee, October 30, 2008. The gist of Kehler's remarks was reported in Colin Clark, "Intel, AF Sats Must Go Separate Ways—Kehler," *DoD Buzz*, available at <www.dodbuzz.com/2008/11/16/intel-af-sats-must-go-separate-ways-kehler/>.

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