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Introduction

Ambassador Roger G. Harrison

Editor-in-Chief

All of the articles submitted for this edition of our journal deal, in one way or another, with an essential change in the relative position of the United States in space, or – to put the matter rather more bluntly – the decline of U.S. space power and what to do about it. I should add quickly that the decline is relative, and the base against which it's measured is arbitrary. What is treated as a base was in fact a high point. It came in the 1990s, when the former Soviet space program was in disarray, the Europeans had not yet found their competitive edge and the prospect of China as a power space player was, at best, on the horizon, no bigger than a man's hand. The U.S. was, for that decade, the unchallenged "shepherd of space" to use Everett Dolman's evocative imagery. It was possible to imagine the world accepting the United States as a benevolent hegemon, setting rules to benefit all while remaining (as hegemonic powers generally do) somewhere outside the rules ourselves. At least this vision of "space control" was possible for U.S. observers to conjure. The rest of the world was simply annoyed.

It isn't necessarily "declinism" to point out that the vision has faded. In space, as in golf, it isn't possible to win by preventing the other guy from doing better, and the circumstances that led to U.S. domination in the 1990's began to change as the century turned. By then, the Russian Federation had regained its balanced, and reminded us that it was a near peer competitor with technology in some areas – notably rocket motors – that was still the best in the world. The European Arianne launcher had proven both reliable and scalable, and by 2000, Europe was a legitimate competitor, too. Commercial companies increased their share of space activity, and became supra-national, moving offshore to places like the Bahamas and Luxemburg. And here came China with both commercial programs and offensive ASAT programs that brought into serious question the central proposition of "space control" ideology, i.e. that the U.S. could control "access to space" and therefore space itself. That seems to have become a hollow – albeit in some circles still hallowed – claim.

The Obama space policy and strategy are meant to deal with this new reality, and with the sobering prospect of budget shortfalls as far as the eye can see. Operating in space sucks resources at a frightening rate, a bad quality to have when the overall pie is shrinking. All of our authors seem to accept this new reality. They focus on its implications, which might be summed up in two thoughts: in the future, the United States will need to collaborate with other nations in space, and get more out of every dollar spent. The era of autarky is over.

What should we do now? That is the subject all our authors address, and I shall leave them to speak for themselves. But there is one omission – not just from these articles, but from the national dialogue on security space in general – that I must point out. In all the discussion of vaguely defined rules of the road, and norms, voluntary codes of conduct and "transparency and confidence building measures" there is a tendency to forget that space is subject to binding international law in

the form of the Outer Space Treaty of 1967. That treaty speaks to issues that are no longer relevant: no one planned even in 1967 to station nuclear missiles on the moon. But also has pertinent things to say about consultation, and interference with the satellite operations of other states. It was meant to begin a process which – had it been taken seriously – might have allowed the evolution over time of a legal structure for space to deal with the problems of crowding and debris that we face now. It might even have been a framework for the discussion of curbing an arms race in space. None of this potential was realized, largely because both the Soviet Union and the United States preferred freedom of action to any legally binding regime in space. The Treaty was signed, ratified, and then largely ignored.

I pointed this out recently to a room full of government space analysts, listing the sorts of things the OST addresses, sometimes in specific terms. Someone commented: "We could never get that sort of thing now." Perhaps not. Luckily, we already have that sort of thing. It may be time to burrow in the archives, dust off the OST and ask ourselves whether its relevant to the concerns we now have in space – and if not, how it can be improved.

RGH

Coalitions in Space:
Where Networks are Power

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Abstract: *This study begins with the widely recognized problem of 21st century space vulnerabilities. To address this challenge, it proposes the new concept of an "allied space network" as a possible means of both reducing risks and enhancing space power. Such a concept would move beyond realist, Cold War "balancing" in space, and instead would require new forms of technical and political cooperation in the military sector among participating states. In thinking about future space security this study argues that trans-national networks and alliances offer considerable untapped potential, with possibly significant benefits particularly for the United States, which—unlike China and Russia—already has established military alliances with a number of countries possessing or now developing advanced space capabilities.*

The challenge of achieving security in space has traditionally been viewed as purely a *national* security matter. Until 1991, space activity was dominated by the hostile U.S.-Soviet rivalry, which prevented active security cooperation in space beyond a series of restraint-based agreements. Other space actors remained too weak to matter. In terms of space operations, the two superpowers kept apart from one another except for occasional, publicity-serving civilian missions like the 1975 Apollo-Soyuz flight. What passed for cooperative space security arrangements during the Cold War emerged from a somewhat uncomfortable mutual tolerance of highly independent (and classified) U.S. and Soviet reconnaissance satellites and a series of largely bilateral (and a few multilateral) treaties that banned certain extremely harmful activities. Fortunately, thanks to these limited mechanisms and policies of self-restraint, the Cold War in space ended without any direct attacks on either side's satellites or other spacecraft.

Yet, since the end of the Cold War, there has been very little further progress made toward strengthening international space security mechanisms, while there has been a spread of space technology and an expansion in the number of actors capable of doing harm in space. China broke an informal 22-year moratorium against kinetic-kill anti-satellite tests in January 2007 by destroying its own *Fen-Yung 1C* weather satellite at 525 miles up, creating more than 3,000 pieces of hazardous debris. In response, India has vowed to develop an anti-satellite capability. In the face of the 2002 U.S. decision to withdraw from the Anti-Ballistic Missile (ABM) Treaty and the Navy's February 2008 destruction of an ailing satellite with a full tank of hydrazine (*U.S. 193*)—although at low altitude and with no long-lasting debris—Russia stated that it would respond to any future U.S. action to weaponize space with its own program. Among new actors, Iran successfully orbited a satellite in 2009, and North Korea has made two attempts to do so, raising concerns about these actors' intentions in space. Recent events have also stimulated interest in space among other national militaries, some of whom now speak of new "threats" to their space assets. In this context,

action-reaction space arming is a widely feared trajectory. These dynamics pose a serious risk, particularly because there are a number of significant loopholes in the loose network of existing Cold War space security treaties and conventions, which currently allow a variety of space weapons to be tested and deployed in compliance with international law. Moreover, the space environment lacks adequate verification mechanisms—such as pre-launch inspections, on-orbit spacecraft monitoring, and comprehensive space situational awareness—and is characterized by an increasing number of actors.

In the face of this worrisome trend, one influential school of thought among U.S. space analysts sees strengthened *national* military measures—including ground-to-space weapons, air-to-space systems, and space-based weapons—as the most desirable path for addressing this emerging space security dilemma. Such perspectives prevailed among the senior ranks of Defense and State Department officials during the George W. Bush Administration and remain popular among conservative analysts. This perspective warns of the risk of what the 2001 Rumsfeld Commission report called a "space Pearl Harbor," unless the United States deploys a range of defensive and offensive space weapons,[1] even though many of these analysts recognize that such deployments might stimulate the same behavior among foreign space programs. But they see few alternatives.

A second school of thought argues that strengthened norms, rules, and international treaties are the best means of achieving space security and preventing a looming space arms race. This school is found mostly among non-governmental organizations, the arms control community, and some members of the Obama Administration, who have argued that the risks to space security are inherently international and that the main problem lies in the lack of clear "rules" for space. They point out that the use of space for weapons purposes will impinge on other actors as well, particularly if the attacking country creates orbital space debris that then becomes a risk to other space assets. For this reason, the Obama Administration made significant changes in the U.S. National Space Policy released in June 2010,[2] which now—in contrast to the Bush Administration's policy—*supports* U.S. consideration of new, verifiable international agreements to improve space security.

Almost two years into the Obama Administration, however, progress on the international front has been elusive. Despite more accommodative policies undertaken since 2009 by both the United States and China at the U.N. Conference on Disarmament in Geneva, there have been no formal international talks on space security, thanks to Pakistan's opposition to forming an agenda that includes a Fissile Material Cut-Off Treaty. This has prolonged a gap in such discussions that has lasted since the early 1990s. In this context, treaty loopholes have festered since the end of the Cold War, while space technology has become more sophisticated and more dispersed during the same years. As a bipartisan U.S. study on security in the

"Space is in serious need of stronger international regimes."

[1] U.S. House Armed Services Committee, "Report of the Commission to Assess United States National Security Space Management and Organization," January 11, 2001, available online from the Air University's National Space Studies Center website, at: http://space.au.af.mil/space_commission/ (accessed August 27, 2010).

[2] The White House, "National Space Policy of the United States of America," June 28, 2010, available on the White House Office Science and Technology Policy website, at: http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf (accessed August 27, 2010).

"global commons" issued in January 2010 concludes, "Space is in serious need of stronger international regimes."[3] Unfortunately, such agreements do not currently appear to be on the horizon, except for a voluntary European-sponsored Code of Conduct proposal. These trends foster uncertainty in regards to space and a tendency among national militaries to look to traditional, weapons-based solutions, whose testing, debris generation, and hair-trigger alert systems may put spacecraft at *greater* risk than even during the Cold War. For these reasons, alternative approaches to reducing space vulnerability are needed—and soon.

Notably, one option that has not been examined seriously enough in the current space debate is a possible middle-ground alternative for reducing spacecraft vulnerability: that of creating an allied space "network." Specifically, linking space capabilities first among formal U.S. military allies and then perhaps with other friendly nations could greatly reduce (if not eliminate) the risks of single-point failures to important space systems and create a new form of space deterrence by raising the stakes for adversaries considering launching attacks on space assets. That is, by spreading capabilities among allies in space through the creation of interoperable, redundant networks of satellites, including in the military sector, space-based partnerships could reduce costs, lessen vulnerability, and raise the challenges facing would-be attackers, thus obviating the need for expensive and destabilizing space-based weapons. This could provide considerable benefits in terms of U.S. and allied space security and improve chances for developing norms of peaceful international behavior.

"Linking space capabilities first among formal U.S. military allies … could greatly reduce the risks of single point failures…

Yet despite these possible advantages of "allied" space thinking, no conceptual framework had been developed to date, and policy support has only very recently emerged in the 2010 National Space Policy and the 2011 National Security Space Strategy. Operational cooperation is still very rudimentary, where it exists at all. Indeed, as the former head of U.S. space operations in Afghanistan complained regarding the *lack* of integration of allied orbital assets, "U.S. space operators are not trained in how to be integrated into a coalition environment."[4] The reason stems from more than five decades of viewing space almost exclusively from a *national* security perspective, rather than an international security or coalition framework. This article argues, however, that changing conditions in space are making the traditional approach out-dated and increasingly ineffective. Instead, an allied approach to space may represent the best short-term route to enhanced U.S. and allied space security, while potentially offering benefits to the global community of space users as well through its promotion of restraint-based norms.

In order to address these issues, this article first analyzes the nature of space vulnerabilities and offers a

[3] Abraham M. Denmark and James Mulvenon, eds., "Contested Commons: The Future of American Power in a Multipolar World," Center for a New American Security, Washington, D.C., January 2010, p. 33.

[4] USAF Lt. Col. Tom Single, quoted in Peter B. de Selding, "U.S. Officer: Secrecy Among Coalition Forces Hinders Use of Space Assets in Afghanistan," *Space News*, May 10, 2010, p. A1.

reconceptualization of the current security dilemma facing nations in space. It next considers the specific emerging threats to 21st century space security and discusses a possible framework for moving from national to multilateral means of combating them. In doing so, it notes certain obstacles to be overcome as well. Finally, the article sketches out in draft form what specific capabilities might be desirable and what foreign contributions the United States might enlist in creating an allied space network to increase the mutual security of its members.

Reconceptualizing Space Security

The issue of spacecraft vulnerability relates to certain basic facts of orbital physics combined with the relative transparency of space to radar, optical, and infrared observation.[5] These conditions make spacecraft liable to tracking even by amateur astronomers with only moderately sophisticated equipment, which is easily obtainable by any entry-level space power. While more complex guidance technology is required for actual attacks on space assets and a global network of radars is needed for conducting post-attack assessments of damage done, the ability of even moderately advanced space powers to conduct significant counterspace activities is not in question. Thus far, only Russia, the United States, and China have tested kinetic capabilities, but a number of other countries (including Iran) have carried out lesser forms of electronic interference. As a major space assessment conducted by NATO's Joint Air Power Competence Centre in 2009 reported on some of the current vulnerabilities faced by the alliance in space:

> There are real and credible threats to Space systems. The ground systems are vulnerable to attack. There has been demonstrated use of GPS and SATCOM jammers. Anti-satellite (ASAT) weapons have been demonstrated by the Soviet Union…and in January of 2007, China demonstrated its capability […]. The potential exists for ground-based laser weapons, electro-magnetic pulse, and co-orbital ASAT weapons. Additionally, there are risks of collision from Space debris and impacts from solar events. There have been many instances of satellite telecommunications interference and piracy.[6]

Space assets are also threatened by a field of orbital space debris that is steadily growing due to the increase in human space activity and the inability of space to "clean" itself quickly. Depending on the altitude of the orbit, it can take years, decades, or centuries for pieces of space debris to deorbit. In the meantime, these particles (even as small as 1 centimeter) represent 18,000 miles-per-hour speeding bullets, which can destroy solar cells and cause often fatal damage to any spacecraft that are unfortunate enough to cross their paths.[7] Today's space environment is also characterized by an expansion in the number of civil, commercial, and military space actors, making international agreements more difficult than in the past.

In the face of these risks and evidence of both expanding military space programs and weapons test programs in several countries, the response by many U.S. military leaders, elected officials, and even experts is still a traditional call for exclusively national action to "defend" U.S. assets in space. To take just

[5] On these issues, see David Wright, Laura Grego, and Lisbeth Gronlund, *The Physics of Space Security: A Reference Manual* (Cambridge, MA: American Academy of Arts and Sciences, 2005).

[6] Ibid., p. 8.

[7] National Research Council, *Orbital Debris: A Technical Assessment* (Washington, DC: National Academy Press, 1995), p. 12.

one U.S. example, Senator Jon Kyl (Rep., Arizona) stated after the 2007 Chinese ASAT test that the United States must deploy a fleet of space-based weapons to defend itself in space.[8] He made no mention of the threat China posed to other allied nations or their possible contributions to the U.S. response.

Historical conditions of anarchy in the international system have contributed to a tendency among leaders to conceive mainly of *national* responses to international threats. States are already organized for national defense, countries are jealous of spending scarce resources in potentially risky ventures with foreigners (even allies), and there are relatively low levels of trust regarding the reliability of international organizations. But three factors have altered global dynamics in the last few decades, each of which has an important space component that supports the creation of an allied approach to space.

First, the scale of multinational interactions to deal with shared problems is increasing due to the growing "finiteness" of the globe, as the world's population continues to expand and as communications technologies become more intrusive and more widespread. Indeed, the very nature of the problems countries are facing is changing as the Earth becomes "smaller": almost all free land and airspace (up to 100 kilometers) have been claimed by nations (or otherwise allotted by international law), the sheer scale of industrial pollutants is beginning to have global effects, and such resources as clean air and water are becoming increasingly scarce. Other problems, such as climate change, are becoming recognized as requiring an international response. Despite its comparative vastness, near-Earth space faces some of the same risks of growing human activity, particularly due to the finiteness of its main, usable resources (geostationary orbital slots, radio frequencies available for broadcasting, and safe access to low-Earth orbit). All of these resources are becoming stressed by increasing human space activity.

Second, economic globalization is an increasing fact of life. Unlike during the Cold War, when the world was dominated by two, nearly self-sufficient blocs, changes in the international economic system (due to both political and technological factors) have made commercial exchange possible across almost all political boundaries, vastly increasing global trade. Interdependent economic relationships are the rule in U.S. ties with our NATO and Asian allies and even, in some areas, with commercial partners like Russia and China. Similar to many industries, the commercial space industry has become truly international and now generates $161-billion in sales,[9] making it a valuable resource for both national governments and the global economy more generally. Technologies built in one country are frequently owned and marketed by another and are sold to clients in yet another. Strong corporate alliances have already been formed in the space industry, for example, linking Russian rocket motors with U.S. launch vehicles (International Launch Services) and U.S. sub-orbital flight technology with British funding and marketing (Virgin Galactic). With some offshore corporations like Intelsat, it is often difficult to tell which individual country a space enterprise actually "belongs" to. National militaries are also purchasing bandwidth on a large number of commercial satellites, causing the breadth of a country's "critical assets" to expand. Some of these assets are already shared with other nations,

[8] "China's ASAT Test and American National Security," remarks by Senator Kyl at the Heritage Foundation, January 29, 2007, posted on the Globalsecurity.org website, http://www.globalsecurity.org/space/library/news/2007/space-070129-kyl01.htm (accessed February 1, 2010).

[9] News Briefs, "Satellite Industry Revenues Topped $160B Globally in '09," *Space News*, June 14, 2010, p. 8.

although not in a joint operational sense. Yet devoted military space cooperation between countries remains highly restricted, a characteristic that is out of step with these integrationist trends.

Third, in military affairs, questions of international legitimacy are placing a growing emphasis on the need to conduct operations via coalitions. Put simply, the unilateral use of force is seen as increasingly unacceptable within the international community. Largely for this reason, the United States fought under a U.N. mandate in 1991 in the Gulf War against Iraq's intervention into Kuwait and in Libya in 2011; it fought under a NATO mandate in the Balkans and now under both UN and NATO mandates in Afghanistan; and it fought (less "legitimately" from the perspective of the rest of the world) with an ad hoc coalition of friends and allies in 2003 in Iraq. Indeed, there is a growing literature on the need for some international approval even for humanitarian interventions by military forces in the modern era.[10] Ironically, given these pressures to cooperate in military activity, space remains an outlier. Unfortunately, the U.S. military has found by experience in Afghanistan that national barriers have impeded its effective use of space-derived data. As one recent analysis of the problem of information-sharing in Afghanistan observes, "secrecy often keeps coalition team members from speaking about space-related topics with each other."[11]

These points raise a critical "process" question: How do countries come to realize that their security needs in a particular area of activity have crossed the line from national to international? Realist political theory argues that security, by its very nature, is something that falls to states, as the essential building blocks of the international system and the repositories of sovereignty within it. Yet space is an area specifically delineated as beyond national sovereignty by international law in the 1967 Outer Space Treaty. The failure of states to expand collective governance mechanisms in regard to space may be a factor of habit, perspective, and inertia, plus normal bureaucratic opposition to negotiations aimed at creating new, specialized institutions beyond national control.

Recent threats to U.S. space assets have been viewed as *national* security threats because there is a long U.S. tradition of self-reliance in international relations and a perspective that successful collective action is rarely achieved. But, in space, all countries have an interest in protecting the environment from military threats and, in fact, from *any* obstacles to either free access or free passage. These conditions create fundamental incentives for collective action that do not exist in other areas of international relations. Ironically, one of the primary obstacles to enhanced collective action to protect space security may be the thinking of the actors themselves, which still remains largely rooted in the unilateral traditions of security provision from past security frameworks. But, as Robert Keohane argues, "To pursue self-interest does not require maximizing freedom of action. On the contrary, intelligent and farsighted leaders understand that attainment of their objectives

"To pursue self-interest does not require maximizing freedom of action."

[10] See, for example, Martha Finnemore, "Constructing Norms of Humanitarian Intervention," in Peter J. Katzenstein, ed., *The Culture of National Security and Identity in World Politics* (New York: Columbia University Press, 1996).

[11] De Selding, "U.S. Officer: Secrecy Among Coalition Forces Hinders Use of Space Assets in Afghanistan."

may depend on their commitment to institutions that make cooperation possible."[12] Working with allies, therefore, may represent the best security solution available at this point in space history, and perhaps may serve as a bridge to broader forms of international cooperation in the future. Alliance-based efforts could mitigate a variety of emerging space-related security concerns. The prior existence of allied military institutions—particularly established patterns of cost-sharing, integration, joint operations, and joint training—both in the case of NATO and in various bilateral arrangements with Asian countries (such as Australia, Japan, and South Korea) should reduce typical collective action problems in forming such new mechanisms for space.

Roots of a Multinational Approach to Space Security

Notably, there is a long history of attempted transnational approaches to space security. Space activity actually began in the context of a major multilateral scientific initiative known as the International Geo-Physical Year (IGY). Both the Soviet Union and the United States announced plans to orbit satellites as part of their contributions to the IGY—and the Soviets got there first. However, any hope of using international science cooperation to promote international security in space soon fell to the wayside, given the context of the hostile competition between the Soviet Union and the United States.

Yet multilateralism in space did not die entirely. Two critical UN resolutions passed in 1963 and the ratification of the Partial Test Ban Treaty helped safeguard safe access to space through collective means in the face of threats of territorial claims, damage caused by ongoing nuclear tests in orbit, and disputes over future liability questions. As mentioned above, the further codification of space rules in the 1967 Outer Space Treaty helped expand the notion of space as an extra-territorial realm with a range of collective restrictions on military activities, particularly on the Moon and celestial bodies. The bilateral ABM Treaty and the Strategic Arms Limitations Talks Interim Agreement (SALT I) in 1972 prohibited space-based missile defenses and interference with national technical means of verification (i.e., satellites). The 1972 Convention on International Liability for Damage Caused by Space Objects further expanded the norm of mutual restraint in space and provided evidence of the willingness of even the world's most powerful militaries to cede areas of space sovereignty to collective agreements in order to help ensure safe and reliable access. As Larry Wortzel observes, "The U.S. and the Soviet Union seemed to realize that it is potentially destabilizing to define the upper limits of sovereignty. Thus, neither country interfered with the other's free passage in space. Also, they agreed that the ability to conduct strategic verification from space stabilized the nuclear balance."[13] Although, joint military activities were not possible in the poisoned political environment of the Cold War, important norms of space restraint did emerge between the two superpowers despite their political tensions.

In the early 1990s, the two formerly most hostile enemies took unprecedented steps after the Soviet break-up in civilian space cooperation, joining with Canada, Japan, and the countries of the European Space Agency

[12] Robert O. Keohane, *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton, NJ: Princeton University Press, 1984), p. 259.

[13] Colonel (U.S. Army, ret.) Larry M. Wortzel, "The Chinese People's Liberation Army and Space Warfare," *Astropolitics*, Vol. 6, No. 2 (May-August 2008), p. 128.

in the construction of the *International Space Station* (*ISS*). This $100 billion civilian project is still ongoing and has linked the human spaceflight programs of all major space-faring countries, except China and India. Despite occasional glitches, it has worked remarkably well and has served U.S. interests. The U.S. commercial sector has become similarly international, including significant cooperation with Russia in the space launch field. But little such effort has been made to promote allied or other transnational space security engagement, particularly in operational programs.

Since the Soviet break-up and the rise of U.S. skepticism of the need for further space arms control, bilateral space security norms from the Cold War have failed to spread adequately among new space-faring nations, such as China. As Wortzel points out, in contrast to the history of bilateral U.S.-Soviet relations in regard to space, "No such dialogue has taken place with China."[14] Wortzel blames opponents from the People's Liberation Army for blocking initial U.S. overtures late in the Bush Administration. Others blame the United States for rejecting talks on space security from 1998 to 2009 at the U.N. Conference on Disarmament in Geneva. Put simply, the United States did not perceive a demand for such a dialogue until China's ASAT test in 2007. This neglect now seems short-sighted. What is more surprising is that, until very recently, there has been little engagement between the United States and its allies in space security matters. Indeed, with the exception of some limited studies in the NATO context, no overarching framework for allied space cooperation to enhance space security has emerged in the post-Cold War period.

As noted in the introduction, the existing framework for space security remains problematic, and there are few new initiatives to address these gaps. The one exception to the current stalemate occurred in December 2007, when the countries of the United Nations agreed to adopt a voluntary set of U.S.-supported debris mitigation guidelines, providing a limited set of norms. But the effort still fell far short of halting non-WMD weapons testing or deployment in space, even kinetic-kill tests, allowing such activities as long as the debris was short lived. It also created no international system for space situational awareness or enforcement, relying only on national means. As for treaties, the only proposal on the international agenda is the Russo-Chinese Prevention of the Placement of Weapons in Outer Space Treaty (PPWT)—a limited effort focused only on banning space-based weapons. However, the proposal exempts testing and development of other space weapons, such systems as China's ground-based ASAT, thus severely diluting the utility of such an agreement. The more limited, European-sponsored Code of Conduct has been informally available for comment since December 2008, but—even if agreed to—will offer only partial effectiveness toward increasing space security given its voluntary status and its lack of specific monitoring and enforcement mechanisms.[15] As of late March 2011, the United States had only announced its support for the "process" of the code's elaboration, not for the document itself. Russian and China have flatly opposed the effort. Under these conditions, it is not yet possible to make the jump to a fully inclusive international space security arrangement or treaty. In the meantime, the United States and its allies

[14] Wortzel, "The Chinese People's Liberation Army and Space Warfare," p. 128.

[15] European Union, Draft Code of Conduct for Outer Space Activities, December 17, 2008, available on the Stimson Center website at: http://www.stimson.org/space/pdf/EU_Code_of_Conduct.pdf (accessed August 27, 2010).

might be well served to start building their own cooperative security network as a critical first step. Such a move would enhance U.S. and allied space security and perhaps serve as a model that can be expanded upon later, if other actors see benefits in joining the system (and the allies agree to such engagement).

To date, the concept of multinational space cooperation has been perhaps best exemplified in the European Space Agency's (ESA's) civil space programs, which are collectively organized, funded, and implemented. The *ISS* case is another example of successful civilian cooperation, bringing together the United States with ESA countries and Russia. Of course, other countries have cooperated in joint scientific and commercial projects as well, but almost none in the security realm. Even in Europe, space security cooperation—particularly in operational terms—has been very limited. Similarly, a review of the recent U.S. literature on space security reveals how little attention has been paid to concepts of possible military alliance-building for space. With a few exceptions, the topic has been largely ignored, due to the enduring propensity of most authors to view space security from a purely nationalistic lens. This is even true within the academic community. A few examples are worth examining to highlight this point.

Everett C. Dolman's well-known book *Astropolitik: Classical Geopolitics in the Space Age* (Cass, 2002) argues that a single, major power (presumably, either the United States or China) will eventually exercise "space dominance" over other actors. Because of this assumption, he fails to consider seriously the possible role of alliance contributions to such strategies, arguing that all other powers will simply be forced to comply with the rules established by the hegemon, rather than themselves establishing a multilateral structure. The concept that an alliance of countries might dominate collectively is not considered, although Dolman concedes that sustaining such a offensive-oriented, state-centric approach to achieving space security is "in the long term…counterproductive and detrimental."[16]

Similarly, Benjamin S. Lambeth's otherwise very thorough coverage of space challenges *Mastering the Ultimate High Ground: Next Steps in the Military Uses of Space* (RAND, 2003) fails to refer to the possible contribution of allies at all, assuming perhaps that U.S. allies have no space assets worth considering. U.S. Navy Commander John J. Klein's book *Space Warfare: Strategy, Principles and Policy* (Routledge, 2006) mentions allies on a handful of occasions but only in a very theoretical context, such as the need to rally support from allies in case of facing a superior space power. Yet there is no discussion of what such countries might contribute in an operational sense in a conflict, much less consideration of the peacetime creation of a space-based alliance as part of a strategy of orbital deterrence. Notably, the Bush Administration's 2006 National Space Policy does not mention U.S. allies in the section on "National Security Space Guidelines," except in a vague manner as possible recipients of U.S. space-derived intelligence data under certain, limited circumstances.[17]

Among authors more supportive of international space cooperation, Joan Johnson-Freese's book *Space as a Strategic Asset* (Columbia University Press, 2007) discusses the failure of NATO to come up with a unified space policy, in part due to the fact that "to date, most European military space programs

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[16] Everett C. Dolman, *Astropolitik: Classical Geopolitics in the Space Age* (London: Frank Cass, 2002), p. 2.

[17] The White House, "U.S. National Space Policy," August 31, 2006, posted on the website of the Federation of American Scientists, at: http://www.fas.org/irp/offdocs/nspd/space.pdf (accessed August 27, 2010).

have been strictly national programs."[18] She contrasts this failure with their highly integrated cooperation in the civil space field. Nevertheless, she remains skeptical of the ability of U.S. NATO allies to make significant contributions to U.S. space security, except in a supporting role. In other areas of space activity, however, Johnson-Freese cautions that unduly restrictive U.S. export controls could stimulate civil and commercial space partnerships among China, Russia, and the countries of the European Space Agency (including many leading NATO members).

USAF Lt. Col. (ret.) Forrest E. Morgan's highly informative report *Deterrence and First-Strike Stability in Space: A Preliminary Assessment* (RAND, 2010) makes the case that the United States cannot expect to address its space vulnerabilities simply through threats of national retaliation, which are unlikely to be effective or convincing in space. Instead, Morgan argues for a mixed strategy of "threatening a range of punitive responses in multiple domains while at the same time reducing the benefits of enemy attacks by improving defenses, dispersing and concealing space capabilities, and demonstrating the ability to rapidly replenish whatever losses are sustained."[19] Somewhat surprisingly, however, Morgan's prescriptions fail to mention the potential role of allies in carrying out such a strategy, perhaps because of the difficulties of overcoming traditional secrecy concerns.

Within the literature, therefore, there are relatively few supporters of new allied space structures. One of the few exceptions is Steven Lambakis's book *On the Edge of Earth: The Future of American Space Power* (University of Kentucky, 2001). Although Lambakis portrays space largely within a realist-driven framework of military struggle, he does consider the possible contribution of allies, noting "The United States will need the political support of its allies and friends as well as their involvement in military space activities, to include economic contribution through collaboration in system development and participation in operations."[20] He concludes by arguing in regard at least to ground stations and surveillance, there are "undoubtedly several contributions U.S. allies can make in these areas."[21] A more recent study by USAF Lt. Col. Michael P. Gleason goes further in spelling out why the specific political-economic situation of the second decade of the twenty-first century is ripe for such efforts, arguing, "With U.S. budgets constrained and U.S. security space programs lagging, now is the time to partner with the EU [European Union] in security space."[22] USAF Lt. Col. (ret.) Peter Hays makes the supporting argument that "State-of-the-art constellations…can be augmented with state-of-the-world capabilities to make these capabilities more resilient."[23]

With some exceptions, this review of some of the leading recent studies of space security shows that there has been inadequate attention paid to the prospects of truly *allied* strategies to accomplish shared goals of space threat reduction, deterrence, and defense. Part of the

[18] Joan Johnson-Freese, *Space as a Strategic Asset* (New York: Columbia University Press, 2007), p. 187.
[19] Forrest E. Morgan, *Deterrence and First-Strike Stability in Space: A Preliminary Assessment* (Santa Monica, CA: RAND, 2010), p. 6.
[20] Steven Lambakis, *On the Edge of Earth: The Future of American Space Power* (Lexington, KY: The University Press of Kentucky, 2001), p. 285.
[21] Ibid.
[22] Lt. Col. (USAF) Michael P. Gleason, "Shaping the Future with a New Space Power: Now is the Time," *High Frontier*, Vol. 6, No. 2 (February 2010), p. 43.
[23] Peter L. Hays, "An Agile and Adaptive Enterprise: Enhancing National Security Space by Improving Management Structures and Leveraging Commercial and International Partners," *Astropolitics*, Vol. 8, Nos. 2-3 (May-December 2010), p. 163.

reason, perhaps, is the general lack of familiarity among U.S. space experts with the emerging capabilities of allied space actors. Given the highly classified world of space operations, many military and governmental analysts simply tend to focus on keeping track of U.S. capabilities and problems. Similarly, existing U.S. export control restrictions make some forms of cooperation simply impossible, depending on the level of technology exchange involved. Congress too has been leery of funding any form of cooperation that might seem like "foreign aid" in space, and has only grudgingly gone along with civil spaceflight purchases from Russia, despite the coming break in U.S. capabilities to deliver astronauts to the *ISS*.

But the United States has global military responsibilities and depends heavily on its space capabilities to fulfill them. It also works closely with allies on the ground, at sea, and in the air, such as in Afghanistan, Iraq, and Libya. Yet as the 2009 NATO assessment laments about the state of members' space assets: "[our] essential capabilities are at risk because we simply have not thought through the Alliance's Space needs, developed any strategy, considered the consequences of no action, or prepared any risk mitigation strategies."[24] As a result, the study complains, "The current approach to Space is piecemeal, a bottom-up effort lacking overarching structure or direction."[25]

The 2011 National Security Space Strategy marked a major turning point in official U.S. thinking about allied space activity when it recognized that in an "increasingly congested, contested, and competitive" environment, the United States faced new "opportunities for leadership and partnership."[26] Although the NSSS provided few specifics, it pledged that: "With our allies, we will explore the development of combined space doctrine with principles, goals, and objectives that, in particular, endorse and enable the collaborative sharing of space capabilities in crisis and conflict."[27] Implementation, however, remains in its initial stages only.

With these challenges and opportunities in mind, it is now worth considering what specific advantages might accrue to U.S. space security from a closer partnership with allies in this regard, as well as how such a new military space partnership might actually be formed.

Getting from Here to There: Building a Layered Framework for Policing Space

Despite the risks facing U.S. space assets, the challenges for an adversary seeking to carry out a sustained campaign against space assets in multiple orbits in a non-cooperative context are still difficult. Redundancy and reconstitution strategies could potentially be very effective against limited attacks. To the extent that a group of allied spacefaring countries could create a network of interactive satellites and develop policies for mutual support in a time of crisis, such efforts could greatly reduce even the risk of individual attacks on satellites, since any gaps could be quickly filled in and therefore rendered pointless. However, the United States and its allies are a long way from establishing this capability. This raises two related questions:

[24] Joint Air Power Competence Centre, "NATO Space Operations Assessment," Kalkar, Germany, January 2009, p. 7.
[25] Ibid., p. 1
[26] U.S. Department of Defense and the Office of the Director of National Intelligence, "National Security Space Strategy (Unclassified Summary)," January 2011, p. i.
[27] Ibid., p. 9.

what countries should be involved and what capabilities should be linked?

While the U.S. military has so far failed to form true space partnerships with other countries, there has been a rapid expansion in the space capabilities of allied militaries in the past 15 years. France has led the way in launch capabilities and Earth imaging (including for military purposes), but an additional five NATO countries—Canada, Italy, Germany, Luxembourg, and the United Kingdom—operate more than 10 satellites apiece for remote-sensing, communications, and scientific purposes. Meanwhile, Spain, the Czech Republic, the Netherlands, and Turkey each operate more than five satellites and associated ground stations.[28] Although the vast majority are civilian satellites, their militaries are becoming steadily more involved in space. Among U.S. allies in Asia, Japan is a major spacefaring country with extensive human spaceflight and space science experience, as well as valuable technology in its *H-II Transfer Vehicle* (used for the *International Space Station*), launchers, and communications satellites. In fact, a recent statement issued on the 50th anniversary of the U.S.-Japan alliance by U.S. Undersecretary of Defense for Policy Michele Flournoy specifically highlighted "the need to strengthen our cooperation under the alliance to promote the security of the global commons, including space and cyberspace."[29] In addition, South Korea has increasing experience in reconnaissance, communications, and satellite manufacturing, while moving steadily toward space-launch capability. Australia, Taiwan, and Thailand also have significant satellite operations experience. Finally, India is a highly capable space power as well, with launch systems to both low-Earth and geostationary orbits, reconnaissance assets, extensive space applications experience, and an expanding pool of skilled personnel. This broad-based collection of space capabilities represents a major, untapped U.S. resource for dealing with its space vulnerabilities. Indeed, it is fair to say that the United States has an "asymmetric advantage" over countries like China and Russia in having a host of significant spacefaring countries that are also military allies or friends. Yet almost nothing has been done to use this advantage to shape the emerging space environment to benefit the United States and its partners, or to set an example for other countries worldwide in responsible space behavior. Instead, as the 2009 NATO space assessment describes, current regulations make space information and operations "'too sensitive' to discuss outside of National boundaries."[30]

But a study of NATO's emerging space needs by USAF Major Thomas Single argues, "The emphasis must be on moving from a 'need to know' to a 'need to share'."[31] Time also may be of the essence. As Lt. Col. Gleason points out, the European Union—given its growing range of space assets—is "perfectly willing to develop its dual-use security space capabilities, architectures, and institutional structures without US involvement."[32] The same might

"The emphasis must be on moving from a 'need to know' to a 'need to share'."

[28] Joint Air Power Competence Centre, "NATO Space Operations Assessment," Figure 5: Nations Operating Satellites, p. 8.
[29] Michele Flournoy, "Point of View: U.S.-Japan alliance a cornerstone in a complex world," *Asahi Shimbun*, July 16, 2010.
[30] Joint Air Power Competence Centre, "NATO Space Operations Assessment," Kalkar, Germany, January 2009, p. 7.
[31] Thomas Single, "Considerations for a NATO Space Policy," *European Space Policy Institute Perspectives*, No. 12, September 2008, p. 4.
[32] Gleason, "Shaping the Future," p. 44.

be said of Japanese and South Korean capabilities in a few more years, without U.S. input. Thus, a priority should be placed on building partnerships from the ground up as these systems evolve in order to, in Gleason's terms, influence the development of capabilities "in ways which will benefit American national security for decades into the future."[33]

While U.S. national security space programs need to be protected in this process, it is also worth observing that the United States has already shared sensitive data successfully with a range of countries in the nuclear sector, including with the United Kingdom and France. Moreover, officials and military officers from Germany and Australia have long cooperated with the United States on sensitive matters related to national defense including, in Australia's case, operating extremely sensitive facilities related to space-derived intelligence and early-warning information. Thus, the view of space operations as "too sensitive" to share may be an out-dated perspective, particularly as risks to assets rise and demands for cooperation increase. Under these conditions, a range of possible means of reducing threats to U.S. and allied systems might emerge through cooperation, with additional benefits in providing the framework for deterring harmful acts and perhaps building bridges with other responsible spacefaring nations. Such efforts would require amendment of existing and highly protective U.S. International Traffic in Arms Regulations (ITAR). But many officials and military leaders have been calling for exactly such reforms for years. Assuming that these controls could be modified to allow greater cooperation, what areas might be most fruitful for such allied networking?

First, the United States and its allies need to know where spacecraft are in orbit and where threats from orbital debris (whether intentional or not) might arise. This requires keeping track of both active and inactive spacecraft still in orbit. Today, the U.S. military operates the Space Surveillance Network, which has the world's most extensive catalogue of space objects. Since the 2009 Iridium-Cosmos collision, the U.S. Air Force has begun to do more complete conjunction analysis and to share this information with other space users. At the same time, U.S. allies could supplement this effort by providing information from their radar systems. In particular, U.S. NATO allies operate a number of radars and telescopes at multiple sites in Europe that could be used to bolster joint capabilities.[34] Japan is also beginning research on space-based surveillance via satellite that could in the future yield additional useful data, particularly on microsatellites and their activities. Improved space situational awareness (SSA) through allied cooperation may be critical to determining interference with spacecraft and determining fault, as well as building international coalitions to establish the "ground truth" necessary for levying fines on space users, depriving perpetrators of access to space business, stripping them of rights to geostationary slots, or cutting-off frequency allocations for broadcasting satellites. Accordingly, the 2010 U.S. National Space Policy calls upon the U.S. government to "Enhance capabilities and techniques, in cooperation with civil, commercial, and foreign partners to identify, locate, and attribute sources of radio frequency interference, and take necessary measures to sustain the radiofrequency environment in which critical U.S. space

[33] Ibid., p. 43.

[34] Xavier Pasco, "Toward a Future European Space Surveillance System: Developing a Collaborative Model for the World," in Logsdon, Moltz, and Hinds, eds., *Collective Security in Space European Perspectives*.

systems operate."[35] Similar techniques need to be developed against laser, microwave, and other hostile technologies.

A second priority area after SSA is ensuring the continuation of service for global positioning, navigation, and timing networks like the U.S. Global Positioning System (GPS). The development of this satellite constellation has provided tremendous benefits to the U.S. military in being able to improve accuracy and reduce collateral damage and deaths with its weaponry, as well as assisting in a range of other military functions. Europe's planned Galileo system, Japan's Quasi-Zenith system, and India's future GAGAN system could provide important supplemental data should the GPS system ever be threatened by hostile actions in space. By ensuring compatibility among these networks and arranging for quick replacement responsibility within the constellation in case of attack, the United States and its friends and allies could guarantee that GPS information would be available in any future crisis.

A third critical area is reconnaissance. Currently, the United States relies on a relatively small number of large, highly expensive satellites in low-Earth orbit to provide high-resolution images on critical adversaries or problem areas. Due to the risk of their loss, the rising costs of such spacecraft, and the need for more data, the U.S. military has already begun contracting with such commercial firms as DigitalGlobe and GeoEye to provide imagery that, while not as precise, is good enough in many instances. Working with allies would provide yet another source of imagery in case of the loss of any U.S. military or commercial satellite in a crisis. These systems might include Japan's Information Gathering Satellites, Germany SAR-Lupe system, France's Helios (and future Pleiades), and Italy's Cosmo-Skymed.[36] South Korea also operates imagery satellites, as does the United Kingdom. Unfortunately, even in conflict zones such as Afghanistan, there has been little cooperation to date due to the lack of established mechanisms and strong countervailing traditions of space secrecy.[37] Such problems could be overcome through establishing protocols for exchanges of information as well as possible designation of certain satellites as "allied," whether under NATO auspices or a larger space cooperation entity that would include non-NATO U.S. allies as well. These capabilities would ideally evolve over time toward development of a common software interface, if not certain shared hardware to promote interoperability and replacements. Joint training of officers could support such a system, thus developing core expertise across the alliance that would serve to expand effective use of space imagery on the battlefield and in peacetime. Surprisingly, excluding U.S. military space personnel (which numbered approximately 100), only one non-U.S. space professional was serving in the Middle East Area of Operation as of 2009.[38] Clearly, this is far from adequate.

As a fourth priority, communications and early-warning satellites located in geostationary orbit should be secured. Fortunately, this job is the easiest given the difficult of carrying out an undetected attack on an object at an altitude of 22,300 miles. Still, the United States and its allies should first develop mechanisms for replacing critical

[35] The White House, "National Space Policy of the United States of America," June 28, 2010, p. 9.

[36] Adam Keith, "Diversifying Capabilities for Image Intelligence," *Space News*, July 19, 2010, p. 15.

[37] De Selding, "U.S. Officer: Secrecy Among Coalition Forces Hinders Use of Space Assets in Afghanistan."

[38] Joint Air Power Competence Centre, "NATO Space Operations Assessment," Table 3: Current Space Operations Personnel, p. 29.

functions in case of problems. They should also begin outreach with other parties—including China, which is not covered by U.S.-Russian non-interference pledges—to respect the inviolability of early-warning satellites, in particular, given their role in promoting nuclear stability. Clearly, China should understand that any attack on an early-warning satellite could be legitimately mistaken as part of the first stage in a major nuclear attack and would trigger extreme means of defense by the United States and its allies.

A fifth area for allied cooperation is that of developing avoidance mechanisms—in other words, decoys and quick replacement capabilities to protect satellites. This is better done in concert with multiple parties than unilaterally due to the advantages of having multiple platforms available *and* multiple launch sites. This could include developing standard, interoperable reconnaissance satellites and other critical spacecraft and locating them in different allied launch sites around the world. In a future world of cubesats, this kind of integration may become easier (and more affordable) than it is currently. Allies could also fly decoy satellites in their constellations to increase the burden of numbers on potential attackers, or collectively develop and deploy spoofing systems or chaff-releasing pods to foil enemy radar seekers.

Sixth, in case a satellite or spacecraft engaged in harmful activity would need to be stopped by the collective forces of a cooperating group of major space-faring powers, having the *collective* ability to deter, disable, and, if necessary, to destroy hostile space assets may be necessary in extreme circumstances. These could include existing ballistic missile defense assets (such as the U.S., Japanese, and South Korean Aegis systems and Ground-Based Interceptors in the United States, future MEADS-type interceptors in NATO, and perhaps other assets). Their use against a rogue actor would have to be coordinated by a joint space council of the allied powers. Such moves have critics and would need to be considered carefully for their possible effects on space security more generally. That is, while there is a temptation to take the next step to allied deployment of orbital space weapons in order to supplement new redundancy capabilities and currently limited ground- or sea-based counterspace weapons, further steps may be unwise, at least absent new threats. Lt. Col. (ret.) Morgan argues in response to calls in some quarters supporting deployment of space weapons and policies of attempted space dominance, "While such arguments resonate with those acculturated in the U.S. military tradition, it is hard to conceive how placing counterspace weapons in orbit would do anything to defend U.S. satellites from enemy ground-based weapons or, for that matter, other weapons in space."[39] Morgan observes that such weapons themselves would be in fixed orbits and vulnerable to attack. He adds: "Taking this step may also encourage other spacefaring nations to follow suit, ultimately resulting in a dangerously unstable strategic environment that would generate severe 'use-or-lose' pressures."[40]

Finally, any allied approach to space security would likely have to create a functioning transnational, operational body to manage share systems, provide joint training, and handle finances. The 2009 NATO assessment concludes by calling for a Space Office at NATO headquarters as well as a NATO Space Operations Coordination Centre.[41] But, given the desirability of involving allies from Asia, a broader center seems to be more prudent.

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[39] Morgan, *Deterrence and First-Strike Stability in Space*, pp. 33-4.
[40] Ibid., p. 34.
[41] Ibid., p. 46.

Access to the operations center would have to be strictly controlled through both a classification system and personnel reliability program. As noted, such efforts have succeeded in the past at sensitive NATO nuclear locations and at space sites in Australia. The program would have to start small and perhaps with a limited numbers of countries most heavily involved in space already: Australia, France, Germany, Italy, Luxembourg, the United Kingdom, Japan, and South Korea.

From this author's informal discussions, support for such a cooperative space network seems to exist already among a number of NATO members and in Australia, Japan, and South Korea. The U.S.-Australian announcement of planned SSA cooperation in the fall of 2010 and joint funding of the Wideband Global Satcom system mark important first steps toward operational integration. Notably, these trends are consistent with the 2010 U.S. National Space Policy's call for new types of cooperation at the international level, including in the area of national security space. Indeed, the section on "National Security Space Guidelines" goes even further in spelling this out: "Options for mission assurance may include rapid restoration of space assets and leveraging allied, foreign, and/or commercial space and nonspace capabilities to perform the mission."[42] These guidelines point to additional useful paths forward.

A supporting mechanism to begin building the model outward to friends and other responsible spacefaring nations—such as India, Israel, and others—might be patterned on the Proliferation Security Initiative (PSI). This concept emerged in 2003 as a means of filling gaps in the Nuclear Non-Proliferation Treaty (NPT) for stopping the illicit transit of weapons of mass destruction and related technologies, materials, and delivery systems. This Bush-Administration-inspired "coalition of the willing" began to organize voluntary national military and law enforcement efforts into a process that would allow inspection and seizure of crews and contraband. Such a model may be useful for space as well. Another supporting concept for collective space security might be the U.S. Navy's idea of creating a large coalition of international assets to engage in collective maritime security: the 1,000-ship navy.[43] As Admiral Mike Mullen describes the maritime model, this would be a "global maritime partnership that united maritime forces, port operators, commercial shippers, and international, governmental and nongovernmental agencies to address mutual concerns."[44] Mullen views it as a voluntary network of maritime powers "interested in using the power of the see to united, rather than to divide."[45] For space, this could include commercial and scientific spacecraft as well and would thus involve many more players—functioning like an active "neighborhood watch" committee. The practical experience of international efforts to combat piracy off of the Horn of Africa may provide a positive lesson in regard to the future "policing" of space.

Despite the advantages of creating such an allied network for space, it must be admitted that a number of current obstacles exist to such efforts. Traditional U.S. thinking about U.S. exceptionalism in space would have to be revised and a more egalitarian view of alliance partners adopted. The U.S. State, Defense, and Commerce Departments would need to engage in ITAR reform and craft new military-to-military agreements (of the type

[42] Ibid., p. 13.

[43] Adm. Mike Mullen, "Commentary: We Can't Do It Alone," *Honolulu Advertiser*, October 29, 2006.
[44] Ibid.
[45] Ibid.

the U.S. has with Australia) to allow the sharing of space information. In Congress, a new political willingness to fund space systems that would not be solely for national benefit or under purely national control would need to emerge. At the technical level, new integration with allied industry would likely be necessary to create common standards and interfaces, which would initially cost time and money. Still, given the emerging risks in space of and the possible benefits to be achieved by joint efforts, these problems do not seem insurmountable.

Conclusion

The challenges of space security today are typically viewed today as a state-centric rivalry for space supremacy: a highly nationalistic framework best suited to unilateral actions.[46] The context of traditional balance-of-power politics, therefore, has colored the lenses of most observers, leading to predictions of a state-versus-state showdown in space, similar to great battles of naval armadas in centuries past. However, under changing conditions, such a stove-piped view of space cooperation and operational practices may make less and less sense and may even increase risks to U.S. and allied space assets. Moreover, given the tightening financial situation in most allied countries today and in the United States itself, pooling resources may be the most effective means of building new capabilities. As the 2009 NATO spaced report concludes, "Increasing fiscal constraints demand increased cooperation to create synergy, reduce duplication of effort and ensure interoperability."[47]

Pooling resources may be the most effective means of building new capabilities.

This effort could begin with joint training among existing allies with more advanced military space experience and gradually building outward to include those allies with still-developing capabilities. During this time, the more advanced militaries could begin to establish an information network to support operational cooperation and eventually feed into a proposed allied space organization. As the assets of this body are developed, operational control could gradually be transferred from national to allied mechanisms, thus providing greatly enhanced peacetime deterrence and, when necessary, increased effectiveness in the use of conventional forces on the ground, at sea, and in the air. Over time these institutions and practices could transform the business of space security from a national into an allied enterprise, spreading risk, reducing individual costs, and increasing reliability. Part of the future-leaning agenda of such an organization might be to explore possible contacts with countries like India, Russia and, eventually, even China, in order to make restraint-based conflict prevention mechanisms for space truly international.

As noted above, the United States is in a uniquely advantageous situation compared to China in having highly capable space partners who are also military allies. As China space expert Gregory Kulacki argues, "China is concerned about the general effort of the US during the Bush Administration to form a Japanese-Indian alliance to contain China,"

[46] On this approach, see Gordon G. Chang, "The Space Arms Race Begins," *Forbes*, November 5, 2009.

[47] Joint Air Power Competence Centre, "NATO Space Operations Assessment," p. 49.

including in space.[48] But Washington needs to be careful not to overplay its hand. Building a collaborative alliance in space to reduce vulnerability could be seen as destabilizing by outside parties. Specifically, building an offensive-oriented space alliance, as noted by Morgan, is likely to threaten China and lead to hostile reactions and possibly a space arms race. For this reason, the United States and its allies need to be careful about their rhetoric and, when possible, be inclusive in terms of confidence-building measures with other countries, portraying the alliance as *defensively* oriented and non-threatening to other countries. Paths to cooperation with other parties through confidence-building measures, participatory space situational awareness, and community "policing" of space to identify bad behavior (such as jamming or laser interference) should also be encouraged. New rules and even treaties might be considered later based on the non-interference norms and newly established collective security practices developed by the alliance.

In this context, collaborative efforts in allied space security may be a good first step toward reducing space vulnerabilities and helping the world avoid action-reaction arming for space and its harmful effects. But this active cooperation in space security, even among existing U.S. allies, will take time, money, technical resources, as well as political commitments from national leaders, given existing national security barriers. Yet the negative implications of alternative paths that are foreseeable for space make these challenges worth addressing head on. If this process is to succeed, moreover, it should begin soon, before new risks to U.S. and allied space security—and further offensive testing by potential adversaries—emerge as alternative space norms.

[48] Kulacki quoted in Peter J. Brown, "China fears India-Japan space alliance," *Asia Times*, November 12, 2008.

The 2010 National Space Policy: Down to Earth?

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The 2010 National Space Policy, intended "to express the President's direction for the Nation's space activities,"[1] was released by the Obama Administration on June 28. Responses were for the most part swift and predictable. While drawing heavily from past consistent principles, all analysts agreed that the tone and emphasis differed significantly from the 2006 Bush Administration policy, which itself was a departure from past policies in terms of a greater military focus and nationalistic orientation.[2] Views on which tone and emphasis is best has ranged along the ideological spectrum. A sampling of opinions is indicative. Baker Spring, from the conservative Heritage Foundation, focused on the Bush approach to space being "right" as much or more than analyzing the Obama policy.[3] Jeff Keuter at The Marshall Institute provided a useful side-by-side comparison of the language, in part, it seems, toward establishing that the Bush policy was consistent with past policies and therefore any changes in the Obama policy required explanation for the shift.[4] Michael Krepon at the Stimson Center positively noted the difference between the Bush and Obama policies regarding Obama's renewed openness to consider diplomatic initiatives toward strengthening U.S. international leadership on space issues, but cited a lack of specifics about potential initiatives, appearing disappointed that the policy did not go further.[5] Some analysts thought there were too many details, some not enough. Experts on a panel held shortly after the policy was released sponsored by The Secure World Foundation (SWF) and The Arms Control Association (ACA) again noted content consistencies with the past, and differences in tone from the Bush policy. Independent analyst Marcia Smith from SpacePolicyOnline.com said it was "less nationalistic, more friendly" but noted "she had a friend" who viewed it as a "policy of appeasement rather than leadership." Bruce MacDonald from the U.S. Institute for Peace said he for one was "overall quite pleased with the revised policy",[6] Not surprisingly, professionals and pundits alike read the policy

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[1] Fact Sheet, The National Space Policy, The White House, June 28, 2010. http://www.whitehouse.gov/the-press-office/fact-sheet-national-space-policy

[2] Joan Johnson-Freese, "The New U.S. Space Policy: A Turn Toward Militancy?" *Issues in Science and Technology,* Winter 2007.

[3] Baker Spring, "Obama's National Space Policy: Subordinating National Security to Arms Control," *Webmemo*, The Heritage Foundation, No. 2950, July 6, 2010.

[4] Jeff Keuter, "Evaluating the Obama National Space Policy: Continuity and New Priorities," Policy Outlook, The George C. Marshall Institute, July 2010; The Space Foundation provided an comparison as well, U.S. national Space Policy Comparison: Comparing the 2010 National Space Policy to the 2006 National Space Policy, www.SpaceFoundation.org/research

[5] Michael Krepon, "The Obama Administration's National Space Policy," 30 June 2010. http://www.stimson.org/pub.cfm?ID=983

[6] Panel Discussion – The New National Space Policy: Prospects for International Cooperation and Mankind Safe Safer for All. July 1, 2010. www.armscontrol.org/events/newnationalspacepolicy

much like a Rorschach test, interpreting it largely based on long-established prior perspectives. Across the spectrum of opinion, all acknowledged that the devil is in the details of implementation.

My own view of the policy is most akin to that of SWF attorney Ben Baseley-Walker, another SWF/ACA panel member. He summarized it as "a very sound, pragmatic approach." I would call it simply a realistic policy. It has both strengths and weaknesses, but overall, commendably, it attempts to inject realism into future U.S. space planning, and realism will ultimately strengthen U.S. security. While inherently more long-term focused and therefore less immediately satisfying, it is important to remember the classic military requirement for an executable, successful plan of attack -- alignment of ends-ways-means. Certainly the requirement for a prolonged U.S. military presence in Iraq after the initial shock-and-awe success demonstrated how a mismatch between those key elements can result. Unfortunately, looking long-term will likely not bode well for the Obama Administration, as the last thing many American people seem to want, and therefore politicians will support, is a policy that recognizes and addresses the changing realities of the space environment. Nevertheless, several areas of change in the policy specifically reflect looking at the world as it is, rather than how the United States wants it to be.

Reality as Risky Political Business

Andrew Bacevich in his 2008 book *The Limits of Power: The End of American Exceptionalism* examines President Jimmy Carter's 1979 speech to the American people about self-indulgence (specifically regarding oil) and what Bacevich terms "profligacy." That speech was quickly dubbed "the malaise speech" by his political opponents, though the word malaise was never used by Carter. His opponent for the presidency, Ronald Reagan, countered with "morning in America" talks which, Bacevich says convinced Americans that "credit has no limits, the bills will never come due."[7] Fast-forward to the October 19, 2009, cover of *The National Review.* It featured a cover image of a robed Obama wearing his Nobel medal while contemplating a bust of Carter. Clearly Obama is intended to be viewed as the snooty, contemporary version of Carter, bearer of bad news and pessimism.

In some quarters, the contemporary additive to the malaise rhetoric is that of decline; instilling fear in the American public that if we don't act (panic) now and act aggressively, America will fall off the precipice of hegemony and into economic, political and/or social decline. "Decline," *The National Review* cover stated, "is a Choice." Using declinist images and rhetoric is perhaps to be expected in partisan politics. However, it is both hackneyed and hyperbolic; eventually each cycle of declinism gives way to reality.[8]

James Fallows in his January/February 2010 article in *The Atlantic* addresses this notion. He points out that declinism is woven into our culture. "Thomas Jefferson was sure the country was going to hell when John Adams supported the Alien and Sedition Acts. And Adams was sure it was going to hell when

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[7] Andrew J. Bacevich, *The Limits of Power: The End of American Exceptionalism*, (New York, Metropolitan Books, 2008) p.36.

[8] Joan Johnson-Freese and Thomas M. Nichols, "U.S. Less Dominant But So What?" Op-Ed, *DOD Buzz*, November 25, 2009. http://belfercenter.ksg.harvard.edu/publication/19743/us_less_dominant_but_so_what.html?breadcrumb=%2Fexperts%2F2145%2Fjoan_johnsonfreese%3Fback_url%3D%252Fpublication%252F20227%252Fspace_stability_and_nuclear_strategy%253Fbreadcrumb%253D%2525252F%26back_text%3DBack%2520to%2520publication

Jefferson was elected."[9] While assuring us that America has historically gone through cycles of crisis and renewal, he also reminds us that renewal takes effort, sometimes based on hard choices, and addressing issues and problems realistically.[10]

This pragmatic approach, however, is not the stuff of the polarized partisan politics sadly characterizing America today. More typically seen is the profligacy of which Bacevich warns, generalized public anger, and a distinct disdain of expertise – the latter especially dangerous on issues such as space where the laws of physics prevail over ideology and wishful thinking. National security, however, is not well served by wishful thinking, nor is realism synonymous with decline. Space assets are too important as vital national interests – and stated as such in both the Bush and Obama policies -- to be subjected to the facile analysis of "declinism" and "gut" analysis rather than sound, though admittedly difficult, realistic strategic planning for a stable and secure future.

Tone and Leadership

The Obama policy begins with two epigraphs, one from President Eisenhower and one from President Obama. These epigraphs speak to the consistent connection between American goals in space and improving life on Earth, and their relationship to American leadership more broadly. They establish a cooperative tone and put forth an important justification for space activity for those who still question why we spend finite U.S. resources on space rather than here on Earth.

Here is President Eisenhower in 1958:

> More than by any other imaginative concept, the mind of man is aroused by the thought of exploring the mysteries of outer space. Through such exploration, man hopes to broaden his horizons, add to his knowledge, improve his way of living on Earth.

And President Obama today:

> Fifty years after the creation of NASA, our goal is no longer just a destination to reach. Our goal is the capacity for people to work and learn and operate and live safely beyond Earth for extended periods of time, ultimately in ways that are more sustainable and even indefinite. And in fulfilling this task, we will not only extend humanity's reach in space – we will strengthen America's leadership on Earth. [11]

These epigraphs talk about all people being able to fully utilize space and the benefits it yields, thereby setting the stage for an internationally cooperative policy.[12]

The 2006 Bush policy, by contrast, was either more assertive and patriotic, or more caustic and bombastic, depending on ideological perspective. While domestic opinion was split, international opinion leaned heavily toward the latter. *The Times* of London perhaps best summed up the international view in an October 19, 2006, commentary entitled "America Wants it All – Life, the Universe, and Everything." There the author posited that space apparently was no longer the final frontier, but the 51st state of the

[9] James Fallows, "How America Can Rise Again," *The Atlantic*, January/February 2010, p 48.
[10] Ibid, p 55.

[11] U.S. National Space Policy, June 28, 2010. p. 1
[12] Deputy Assistant Secretary of State Frank Rose called international cooperation a "key cornerstone" of the new policy. Press Conference: Deputy Assistant Secretary Frank A. Rose – U.S. National Space Policy 2010, July 13, 2010. http://geneva.usmission.gov/2010/07/13/rose-press-briefing

United States. It went on to say that "The new National Space Policy that President Bush has signed is comically proprietary in tone about the U.S.'s right to control access to the rest of the solar system."[13]

The Obama tone reflects the reality that leadership cannot be coerced (at least not indefinitely) and true leadership requires others wanting to follow. While many of the same points are reiterated in the Obama policy as in the prior Bush policy, they are reiterated in less nationalistic language and recognize that a right declared by the United States is going to be expected to have universal application.

…true leadership requires others wanting to follow.

Jeff Foust points out a useful example of difference in tone and language in his article, "A Change in Tone in National Space Policy":

> For example, the Bush policy stated "The United States considers space systems to have the rights of passage through and operations in space without interference. Consistent with this principle, the United States will view purposeful interference with its space systems as an infringement on its rights." Contrast that with the new policy: "The United States considers the space systems of all nations to have the rights of passage through, and conduct of operations in, space without interference. Purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation's rights." The Bush policy spoke only of interference with US space systems, while the Obama policy refers to interference with any nation's space systems.[14]

If the goal of the United States is to maintain space as a peaceful, secure and sustainable environment for the benefit of all - a global commons - then it must lead by example and in a way that others are willing to follow. [15]

With almost one thousand space assets in orbit critical to all aspects of our way of life and security, and almost half belonging to the United States,[16] "stability" is not just a realistic policy goal, but a security imperative. It is not in the interest of the United States to have the space environment (more) littered and volatile. Bruce MacDonald pointed out that the 2009 Strategic Posture Review Commission reached similar conclusions about space. MacDonald, who served as Senior Director to the Commission, noted the commission recommendation "that the U.S. should develop and pursue options for U.S. interests and stability in space, including the possibility of negotiated measures." This commission was not a group of left-wing ideologues; it was six Republicans and six Democrats headed by former Defense

[13] Bronwen Maddox, "America Wants it All – Life, the Universe, and Everything," *The Times* (London), October 19, 2006. http://www.timesonline.co.uk/tol/comment/columnists/bronwen_maddox/article605583.ece. See also: "Russian official slams new US space policy as leading to confrontation," *BBC Monitoring Former Soviet Union*, December 1, 2006; "Bush Doctrine goes into space: Unilateralism at the last frontier," *Sydney Morning Herald* (Australia) , October 23, 2006, p.14.

[14] Jeff Foust, "A change in tone in national space policy," The Space Review, July 6, 2010. http://www.thespacereview.com/article/1660/1

[15] See, *America's Future in Space: Aligning the Civil Space Program With National Needs*, National Research Council, 2009, p. 44.

[16] See Union of Concerned Scientists Satellite Database. http://www.ucsusa.org/nuclear_weapons_and_global_security/space_weapons/technical_issues/ucs-satellite-database.html Of the 438 satellites owned by the United States as of August 2010, ownership is dispersed between the military, intelligence, other U.S. government organizations, civil and commercial sectors. Of those foreign –owned assets, many still provide service for the U.S. military and Americans in general.

Secretaries Perry and Schlesinger.[17] While turning from unilateralism and an emphasis on space war to a new tone of internationalism and stability is clearly viewed by some as "weakness,"[18] the Obama Administration, perhaps recalling that the 2009 Schriever V space wargame clearly demonstrated the need for allies and partners in times of conflict,[19] is striving for less chest thumping and more cooperation.

Like it or not, the United States is not the only spacefaring nation. Other countries increasingly see space assets as requisite tools for success in a globalized world because of the information they yield. They are not willing to forego their ownership and use, and in fact are seeking to expand both. This is a reality the United States must acknowledge and deal with - as the 2010 policy does - rather than trying to discourage and hinder the use of space by others, as has been the case for those who see an increase in China's space capabilities as inherently zero-sum for the United States. In other words, trying to maintain the status quo so that U.S. preeminence (or what some call dominance) can never be challenged is unrealistic. Whether other countries with, in some cases, rapidly maturing space programs – China, India, Iran, Brazil, and Nigeria, for example -- will be willing to step up to the challenge of acting as responsible spacefaring actors remains to be seen, but it is evident that the world is not willing to follow a leader who seems primarily self-interested.

Trying to maintain the status quo so that U.S. preeminence can never be challenged is unrealistic.

Reasserting U.S. space leadership will pay important dividends on Earth. The United States unquestionably "leads" space activity based on sheer numbers of assets and the ability to use them. But when considering metrics such as United Nations' voting coalitions on space issues, where the United States is often in a minority even against our allies, and the decreasing share of foreign satellite orders going to U.S. firms, U.S. leadership has been lacking for some time. The 2009 National Research Council report, *America's Future in Space*, directly spoke to space enhancing U.S. strategic leadership on Earth.

> Strategic leadership for the United States means thinking about the future in a way that sees beyond immediate and particularly American needs and policies – such as assuring access to resources or a temporary military advantage – and positioning the nation to help set an agenda for worldwide action. In considering both its own national interests and benefits to humankind, the United States should aim for more than immediate solutions to transitory problems and should find approaches that seek to shape the future.[20]

Effectively re-asserting American leadership will help create a more stable and predictable environment in space and more realistically allow the United States to shape a secure and prosperous future.

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[17] Panel Discussion – The New National Space Policy: Prospects for International Cooperation and Mankind Safe Safer for All. July 1, 2010. www.armscontrol.org/events/newnationalspacepolicy

[18] Taylor Dinerman, "National Space Policy," from Strength to Weakness, July 16, 2010. http:// www.hudson-ny.org/1417/national-space-policy-strength-weakness

[19] See articles reviewing Schreiver V in *High Frontier*, Vol. 5. No. 4, https://newafpims.afnews.af.mil/shared/media/document/AFD-090827-008.pdf

[20] *America's Future in Space: Aligning the Civil Space Program With National Needs*, National Research Council, 2009, p. 42

Using all U.S. Tools to Protect Our Space Assets

In admittedly simplistic terms, the United States has four basic categories of "tools" available to implement its policies abroad: diplomatic, informational, military and economic – sometimes referred to by the acronym DIME. Alone and in combinations, they represent the spectrum of U.S. power.

Since the end of the Cold War, however, "power" has become a much more complicated concept. No longer does power simply equate to kinetic, or "hard," power deliverable by platforms that can be counted and countered. Joseph Nye coined the term "soft power," though initially Donald Rumsfeld, then Secretary of Defense, said he didn't "know what that means."[21] Walter Russell Mead distinguished between sharp power (military), soft power (cultural power, the power of examples), sweet power (values, culture, and policy, and setting the agenda) and sticky power (economic).[22] At her Senate confirmation hearing, Secretary of State Hillary Clinton took these a step farther, calling for the United States to execute "smart power," a combination of diplomacy and defense, to restore American power.[23] Clearly, the United States is preeminent in its hard, or sharp, power capabilities. After the invasion of Iraq, the United States was viewed by much of the world as relying too heavily on the military sharp power tool, and as a first choice. But in a globalized world populated with transnational and non-traditional threats and challenges, not all are effectively dealt with by kinetic power. Increasingly, effective abeyance requires coordinated international efforts, and reliance on hard power and coercion is counterproductive if they alienate those with whom we must work to be successful.

All the tools of U.S. power must be available. The United States must be willing and able to use its sharp power if necessary, but it shouldn't be the first or only option, and it may not be the best option. The 2006 policy states that the United States should "develop capabilities, plans, and options to ensure freedom of action in space, and, *if directed,* deny such freedom of action to adversaries." The 2010 policy instead uses the language "develop capabilities, plans, and options to deter, defend against, and *if necessary,* defeat efforts to interfere with or attack U.S. or allied space systems." The Obama space policy recognizes the potential for using hard power, but also recognizes that such use (and the debris it creates) could be damaging to U.S. assets as well, and so adjusts the tone to encourage cooperation, and opens the door to a greater use of diplomacy. That door, though rhetorically not completely slammed shut during the Bush years, had *de facto* been largely ignored.

What increased diplomacy will mean in practice remains to be seen and will

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[21] See: Joseph Nye, Jr. "Think Again: Soft Power," *Foreign Policy,* March 1, 2006, http://yaleglobal.yale.edu/content/think-again-soft-power

[22] Walter Russell Mead, *Power, Terror, Peace and War*, (New York, New York: Alfred A. Knopf, 2004) pp. 24-25.

[23] Anne E. Kornblut and Glenn Kessler, "In Foreign Policy, A New Trio at the Top," *Washington Post*, January 13, 2009. http://www.washingtonpost.com/wp-dyn/content/article/2009/01/12/AR2009011203510.html

not be without difficulties. What stance the United States will take at future United Nations Conference on Disarmament meetings and votes will be indicative. For many years the conference has pursued an agenda item called "Prevention of an Arms Race in Space" (PAROS). While the United States has since 2002 cast the only "no" vote against a resolution to establish a working group on PAROS, in 2009 it switched its vote to an abstention – a small but significant step in the right direction. Additionally, another resolution, this one Russian-led, called "Transparency and Confidence-building Measures in Outer-space," encourages states to submit concrete proposals on international confidence building and transparency measures to the U.N. Secretary General. While the United States voted "no" in 2008, it declined to participate in 2009, thereby allowing the resolution to be adopted by consensus.[24] The United States had previously been a consistent obstacle to furthering such cooperation. This obstructiveness had allowed China and Russia, the two countries which have set forth proposals for a treaty banning the use of weapons in space and the transparency resolution, to portray the United States as opposing peace in space and as perhaps its greatest threat. U.S. rhetoric, through the 2006 National Space Policy, and actions at the United Nations, made it understandable that other countries would accept this portrayal.

It is unlikely that the United States will (or even should) support a space weapons treaty. The United States generally has not been favorably inclined toward multilateral treaties in recent years, dating back to the Clinton Administration. Alternatively, Ben Baseley-Walker refers to the potential for "soft-law" options toward actions management.[25] This could include efforts such as Codes of Conduct, or Rules of the Road, which have drawn increasingly support from European countries, commercial organizations, and even from within the U.S. military[26] - indeed anyone seriously interested in protecting the space environment.

It is unlikely the United States will (or even should) support a space weapons treaty.

The idea is that actors should and can learn to manage their actions toward a stable and sustainable space environment. When the United States tested an anti-satellite (ASAT) weapon in 1985 by destroying its Solwind satellite, and China tested its ASAT in 2007, neither explicitly broke any specific "rules" or laws.[27] But each

[24] Paul Meyer, "US Space Security Policy: Still in Orbit or Commencing Re-entry?" unpublished assessment. July 2010.

[25] Panel Discussion – The New National Space Policy: Prospects for International Cooperation and Mankind Safe Safer for All. July 1, 2010. www.armscontrol.org/events/newnationalspacepolicy

[26] See: Answers to Advance Questions for General Kevin P. Chilton, USAF, Nominee for Commander, U.S. Strategic Command. http://armed-services.senate.gov/statemnt/2007/September/Chilton%2009-27-07.pdf

[27] Lawyers could argue that Article 9 of the Outer Space Treaty required consultations ahead of time for actions that could affect others' space assets. It could also be argued that since the United States had observed prior Chinese fly-by tests and likely knew of the potentially upcoming impact test, it had a responsibility to warn others. As with all legal arguments, however, it is likely both arguments would be refuted as not applying for one reason or another.

created a substantial amount of space debris potentially dangerous to other spacecraft. The United States subsequently adjusted its manner of testing, as a matter of self-interest. China, after the rightful international condemnation it suffered consequent to its debris-creating 2007 ASAT test, seemed to learn as well. When China tested similar technology again in 2010, the test was characterized as a missile defense test and conducted more along the political and technical lines of what the United States did when it deliberately destroyed its malfunctioning USA-193 at a lower orbit, indirectly rather than explicitly testing ASAT technology, thereby avoiding both political condemnation and the creation of lingering debris.

As a matter of fact, China created the biggest space mess in history with its ASAT weapon in 2007, at the very time the United States was aiming for, or claiming, space dominance. That test deflated if not dispelled completely the idea that the United States could technologically protect its space assets by constantly playing defense better than anyone else could play offense. The Chinese quickly and harshly demonstrated both the ineffectiveness of bellicosity and the tenuousness of space dominance. It is possible to establish air dominance over a specific area for a limited time. The same is true for sea control. But unless the United States is willing and able to shoot down anything that anyone launches that we don't approve of, anytime and anywhere – and deal with the consequent creation of an orbital debris mess, to say nothing of potentially igniting a war – claiming dominance leaves the United States to preach that others should "do as we say, not as we do."

Implementation Complications

The single-most complicating factor in space policy stems from the vast majority of space technology being dual-use, over 90% by most approximations. The term "dual-use" has two equally important meanings: 1) that the same basic technology has applications in both the civil and military sectors, and 2) that it is often difficult to distinguish whether military space technology is intended for defensive or offensive use. Much of the world considers investment in dual-use technology a good investment since it can be used for multiple applications. The United States, however, with its more highly bifurcated civil and military programs than other countries (and with larger budgets), largely considers dual-use technology as an opportunity for countries like China, Iran and North Korea to develop military technology for nefarious use under civilian guise.

For example, imagery satellites are neutral in themselves; the way the imagery they produce is used - whether for crop rotation or targeting weapons - determines whether it is a civil or military asset, or in the case of, for example, the Japanese Information Gathering Satellite (IGS) system, both.[28] By some U.S. accounts, nearly all Chinese space assets are military, though often very similar

[28] Joan Johnson-Freese and Lance Gatling, "Security Implications of Japan's Information Gathering Satellite System," *Intelligence & National Security*, Issue 19/3 (2004).

technologically to U.S. civil programs. In another case, as long as the United States pursues missile defense, some countries will consider the United States as having an (offensive) anti-satellite capability because the technology is so well-suited for the ASAT mission. The self-congratulatory American media coverage after the successful intentional destruction of USA-193 basically confirmed that ASAT capability to the world. "The unprecedented downing of an errant spy satellite by a Navy missile makes it clear that the Pentagon has a new weapon in its arsenal – an antisatellite missile adapted from the nation's missile defense system."[29]

Though space has long been militarized, the Bush Administration continued to assert that the Rubicon of actual space weaponry had yet to be crossed.[30] But dual-use technology blurs the line between militarization and weaponization considerably. While the Obama Administration has backed away from initial indications it would ban space weapons, it has encouraged instead other avenues for "actions management" - ways to distinguish between legitimate military uses of space and weaponization, or at least to discourage weaponization.

Strengthening measures to mitigate orbital debris, an example of "actions management," is given a special nod as part of the stated 2010 policy goal of "strengthening stability in space" through "domestic and international measures"[31] and elaborated on in discussion regarding preserving the space environment.[32] Ideally that might mean a treaty to prohibit certain debris-creating actions. Realistically, however, ratification of such a treaty would likely evoke a partisan battle in the Senate, framed as between those who want to protect national security and those who are willing to forego it for the sake of soft international goals. Bacevich sees the former group as supporters of an "Ideology of National Security" that allows American profligacy - and reality avoidance - to prevail.[33]

Policy language that "The United States will consider proposals and concepts for arms control if they are equitable, effectively verifiable, and enhance the national security of the United States and its allies" could also present real difficulties in making that ideal occur, to the likely disappointment of many. Under what circumstances, for example, could a space treaty be considered verifiable? Though verification has long been considered a potential "stopper" for space arms control mechanisms, there are efforts underway to specify conditions for verifiability from both a political and technical perspectives.[34]

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[29] Marc Kaufman and Josh White, "Spy Satellite Downing Shows a New Weapons Capability," *Washington Post*, February 22, 2008, A03.

[30] Although Baker Spring says in his July 6, 2010 *Webmemo* that "space has been weaponzied since the dawn of the space age."

[31] 2010 NSP, p. 4.

[32] 2010 NSP, p. 7

[33] See: Andrew J. Bacevich, *The Limits of Power: The End of American Exceptionalism*, (New York, Metropolitan Books, 2008), pp. 74-84.

[34] See: Ambassador Roger G. Harrison, Space and Verification, Volume I: Policy Implications, Eisenhower Center for Space & Defense Studies, 2011; Dr. David Finkleman, Space and Verification, Volume II: Technical Assessment, Eisenhower Center for Space & Defense Studies, 2011.

Though still preliminary, it is heartening that discussion has begun rather than simply being assumed to be "too hard." In the meantime, efforts for debris management, support for increased space situational awareness, and the fragile support for arms control indicate a more likely path toward actions management, rather than the creation of a legal regime that may not be able to be enforced anyway. Equally important, while the Obama Administration clearly wants to return U.S. space policy back to within mainstream international views, it must do so within domestic considerations. Politics is the art of the possible, not the ideal. Thus, while those who would support a treaty actually have a realistic view of the debris problem as one unsolvable by hard power unilateralism, a treaty is just as likely an unrealistic approach to solving it. Creativity will be at a premium.

JetBlue to Space?

A plethora of studies and commissions, particularly in the 1980's and 1990's, have looked at how to "fix" space, meaning how to more effectively utilize government resources and grow the space development field.[35] Fairly consistently, findings fall along three general axes: lower launch costs, more cooperation between the civil and military space communities, and more commercial involvement. We have known the necessary goals for some time, yet all remain elusive. Since President Obama clearly intends to rely considerably on commercial space for achieving his human spaceflight plans, as became clear with the FY 2011 NASA budget request, more appears to be riding on this iteration of the expanding commercial space effort of "fixing space" than in the past. This pragmatic approach seems necessary as the U.S. human spaceflight program has, since Apollo, often been funded by unsupportable methods, somewhat analogous to using a Mastercard to pay off a Visa. So this, again, is an attempt at a realistic approach to an old problem.

We have known the necessary goals for some time, yet all remain elusive.

This pragmatic approach has not seen universal acclaim; the cancellation of the Constellation program brought American-hero astronauts Neil Armstrong and Eugene Cernan out from retirement to protest. They claimed the move was "devastating" to the space program and that Obama's new plan was a "blueprint" to get to "nowhere."[36] Their angst is understandable. It is like watching the

[35]See, for example, *Pioneering the Space Frontier*, the 1986 report of the National Commission on Space; the 1987 *Leadership and America's Future in Space* generated by the first American woman in space, Sally Ride; the *Space Architect Study* done by DOD in 1988; the 1990 *Report of the Advisory Committee on the Future* of the US space Program (the Augustine committee); the 1991 *Synthesis Group Report* (the Stafford committee); the 1992 reports from the National Space Council and the Vice-President's Space Policy Advisory Board, *The Future of US Space launch Capability* and *A Post Cold War Assessment of US Space Policy*, and the 1992 National Research Council report *From Earth to Orbit*.

[36]Kathy Steinmetz, "Moonwalkers Defense Spaceflight at Senate Hearing," *Time*, May 13, 2010. http://www.time.com/time/nation/article/0,8599,1989024,00.html

auto plants in Michigan close up and move to Mexico. But both candidates Obama and McCain realistically had to tell voters in Michigan that those auto manufacturing jobs weren't coming back. In the same vein, economic realities have left President Obama to tell disappointed space enthusiasts that the Constellation program was being cancelled. This is a particularly bitter pill to swallow during very difficult economic times, as jobs were subsequently lost in key aerospace states like Florida, Alabama, Texas and California. Nonetheless, the adage "only poets write strategy without a budget" comes to mind when retrospectively viewing the Constellation program from its roots in the 2004 Bush Vision for Space Exploration speech.[37] The reality is – as supported by the report of the 2009 Augustine Commission,[38] specifically created to advise the President on the human spaceflight program – Constellation, as it stood at the time of cancellation, suffered an irrecoverable ends-ways-means mismatch such as discussed prior. As the program stood, potential success was an illusion.

Based on the cancellation of Constellation and his speech in April 2010,[39] the Obama Administration appears to have largely heeded the advice of the Augustine Commission. The commission recommended taking a flexible approach to exploration if significant budget increases were not forthcoming, which were not. Obama's epigraph at the beginning of the 2010 NSP says the United States' goals in space go beyond "a destination to reach." Coupled with the cancellation of Constellation, it is clear we are no longer racing the Chinese (back) to the Moon, a race we handily won against the Soviets in 1969, but in which we stood a good chance of losing this time around. Likely anticipating the outcry from those at a loss without destinations and timetables, however, it also states the United States will "begin crewed missions beyond the moon, including sending humans to an asteroid" by 2025 and "by the mid-2030s, send humans to orbit Mars and return them safely to Earth."[40] Clearly these were intended to reassure skeptics that the future of human spaceflight remained a priority. Personally, I think it was a mistake to include timetables for which there are no programs authorized or funding to achieve them. The political will to fund human spaceflight to a level commensurate for success within a timetable is unlikely to be any stronger for a new program than it was to fund Constellation. This is where (and why) the commercial sector is being counted on to step up.

That commercial, civil, and national security space sector guidelines for policy implementation are listed in the 2010 National Space Policy beginning with the commercial space sector and ending with national security space sector has been analyzed with

[37] Statement by Joan Johnson-Freese, Senate Hearing on Reauthorizing the Vision for Space Exploration, May 7, 2008. http://www.spaceref.com/news/viewsr.html?pid=27924

[38] Seeking a Human Spaceflight Program Worthy of a Great Nation, October 2009. http://legislative.nasa.gov/396093main_HSF_Cmte_FinalReport.pdf

[39] Kenneth Chang, "Obama Vows Renewed Space Program," *New York Times*, April 15, 2010. http://www.nytimes.com/2010/04/16/science/space/16nasa.html

[40] 2010 NSP, p.11.

Talmudic scrutiny. Those who consider space-related national interests as equating first and foremost to the national security space sector have cited that ordering as indicative that national security has been subordinated to arms control in this NSP.[41] Government strategies are intended to be in alignment like "nested" Russian dolls, one fitting within the other. If the NSP is nested within the National Security Strategy (NSS), as is likely and intended, then the space sector prioritization is not really surprising. While the 2006 NSS began with the words "America is at war,"[42] clearly and unequivocally focusing America on the fight against terrorism, the Obama NSS begins with a note of change.

> Time and again in our nation's history, American's have risen to meet – and shape – moments of transition. This must be one of those moments. We live in a time of sweeping change. The success of free nations, open markets, and social progress in recent decades has accelerated globalization on an unprecedented scale. This has opened the doors of opportunity around the globe, extended democracy to hundreds of millions of people, and made peace possible among the major powers. Yet globalization has also intensified the dangers we face – from international terrorism and the spread of deadly technologies, to economic upheaval and a changing climate.[43]

The importance of national security is not downgraded, but it is being defined more broadly and realistically. In terms of space, "change" means attempting – and I say attempting in recognition of past efforts – to bring space development to a path more similar to other areas of high-tech development rather than the anomaly it has been. Whereas airplanes and computers required government investment as seed money to then (relatively quickly) allow a commercial sector to flourish, in human spaceflight, the tipping point for the commercial sector to overtake government efforts has yet to occur. More than fifty years after John Glenn orbited the Earth, the government still controls tickets to space much differently than passengers booking a ticket on Jetblue, an aberration in an era of globalization.

Globalization has meant that capabilities like high resolution imagery, once available only to security communities in a very few countries, are now available on the commercial market. Globalization also means that countries are connected in ways that change how they can act and react in shaping and coercing the actions of others. Ben Baseley-Walker illustrates that point well when it comes to space. "If, for example, the United States blows up a Chinese satellite, what would I do if I were sitting in Beijing? Would I go and launch a missile at an American satellite? No, I would crash the dollar."[44] Space is a different venue

[41] See: Baker Spring, "Obama's National Space Policy: Subordinating National Security to Arms Control," *Webmemo*, The Heritage Foundation, No. 2950, July 6, 2010.
[42] http://georgewbush-whitehouse.archives.gov/nsc/nss/2006/
[43] http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf

[44] Panel Discussion – The New National Space Policy: Prospects for International Cooperation and Mankind Safe

than it was during the Cold War when governments controlled all assets, and hard power ruled the day.

Despite the best attempts of some entrepreneurs, human spaceflight has remained largely the purview of governments. Some of those best attempts have taught investor billionaires that space is an arena where large fortunes can quickly become small ones. PayPal founder Elon Musk got into the space launch business and founded the SpaceX Corporation, subsequently saying: "I want to be able to make sure that we have enough capital to survive at least three consecutive failures. If you want to make a small fortune in the launch vehicle business, start with a large one."[45]

Where the Obama policy offers new hope for the heretofore unattainable goal of commercial viability is in its definition of the commercial sector, including the omission of a previously laudable but unrealistic parameter. According to the NSP, commercial space "refers to space goods, services, or activities provided by private sector enterprises that bear a reasonable portion of the investment risk and responsibility for the activity, operate in accordance with typical market-based incentives for controlling cost and optimizing return on investment, and have the legal capacity to offer these goods or services to existing or potential nongovernmental customers."[46] A major change in this policy is the removal of a clause forbidding direct subsidies for commercial space, a ban included in both the Bush and Clinton policies. The apparent intent is to move U.S. commercial space activities onto a level playing field with most other spacefaring nations. Is the Ariane rocket, for example, marketed through Arianespace, a commercial space venture? It is certainly categorized as such within the international launch market, but the majority of shares are owned by the French government.[47] The French government also invested heavily in its development. The United States appears to be moving in the direction of this model, which other countries have long utilized. Again, there is no guarantee that the commercial sector will step up to the challenge, but trying to change the status quo model to a more realistic and sustainable approach over the long-term is laudable.

From Muddling Through to a Realistic Approach?

It has been apparent for some time to those who scrutinize space budgets and timetables that a day of reckoning was coming, sooner rather than later. That day has arrived. In human spaceflight and exploration, you get what you are willing to pay for. Without a viable commercial sector, it is largely up to the American public, through their Members of Congress, to decide what

Safer for All. July 1, 2010. www.armscontrol.org/events/newnationalspacepolicy

[45] http://www.evancarmichael.com/Famous-Entrepreneurs/1610/Elon-Musk-Quotes.html

[46] 2010 NSP, p.10.

[47] The French space agency, Centre National d'Études Spatiales (CNES), owns 32% of Arianespace. http://www.arianespace.com/about-us-corporate-information/shareholders.asp

they need, in accordance with what they want to spend.

While there are those in Congress who are angry and vocal over the cancellation of Constellation (including the loss of jobs in many of their districts) it must be remembered that Congress can always reallocate funds into the space budget if there really is enough political will to do so. In the early years of NASA, Congress provided more money than the agency requested in their eagerness to counter Soviet space achievements. Today, however, with competition for federal funding running the gamut across social welfare programs, job stimulus programs, on-going war efforts, domestic infrastructure, the environment, education, health care and more, human spaceflight will likely find itself with more rhetorical support than actual funding.

The President has said space is a vital interest of the United States, but there are finite resources to meet infinite possible interests. Though rhetorically supportive, the American public largely sees space exploration and development as admirable, but more expendable than schools, roads, health care, tax cuts and other priorities.[48] The Obama policy sets a way forward to try and achieve realistic goals within realistic budgets. It will require unprecedented levels of cooperation with other countries and reform of Cold War-era, ham-fisted, complicated export control laws to allow the United States to work with other countries and revitalize its competitive place in the international aerospace market.[49] The illusion that we can defend space technology exclusively with technology has been debunked and overcome by events, specifically the 2007 Chinese ASAT test. Yet whether the Obama Administration has the political capital to push the execution of this policy forward, and the political will to spend that capital on this issue, remains to be seen.

The Obama policy will require unprecedented levels of cooperation with other countries.

Recognizing and choosing a new path forward, one perhaps less "visionary" in the short term, could be more realistic in the long term. The auto manufacturing jobs are not coming back to Michigan and Ohio, and the United States is not going to be standing on the Moon in 2020. But resistance to change will still be strong.

Already there are signs that short-term, muddling-through advocates will not give up easily. The Senate Committee on Commerce, Science and Transportation unanimously agreed in July to an authorization bill plan to cut Constellation, but initiate development of a heavy-lift rocket in 2011,

[48] "50% Favor Cutting Back on Space Exploration," Rasmussen Reports, January 15, 2010. http://www.rasmussenreports.com/public_content/lifestyle/general_lifestyle/january_2010/50_favor_cutting_back_on_space_exploration; Darren K. Carlson, "Space: to Infinity and Beyond on a Budget," August 17, 2004. http://www.gallup.com/poll/12727/space-infinity-beyond-budget.aspx

[49] See: Joan Johnson-Freese, "Becoming Chinese: Or, How U.S. Satellite Export Policy Threatens National Security," *Space Times*, January-February 2001; Joan Johnson-Freese, "Alice in Licenseland: U.S. Satellite Export Controls Since 1990", *Space Policy*, August 2000.

potentially to be ready for use by the end of 2016. Again, politics being the art of the possible, that compromise provides jobs in aerospace states for politicians and near-term action for those who demand them. Not surprisingly, the money to start work on the heavy-lift vehicle will not be new money, but will be sliced from funds the administration proposed for developing new space technologies and commercial efforts. Also, since the Senate bill only covers the next three years, it is unknown what will happen after that.[50] So again, funding problems have not been realistically solved, just put off for somebody else to deal with.

There will be those who will resist change in time-honored ways: slow-rolling, dwelling on difficulties with past change efforts (just too hard), magnifying risks, and pointing out potential personal power impacts. Baker Spring warns against arms control agendas that "effectively circumvent the Senate's constitutional role in consenting to the ratification of international agreements that should be concluded as treaties."[51] While certainly not advocating a treaty, he also objects to anything short of a treaty (such as a Code of Conduct) - effectively reinforcing the "status quo" - by cautioning the Senate that its power could be circumvented. Additionally, there are those in government and in Congress especially (on both sides of the aisle) who will oppose any sort of cooperation with China on ideological grounds.[52] There are also those who will oppose the NSP on simple partisan grounds. But the time for profligacy is over, and the time for renewal and reality-based decision-making is here.

Those who have been pushing for the United States to move toward space dominance, to include the development of space weapons, under the guise of offensive-defensive capabilities or any other guise, will just have to try to wait out the President. While President Obama will likely not ban them, he also is unlikely to promote them. There are parallels in the space sector to that of the nuclear sector – where the President has said he wanted to move to "zero" but has found the path there strewn with political compromise and efforts by nuclear modernization stalwarts to "hold on" for the future. Space weapons advocates will likely do the same.

The 2010 NSP offers a blueprint for renewal rather than a blueprint back to the Moon, or a space battle plan. The challenge for NASA is to develop – quickly – innovative, affordable and, yes, inspiring, plans to take America forward in human and robotic space exploration. The commercial sector's challenge will be not only to facilitate NASA's plans, but also to innovate and implement plans of their own to go beyond NASA and truly develop space. The challenge for the military is to protect space as an environment for use by all, but especially the United States, without relying on potentially

[50]Kenneth Chang, "Senate Committee's NASA Plan Cuts Moon Program," *The New York Times*, July 15, 2010.
[51]Baker Spring, "Obama's National Space Policy: Subordinating National Security to Arms Control," *Webmemo*, The Heritage Foundation, No. 2950, July 6, 2010.

[52]See comments in: Peter J. Brown, Asia takes stock of new US space policy," *Asia Times,* July 16, 2010. http://www.atimes.com/atimes/printN.html

counterproductive, debris-creating, extremely expensive and technically unfeasible hardware. Taking up these challenges will yield not just benefits in space, but benefits regarding U.S. strategic leadership on Earth and in international security. The new blueprint offers new technical goals and opportunities ahead, and the revitalization of our strategic leadership. All are realistic goals worth pursuing. If we ignore them in favor of short-term, status quo approaches, it will ultimately be at the peril of U.S. national security.

Operationally Responsive Space: Past, Present and Future

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The Past

Where did the idea of Operationally Responsive Space originate? You might imagine that the idea was born during the First Gulf War, (sometimes called the First Space War), where use was made of strategic space systems to support operations. It was apparent, though, that strategic systems with very small fields of view and long revisit times were not well suited to operational reconnaissance. Other limitations of these strategic systems included a tasking system not suited for tactical timelines; significant data downlink requirements, making it difficult to deliver data into the theatre; a large in-theatre "footprint" for intelligence analysts; and lack of "command assurance" that the requested collection would not be pre-empted by higher national priorities, for which reason field commanders were unwilling to place reliance on them for critical operations. It is tempting to think that these limitations inspired system designers to conceive of constellations of smaller, more affordable satellites with wider fields of view.

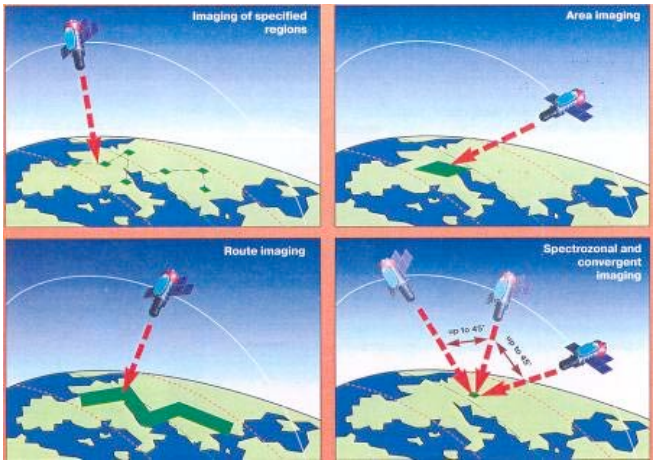
But in 1991, while the West was struggling to adapt the operations of its satellites to meet the demands of the conflict situation, the Russians were launching optical and RF surveillance satellites at an impressive rate. If the ORS programme does ever succeed in launching 18 low Earth orbit surveillance satellites in a four-month period like the Desert Shield operation, it will simply be emulating what the Russians achieved 20 years ago. In the same period in 1991, the West launched just one military mission, and had Russia chosen to engage in that conflict, it is clear which side would have possessed the "information edge". Analysts in the West quietly doffed their caps to the "operationally responsive" space programme in Moscow, who had comprehensively demonstrated a "Tier-2" launch-on-demand capability long before the concept was formally articulated in the West

And the Russians didn't stop there. In the mid-1990's they fielded a system called Arkon, which had an astonishing level of tactical capability. Placed in a high-altitude LEO, (with an apogee of 2750 km and a perigee of 1500 km), this large mission, (which would be considered a "Tier-1" asset in today's responsive space terminology), was able to deliver imagery with a resolution of better than five meters over enormous fields of regard. In the summer months, when the lighting in the Northern hemisphere was at its best, this single satellite could have provided between 8 and 10 images of a given point on the Earth's surface per day, and its high-altitude orbit would also have provided frequent opportunities for commanding and data dissemination.

The Russian Arkon Satellite

The Arkon satellite had a repeating ground trace, allowing it provide repeat coverage from the same point in space when required. This capability allowed the imagery from two consecutive days to be compared very easily, highlighting changes which would focus the attention of the analysts on areas of interest within the very large imagery scenes.

The Arkon satellite was large – it required a Proton launch vehicle to place it in orbit – but it was also agile. Illustrations released by the production organization in Russia showed at least four different modes of operation, including imaging of point targets, of areas, of lines of communication, and a mode in which the satellite could be trained on a specific location for tens of minutes if required.

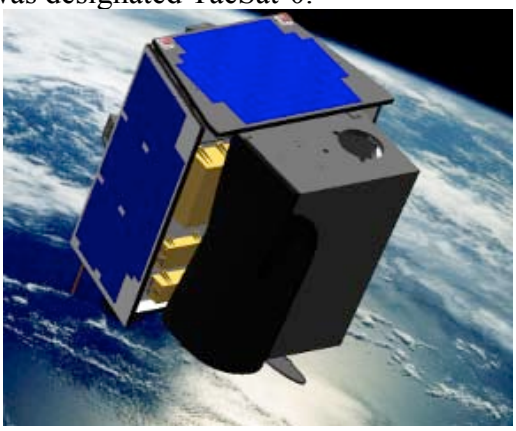


The Arkon Satellite's Operational Modes

Once again, analysts in the West doffed their caps!!

The Present

Tactically oriented satellites in the West have taken a different path, based on much smaller hardware, but it was not the United States who took the lead. Built in the United Kingdom, the TopSat satellite set a world record for "resolution per mass of satellite" by delivering better than three meter resolution imagery from a satellite platform weighing just 120 kg. For a satellite that cost less than $20m to build and launch, this mission set a new performance threshold. By the time TopSat was launched in 2005, the U.S. tactical space programme had commenced, and had assigned the designators TacSat-1, TacSat-2, TacSat-3, etc. Since TopSat preceded these US missions into orbit, collaborative experiments were conducted with U.S. researchers and TopSat was designated TacSat-0.



The TopSat satellite and one of its images of Kirtland AFB, NM

The specific technical trick that TopSat employed was to pitch backwards quite deliberately as it passed over its targets. This pitching motion slowed the effective ground rate of its sensor, allowing more light into the camera system, thereby getting close to the diffraction-limited performance of its 20 cm aperture telescope. This level of agility is only

possible with small, rigid satellites. Large platforms are seldom capable of achieving the angular rates required; and generally initiate vibrational modes that demand significant "settling time" before acceptable quality imagery can be collected.

But TopSat's pitching trick permits two other advantages that are key to ORS. One is that, if deployed into a sun-synchronous orbit, the satellite is no longer constrained to a local time of ascending node close to noon. It is able to extend the range of local times of day when imagery can be collected by pitching through a larger angle; compensating for the comparative lack of reflected sunlight near the terminator by slowing the ground rate of its sensor still further. The other key advantage is that a satellite like TopSat is no longer constrained to operate in a sun-synchronous orbit. If a satellite is deployed into a lower inclination orbit, (to provide more frequent revisits over operational regions, for instance), it is inevitable due to the laws of orbital dynamics that it will pass over its targets at different local times of day. For a larger satellite, this might be a problem, but for TopSat it simply means selecting an appropriate pitch rate for the local time of day and the prevailing lighting conditions.

The low cost of the TopSat mission demonstrated the potential affordability of constellations of small satellites to provide significantly greater timeliness, but to date it is Germany which has exploited the constellation concept most effectively for military purposes. Germany now has two 5-satellite constellations at its disposal; the military SAR system, SAR-Lupe, and the commercial RapidEye optical imaging system. SAR-Lupe and RapidEye are specifically designed to operate as constellations with much better revisit characteristics. The RapidEye constellation is comprised of small agile satellites which can roll off-nadir, meaning that the constellation can provide imaging opportunities over the entire globe at least once per day. And the SAR-Lupe satellites are equipped with an intersatellite link system which enables the satellites to transfer commanding information when they come within view of one-another and thereby enhance the response time of the system.

In an ORS context, both these systems would be regarded as "Tier-1" capabilities, in that they are already "on-orbit". However, they differ from the assets that have traditionally been assumed to comprise Tier-1 because they are not strategically oriented, single satellites being pressed into service as inefficient tactical surrogates.

These systems differ philosophically from the missions in the TacSat and ORS programmes in at least three key respects:-

- Firstly, they are clearly designed to operate as part of a constellation, (which affects all aspects of the satellite design, including both the payload and the platform). By contrast, the U.S. systems have yet to clearly indicate the "objective systems" that might result if the TacSat and ORS experiments are deemed successful.

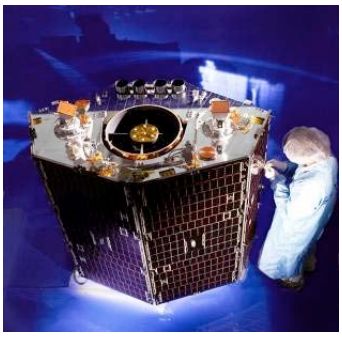
- Secondly, they are being used to support commercial and strategic applications whilst in orbit. It is arguable that one reason why the ORS programme in the US has not gained more momentum is that it is seeking to find funding for missions which, if only used over operational zones, are only going to be exploited for 1% or 2% of the time. Clearly the value for money from a satellite is greatly enhanced if it can also be used to support other missions, such as homeland defense; commercial collection; operational

training; and the requirements of allies elsewhere on the globe.

- Thirdly, they are expected to be launched once constructed, rather than being held on the ground as a series of sub-systems. For a commercial system like RapidEye, there is clearly a significant "opportunity cost" involved in having valuable hardware on the ground rather than in orbit, and even in the case of a military system such as SAR-Lupe, the pace of change in small satellite design means that hardware can rapidly become technically obsolescent if kept in storage for too long, (which some might suggest was the fate of the original TacSat-1 payload)

Now it might be argued that it is very difficult to design a satellite that can be used to support all these differing requirements, and this may once have been true. However, sensor and payload technology has advanced to the point where the agility of small satellites can support a number of different modes of operation. The SSTL-300, which is due for its first launch in May 2011, is a prime example.

Some of these modes presume detailed advanced knowledge of the target regions, and so are more suited to strategic surveillance, whereas others cover larger regions and can provide support to operational and tactical missions. Moreover, the satellite is equipped with both wide area cameras and a high resolution camera on the same platform. This is analogous to the way that the human eye operates, with the lower resolution, wide-area "peripheral vision" cameras providing detection and cueing data for the higher resolution, small area camera that provides the high fidelity imaging.



The SSTL-300 imaging satellite

So where have the major successes of the ORS programme occurred to date? One of the principal achievements was the inclusion of both imagery and Radio Frequency (RF) surveillance sensors on the TacSat-2 mission. To extend the analogy with the human sensing system, this satellite had ears as well as eyes, and was therefore potentially capable of greater "self-cueing". (In practice, accommodation constraints and power budget limitations meant that TacSat-2 was not able to operate its eyes and ears simultaneously over the same region of the ground, but it certainly points towards the future.)

Another clue to the future is provided by the feedback from the TacSat-3 mission. Equipped with a small-footprint hyper-spectral sensor the satellite demonstrated the potential value of spectral imagery, if not the area coverage rate and timeliness required to support the warfighter.

The Future

As technologies continue to improve, the contribution that operationally responsive space systems can make to military operations will continue to increase. Charge Coupled Device (CCD) detectors now allow the imaging of far greater areas than was possible previously.

The image below shows the image footprint of a modern small satellite over Australia. The much smaller brown stripes across the continent are the footprints generated by the Landsat satellites at a comparable resolution.

A comparison of current and historical coverage rates

Clearly, the increased volumes of data generated by such sensors demand greater on-board storage capacities, and higher data downlink rates, but again the rapid pace of development in terrestrial computing technologies is providing a solution to these problems. In the case of the SSTL-300, the demand for greater downlink capacity is being addressed via the development of a steerable data downlink antenna system which can track a specific ground station with a narrow beam-width antenna, enabling the available satellite power to be concentrated into a smaller region and so deliver a higher capacity link budget.

And as the power of on-board computing increases, it will become increasingly common to process the imagery data on board the satellite, and downlink a much smaller image file, rather than transfer the raw collection to the ground – although the raw data could be downloaded if necessary.

And the nature of the connections available to transfer this data will also change. At present, the number of ground stations available to an ORS system is usually quite limited. This constrains both the speed with which the imagery data can be returned, and the overall capacity of the system, (since the number of times that the satellite's on-board memory can be filled and emptied on a given day will also be dependent on its access to ground station facilities).

Those downlink requirements are becoming more impressive all the time. An example is SSTL's Earthmappper system, where a constellation of 5 satellites, each weighing just 100 kg, now has the capability to image the entire landmass of the globe on a daily basis.

Essentially the satellites are "always on", and collect imagery whenever the mission is over the Earth's surface. The challenge is clearly to ensure that this valuable imagery is down-linked to the ground, and not trapped on orbit.

In the next generation, it is expected that the use of inter-satellite links will become increasingly common on ORS assets. Currently, such links are generally reserved for grand strategic systems, but the success of UAV's using satellite communication systems suggests that this will also become routine for satellites in the future. They are, after all, the ultimate high-flying UAV's, and some, (e.g. ORS-1) are even based on modified airborne sensor technology!

Another obvious solution to the downlink issue is to internationalize the ORS programme, providing the opportunity to access ground station facilities in multiple nations at different longitudes around the globe. A thirteen-nation MOU is currently in

the process of negotiation, and this has the potential to start the process of creating the "Coalition ORS" concept which has been proposed previously.

Moreover, international collaboration between the United States and other nations already exists elsewhere in the space arena. One example is the use by the U.S. Government of leased capacity on Paradigm's Skynet 5 satellites, which were launched to provide secure communications for the UK MOD under an innovative procurement process which transferred significant risk to the contractor in exchange for a long duration contract. This arrangement establishes a precedent which could also be exploited in the surveillance domain if the UK elects to invest in a sovereign surveillance system. . The recently released U.S. National Space Policy and the DoD National Security Space Strategy both direct the use of coalitions where appropriate for both operational and geopolitical reasons.

As satellites have become essential to war-winning, they have increasingly become the target for anti-satellite capabilities – both in space and on the ground. Expect to see increasing efforts to protect satellites from such measures by the application of stealth technologies to the space vehicles and continuing efforts to harden the terrestrial networks and infrastructure against all forms of hostile interference. Augmenting existing satellite constellations with small satellites makes intentional or unintentional interference or denial of the overall capability more difficult. Additionally, integrating space and terrestrial capabilities can further enhance the overall resilience of the system, and although breaking down "stovepipes" is difficult, this is another possible medium-term development.

Conclusion

Finally and perhaps most importantly, small satellites can radically change the calculus concerning satellite lifetimes. Smaller, cheaper satellites simply do not have to last as long as large satellites in order to deliver the same value for money. As a consequence, it is logical to consider deploying them in lower, shorter-lived orbits, and this could modify the overall approach to ORS enormously. Satellites closer to the Earth require smaller apertures and less power, with the result that the missions can be scaled down to the point where they become candidates for air-launch.

These new technologies and new capabilities offer tremendous flexibility that will make the next generation of satellite constellations truly operationally responsive.

Space Deterrence or Dominance?

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**Unless otherwise noted, the conclusions expressed herein are solely those of the author writing in his personal capacity. They are not intended and should not be thought to represent official ideas, attitudes, or policies of any agency of the United States Government. The author has used publically available information in the researching and presentation of this work.*

ABSTRACT: *A strategy to safeguard United States' space assets is needed. Deterrence strategies, like Cold War nuclear deterrence, are often recommended. Nuclear deterrence history reveals that deterrence through dominance is what early strategists employed. Both Cold War adversaries attempted repeatedly to gain the lead in nuclear weapons. Seeking short term advantages activated the security dilemma and both sides responded in kind, guaranteeing an arms race. The faulty logic of the security dilemma was that the next advantage would bring security. This did not happen and illustrated how mutual vulnerability resulted from long term and determined opposition. That condition exists to this day, made bearable by agreements and procedures that reduce fear through increased transparency and verification.*

The 2001 Space Commission Report identified the threat of a "Space Pearl Harbor" and called for military solutions, including denying space to adversaries. This set United States' space policy on a course to repeat the Cold War mistake of seeking deterrence through dominance.

The United States' best option is to abandon space deterrence through dominance strategies and accept the inevitable end state of mutual vulnerability and thereby avoid engaging in a space arms race. A cooperative legal framework with transparency to assuage fear is the best policy, not because of an idealistic view of benevolent human nature, but because that will be the end result in the long run even after great effort and expense to dominate space.

"I DO BELIEVE THAT MAN'S WISDOM IN AVOIDING WAR IS OFTEN SURPASSED BY HIS FOLLY IN PROMOTING IT."[1]

Space capabilities are vital to the United States. It is critical, therefore, for the United States to develop an effective long term strategy to safeguard assets in space. Deterrence strategies based on the Cold War example are often discussed as a model for space. Examining the evolution of nuclear deterrence reveals, however, that a deterrence model accepting long term vulnerability emerged after attempts at deterrence through dominance strategies failed. The Cold War experience with two determined adversaries illustrates how the security dilemma can spawn an arms race. In the long run, however, a situation of deterrence based on mutual vulnerability is the inevitable end state. The deterrence found in mutual vulnerability is based on both sides having the ability to inflict harm. It is deterrence from a position of reciprocal strength. While dominance in a

[1]Robert S. MacNamara, "The Dynamics of Nuclear Strategy," *Department of State Bulletin* 57, (9 October 1967), p. 450.

military capability can provide deterrence while it lasts, it also activates the security dilemma and any ensuing arms race negates the deterrent effect just recently enjoyed. In spite of the Cold War example of unsuccessful short term dominance strategies, the United States openly advocated steps toward a dominance strategy in space with the release of the *Report of the Commission to Assess United States National Security Space Management and Organization* published in 2001 (hereafter referred to as the Space Commission Report). While deterrence is cited as the goal for space, some of the actions called for by the Space Commission Report can be interpreted as steps toward a dominance strategy. A possible outcome of the military's pursuit of some of the more aggressive goals set out in the Space Commission Report is a costly arms race. History shows that new offensive capabilities are eventually negated by defensive countermeasures or countered with greater numbers of opposing capabilities. Once begun, arms race momentum is difficult to reign in. In a competitive global environment, there is little likelihood that the United States can maintain space dominance over the long run. Like the nuclear arms race of the Cold War, a space policy seeking deterrence through dominance will yield mutual vulnerability as the end state. The key to making deterrence under mutual vulnerability bearable is to increase transparency in order to ease fears and build trust. For space, this requires much better space situational awareness (SSA) for all concerned parties. Comprehensive and cooperative SSA will allow space faring nations to know what is actually happening in space instead of defaulting to worst case scenario assumptions. The best approach to space policy for the long run is a cooperative arrangement that accepts mutual vulnerability because that's the situation most likely to emerge even after great efforts to dominate space are made.

The Cold War

"WE DO NOT WANT A NUCLEAR ARMS RACE WITH THE SOVIET UNION—PRIMARILY BECAUSE THE ACTION-REACTION PHENOMENON MAKES IT FOOLISH AND FUTILE."[2]

The last chapters of the Cold War left an impression that nuclear deterrence was finally attained after years of effort. Mutually Assured Destruction (MAD) is the nuclear deterrent end state that the world became familiar with. It involves living under threat of annihilation because of the reserved capability to inflict equally unacceptable devastation upon the enemy.[3] This "delicate balance of terror" continues to keep both sides in check and is what we have come to know as nuclear deterrence.[4] This idea of nuclear deterrence—deterrence under mutual vulnerability—is a strategy that emerged after attempts at deterrence through dominance failed. Deterrence through nuclear dominance was embraced from the outset as illustrated by the U.S. reaction to the Soviets' first successful atomic detonation. The U.S. response was "to raise the nuclear stakes even higher by authorizing development of the hydrogen (thermonuclear) bomb."[5] This capability escalation in order to gain, maintain or regain an advantage continued throughout the Cold War. The ensuing arms race was enormously expensive to both sides and neither felt much more secure for the effort.

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[2] Ibid., p. 447.
[3] Fred Iklé, "Can Nuclear Deterrence Last Out the Century," *Foreign Affairs* 51, no. 2 (January 1973), p. 268.
[4] Albert Wohlstetter, "The Delicate Balance of Terror," *RAND P-1472*, (Santa Monica: RAND Corporation, 6 November 1958).
[5] Lawrence Freedman, "The First Two Generations of Nuclear Strategists," in *Makers of Modern Strategy: from Machiavelli to the Nuclear Age*, edited by Peter Paret (Princeton: Princeton University Press, 1986), 738. Walter A. McDougal, *...the Heavens and the Earth* (Baltimore: Basic Books, 1985), p. 50.

Competitiveness and seeking advantage are part of human nature. Nowhere is this more evident than in military organizations. Military leaders are charged with fighting and winning the nation's wars. They are archetypal advantage seekers, an essential trait their fellow citizens demand of them. It should come as no surprise that military thinkers advocate dominance strategies. There are negative consequences to always seeking the advantage, however. The most significant is the "security dilemma" (originally "security and power dilemma") which describes a situation where one nation's effort to attain more security, normally through armaments, serves to threaten the security of another nation.[6] The security dilemma is the foundation for an arms race—essentially an action-reaction model. "Country A is stimulated by B's arms accumulation, and what A does by way of reaction serves as a further stimulus to B…."[7] This can become a never ending cycle when resolute adversaries confront one another, each apprehensive of the other and determined to protect itself. It seems a logical choice to try to attain or maintain an advantage over an adversary. Unfortunately, the very act of deterring through military advantages is a dominance strategy and practically guarantees an arms race when a determined adversary exists and has the means to compete. The irony of the security dilemma and subsequent arms race is that, despite the incredible effort and expense, there is little added security in the long run due to the heightened danger caused by high levels of armament.

The Cold War illustrates the security dilemma and resulting arms race very well. At the close of the Second World War (WWII), the United States sought to offset Soviet conventional force superiority by using its relative advantage, atomic weapons. The Soviet Union, threatened by this, countered the U.S. advantage by developing atomic weapons of its own. The U.S. advantage eroded under this concerted opposition, so it stayed competitive by developing the hydrogen bomb. It did not occur immediately to advocates of the hydrogen bomb that an arms race would be the result. The thermonuclear bomb was a way to stay in the race and hopefully win.[8] This is the problematic logic of the security dilemma, that the next advantage will provide the security desired—the fallacy of the last move. An arms race is a short sighted plan to garner security through the "immediate benefits that temporary superiority might afford."[9] After embarking down this path, it proved impossible for either to change course.

When there were 100 nuclear warheads, deterrence was thought to hold. When there were 1000, the same was true. At 10,000, people probably felt about as safe as they had at 100, and yet the sides continued to build to more than 30,000. It is estimated that between 1945 and 2000, the United States built 70,000 nuclear warheads and the Soviet Union/Russia 55,000.[10]

As the security dilemma predicts, both countries increased their capabilities in a cycle of action and reaction. By the end of the Cold War both sides had spent an enormous amount of money with neither feeling much safer for the expense.

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[6] John H. Herz, *Political Realism and Political Idealism: A Study in Theories and Realities*, (Chicago: University of Chicago Press, 1951).

[7] James E. Dougherty and Robert L. Pfaltzgraff, Jr., *Contending Theories of International Relations: A Comprehensive Survey*, (New York: Longman, 2001), p. 292.

[8] Richard Rhodes, *The Making of the Atomic Bomb* (New York: Simon & Shuster, 1986), p. 768.

[9] Freedman, "Nuclear Strategists," p. 739.

[10] Edward Ifft, "Deterrence, Blackmail, Friendly Persuasion," *Defense & Security Analysis* 23, no. 3, (September 2007), p. 240.

In addition to matching offensive capabilities, defensive measures are an important part of the competition too. In an arms race, each new offensive capability is offset by defensive countermeasures which, in turn, spur the next round of offensive capabilities.[11] The Cold War illustrates this "iron law of weapons development" which says that any new capability is countered over time with technology and procedures to defeat it.[12] The sword was met with armor and shields. German bombers were identified with British radar. Submarines spawned sonar and depth charges. Tanks were attacked with bazookas. Radio communications were foiled by jammers. The list is long and the point behind it paramount. Where a determined adversary exists, the security dilemma dictates that there is seldom more than ephemeral advantages. To avert an arms race, a way must be found to avoid short term dominance strategies. The Cold War illustrates the intoxicating logic of seeking advantage as a way to attain deterrence, then embracing as rational the arms race and insecurity it produces.

Nuclear policy began to shift from deterrence via dominance to deterrence under mutual vulnerability with the introduction of Intercontinental Ballistic Missiles (ICBMs). ICBMs represented, in some ways, the culmination of the offense-defense duel. They were a relatively safe offensive weapon due to mobility and hardened facilities and nearly impossible to defend against because of their flight path and speed.[13] As a result of these characteristics, ICBMs were fielded with the knowledge that populations on both sides would be vulnerable.[14] The nuclear arms race ran its logical course and mutual vulnerability was the end result. With the realization of mutual vulnerability came strategies that were more purely deterrent in nature.[15] This is not to say that deterrence wasn't sought all along. It was. However, much Cold War deterrence was sought through advantage or dominance strategies, not from positions of equality or mutual vulnerability. Unlike deterrence strategies based on some level of dominance, the new deterrence introduced by ICBMs accepted the reality of the other side's capabilities and sought to manage the situation somewhere short of conflict. Since deterrence seeks security through maintaining capabilities to dissuade aggressive behavior from the other side, the ideal situation is to keep that level of military capability at the lowest possible level. This reduces overall costs and the inherent danger of large weapons stockpiles. The huge buildup of weapons during the Cold War illustrates that the longer it takes to transition from deterrence via dominance to deterrence accepting mutual vulnerability, the more costly and potentially dangerous the arms race.

Arresting the momentum of the arms race during the Cold War was difficult to do. Greater transparency was essential to disrupt the cycle of fear. This was because military leaders' desire for more weapons was often motivated by the unknown capabilities of their adversary. Military leaders must plan for the worst case scenario. Lack of real knowledge of Soviet capabilities led to more U.S. weapon acquisitions that fueled the "mad momentum" of the arms race.[16] The Cold War saw bomber gaps, missile gaps and every other conceivable capabilities gap which required more weapons to fill. Closing all of these perceived gaps gave momentum to the arms race until, after significant effort and great expense, "both

[11] Freedman, "Nuclear Strategists," p. 755.
[12] Benjamin S. Lambeth, "Air Power, Space Power and Geography," *Journal of Strategic Studies* 2, no. 2/3, (June/Sept 1999), p. 72.
[13] Warren Amster, "Design for Deterrence," *Bulletin of the Atomic Scientists*, (May 1956), p. 165.
[14] Freedman, "Nuclear Strategists," p. 757.
[15] Amster, "Design for Deterrence," p. 165.
[16] MacNamara, "Dynamics of Nuclear Strategy," p. 450.

sides gradually came to understand that transparency…could improve their security."[17] Transparency permitted planning for real threats, not imagined ones, and allowed the upward trajectory of the arms race to finally subside. Arms control agreements were negotiated and verification procedures provided the necessary transparency to gradually ease fears. The end result was a way out of the arms race with transparency making the uncomfortable feeling of mutual vulnerability a bit more bearable.

This is a narrow review of just some of the dynamics of the Cold War that are applicable to future space policy. It is not intended as a complete analysis of the myriad dynamics of Cold War strategy, policy or decision making. It is clear, however, that in spite of difficult debates and agonizing decisions over Cold War military strategy, both the United States and former Soviet Union did, in fact, develop nuclear weapons in the tens of thousands only to work toward their destruction after the Cold War thawed.[18] Space policy practitioners can learn some lessons from Cold War deterrence practices. First, deterrence through dominance (advantage seeking) is a short term strategy if a capable and determined adversary exists. The long term situation will be deterrence under mutual vulnerability and acceptance of other nations' capabilities. Second, policy makers should recall that the security dilemma, once activated, can lead to an arms race which is very difficult to reign in. Finally, transparency is required to assuage fears, whether to prevent an arms race or to end one. These lessons are important to remember because the United States indebted future generations with the cost of "winning" the Cold War and the Soviet Union ceased to be.

The Space Commission Report

"BUT WE SHOULD BEAR IN MIND THAT IT IS MONEY SPENT BECAUSE OF THE ACTION-REACTION PHENOMENON."[19]

Fear of losing a vital capability can drive the security dilemma in the same way as fear of another's capabilities. Relative capabilities and advantages matter most for security concerns since one nation's strengths are important mostly as compared to the strengths of others. The United States publicly announced fear of a "Space Pearl Harbor" in the Space Commission Report.[20] This fear has some parallels to the situation at the close of WWII. Then, as now, the United States actually had the advantage. The fear then, as now, was of losing it. The perceived threat to U.S. space dominance spurred the United States to action. According to the Union of Concerned Scientists database, as of 1 January 2010 there were 926 satellites in orbit. Of those, 422 were solely U.S. satellites with another 20 having the United States as a cooperating partner. This means the United States operates solely, or has a stake in, 48 percent of all satellites in orbit.[21] In spite of this substantial numerical advantage, the commission expressed concern. This concern is founded on one belief in particular. "We know from history that every medium—air, land, and sea—has seen conflict; reality indicates that space will be no different."[22] This logic is similar to the logic that led to the

[17] William C. Martel and Toshi Yoshihara, "Averting a Sino-U.S. Space Race," *The Washington Quarterly*, (Autumn 2003), p. 28.
[18] Robert Norris and Hans Kristensen, "Global Nuclear Stockpiles, 1945-2006," *Bulletin of the Atomic Scientists*, (July/August 2006), pp. 64-66.
[19] MacNamara, "The Dynamics of Nuclear Strategy," 448.
[20] *Report of the Commission to Assess United States National Security Space Management and Organization*, (11 January 2001), p. 22.
[21] "UCS Satellite Database," *Union of Concerned Scientists*, http://www.ucsusa.org/nuclear_weapons_and_global_security/space_weapons/technical_issues/ucs-satellite-database.html.
[22] *Report of the Commission*, p. 100.

Cold War arms race. The United States expected the former Soviet Union to advance conflict in every way possible, and the Soviets expected the same. Due largely to this pessimistic and uncooperative view of human nature, both nations' fears were realized in the arms race that followed. While the commission's assessment of conflict in every medium is accurate, history reveals another important factor that the commission did not address. To borrow from the commission's statement about history: we know from history that every *military capability*—whether in air, land, or sea—has seen *countermeasures*; reality indicates that space will be no different. This is also an "iron law" from history and warns of an arms race to follow if determined opposition exists.[23] Policy makers must deal with both these realities or risk activating the security dilemma.

The foundational beliefs of the 2001 Space Commission Report were incorporated into the 2006 National Space Policy. The commission's recommendations set the stage for a more assertive space policy. The specific language of the 2006 National Space Policy that received a great deal of attention is that of denying space capabilities to potential adversaries. Joan Johnson-Freese writes that "although the words 'space weapons' are never uttered, they can be heard if one listens closely."[24] The assumption is that denying a space capability to an adversary will require some type of space weapon, something the Space Commission Report advocates outright.[25] Whether or not the policy explicitly calls for weapons in space, its tone promotes the image of space superiority. The second paragraph of the policy states that "those who effectively utilize space…will hold a substantial advantage over those who do not."[26] This is the language of competition and dominance like that of the early Cold War. An arms race in space could emerge if a determined adversary with the means to compete chooses to do so.

An alternative to the aggressive approach suggested in these two documents seems unlikely to come from military leadership. The military is charged with ensuring that if the nation "calls its sons and daughters to arms…that they have every advantage in the field so that they prevail."[27] Gaining and maintaining capability advantages is what the military does. Space will be no different.

Indeed, three months after the release of the Space Commission's report, General Eberhart indicated that Air Force Space Command had supported the commission's recommendations "in every respect." He also noted that the Air Force chief of staff, General Ryan, had moved promptly to cut off any nonconcurring groups within the Air Force to telegraph clearly that the Air Force had accepted the commission's recommendations in principle and was now deep in the process of trying to determine how best to comply with them.[28]

A survey of 75 space professionals attending classes at the National Security Space Institute (NSSI) in March 2010 confirms that the military has internalized the space commission's assessment. Of those surveyed, 92 percent believe that space will see conflict, with 81 percent identifying China as the primary competitor. An almost unanimous 97

[23] Lambeth, "Air Power, Space Power and Geography," p. 72.
[24] Joan Johnson-Freese, "The New U.S. Space Policy: A Turn Toward Militancy?," *Perspectives,* (Winter 2007), p. 34.
[25] *Report of the Commission*, p. 17.
[26] "U.S. National Space Policy," The White House, August 31, 2006, p. 1. http://www.whitehouse.gov/sites/default/files/microsites/ostp/national-space-policy-2006.pdf
[27] John Hyten and Robert Uy, "Moral and Ethical Decisions Regarding Space Warfare," *Air & Space Power Journal*, (Summer 2004), p. 55.
[28] Benjamin S. Lambeth, *Mastering the Ultimate High Ground: Next Steps in the Military Uses of Space*, (Santa Monica: RAND, 2003), p. 80.

percent believe the United States should attempt to maintain its current advantage in space.[29] These views represent space professionals dedicated to a dominance strategy in space. This was the approach followed at the start of the Cold War as well—trying to stay ahead. Predicting what lies ahead, 69 percent of those surveyed also think an arms race in space is likely.[30] In light of the near unanimous call to maintain U.S. advantages in space, this indicates that the current group of space professionals has embraced the concept of an arms race to stay ahead—space dominance.

There is a time to engage in an arms race, but that time is not now. Participating in an arms race makes sense if an adversary builds military capabilities that represent an existential threat to national survival. During the Cold War, both the United States and the former Soviet Union built nuclear arsenals that could almost completely destroy the other. Faced with the threat of destruction, it did make sense for both sides to offset the capabilities of the other. The faulty logic was in endlessly pursuing dominance rather than accepting deterrence and the mutual vulnerability it implied. Neither the United States nor the former Soviet Union was satisfied to stop the arms race unless they were in the lead. This focus on short term advantage even when long term mutual vulnerability was evident is why the arms race took on such a "mad momentum."[31] All this effort was ultimately unnecessary since the condition of mutual vulnerability, once established, did not change throughout the Cold War. It is the condition that remains today. To some extent, the problem early in the Cold War was unmitigated fear of the unknown. Lack of real knowledge about Soviet capabilities and intentions certainly motivated the United States to participate in the arms race. After all, national survival was at stake. Soviet apprehension about the United States motivated them in the same way.

Representative of the military dominance approach to space, Everett C. Dolman, professor at the Air Force's School of Advanced Air and Space Studies, writes that "the United States should seize control of outer space and become the shepherd (or perhaps watchdog) for all who would venture there, for if any one state must do it, it is the most likely to establish a benign hegemony."[32] The rest of the world seems not to agree with this assessment of the United States as an unthreatening power. The European Union is developing its own version of the Global Positioning System (GPS), called Galileo, illustrating its doubt about the enduring benevolence of the United States.[33] Russia and China are developing and improving their own space based navigation systems as well. This in spite of U.S. assurances that the GPS signal would never be denied to worldwide users. China feels that "the United States' self-appointed guardianship of space is presumptuous and represents a genuine challenge to China's national security concerns."[34] Rather than speak with words that the United States might not hear, China demonstrated an anti-satellite (ASAT) weapon in January 2007, destroying one of its own satellites in a possible "shot across the bow of

[29] Author's survey of students attending National Security Space Institute (NSSI) classes, March 2010.
[30] Ibid.
[31] MacNamara, "The Dynamics of Nuclear Strategy," p. 450.
[32] Everett C. Dolman, *Astropolitik: Classical Geopolitics in the Space Age*, (Portland: Frank Cass, 2002), p. 157.
[33] Simon P. Worden and Joan Johnson-Freese, "Globalizing Space Security," *Joint Forces Quarterly*, (Winter 2002-2003), pp. 65-66.
[34] Martel and Yoshihara, "Averting a Sino-U.S. Space Race," p. 19.

U.S. military power."[35] Uncontested hegemony in space is as unlikely as earlier attempts at nuclear hegemony—opposition is evident.

Mutual Vulnerability

"FOR IT IS A PROFITLESS WASTE OF RESOURCES, PROVIDED WE AND THE SOVIETS CAN COME TO A REALISTIC STRATEGIC ARMS LIMITATION AGREEMENT."[36]

The long term end state in space will be deterrence under mutual vulnerability, as with nuclear weapons before. In a competitive strategic environment, there are essentially three alternatives to this end state over the long run. The United States could fight a preventive war to eliminate an adversary's space capabilities so they cannot threaten U.S. space assets. Absent war, a unique situation could arise where no competitor emerges to challenge U.S. dominance in space—a forfeit win. The final alternative is to compete in an arms race and win, maintaining the dominance sought. An examination of each alternative reveals that, for a variety of reasons, mutual vulnerability will be the long term end state.

Preventive war is striking a country without provocation for the purpose of maintaining a power advantage. This is the most violent side of dominance strategies where it is deemed acceptable to wage war rather than accept a potential threat sometime in the future. Preventive war is something that liberal democracies are averse to do since justification for it usually fails to cross the political and moral imperative thresholds. China is the country most often mentioned as the next potential threat to the United States. Absent a state of hostilities, it is difficult to imagine U.S. civilian decision-makers authorizing a U.S. first strike on China for the morally indefensible goal of staying in the lead in space. China and the United States are also intimately connected through trade and financial transactions, with China holding a large stake in U.S. debt. This, and the fact that the American people are unlikely to tolerate a preventive conflict to stay ahead in space, makes preventive war highly improbable.

Another alternative to mutual vulnerability is the fortuitous situation where no adversary emerges to challenge U.S. space dominance. This thinking often accompanies dominance strategies. It suggests that U.S. space capabilities will not be challenged due to the enormous effort required to catch up. As previously discussed, the former Soviet Union's actions early in the Cold War when its atomic detonation ended the U.S. nuclear monopoly undermine this kind of thinking. An unchallenged position in space today is as unlikely as an unchallenged position in nuclear arms was after WWII. China, Russia, and the EU have signaled various degrees of dissatisfaction with unchecked U.S. dominance and, if history is a guide, that position will not go uncontested over the long run.

The final alternative to mutual vulnerability in space is to engage in, and win, a space arms race. Winning an arms race means the U.S .maintains space dominance and does not have to accept mutual vulnerability as the end state. Winning is not just participating in an arms race and surviving. Winning means attaining the goal—dominance. If mutual vulnerability lies at the end of the arms race then nothing has been won.

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[35] Bates Gill and Martin Kleiber, "China's Space Odyssey: What the Antisatellite Test Reveals About Decision-Making in Beijing," *Foreign Affairs* 86, no. 3, (May/June 2007), p. 2.
[36] MacNamara, "The Dynamics of Nuclear Strategy," p. 448.

The Cold War illustrates that true deterrence is a strategy that accepts mutual vulnerability, not dominance. It is certainly true that dominant military capabilities have a profound deterrent effect *while they last*. But deterrence based on dominance is fleeting. A stable deterrent end state is based on mutual vulnerability after the competition subsides. However, mutual vulnerability doesn't mean defenseless. Nor is it a position of weakness. It is simply the condition that emerges when neither side can dominate the other, but each maintains a capacity to inflict harm. This concept of mutually vulnerable deterrence already applies to space. Satellites are practically the definition of vulnerable, flying predictable orbits with few defenses. Due to this orbit predictability, lack of defenses and an inadequate space object identification and characterization capability, the offense has the advantage over the defense in space such that taking out a satellite is relatively much less difficult than defending one.[37] This means that mutual vulnerability is the condition that exists in space today. Combined with the knowledge of ready space competitors and demonstrated countermeasures, the likely end state is clear. Deterrence based on mutual vulnerability, not dominance, is the future of space.

An important step toward making deterrence under mutual vulnerability politically and militarily tolerable is to increase transparency. Cooperation between space faring nations will require agreed upon procedures that establish the transparency necessary to solidify trust.[38] Verification of the conditions of an agreement serves to lower tensions in a de-escalating cycle opposite that of the escalating cycle of the security dilemma. As the dominant space power, increasing transparency will pose difficulties for the United States. A verification study conducted by the Eisenhower Center for Space and Defense Studies points out that "[i]ncreasing the openness of space operations…involves inequity for the United States. Because we can see more and see further, others stand to gain more in the short run than we do. A political judgment will be needed as to whether the long term gain in stability and predictability outweighs this short term, relative disadvantage."[39] As discussed so far, the Cold War example strongly suggests that long term stability is preferable to short term advantage. When the United States feared the unknown nuclear capabilities of the former Soviet Union during the Cold War, the introduction of reconnaissance satellites helped lower anxiety levels. Real information was far more useful than the imagined worst case scenarios in military planners' minds. Once arms control agreements where negotiated and in place, transparency made them bearable and helped them stick.

U.S. de facto dominance in space means that the United States has the most to lose there. In order to keep an arms race at bay, the United States needs to improve its information about what is happening in space in an accurate and timely manner. Like reconnaissance satellites during the Cold War, better SSA can provide real information and alleviate tension. SSA is the ability to assess the big picture in space through detection, characterization and tracking. It is who, what, where, and why for all things in space. But the capability to accomplish this in a timely manner at the level of fidelity required for accurate characterization of both capability

[37] Robert Giffen (General, USAF retired, PhD) in discussion with the author, March 2010.
[38] Martel and Yoshihara, "Averting a Sino-U.S. Space Race," pp. 27-28.
[39] Roger G. Harrison, *Space and Verification*, "Volume I: Policy Implications," (Eisenhower Center for Space and Defense Studies, 2009), p. 13.

and intent does not currently exist.[40] As Dr. David Finkleman points out, "the United States Air Force Space Surveillance Network (SSN) cannot gather data sufficient for complete collision avoidance" of objects in space.[41] In light of the vital nature of space assets to U.S. national security, this knowledge gap serves to aggravate U.S. fears and gives credence to calls for dominance strategies. One step toward improving SSA could be the incorporation of "Persistent Technical Means for ground-based space situational awareness."[42] This method would employ the many civil and commercial means of space surveillance already in place, providing more timely and accurate SSA than is possible utilizing just the Air Force Space Surveillance Network (SSN). One unique benefit of this approach, from a cooperative legal framework perspective, is that "[n]o single authority or stakeholder could prevent the collective perception."[43] In other words, a degree of transparency is implied in the collaborative process itself, partially relieving the problem of trusting no verification means but your own. This approach has the added benefit of including those with the least technical means in cooperative arrangements since they can attain the information required for verification from outside resources. However it evolves, an improved, reliable and comprehensive SSA capability is a critical step toward accepting the relative security of deterrence within a legal framework of verifiable mutual vulnerability.

[40] Robert Giffen (General, USAF retired, PhD) in discussion with the author, March 2010.
[41] David Finkleman, *Space and Verification*, "Volume II: Technical Assessment," (Eisenhower Center for Space and Defense Studies, 2009), p. 6.
[42] Ibid., p. 16.
[43] Ibid., p. 1.

Deterrence or Dominance?

"WHAT MADE WAR INEVITABLE WAS THE GROWTH OF ATHENIAN POWER AND THE FEAR WHICH THIS CAUSED IN SPARTA."[44]

The Cold War illustrates how nuclear deterrence under mutual vulnerability emerged after deterrence through dominance, pursued by both sides, failed. Faced with a determined adversary, there are only short term advantages. The security dilemma guarantees a response by the other side and the action-reaction cycle ensures that neither gains any lasting security. The Cold War experience shows that, in spite of enormous effort and expense, two competitors can remain nearly as vulnerable in the end as when they started. There was evidence early in the Cold War that the long term reality would not be dominance for either side, but rather managed cooperation due to the de facto condition of mutual vulnerability. The same will likely be true of space. Space assets are vulnerable today and will remain so in spite of all the effort and money the United States can muster. The difference now is that the United States can work to implement that long term reality before spending large amounts of money trying to ward off the inevitable vulnerability. There is an opportunity to avoid a space arms race entirely. In light of the current financial troubles in the United States and elsewhere, it is in the United States best interests that an arms competition in space never occurs.

The latest National Space Policy published by the Obama administration in June 2010 is a small step in the right direction. It uses more cooperative language than the previous space policy and avoids the dominance rhetoric, but

[44] Thucydides,"*History of the Peloponnesian War,"* translated by Rex Warner (New York: Penguin Books, 1954), p. 49.

does not go far enough.[45] The next iteration should include specific steps required to move toward long term cooperation with a workable verification regime. Political leadership from the highest levels is required both to guide military efforts and to garner international cooperation and commitment. The effort will not be easy, but it's much better to do it now than to wait for a space arms race to put a further drain on national coffers.

[45] "National Space Policy of the United States of America," The White House, June 28, 2010, pp. 2-7.

Notes for Contributors to *Space and Defense*

Space and Defense seeks submissions that will contribute to the intellectual foundation for the integration of space policy into overall security studies. The collaboration of soldiers, scholars, and scientists studying nuclear deterrence in the 1950s led to a robust evolution of doctrine that shaped national and international policy for the succeeding forty years. Our goal as a Center is to create this same robust dialogue with a research agenda that focuses on the integration of space policy and security studies. Indeed, the emergence of space as a unique and critical element in national security, economic security, homeland security, cyber security, environmental security, and even human security has persuaded us that this line of inquiry is vital to the future of international security.

Contributions are welcome from academic scholars and policy analysts at think tanks and research institutes; senior management and policy officials from international and governmental agencies and departments relevant to space and security issues; senior management and policy officials from organizations responsible for critical national and international infrastructures that rely upon space; major aerospace corporations; scientists and engineers interested or involved in space and security policy issues; military officers and operators in relevant units, commands, and in staff colleges and service academies.

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Tables and Figures

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Listed below are some additional style and writing guides:

- Dates in the form: 1 January 2009.
- Headings (bold title case and centered).
- Subheadings (italic title case and centered).
- Acronyms/abbreviations should always be spelled out in full on first use in the text.
- The 24-hour clock is used for time, e.g., 0800, 1300, 1800.
- Use percent rather than % except in figures and tables.
- For numbers, spell out numbers less than 10.
- Make use of 21st style where appropriate.
- Keep capitalization to a minimum.
- Concise paragraphs and sentences are desirable.
- Avoid a paper that is just descriptive; rather engage in analytical rigor and assessment.
- Avoid policy recommendations in the analysis part of paper; leave this, if applicable, for a separate section at the end of the paper.
- Define all new terms used in paper.
- Avoid hyphenated words when possible.
- Avoid the use of passive voice when possible.

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