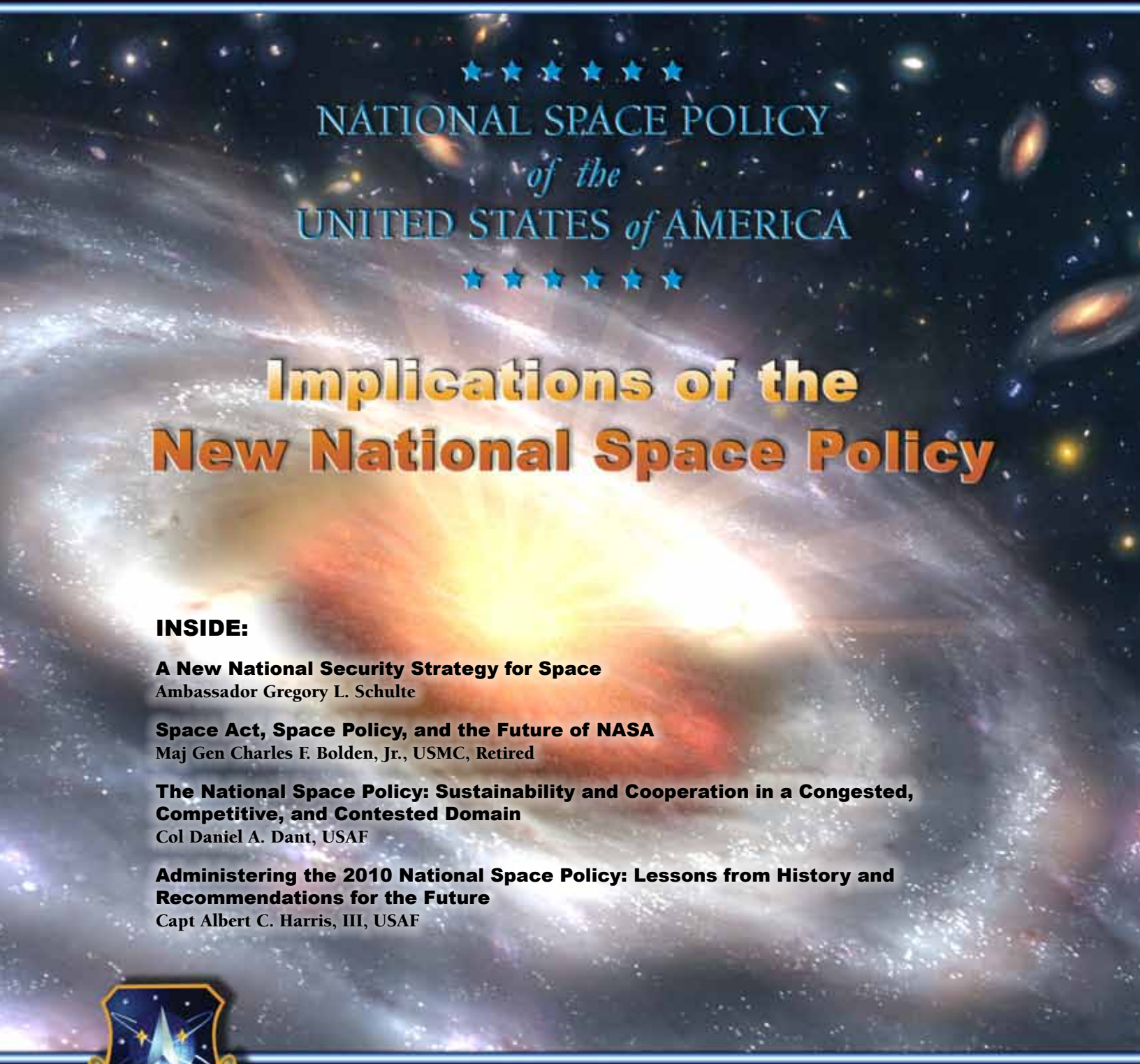
AIR FORCE SPACE COMMAND

Volume 7, Number 2

HIGH FRONTIER

THE JOURNAL FOR SPACE AND CYBERSPACE PROFESSIONALS



Implications of the New National Space Policy

INSIDE:

DIGITAL EXTENDED VERSION

Headquarters
Air Force
Space Command
Peterson Air Force Base, Colorado

Commander
General William L. Shelton

Vice Commander
Maj Gen Michael J. Basla

Director of Public Affairs
Col Dewey Ford

Creative Editor
Ms. Nadine Sage

Published by a private firm in no way connected with the US Air Force, under exclusive written contract with Air Force Space Command. This command funded Air Force journal is an authorized publication for members of the United States military Services. The views and opinions expressed in this journal are those of the authors alone and do not necessarily reflect those of the United States Department of Defense, the United States Air Force, or any other government agency.

Editorial content is edited, prepared, and provided by the *High Frontier* staff. All photographs are Air Force photographs unless otherwise indicated.

High Frontier, Air Force Space Command's space professional journal, is published quarterly. The journal provides a scholarly forum for professionals to exchange knowledge and ideas on space-related issues throughout the space community. The journal focuses primarily on Air Force and Department of Defense space programs; however, the *High Frontier* staff welcomes submissions from within the space community. Comments, inquiries, and article submissions should be sent to AFSPC.PAI@peterson.af.mil. They can also be mailed to:

AFSPC/PA
150 Vandenberg St. Ste 1105
Peterson AFB, CO 80914
Telephone: (719) 554-3731
Fax: (719) 554-6013

For more information on space professional development please visit:
http://www.afspc.af.mil

To subscribe:
Hard copy: nsage@sgis.com
Digital copy: http://www.af.mil/subscribe

Cover: Bursting with Stars and Black Holes, Spitzer Space Telescope, Jet Propulsion Laboratory, California Institute of Technology. Image credit: NASA/JPL-Caltech
Back Cover: Found among the Small Magellanic Cloud's clusters and nebulae NGC 346 is a star-forming region about 200 light-years across, pictured taken by the Hubble Space Telescope. Image credit: NASA, ESA, A. Nota (ESA/STScI) et al.

HIGH FRONTIER

The Journal for Space and Cyberspace Professionals

February 2011 | ***Extended Digital Version*** | Volume 7, Number 2

Contents

Next Issue: ***Cyber Defense – Protecting Operations in an Evolving Domain***

Introduction

General William L. Shelton, USAF
Commander, Air Force Space Command

In June 2010, the president released a new National Space Policy (NSP) defining the principles, goals, and guidelines aimed at advancing and preserving national space interests. The new policy acknowledges the congested, contested, and competitive nature of space as compared to the beginning of the Space Age when there were only a few nations which possessed the means to access and benefit from the space domain. Today we live in a world enabled by space capabilities providing weather, imaging, communications, warning, position, timing, and navigation information used by governments and individuals alike. At Air Force Space Command (AFSPC), we understand this well as the providers of GPS capability. GPS timing signals literally enable the interactions of the global economy, yet it was originally intended to provide accurate navigation for military systems. Indeed, much has changed since the dawn of the Space Age, and the president's NSP acknowledges the opportunities and challenges in space.

The theme of this issue of the *High Frontier Journal* sparked interest inside the national security space enterprise and across the government. The contributing authors to this edition span the Department of Defense (DoD), civil organizations, and industry partners. Deputy Secretary of Defense William J. Lynn and Ambassador Gregory L. Schulte, deputy assistant secretary of defense for space policy, both provide the senior DoD perspective on the implications of the president's policy and how it impacts the DoD's strategic approach to space. The Honorable Erin C. Conaton, under secretary of the Air Force, outlines the Air Force's focus areas of greater space situational awareness and launch as key enablers of the new policy. Given our continued focus on improving space acquisition, we are fortunate to have the perspective of Mr. Robert A. Gold, senior advisor, deputy assistant secretary of defense for space and intelligence in the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. He outlines five major acquisition challenges as DoD implements the NSP.

AFSPC has tremendous partnerships with National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), and the National Reconnaissance Office, and leaders in those organizations kindly contributed to this edition. NASA Administrator Major General Charles B. Bolden, Jr., USMC, retired, outlines the president's vision for the future of civil space and discusses NASA's future partnerships with commercial launch companies for access to low Earth orbit. Brigadier General John Raymond and Mr. Kurt M. Neuman discuss preservation strategies for the space environment and the need for international cooperation. NOAA's Acting Director, Office of Space Commercialization, Mr. Charles S. Baker, discusses cooperative acquisition initiatives with NASA and efforts to develop the space workforce. Rounding out the Senior Leader Perspectives is Dr. Andrew Palowitch, director, Space Protection Program, who offers another view of cooperation through the lens of collective assurance with international partners.

The new NSP generated much discussion among space professionals of all ranks and that is very encouraging. In fact, we received so many articles that this edition comes in an extended online version. Contributing authors cover the strategic and operational aspects of the policy, its historical context compared to previous space policies and challenges with implementation. I encourage everyone to visit the *High Frontier Journal* website and explore the extended digital version.

The next issue of the *High Frontier Journal* will examine Cyber Defense—Protecting Operations in an Evolving Domain. The fast pace of change in the cyber domain requires a forward-leaning approach from all our professionals. There are unique challenges and opportunities within the cyberspace domain and I look forward to the perspectives and discussion in the next journal.

General William L. Shelton, USAF (BS, Astronautical Engineering, US Air Force Academy [USAFA], Colorado; MS, Astronautical Engineering, US Air Force Institute of Technology, Ohio; MS, National Security Strategy, National War College, Washington, DC) is the commander of Air Force Space Command, Peterson AFB, Colorado. He is responsible for organizing, equipping, training, and maintaining mission-ready space and cyberspace forces and capabilities for North American Aerospace Defense Command, US Strategic Command, and other combatant commands around the world. General Shelton oversees Air Force network operations; manages a global network of satellite command and control, communications, missile warning and space launch facilities; and is responsible for space system development and acquisition. He leads more than 46,000 professionals, assigned to 88 locations worldwide and deployed to an additional 35 global locations.

General Shelton entered the Air Force in 1976 as a graduate of the USAFA. He has served in various assignments, including research and development testing, space operations, and staff work. The general has commanded at the squadron, group, wing and numbered air force levels, and served on the staffs at major command headquarters, Air Force headquarters and the Office of the Secretary of Defense. Prior to assuming his current position, General Shelton was the assistant vice chief of staff and director, Air Staff, US Air Force, Pentagon, Washington, DC.

Remarks on Space Policy

Mr. William J. Lynn, III
Deputy Secretary of Defense
Pentagon, Washington, DC

During the past 50 years, our space activities have benefited the global economy, enhanced our national security, strengthened international relationships, advanced scientific discovery, and improved our way of life. However, the space environment is evolving—it is more congested, contested, and competitive than ever before—and US space systems face increasing threats.

On 3 November 2010, I outlined the challenges we now face in the space environment, along with the Department of Defense's (DoD) approach to meeting these challenges and harnessing the opportunities they provide.

Enabled by the new National Space Policy (NSP), the DoD intends to promote the responsible use of space, pursue greater cooperation with allies and commercial firms, assure mission-essential space functions, and improve acquisition processes to energize the space industrial base. I noted that implementing these changes will strengthen our national security, positively affect US industry, and protect the space-enabled services we rely on.

The speech, "Remarks on Space Policy at US Strategic Command Space Symposium" as delivered at the 2010 Strategic Space Symposium, is reprinted here.[1]

We meet at an important juncture in military space. At the National Space Symposium in April, I outlined how the space environment we operate in is changing. In June, the president's NSP codified several precepts about this new environment and how we as a nation should approach it.

Today, I would like to share my thinking on how the DoD's strategic approach to space must shift. For over 50 years we have derived tremendous benefits from our presence in space. We have been—and will continue to be—the world's preeminent leader in space. But the environment we operate in has changed so markedly that we have reached a historical inflection point.

For the first few decades of the space age, space was the private preserve of the US and USSR. The reality of superpower dominance in space was not only borne out in the skies above. It was also embodied in the thinking and institutional practices of our military space community.

Rather than working closely with other nations, we chose to go-it-alone on most key space systems. We also chose to place multiple missions on single buses. And for the most part, we chose not to let cost restrict our ambitions. Funding for military space programs was strong, and our industrial base was buoyed by its near-monopoly on global space exports.

These long-standing features of the space environment have given way to far more complex realities.

A decade into the 21st century, space is characterized by what I have called the three C's: congested, contested, and competitive.

Congested because 60 nations now have a presence in space. 9,000 satellite transponders will be active by 2015. And the skies over Earth are so cluttered with debris that further collisions could eventually put some usable orbits in jeopardy.

As I said in April, we are approaching a point at which the limitless frontier no longer seems quite so limitless.

Space is also becoming contested.

In today's space environment we cannot take the stability or sustainability of space—or access to it—for granted. It used to be that the primary threat to a satellite was launch failure. Now many countries can hold space systems at risk through kinetic and non-kinetic means. Some nations are even jamming satellite signals to censor news, illustrating how counter space capabilities can be used for political, as well as military purposes.

The market for space services has also become more competitive. US firms once captured nearly three quarters of global business. They now account for 30 to 40 percent.

In short, the space environment has fundamentally changed, and probably irrevocably so.

The president's NSP, released in June, recognizes these changes, and directs several important shifts in space policy.

Today I would like to outline four key elements that emerge from the president's policy that the DoD will carry forward in its military space activities. These elements will inform the development of the National Security Space Strategy, which we will release jointly with the director of national intelligence later this fall.[2]

They are a move toward the sustainability and stability of the space domain; a new emphasis on international cooperation; an expansion of how we protect space systems in a contested environment; and, finally, the improvement of our space acquisition process.

Let me outline each of these developments in turn.

First, the president's NSP declares that the sustainability and stability of space, as well as free access to it, is a vital national interest.

Fostering a more cooperative, predictable environment with minimal risk of accidents or purposeful interference will enhance, rather than detract from, our national security. To create this environment, the president's space policy calls for bilateral and multilateral transparency and confidence building measures which will help establish norms of behavior in space.

Along with the right to use and explore space comes the responsibility to be a good steward of it.

So, a key question for the department is how our national security space systems can help enable this vision.

Thanks to the work done by US Strategic Command and its components to track debris and alert other nations about possi-

ble conjunctions between spacecraft, our systems have already helped foster cooperation in space.

The European Union's initiative to develop an international "Code of Conduct for Space Activities" is another way to develop norms that reduce mishaps, misperceptions, and mistrust. We now need to consider what further measures of transparency, verification, and confidence-building can enhance the stability of space.

Second, the president's space policy places a new emphasis on international cooperation.

Though we have said before that we will pursue international cooperation, this time I am convinced that the need for it in military space is more pressing than ever. With some exceptions, we have not fully embraced partners in the design or operation of military space systems, or fully extended to allies the battlefield advantages space systems provide. We will now.

As with terrestrial defense alliances, partnerships in space can add resilience and capabilities, without relinquishing the strategic advantage our systems provide. At their fullest, these partnerships could consist of completely interoperable systems in which costs, benefits, and risks are shared among trusted participants.

Our partnership with Australia on the Wideband Global Satellite Communications system is one example of how we can integrate allies into our space architecture. But we can go further.

For instance, US Strategic Command is exploring how to implement concepts such as evolving the *Joint* Space Operations Center that is a US-only enterprise to a *Combined* Space Operations Center that has international participation. Turning our space operations center into a coalition enterprise, with close allies working side-by-side with our own commanders, could bring levels of cooperation to new heights.

We must also explore sharing capabilities, such as missile warning and maritime awareness, with a wider set of partners. Increasingly, we will want to operate in coalitions in space, just as we do in other domains.

To achieve this, the department will examine all mission areas to identify where shared interests open the door to greater levels of cooperation. We can and we will utilize partnerships with other nations to achieve our mission goals.

Alliances in space can strengthen deterrence as well. Integrating our capabilities with those of our allies and partners can raise the costs of aggression and make it more difficult for a potential adversary to successfully target our systems.

Alliances in space serve the same deterrent function as basing troops in allied countries. They ensure an attack on one is an attack on all.

We must also continue to expand our partnership with commercial providers. By sharing or exchanging capabilities and data, we can ensure access to information and services from a more diverse set of systems—an advantage in a contested space environment.

Coalitions and partnerships, with both nations and firms, will not only help us achieve our security objectives in space more efficiently. They will also fundamentally strengthen our space posture.

Third, the new space policy directs the DoD to assure mission essential functions, even when space assets are degraded or disrupted.

Achieving this will entail expanding how we protect our space systems in a contested environment.

Deterrence has always been a core part of our national security strategy. But, in the contested space environment we face today, we can no longer rely solely on the threat of retaliation to protect space systems from attack.

Making our space systems more resilient, and our combat power less reliant on their full functioning, will help deny adversaries the benefit from an attack in space. Just as in the cyber domain, denying the benefit of attack can join retaliatory deterrence as a disincentive to adversaries.

To learn how to operate in a degraded information environment, and thereby lower the benefit of an attack, we are holding training exercises where we experience "a day without space." Through these training exercises, we are slowly learning how to "fight through" interference.

We are also developing technology to help us mitigate the loss or degradation of on-orbit systems. For instance, we now have ground-, air-, and naval-based platforms that increasingly can augment or replace space assets. Responsive space capabilities can also play an important role in reconstituting functionality either during or after an attack.

Ultimately, there is no silver bullet solution to a contested space environment. But a strategy which encompasses a broad range of options will have the greatest chance of success.

At the same time, we need to make clear that the US views its space assets as a vital national interest. Consistent with our inherent right of self-defense, we will respond accordingly to attacks on them.

Dealing with a congested, competitive, and contested space environment is not our only challenge. The fiscal climate our nation faces, as well as the globalization of the aerospace industry, makes it even more difficult to maintain our competitive advantage in space. We must become better buyers of space systems and work to ensure the health of our space industrial base.

Let me briefly touch on initiatives in two areas that affect the industrial base.

As you know, Secretary Robert M. Gates has made export control reform a priority.

Presently, many items generally available on the global market for space commerce are prohibited from being exported by US companies without government approval. Our current export policy puts us in a double bind. We are hurting our own space suppliers in the international market. But we are not really hindering states of concern from acquiring sensitive space technologies.

To redress the current state of affairs, the administration is committed to comprehensive export control reform. The foundation of this is what we term the "four singles:" a single export control licensing agency, a single tiered list of controlled items, a single coordination center for enforcement, and a single, uni-

fied information technology infrastructure.

We recognize that controlling sensitive space exports remains a concern. But we need a different approach. We should be building "higher fences" around our most sensitive technologies, while delisting those items whose export does not threaten our security.

We are currently reviewing space items controlled under the munitions licensing authority of the Department of State, as well as the related category on the Commerce Department's dual use item control list.

Our review recommends placing items in tiers according to the importance of their technology and substantially revising how they are controlled. We are replacing vague, catch-all terms with objective, specific criteria. Our goal is to clearly delineate what is controlled and what is not. And we will soon be reaching out to industry to ask for their involvement.

To complement export control reform, the department needs to improve its space acquisition process to ensure we maintain world-class space capabilities at affordable costs.

Space systems have often been among the most expensive platforms we acquire for our defense. Hard work by industry and by government has begun to yield performance improvements.

But, despite hard won progress, we need to become even more efficient if we are to continue fielding new capabilities at the rate necessary to preserve our technological edge.

In the military space sector, as in other sectors, transformational development should only be employed in circumstances where compelling reasons exist to do so.

But in many cases incremental development will be the right approach. And here, we can gain substantial efficiencies through two innovative techniques: block buys of satellites and the deliberate management of the engineering workforce.

Block buys have the potential to reduce costs and timelines by creating more predictable demand and allowing larger material buys with fewer spares. Similarly, establishing a predictable demand schedule can stabilize the engineering workforce associated with a project. Keeping engineers in place allows them to pursue development and production simultaneously, further reducing manufacturing costs while incrementally increasing capabilities.

Together with export control reform, better acquisition models and practices can help strengthen our space industrial base. Our intent is to maintain US leadership both in space technologies and in the international marketplace for space goods and services.

In conclusion, the new NSP affirms the centrality of space to our national security and seeks to maintain those advantages in the face of an evolving space environment.

Today I have identified four precepts established in the NSP that are critically important to military space: a move toward the sustainability and stability of the space domain; a new emphasis on international cooperation; expanding how we protect space systems in a contested environment; and the improvement of the space acquisition process.

These precepts will inform our National Security Space Strategy, which will be released later this fall.

Succeeding in the new space environment will depend as much on changing mindsets 50 years in the making as it will on altering longstanding institutional practices. The fundamental mission of the DoD to deter war and to protect the security of our country stays the same. But how we use space capabilities to achieve this mission will change.

As representatives from industry, from across government, and from other nations, all of you will play an important role in building this new future. We have the most to lose from this changing environment in space, and we have the most to gain if we adapt our strategy and process. So I challenge you to help bring this new era of cooperation in military space into being, and to ensure we achieve the industrial efficiencies necessary to underwrite innovation over the long term.

Together, I am confident we can preserve our ability to operate in space, and to enjoy the benefits that entails.

Notes:

[1] Deputy Secretary of Defense William J. Lynn, III, "Remarks on Space Policy at US Strategic Command Space Symposium," speech, Nebraska, 3 November 2010.

[2] The National Security Space was signed in January 2011.

Mr. William J. Lynn, III (BA, Dartmouth; JD, Cornell; MPA, Public Affairs, Princeton) is the 30th deputy secretary of defense. Mr. Lynn's career has included extensive public service at various levels within government. Mr. Lynn served as the under secretary of defense (comptroller) from 1997 until 2001 and for four years prior to that he was the director of program analysis and evaluation in the Office of the Secretary of Defense.

Before entering the Department of Defense in 1993, Mr. Lynn served for six years on the staff of Senator Edward Kennedy as liaison to the Senate Armed Services Committee. Prior to 1987, he was a senior fellow at the National Defense University and was on the professional staff of the Institute for Defense Analyses. From 1982 to 1985, he served as the executive director of the Defense Organization Project at the Center for Strategic and International Studies.

Mr. Lynn also has experience in the private sector from 2001-2009. He served as senior vice president of Government Operations and Strategy at Raytheon Company. He also served as executive vice president of DFI International, a Washington-based management consulting firm, from 2001 to 2002.

His publications include a book, *Toward a More Effective Defense*, as well as articles in various newspapers and professional journals. He has been recognized for numerous professional and service contributions.

Senior Leader Perspective

A New National Security Strategy for Space

Ambassador Gregory L. Schulte
Deputy Assistant Secretary of
Defense for Space Policy
Washington, DC

The Department of Defense's (DoD) strategic approach to space must change.

This was the message of Deputy Secretary of Defense William J. Lynn, III at US Strategic Command's (USSTRATCOM) Space Symposium last November. And this is the significance of the National Security Space Strategy jointly signed by Secretary Robert M. Gates and Director of National Intelligence James Clapper.[1]

Change is required to implement the new National Space Policy (NSP), and change is required to meet the new challenges in space. The National Security Space Strategy provides the strategic guidance—the "ends" and "ways"—for that change. The DoD space community must now work on implementation—the "means."

The Changing Space Environment

During the Cold War, space was the private reserve of the US and Soviet Union. It was the "high frontier" from which we could support national defense and power projection with near impunity.

Today, space is increasingly a shared domain in which we operate together with more and more space-faring countries—both close allies and potential adversaries. It is a domain that is increasingly challenged by what Secretary Lynn has called "the three C's": congested, contested, and competitive.

- ***Congested.*** There are over 1,100 active systems on orbit, and an additional 21,000 pieces of debris littering the skies. Radio frequency interference is also a concern, with more than 9,000 satellite transponders expected to be on orbit in 2015.
- ***Contested.*** China demonstrated a direct-ascent antisatellite capability in 2007 and is developing other capabilities to disrupt and disable satellites. Iran and others have demonstrated the ability to jam satellite signals. Our reliance on space tempts potential adversaries to see it as a vulnerability to be exploited.
- ***Competitive.*** Eleven countries are operating 22 launch sites. More than 60 nations and government consortia currently operate satellites. The US share of worldwide satellite exports dropped from nearly 2/3 in 1997 to 1/3 in 2008. This is a significant challenge to our industrial base … but also opens opportunities for international cooperation.

National Security Objectives—The "Ends"

The new National Security Space Strategy lays out three primary objectives to implement the NSP and address the increasingly congested, contested, and competitive nature of the space environment. These objectives are to:

1. Strengthen safety, stability, and security in space;
2. Maintain and enhance the strategic national security advantages afforded to the US by space; and
3. Energize the space industrial base that supports US national security.

In the past, our overriding objective was to protect our national security advantages in space. Now we must also concern ourselves with protecting the domain itself. We also must protect critical aspects of the industrial base that support our advantages.

Strategic Approaches—The "Ways"

To achieve these objectives, the new National Security Space Strategy lays out five strategic approaches:

1. Promote responsible, peaceful, and safe use of space;
2. Provide improved US space capabilities;
3. Partner with responsible nations, international organizations, and commercial firms;
4. Prevent and deter aggression against space infrastructure that supports US national security; and
5. Prepare to defeat attacks and to operate in a degraded environment.

These approaches, as elaborated in the strategy, require us to think differently in a variety of areas. I wish to emphasize four that are particularly important from a policy perspective.

Rules of the Road

Imagine driving your vehicle at 70 miles per hour, amidst thousands of other drivers on a busy interstate, with no traffic rules or police to enforce good behavior. While this seems like a daily occurrence in the Washington, DC area, it is analogous to the increasingly congested space domain in which we operate and depend upon for vital national security services and information. We must accelerate our work on "rules of the road," norms, or codes of conduct in the domain, all synonymous terms for defining acceptable behavior by responsible actors in space.

There are a variety of potential roles for such rules. These include: promoting spaceflight safety; reducing unintentional interference; maximizing the use of crowded orbits; reducing mistrust and misperceptions; and discouraging destabilizing behavior. Rules encourage good behavior but also provide a way to hold accountable those who act irresponsibly.

Rules normally apply in peacetime, but may also help to shape crisis behavior. Rules may be written and agreed to internationally. Rules may also be tacit, based upon established practice, diplomatic or military-to-military exchanges, or even

declaratory policy. During the Cold War, there were tacit "rules of the road" between the US and USSR founded in part on treaty obligations not to interfere with either side's "national technical means." Such rules of the road do not exist today in clear and verifiable terms, even as more countries develop capabilities that can be used for hostile purposes.

As a first step in developing rules, the DoD and the State Department are seriously engaging the European Union on its proposed Code of Conduct for the responsible use of space and are encouraging other space-faring countries, including Russia, China, and India, to do the same. In his November speech, Secretary Lynn called for considering what further measures of transparency, verification, and confidence-building can enhance the stability of space, and we are working actively towards this end.

If we are to see these rules reach fruition and meaningfully shape responsible behavior in the space domain, they must be accompanied by practical measures to implement them and monitor compliance. USSTRATCOM is already doing important work to help other countries avoid collisions by providing space situational awareness (SSA) services. Just as the Air Force is the world's premier provider of global positioning data, USSTRATCOM is becoming the world's premier provider of collision warning.

While there may be no help for DC traffic, strengthening SSA and our mechanisms to share it will reinforce the development of international norms to help promote responsible use of the space domain and to strengthen its safety, stability, and security.

Resiliency and Mission Assurance

Second, we need to increase our emphasis on resiliency and mission assurance in an increasingly congested domain.

Past means to protect our space systems were frequently too narrow. Too often they provided system-level protection or no protection at all. They also tended to focus on specific satellites, not the missions they performed.

We need a different approach. Specifically, we need to make our space-based architectures more resilient and to assure the missions they support. This may entail a variety of means:

- No matter what else, we must improve our capability to "fight through" interference. Our military services are already conducting training and exercises that simulate a degraded space environment, helping and indeed requiring them to develop the necessary tactics, techniques, and procedures for this environment.
- Rather than relying on a small number of complex satellites for critical functions, we may want to distribute their functions across multiple satellites or increase the number of simpler, singly purposed spacecraft. Hosting DoD payloads across a larger number of commercial, civilian, or foreign satellites could similarly increase resiliency.
- We may want to use international partnerships to increase resiliency through collaborative spacecraft development, shared constellations, hosted payloads, or shared missions. Wideband Global Satellite Communications is a good example. Australia has joined the constellation and other allies are looking at doing the same. A larger, more international constellation adds resilience and also encourages adversary restraint by making "an attack on one an attack on all."
- We may want to have a responsive capability to rapidly augment, replenish, and reconstitute space-based capabilities that have been degraded or lost. The Operationally Responsive Space program is starting us on a trajectory to that end.
- We may want to pursue cross-domain solutions with ground-, sea-, or air-based systems backing up space-based capabilities. Space problems do not always require a space solution. Interdependent, multi-domain capabilities provide an effective way to assure critical warfighting and intelligence functions despite potential degradation or loss. Unmanned aerial vehicles are one option that we are exploring.
- In many cases, we may want to pursue multiple means. Take for example the Global Positioning System, a space-based capability critical to all of our services. To enhance its resiliency and mission assurance, we may want a combination of on-orbit spares, interoperability with Europe's Galileo satellite system, and land- or air-based backup systems.

Resiliency and mission assurance can help protect critical capabilities in crisis and conflict. Moreover, to the extent we develop and demonstrate resilience and mission assurance, potential adversaries may be dissuaded in peacetime from pursuing counterspace capabilities.

Deterrence

We also need to think differently about deterrence.

We must not assume that attacks in space can or should be deterred by the threat of retaliation in space. Rather, as Secretary Lynn has argued, a strategy that encompasses a broad range of options will have the greatest chance for success.

Many of the actions that I previously described can contribute to deterrence by encouraging adversary restraint:

- Creating norms that would need to be broken;
- Building international partnerships that would need to be attacked; and
- Strengthening resilience and mission assurance that would reduce the benefit of attack.

The threat of retaliation—imposing costs—can still play a role, though it need not be confined to space. Indeed, the threat of retaliation elsewhere may be more credible.

As Secretary Lynn said, we must make clear that the US "views its space assets as a vital national interest. Consistent with our inherent right of self-defense, we will respond accordingly to attacks on them." This implies certainty of response but in a manner of our own choosing.

Ultimately, like any deterrent strategy, the deterrent strategy for space must be developed in the context of particular countries and particular scenarios. And we must consider the best means

to convey our deterrent messages in peacetime and to influence the decision-making of potential adversaries in crisis and war.

Acting in Coalition

The new strategy also requires us to think differently about coalition operations in space.

In the past, space was a domain in which we operated largely alone or with only a few very close allies. Increasingly we need to think about space as a domain where we operate as a coalition.

Coalition operations are already routine in the air, on land, and at sea. Our Airmen, Soldiers, Sailors, and Marines regularly operate with the armed forces of allies and partner nations, whether patrolling for pirates off the coast of Somalia or countering insurgents in Afghanistan. We have developed the doctrine, procedures, and command and control to enable coalition operations, whether through alliances like North Atlantic Treaty Organization or through more ad hoc coalitions of the willing.

We need to do the same for space. More and more of our allies and partners are developing space capabilities, and all of our armed forces are increasingly reliant on space. We need to ensure that land, sea, and air coalition operations can be effectively enabled by coalition space assets, and that we can effectively command and control those assets to provide optimum support.

Ultimately, the USSTRATCOM commander will become a coalition commander, just like his counterparts commanders at Central and Pacific Commands. Setting the conditions (policy and resources) for the Joint Space Operations Center to transform into a Coalition Space Operations Center will be a first important step in that direction. Procedures, training, and foreign disclosure will also be crucial. As in other domains, we will need to balance the "need to protect" with the "need to share."

Implementation—The "Means"

The National Security Space Strategy lays out the "ends" and the "ways." Within DoD, Secretary Gates has directed implementation—the "means." Implementation is aimed at ensuring the strategy is fully reflected in DoD guidance, plans, doctrine, programs, and operations.

Implementation of the strategy will be overseen by the newly established Defense Space Council, chaired by the secretary of the Air Force as the department's executive agent for space. Secretary Lynn recently established the Defense Space Council as the department's principal advisory forum on all space matters. One of the council's key tasks is to guide the development of integrated architectures for our space-based systems. These architectures will be crucial to improving our space capabilities, increasing their resilience, and leveraging commercial and foreign capabilities in line with the new National Security Space Strategy.

Implementation is not just about process and architectures. It is also about the way we think. Secretary Lynn said last November: "Succeeding in the new space environment will depend as much on changing mindsets fifty years in the making as it will on altering longstanding institutional practices."[2]

Conclusion

In the past, space was seen as our own "high frontier." Today, we increasingly must view space as a "shared domain" that is increasingly congested, contested, and competitive. As the environment changes, so must our strategy. The new National Security Space Strategy lays out the necessary, long-term approach to protect our security through space.

Notes:

[1] An unclassified summary of the new National Security Space Strategy, http://www.defense.gov/nsss/.

[2] Deputy Secretary of Defense William J. Lynn, III, "Remarks on Space Policy at US Strategic Command Space Symposium," speech, Nebraska, 3 November 2010.

Ambassador Gregory L. Schulte (BA, UC Berkley; MPA, Public Affairs, Princeton) has served as deputy assistant secretary of defense for space policy since May 2010.

Ambassador Schulte was the US permanent representative to the International Atomic Energy Agency and the United Nations (UN) in Vienna, where he was dispatched by President Bush in 2005 and extended by President Obama through June 2009. Ambassador Schulte helped report Iran to the UN Security Council, implement the US nuclear cooperation agreement with India, and establish international nuclear fuel banks. After Vienna, Ambassador Schulte spent 10 months as a Senior Visiting Fellow at the National Defense University's Center for the Study of Weapons of Mass Destruction.

Mr. Schulte served three tours in the White House under two presidents. As executive secretary of the National Security Council (NSC) from 2003 to 2005, Mr. Schulte traveled extensively with President Bush, oversaw the White House Situation Room, and was responsible for NSC emergency readiness after 9/11. As senior NSC director for Southeast European Affairs from 2000 to 2002, Mr. Schulte advised Presidents Clinton and Bush on US diplomacy and military deployments in Bosnia and Kosovo and oversaw US efforts to bring democracy to Serbia and prevent civil war in Macedonia. As special assistant to the president from 1998 to 1999, Mr. Schulte advised President Clinton on the Kosovo crisis and oversaw interagency planning and decision-making for the NATO air campaign and subsequent deployment of Kosovo Force and a UN mission.

From 1992 to 1998, Mr. Schulte was assigned to the North Atlantic Treaty Organization (NATO) headquarter in Brussels. As director for crisis management and operations and director for nuclear planning, Mr. Schulte helped NATO adapt its planning and posture after the end of the Cold War. As director of the Bosnia Task Force, Mr. Schulte helped NATO organize its first out-of-area deployments and its first collaboration with the UN. Mr. Schulte was the first civilian outside the theater of operations to be awarded the NATO Medal.

Mr. Schulte is a member of the Senior Executive Service and has received two Presidential Rank Awards. Mr. Schulte previously served in the Office of the Secretary of Defense as principal director for requirements, plans, and counterproliferation policy, director for strategic forces policy, and assistant for theater nuclear forces policy. He began his career in 1983 as a presidential management intern.

Air Force Implementation of the National Space Policy: Space Situational Awareness and Launch

The Honorable Erin C. Conaton
Under Secretary of the Air Force
Pentagon, Washington, DC

Mr. Rudy Barnes
Special Assistant
Under Secretary of the Air Force
Pentagon, Washington, DC

The space age began as a race for security and prestige between two superpowers. The opportunities were boundless, and the decades that followed have seen a radical transformation in the way we live our daily lives, in large part due to our use of space.… When the space age began, the opportunities to use space were limited to only a few nations, and there were limited consequences for irresponsible or unintentional behavior. Now, we find ourselves in a world where the benefits of space permeate almost every facet of our lives. The growth and evolution of the global economy has ushered in an ever-increasing number of nations and organizations using space.

~ National Space Policy, 28 June 2010

As the new National Space Policy (NSP) notes, space has become a mature domain, with the number of uses and users growing rapidly. The NSP reinforces and highlights the significance of space not only to the national security community, but to the nation and indeed the globe. The increased population of actors and activities in space is generating ever-increasing demands for the basic requirements of any heavily traveled or populated domain. Developing a detailed understanding of the "terrain," for instance—space situational awareness (SSA)—has become a national security priority of the first order. Likewise, mastery of the means to travel in and across the domain—launch capability—is also a top national security requirement. And the Air Force is delivering for the nation on both of these requirements.

The new NSP—the first since the classified 2006 NSP—is a consensus document from across the federal government. It highlights the fact that space is growing more and more congested, contested, and competitive, and spells out priorities in light of these challenges: enhanced SSA, assured access to space, and increased resiliency for our constellations. The NSP also emphasizes renewed attention to inter-agency and international partnerships, and increased cooperation with the commercial sector.

Principles and Objectives of the NSP

Overall, the NSP offers six basic principles to guide US space policy:

- "It is the shared interest of all nations to act responsibly in space to help prevent mishaps, misperceptions, and mistrust. The US considers the sustainability, stability, and free access to, and use of, space vital to its national interests. Space operations should be conducted in ways that emphasize openness and transparency to improve public awareness of the activities of government, and enable others to share in the benefits provided by the use of space.
- A robust and competitive commercial space sector is vital to continued progress in space. The US is committed to encouraging and facilitating the growth of a US commercial space sector that supports US needs, is globally competitive, and advances US leadership in the generation of new markets and innovation-driven entrepreneurship.
- All nations have the right to explore and use space for peaceful purposes, and for the benefit of all humanity, in accordance with international law. Consistent with this principle, "peaceful purposes" allows for space to be used for national and homeland security activities.
- As established in international law, there shall be no national claims of sovereignty over outer space or any celestial bodies. The US 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 US will employ a variety of measures to help assure the use of space for all responsible parties, and, consistent with the inherent right of self-defense, deter others from interference and attack, defend our space systems and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them."[1]

Each of these principles applies to Air Force space programs and activities, and they provide a broad policy framework for virtually all Air Force space initiatives. With these basic principles as context, the NSP then identifies six broad goals for US space policy:

- ***Energize competitive domestic industries*** to participate in global markets and advance the development of: satellite manufacturing; satellite-based services; space launch; terrestrial applications; and increased entrepreneurship.

- ***Expand international cooperation*** on mutually beneficial space activities to: broaden and extend the benefits of space; further the peaceful use of space; and enhance collection and partnership in sharing of space-derived information.
- ***Strengthen stability in space*** through: domestic and international measures to promote safe and responsible operations in space; improved information collection and sharing for space object collision avoidance; protection of critical space systems and supporting infrastructures, with special attention to the critical interdependence of space and information systems; and strengthening measures to mitigate orbital debris.
- ***Increase assurance and resilience of mission-essential functions*** enabled by commercial, civil, scientific, and national security spacecraft and supporting infrastructure against disruption, degradation, and destruction, whether from environmental, mechanical, electronic, or hostile causes.
- ***Pursue human and robotic initiatives*** to develop innovative technologies, foster new industries, strengthen international partnerships, inspire our nation and the world, increase humanity's understanding of the earth, enhance scientific discovery, and explore our solar system and the universe beyond.
- ***Improve space-based Earth and solar observation*** capabilities needed to conduct science, forecast terrestrial and near-Earth space weather, monitor climate and global change, manage natural resources, and support disaster response and recovery.[2]

Implications for the Air Force

Like the primary NSP principles, these goals touch on the full array of Air Force space programs. They are fully consistent with Air Force space programs and activities, and in a very real sense, we are engaged in pursuit of these objectives every day. The NSP in effect highlights how strong the demand signal is to the Air Force for what we provide to the warfighter and the broader community, and underscores the fact that this demand is getting stronger. The joint warfighting community, a range of other US government organizations, and broader civilian society rely on the Air Force to deliver a wide array of space capabilities including: SSA; space launch and range operations; missile warning; weather; and position, navigation, and timing. The Air Force also provides and operates the majority of Department of Defense (DoD)-owned military satellite communications satellites.

The implications of the NSP for the Air Force are thus wide-ranging, and their breadth and depth highlights the lead role the Air Force plays in national security space. Indeed, the secretary of the Air Force has been recertified as the DoD executive agent (EA) for space. As the EA, the secretary of Air Force will play a significant role implementing the new NSP and the resulting National Security Space Strategy, as will the Air Force as a whole. Per the new NSP, this implementation will be built around a greater focus on inter-agency efforts, increased international engagements, and a commitment to cooperation with our industry partners, as well.

We are off and running with these priorities. The Air Force is actively engaged in co-leading a reinvigorated Space Industrial Base Council (SIBC), working with the National Reconnaissance Office (NRO), National Aeronautics and Space Administration (NASA), the Department of Commerce, and others to identify critical areas of emphasis for the commercial space sector. And SIBC is just one example of inter-agency collaborations. We are also proud of our partnership with Australia in the Wideband Global Satellite Communications program, and actively looking at ways to build and expand on that partnership and to increase our number of international space agreements.

At the same time, the Air Force and the DoD are moving into an era of tightening budgets, so our implementation of the NSP will occur in a resource-constrained environment. The Air Force—and the DoD itself—will therefore have to prioritize to maximize our contributions to the principles and goals of the NSP. The Air Force is committed to finding and delivering cost efficiencies that will allow us to meet the goals of the NSP in a manner that is both fiscally and operationally effective.

Air Force Focus Areas

Among the broad objectives of the NSP described above, two areas of emphasis stand out because they provide the foundation for virtually all that we do in space: SSA and space launch capability.

Space Situational Awareness

Enhancing our nation's SSA capabilities was a priority for the Air Force before the NSP was released, but the emphasis in the new policy on better SSA underscores just how important our existing programs are. Because of the crucial role space plays for all the military services and DoD, having a better grasp of what is happening in space is not simply a "nice to have," or even just a priority for national security space activities. Instead, it is a top national security priority overall. Consequently, the NSP makes it a national priority to "maintain and integrate space surveillance, intelligence, and other information to develop accurate and timely SSA. SSA information shall be used to support national and homeland security, civil space agencies, particularly human space flight activities, and commercial and foreign space operations."[3]

The Air Force is committed to these goals, and shares a vision with US Strategic Command to gain and maintain comprehensive SSA to support timely and accurate decision-making. Securing this vision requires the integrated SSA and command and control forces of our space forces to successfully pursue four broad objectives: execute global space operations; provide threat assessment and threat warning through the Joint Space Operations Center (JSpOC); conduct operational-level space campaign planning and strategy; and maintain a space operating picture and order of battle, including blue force status.

Even boiled down to its most basic description, the scope of SSA is far-reaching: knowledge of all aspects of space. Achieving such an awesome goal requires excellence across several

specific activities:

- Monitoring US space assets, capabilities, and operations.
- Conducting surveillance of all space objects and space activities.
- Carrying out detailed reconnaissance of space objects of interest.
- Collecting intelligence on adversary space activities.
- Monitoring and analyzing conditions in the space environment.
- Conducting processing, fusion, analysis, dissemination and archiving of data on space activities.

As we look to implement the NSP and enhance the nation's SSA capabilities, the Air Force has three near term priorities. First, we need to better integrate SSA data to provide real-time, actionable information to support well-informed, rapid decision-making. Second, we must extend the lives of existing sensors to avoid operational capability gaps. And third, we need to enhance Air Force SSA capabilities in the development of new sensors to detect, track, and characterize emerging space threats. This third priority area includes achieving better coverage of space, thus closing existing geographic gaps.

In the first focus area—better integration of SSA data—the Air Force has two major efforts underway: standup of the JSpOC Mission System (JMS), and continued development of Net-Centric Sensors and Data Sources (NCSDS). JMS will enable timely delivery of integrated SSA information and national intelligence in order to support the command and control of US space forces. It will provide a marked increase in the speed with which analysis and assessments are conducted as well as in sheer computational capability. And it will be based on an agile and scalable service-oriented architecture that will allow for future expansion of capability. The Air Force plan to develop JMS over the Future Years Defense Program is built on regular "releases" of progressive iterations of JMS, each with enhanced capability. JMS Release 0 will become operational this year, and Release 1 is scheduled to be operational in fiscal year 2013. NCSDS will expose and share the data of legacy SSA sensors and non-traditional systems in a net-centric manner, to include integration of numerous sensors and all-source intelligence data.

The second major area of the Air Force SSA focus is to extend the lives of existing sensors to avoid operational capability gaps. This will include a Service Life Extension Program (SLEP) for the ground-based radar at Eglin, upgrades to the Haystack Ultra-wideband Satellite Imaging Radar, and SLEPs for the Ground-based Electro-Optical Deep Space Surveillance telescopes and the Globus II radar. These legacy systems are aging, but bring critical capability to our SSA efforts.

Our third major focus area aimed at enhancing Air Force SSA capabilities is the development of new sensors to detect, track, and characterize emerging space threats. Examples of Air Force initiatives in this area include the Space-Based Surveillance System, the space fence, the space surveillance telescope, and SSA environmental monitoring.

As these examples indicate, Air Force SSA efforts are wide-ranging and far-reaching—which is only fitting given the scale of the SSA challenge. The NSP makes plain that improved SSA is a first-order national priority, and the Air Force is actively engaged to deliver on this objective for the nation.

Launch Capability and Assured Access

Assured access to space is not possible without launch, but it is important to note that space-based programs and activities rely heavily on a wide array of terrestrial facilities and assets. The recent launch of the first advanced extremely high frequency (AEHF) satellite is a case in point. Shortly after an apparently flawless launch, the AEHF liquid apogee engine failed and a large team of Airmen and our space enterprise partners were challenged to get the satellite into its final orbit without the planned use of this upper stage. Thanks to extraordinary ingenuity and creativity, the team at Space and Missile Systems Center, under the direction of Lt Gen John T. "Tom" Sheridan, has risen to the challenge. These capabilities—human capital, in other words—along with the powerful boosters and other hardware that push space vehicles into orbit, are critical elements of the Air Force approach to assured access.

Because launch is so critical to our space enterprise, the Air Force is making significant investments in launch capability and undertaking major efforts to improve launch acquisition. The reliability of the evolved expendable launch vehicle (EELV) program to date has been outstanding. The Delta IV and Atlas V launch vehicles that comprise the EELV program have a 100 percent launch success rate—37 of 37. Unfortunately, at the same time, the costs of launch services are surging, putting pressure on the enterprise.

As a recent senior level review of the nation's launch capabilities noted, recent launch success is not assured. Instead, the operational measure of assured access is space-based capabilities on-orbit, on-time, and with the required performance. More than a decade ago, the Air Force and the NRO faced a fundamental challenge to assured access to space—launch reliability. There were significant reliability challenges with the legacy Titan IV, and even Atlas and Delta, with a string of launch successes, experienced eight major anomalies over 1997 to 1999. Furthermore, the Atlas 141 was on Pad 3E at Vandenberg AFB, California for more than two years due to spacecraft and upper stage issues. Since then, however, the Air Force has implemented a series of steps to improve launch capability with positive results, and the NRO has also implemented proven mission assurance processes.

As the Air Force and its partners survey the launch enterprise today, several important factors emerge:

- The EELV system is still maturing and will require continued focus on mission assurance process and resources.
- The primary cost driver for capability on orbit remains the cost of the payload.
- The impacts from the loss of a payload are so dominant that continued commitment to mission assurance is mandatory.

In addition, for many critically important payloads there is no backup system, and the leading cause of delayed capability in space continues to be late delivery of space vehicles. So while our focus on mission assurance is producing the desired results, there are elements of fragility behind our launch successes that require additional work.

At the same time, our current acquisition strategy for launch services is not adequately containing costs, and is straining the industrial base with small buys and short-term demand forecasts. Air Force senior leaders understand that purchasing launch hardware one launch at a time will not sustain the capability over the long term—and perhaps not even over the short term. Consequently, we are examining options that could provide a steady baseline transportation capability, such as utilizing block-buys with quantities tied to expected demand for launch services. The government would of course assume some risk with a block buy approach, but working in partnership with NASA and NRO, such risk should be mitigated over time to a manageable level. And these changes in our approach to the acquisition of launch capability and services must be made in concert with a more economical launch business case.

The mandate to sustain our focus on mission assurance, then, is matched by our determination to do better. The new NSP makes clear that Air Force contributions to national security via our space programs are enormous—not least in the area of space launch and assured access. But to be good stewards of the space mission in the emerging budget environment, we have to make our programs more competitive. Consequently, the Air Force is working to ensure the reliability of EELV is matched by a contract structure that enables more efficient production and that provides more affordable launch vehicles for our space enterprise. As part of this effort, and in tandem with our industry partners, the Air Force is pressing to make our space acquisition contracts more transparent, to provide greater visibility into the way our resources are applied. Without such visibility, we are unable to demonstrate with the value of our investment with the granularity required by the DoD and Congress. The new NSP's emphasis on assured access and the dependence of all other space activities on launch underscore the urgency of our efforts.

Conclusion

The new NSP has clear, wide-ranging implications for the Air Force. Because space has long been a core function of the Air Force, and because the demand for our space security efforts is broad, we are focused every day on virtually all of the goals identified by the NSP. At the same time, we recognize the new policy as a fundamental call for renewed emphasis on inter-agency, international and industrial partnerships as we pursue the range of objectives identified by the NSP. But because the goals of the NSP are so broad, and because we must operate in a fiscally realistic manner, we must prioritize. No objectives identified by the new NSP have greater consequence for the larger space enterprise than improved SSA and assured space launch capability, because they form the pillars on which the larger space enterprise stands. And the Air Force is absolutely committed to realizing the aims of the NSP in both SSA and launch.

Notes:

[1] President Barack Obama administration, *National Space Policy of the United States of America*, White House, 28 June 2010, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf, 3.

[2] Ibid., 4.

[3] Ibid., 13-14.

Ms. Erin C. Conaton (BA, Foreign Service, Georgetown University, Washington, DC; MA, Law and Diplomacy, The Fletcher School, Tufts University, Massachusetts) is the under secretary of the Air Force, Washington, DC. She is responsible for the affairs of the Department of the Air Force on behalf of the secretary of the Air Force, including the organizing, training, equipping, and providing for the welfare of its more than 334,000 men and women on active duty, 176,000 members of the Air National Guard and the Air Force Reserve, 170,000 civilians, and their families. She also oversees the Air Force's annual budget of more than $110 billion and serves as acting secretary of the Air Force in the secretary's absence.

From 2007 until her current appointment, Ms. Conaton served as the staff director of the US House of Representatives Committee on Armed Services. As the staff director, she served as the primary adviser to the chairman and 61 other members of the Armed Services Committee. She directed the overall operations, strategic planning and substantive agenda of the committee, to include drafting and overseeing the annual defense authorization bill. Prior to this position, she served as the minority staff director and as a professional staff member on the committee.

Mr. Rudy Barnes (BA, University of Virginia; MPP, Kennedy School of Government, Harvard University) is special assistant to the under secretary of the Air Force. He is the senior civilian advisor to the under secretary within her office, focusing primarily on strategic weapons and security issues, including ballistic missile defense, national security space programs, and nuclear weapons policy.

Immediately prior to joining the under secretary's staff, Mr. Barnes was a senior manager for Sandia National Laboratories, where he was responsible for advising the Sandia leadership on government and stakeholder relations, and supporting strategic planning and strategic studies.

From January 2007 to March 2010, Mr. Barnes was a professional staff member for the House Armed Services Committee, with chief responsibility for nuclear weapons policy issues. He also served as lead staff for the Subcommittee on Strategic Forces, where he bore overall responsibility for the subcommittee's contributions to the annual National Defense Authorization Act, including oversight of atomic energy defense activities, ballistic missile defense programs, and military space issues. While on the committee staff, Mr. Barnes helped author provisions establishing the Congressional Commission on the Strategic Posture of the United States, and led the drafting of the now-codified Stockpile Management Program.

Acquisition Challenges from the New National Space Policy

Mr. Robert A. Gold
Senior Advisor, Deputy Assistant Secretary of Defense
Space and Intelligence
Office of the Under Secretary
Defense for Acquisition, Technology, and Logistics
Washington, DC

On 28 June, President Barack Obama unveiled the new National Space Policy (NSP) reflective of a space environment dramatically different from that which existed five or 10 years ago. Space capabilities not only affect the lives of most US citizens more than ever but international interests and capabilities in similarly improving the lives of its citizens have grown at an even greater rate. This combination of increasing international activity and growing domestic dependence drove the need for a new space policy with a commensurate level of emerging challenges for the national security space acquisition community.

A brief examination of the new space policy reveals that many of its principles have direct or significant indirect implications for defense space acquisition. *Acting responsibly in space* is an indirect technology challenge to acquisition. Can we design satellites and rockets to minimize the release of unintended objects into orbit? Can we design spacecraft to ensure control at all times, even through emergencies, unforeseen operations scenarios, or at the end of payload life? Ensuring a *robust and competitive commercial space sector* is a direct challenge to the business decisions we make. Do we have the resources to adequately define which technologies we can allow industry to offer in non-government markets? Can we choose the right space mission areas to purchase as a commercial service without risking those capabilities to less robust (e.g., unprotected communications) implementations? Can we recognize which mission areas have the potential to support commercial application and what can be done to foster those markets? *No claims of sovereignty* means we will choose to act responsibly and is not fundamentally a critical technology or acquisition challenge; however, *assuring use of space for all responsible parties* is. Can we build and afford the necessary space situational awareness capabilities to monitor continued freedom of access and action in space? Can we build and afford technologies to actively protect those freedoms?

All the goals of the new space policy have profound implications to defense acquisition. *Energize competitive industries* requires Department of Defense (DoD) to consider the implications of its acquisition actions and investments in the national and commercial marketplace not just within the military industrial complex. What DoD mission areas or technologies could increase the ability for our industry to compete internationally if allowed to employ those technologies without risking national security? Which mission areas or technology have sufficient equivalent need outside DoD that we could convert to a fee for service or lease business model. *Expand international cooperation* offers opportunities for us to reduce our investments by sharing costs leaving funds available for other space, defense, or national needs. Are we willing to increase dependency on foreign partners for critical defense needs? Are we willing to accept the additional time, cost, and decision complexity that come with those interdependencies? *Increase assurance and resilience of mission-essential functions* is the most obviously profound for defense acquisition in that it requires DoD to address the need, in a contested and congested arena, to not only provide the required capabilities but ensure those capabilities will continue to exist under duress, battle, and natural disaster. Can we afford additional layers of space or terrestrial capability to assure the core? Can we harden new satellite designs to work through direct and indirect challenges? Can we design, build, and launch additional space elements to protect our critical spacecraft in all orbits? *Pursue human and robotic initiatives* drives defense to provide space elements which can actively sustain or defend space capabilities. Are we willing to move resources to these infrastructure and support (non-mission) activities at the expense of core mission capabilities? Are we prepared for the additional space control and operation requirements to conduct active operations? *Improve space-based Earth and solar observation* addresses the need to better observe conditions (environmental monitoring) or activities (reconnaissance). How long should defense retain space and terrestrial weather monitoring capabilities when civil and foreign interest in weather is on par with DoD's?

Similar sets of insights and questions can be developed from both the inter-sector and sector guidelines. Many of those guidelines, especially the sector guidelines delegated to the secretary of defense, provide clear direction on national priorities for defense acquisition. The national space policy clearly notes, for example:

- All departments and agencies shall conduct basic and applied research to increase space capabilities while decreasing their costs.
- DoD is responsible for space situational awareness, with support from the director, national intelligence.
- DoD will maintain capabilities in space support, force enhancement, space control, and force application.
- US government shall provide continuous worldwide access, for peaceful civil uses, to the GPS free of direct user charge.

The acquisition community's collective challenges across the defense enterprise are not in understanding which specific missions, capabilities, or other space activities are necessary to support the national policy. Most DoD mission-specific needs are appropriately derived directly from warfighter needs. The

enterprise challenges for the DoD largely arise in the new policy from trying to meet all those goals simultaneously within a fixed and perhaps shrinking, in terms of real spending power, budget in a broad mission area in which the government is, by-and-large, the primary customer. DoD has time-tested abilities in defining, budgeting, and executing individual programs. Setting up and executing those programs in the broader context and guidelines identified in the new space policy brings new challenges to the defense space enterprise governance and stewardship. It is the purpose of this analysis to describe the enterprise-level challenges arising from the principles, goals, and guidelines proscribed in the NSP. Emerging defense enterprise space acquisition challenges can be grouped into five major areas: (1) affordability in the face of increasing competition and contention; (2) complex architectures across space and non-space environments; (3) capability-level acquisition strategies which include interagency and international cooperation as an integral element; (4) improving the performance of space acquisition programs; and (5) managing the technology loop across the space industrial base. Note, there is no priority order to these challenges—I consider them to be of equal importance and equal complexity but differing in the details and affecting different parts of the space acquisition enterprise.

Challenge 1: Affordability in the face of increasing resiliency, contention. As the department strives to meet current requirements and retain current capabilities (e.g., positioning, navigation, and timing) we are simultaneously being asked to increase the resiliency and responsiveness of those things we do well while increasing capabilities in space situational awareness, environmental monitoring, and improving the launch infrastructure. At the same time, some current space programs are still experiencing cost and schedule growth, most visible are the overruns in the Space-Based Infrared System High program and those experienced prior to the recent restructure of the National Polar-orbiting Operational Satellite System (NPOESS).

We currently maintain our performance and capability edge through the use of cutting-edge high-performance individual satellites with large procurement times and costs. At some point in the near future, these combined pressures of limited budgets, increasingly expensive implementations, and need for increased resiliency and robustness will result in the DoD having to make difficult choices about which mission areas to either reduce investment in by sharing or take risk by accepting lesser performance while enhancing performance or resilience in others.

This requires the four pillars of space decision making—requirements, policy, acquisition, and resources—to work in concert with one another to make investment decisions in a coordinated manner across the space enterprise so that acquisition decisions support requirements and policy within the limits of resources. However, we do not yet have adequate framework or mindset to make these critical trades at the enterprise level. Several factors are coming together which will enable the DoD to make these tough choices.

The current administration's efficiency initiatives may provide enough investment efficiency to somewhat reduce the need for critical decisions as the efficiency gains are plowed back into meeting warfighter needs. Recently approved space governance initiatives are intended to provide enterprise-level management activities and decision making authorities in a manner that will allow these critical issues to be assessed and decided. A newly appointed Defense Space Council, supported by a reinvigorated executive agent for space, is expected to serve as the forum under which senior defense space managers can come together to coordinate the 'difficult decisions.' Congressionally directed actions for a 15-year investment strategy and establishment of a formal Major Force Program 12 also help motivate activities to take a broad coordinated look at our space investments within the priorities and guidelines set forth in the recently approved NSP. An effective framework under which to make these trades is still missing however. How do we judge whether an investment in deep space situational awareness is better than an investment in improving weather prediction? Are we better served by providing added layers of resilient protected satellite communications or investing in active space protection measures?

Challenge 2: Complexity of space and, where applicable, non-space architectures: Space architectures were, in some ways, inherently simpler than some terrestrial warfighting architectures (e.g., air and missile defense) in that few of the elements, other than satellite to ground, necessitate tight 'real-time' coupling of functions, system states, and data between those elements. These areas of relative simplicity will become fewer and fewer as we migrate to the principles and elements under the new NSP. Driving responsive resiliency into our space capabilities and any corresponding non-space capabilities will increase the need for better awareness and responsiveness through automation due to shortening response times and increased interdependencies in our mission capabilities. Systems will have to determine, on their own, when they are under attack or capability elements are otherwise rendered incapable. These systems will then have to respond appropriately to those situations in concert with other elements in the mission capability or, at a minimum, ensure operators are adequately informed to enable their response.

This sort of responsiveness and resilience in the form of battle damage assessment and 'fail-over' mechanisms requires the ability to build complex functional architectures and the associated systems engineering details; then implement them across multiple space and non-space programs. All of this has to be done across warfighting systems which now include space and non-space environments and already have fundamentally complex mission functions and technical implementations. The above mentioned governance authorities must adapt to this need by having the ability to: recognize when complex architectures are required; implement programs which meet those additional complexities; and identify the end state 'to be' towards investments and systems will evolve to achieve the necessary levels of mission capability, protection, and resilience. These interdependencies are further complicated by the direction under the new space policy to increase cooperation with agency and international partners.

Challenge 3: Employing capability-oriented acquisition strategies with interagency and international cooperation as an integral element. The need for complex resilient mission architectures means decisions about defense space capabilities transcend individual programs. Acquisition decisions isolated to individual acquisition programs are no longer effective for a

space environment which requires resiliency and relies on cooperation with other organizations. Acquisition decisions about communications satellites affect investments in airborne networks. Resource decisions in defense space weather monitoring affect interests in both National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration and is beginning to garner international interest as well. Review of the entire capability is now, and will increasingly be, an integral part of investment and acquisition decisions, to include increased cooperation with other initiatives to make space more affordable.

While increased cooperation offers opportunities to make space missions more affordable by sharing costs with other parties with similar interests, it also brings the potential for slower, more onerous, decision making bodies. Such an attempt was made under NPOESS by combining the terrestrial weather interests across the NOAA with those of the DoD and the European weather community. However, as declared by the Executive Office of the President in the February 2010 restructure,[1] the US-only tri-agency governance structure failed to act in a timely manner to effectively deal with cost and schedule growth due to differing objectives and acquisition procedures between the agencies. Similarly, international arrangements have the potential to share costs across parties with common interests but tighten the coupling between the organizations increases the time it takes the collective group to make decisions.

As military needs evolve more rapidly, lengthy acquisition programs tend to become less responsive to meeting those changing mission needs. The challenge this brings to the acquisition, requirements, and resourcing communities is the need to manage capabilities and make critical investment decisions against the backdrop of provisioning changing capabilities, not just approving and resourcing programs. Some progress is being made—most recently, the Joint Staff established an Interim Capabilities Document for positioning, timing, and navigation. The 2006 Nunn-McCurdy reviews for NPOESS looked across the suite of weather capabilities and made several difficult decisions (e.g., de-manifesting sensors, reducing US orbits by incorporating European Organization for the Exploitation of Meteorological Satellites capabilities) at a mission architecture level.

We need to maximize learning from these initial examples as this kind of enterprise perspective will continue to grow to include technology and industrial base perspectives as discussed in challenge area five. Having a complementary requirements process would help drive some of these behaviors into the acquisition community as well. Requirements documentation and assessment across a capability area inclusive of resiliency requirements, as is being done for PNT, necessitates the acquisition community construct complementary frameworks in the form of layered space/non-space architectures with real elements targeted towards addressing resiliency needs. This type of activity should be extended across the other space mission areas and include an assessment of impacts to infrastructure elements such as space access and space operations.

Challenge 4: Improving the performance of space acquisition programs within the context of the new space environment. Although not a new critical interest area for the DoD, the need for affordability, broadening of the customer base in cooperative programs, and increased pressure to continue to excel in every mission area while adding resilience necessitate being able to establish realistic cost, schedule, and performance baselines and hold to them through completion of the program. The biggest, but not only, factor I have observed in the satellite programs I have worked is conducting a sufficient amount of effective design enumeration and analysis. Much of what plagued those programs was tremendous amount of rework late in the program, much of it in software, creating additional expenses due to redoing the design and the costs of the standing army while subelements delayed progress at higher levels of assembly and test.

Three major elements offer opportunities to begin building confidence back into satellite developers—reduce design complexity, ensure across-the-board multi-disciplinary teams assess the design, develop, and employ more robust design analysis tools to increase the sophistication (ability to anticipate unintended consequences) of the analysis, and consideration and analysis of design alternatives to better understand hidden design drivers. There is a tendency for developers and their government overseers to consider the design phase as a one-pass process—once the design is considered 'good enough' for the basic technical performance measures, we immediately move to implement and test. However, we are finding that a determination of 'good enough' during critical design really is not sufficient because of a lack of detail in the analyses failed to uncover fundamental flaws. These fundamental flaws go unfound, sometimes because we failed to anticipate emergent behaviors and critical interdependencies, sometimes we fail to consider the difficulties in manufacturing an elegant but complex design, sometimes because we just missed a design flaw in spite of all the peer reviews, prototyping, and testing that could have been found through increased robustness in design tools and activities.

We need to consider the design phase as the best time to really wring out as many of the implementation and performance issues from the program as possible. The design phase usually has lower labor costs than later phases—the work force is smaller and the errors are easier to correct—so taking more time early in the program is a modest schedule hit, not a major cost hit. Taking the time to bring in outside experts, perform more modeling and analysis, consideration of alternative approaches can, at a minimum, significantly increase the amount of understanding in design drivers and limitations, at best, assuring good design will prevent complete rework because fundamental design flaws do not get passed into subsequent development phases.

Other, more strategic opportunities are being explored—reducing the mission complexity, increasing the rate at which we fly lower complexity satellites, alternative business strategies such as block buys and incremental funding all serve to make acquisition programs more manageable but this is a goal for which we should continue to strive for improvement. In many instances, old techniques will still serve us well so continued rigor in areas such as earned value, multi-disciplinary design teams, and formal risk management should be the norm for acquisition programs. There is still a need for investment in design tool and methodology improvements—tools which allow us to better realize and analyze the designs across increasingly complex amounts

of hardware and software and which allow us to identify hidden dependencies and emergent behaviors.

Challenge 5: Managing the technology loop effectively across the space industrial base. The technology loop is the management of science and technology investments and their transition into space acquisition programs and is the primary path employed by DoD to transition cutting edge technologies and techniques into capability on orbit. It's characteristics are heavily influenced by the critical path through the industrial base. While this loop has been a long standing part of DoD's ability to field high-performing technologies, the new space policy adds the elements of increasing commercial use, adding resilience to space capabilities, and increasing US industry competiveness in international markets.

The first, but not only, challenge in managing the 'loop' is the underlying business model for acquisition programs. Cost-plus contracting is a reasonable way to manage and reward higher risk developments but tends to discourage innovation. Cost-plus contracting tends to drive the developers to use what they consider to be proven design methods and technologies because those elements are have predicable cost and outcome. However, are we willing to re-try fixed-price based models in spite of the lessons learned from the mid-80s to encourage contractors to be more aggressive about implementing cost reducing technologies and techniques?

Next is the ability for contractors to manage their critical staffing and expertise. The trend within the DoD in the recent past is buying fewer satellites with longer development times but which provide very high-performance. These long development cycles tend to reduce the amount of opportunities available at any given time within which critical work skills could be transferred as old projects complete and new ones start. Shorter development cycles are expected to support a smaller overall industrial base because the total funding and functional content, at a given point in time, associated with the shorter cycles will be smaller but improvements in higher numbers of competitive procurement actions, increased opportunities for technology insertion, and smaller gaps in technical work. The total work is unlikely to be significantly less because we're mostly smoothing over the large peaks and valleys associated with large space acquisitions.

Managing the technologies themselves—usually emerging from government or internally-managed research funding, into development programs—has inherent challenges in dealing with intellectual property rights to protect the interests of the technology developers to pursue the intellectual and financial benefits of their inventions while allowing the government to pursue 'best-of-breed' approaches in acquisition. In space, those technology challenges are made less tractable by the inherently exquisite nature of those technologies and the harsh environment in which they're expected to operate. Export controls have been the center of discussions about US industry competitiveness recently but the needs and views are mixed. The current space policy strives to increase US commercial competitiveness through reduced export controls while stemming the flow of advanced space technologies to unauthorized parties. Critics of current export controls cite lengthy approval cycles and overprotection of common implementations, proponents note technologies provide a significant part of our warfighting advantage and data shows license approval cycles are reasonable. Obviously the proper balance between protecting our technological edge and improving overseas competitiveness of our industry partners is at the core of this issue and must be handled in the details, not through broad decree. The ability to strike this balance comes from combined efforts across intelligence, acquisition, and security.

Additional formidable challenges are explicit or implicit in the new policy—for example, space cadre and information assurance areas are as challenging as any I have mentioned above and will be addressed by others as we continue to implement the direction of the current leadership. I have offered a couple of suggestions to deal with the emerging challenges identified as follows:

- Revise space governance and develop an investment framework to enable the difficult decision making.
- Invest more efforts on getting the satellite and ground designs right by allowing time for analysis and providing better tools/methods.
- Develop flexible comprehensive architectures inclusive of space and ground.
- Pursue smaller, rapid, and affordable acquisitions, where possible, to enable a healthier industrial base.
- Develop requirements and acquisition strategies for capabilities, not just programs and include policy and cooperation (commercial, interagency, and international) as an integral part of those strategies.

Each of the above challenges areas and the modest number of solution areas I have suggested are worthy of additional in-depth analysis as opportunities for progress exist. The new space era, reflected in the revised NSP needs our new ideas and new energy to meet and overcome to these challenges.

Notes:

[1] "Restructuring the National Polar-orbiting Operational Environmental Satellite System," fact sheet, NPOESS Decision, 1 February 2010.

Mr. Robert A. Gold (BSEE, Lehigh University; MS, Systems Engineering, Virginia Polytechnic Institute; Public Management Certificate from Indiana University - Purdue University Indianapolis) currently works for the deputy assistant secretary of defense for space and intelligence (DASD[S&I]) in the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. He has over 22 years of defense acquisition experience and focused on complex software-intensive system development for the majority of those years. Mr. Gold began employment with Naval Sea Systems Command in 1986, where he served in a variety of systems engineering, software engineering, and acquisition positions for submarine, surface ship, and missile programs. Mr. Gold has served the Office of the Secretary of Defense since 2001 and has been a member of the Senior Executive Service since 2008. He was director, Engineering, Prototyping, and Technology Integration before coming to DASD(S&I). He is a member of the Professional Acquisition Workforce and is DAWIA Level Three certified in systems engineering, program management, and science and technology management.

Senior Leader Perspective

Space Act, Space Policy, and the Future of NASA

Maj Gen Charles F. Bolden, Jr., USMC, retired
NASA Administrator
Washington, DC

National Aeronautics and Space Administration (NASA) is pleased to be an integral part of President Barack Obama's National Space Policy (NSP) announced in June. Along with several other technical and defense agencies, we are part of a national focus on reinvigorating research and development. It is a critical time for this new direction, as we have under-invested in this area for years. We know a lot about what capabilities we need to make the next big leaps in space exploration—we have conducted studies and compiled capability needs lists for decades without much achievement. The president has given us his backing and a blueprint to help us reach those goals by signing into law the NASA Authorization Act of 2010.

This is the earliest a president has issued a space policy in any of the past three administrations. It shows how serious President Obama is about space and how much he believes in its potential to benefit our economy and to have a positive impact on the larger issues affecting our world.

The US has always been a leader in science and technology, with a drive to create grand new things that did not exist before and push the envelope of our human potential. The NSP gives our nation the opportunity to reignite its excellence in research and development and innovate in many areas that will drive our future. The benefits will not only be economic. With a continued focus on innovation, we will create capabilities for future generations to strive and achieve and help to build bridges throughout the world.

One of the foundational activities that we are directed to do under the space policy is to enhance capabilities for assured access to space. We are directed to acquire space launch services that are reliable, responsive to US government needs, and cost-effective. We are also directed to purchase and use commercial space capabilities and services to the maximum practical extent. We are to develop governmental space systems only when it is in the national interest and there is no suitable, cost-effective US commercial or, as appropriate, foreign commercial service or system that is or will be available.

Consistent with this policy is the orderly phase-out of the space shuttle program. As a former shuttle commander, I know that the program has served our nation well and contributed greatly to our understanding of human spaceflight and helped us achieve many scientific and technological breakthroughs. However, a decision was made back in 2004 to phase the shuttle out, and this has been reinforced by the tenets of the NSP, and now it is our job to see this process through to completion. Fortunately, the future for human spaceflight is bright, and we expect to have many more capabilities for accessing low Earth orbit (LEO) than we have now.

To move beyond the shuttle program to the next decade of utilization of the International Space Station (ISS) and the technologies for exploring beyond LEO, we have the NASA-specific Civil Space Guidelines of the NSP. To summarize and paraphrase, they are:

- To set far reaching milestones, including crewed missions beyond the moon by 2025 and to orbit Mars with humans by the 2030s.
- To use the ISS as the incredible resource it is to further human exploration and also make the most of its potential for international cooperation.
- To expand our work with the private sector to enable safe, reliable, and cost-effective commercial spaceflight capabilities for crew and cargo to and from the ISS.
- To robustly pursue those technologies, working with industry, academia, and international partners, to increase the capabilities, decrease the costs, and expand the opportunities for future space activities.
- To work steadily toward the next generation of launch systems.
- To send more robots into the solar system to help us learn more about it, scout for new destinations and test technologies.
- To continue our strong program of space science for observations, research, and analysis of our cosmos.
- To increase our capabilities to detect, track, catalog, and characterize near-Earth objects to reduce the risk of harm to humans from an unexpected impact on our planet and to identify potentially resource-rich planetary objects.
- And in concert with other agencies, increase our Earth observing capabilities and knowledge of weather and natural phenomena on our planet and the gathering of data about it.

All of this unfolds from a well thought out seed, the National Aeronautics and Space Act of 1958. This is NASA's founding document.

The Space Act has been amended frequently, but always in the spirit of the original and to take into account new possibilities and challenges. The president's proposal for NASA's future and his further delineation of those goals in the NSP is aimed squarely at fulfilling key principles of Congress' design for our nation's civil aeronautical and space activities—and the administration it created to conduct them—that were laid out in that cornerstone legislation.

Right up front in the Space Act's Declaration of Policy and Purpose, Congress directed NASA to make concrete and genuine contributions to nine fundamental objectives. Over the course of its nearly 52-year history, NASA's success in advancing those goals has been impressive—and in many cases spectacular. The course that President Obama has now charted for NASA is de-

signed to raise that bar. The first five objectives of the space act are specifically addressed in the president's policy:

- Expand human knowledge of the earth and of phenomena in the atmosphere and space;
- Improve aeronautical and space vehicles;
- Develop and operate space vehicles to carry equipment and living organisms through space;
- Conduct long range studies on aerospace opportunities, benefits, and challenges; and
- Preserve the role of the US as a space leader.

In some ways the president's policy can be seen as a departure from previous policies because it puts us squarely on a path of future-thinking, highlighted by capabilities rather than a destination focus. This approach forces us to take actions that lead to tangible progress on the technologies that will truly make us a spacefaring nation in an affordable, sustainable, realistic way. But it also maintains continuity with the fundamental precepts that have endured since the dawn of the space age, which have served this country very well and made it a leader in space and led to accomplishments that have benefited the entire world.

The way NASA redefines how it functions as an agency and meets the competing demands of its stakeholders—not least the American taxpayer—but also other government agencies, industry, academia, and other participants, and remains a good partner to the nations who want to contribute to a global exploration enterprise along with us, is going to be one of our greatest challenges. It is not going to be painless, but the NSP gives us a viable roadmap. Our purpose in taking NASA forward on a bold new path is to uphold and advance the fundamental principles of the space act.

To put all of this in real-world context, compare the Space Act and the NSP to NASA's latest authorization act, signed into law by the president in October 2010. That bill gives us the guidance on how to bring these conceptual ideas to life over the next three years. In the broadest sense, that authorization act calls on NASA to:

- Sustain capability for long-duration presence in LEO
- Determine if humans can live for long periods in space with decreasing reliance on Earth
- Maximize exploration's role in advancing knowledge of the universe, support national and economic security and inspire young people's education
- Build upon cooperative framework of ISS partnership

The concrete actions behind each of these precepts include maintaining shuttle launch capability through fiscal year 2011. The authorization act also extends the ISS through at least 2020. The other partners have agreed to this in principle, and we are now working out the specifics.

The act directs NASA to develop a Space Launch System with capability of lifting payloads of 70 to 100 metric tons to LEO without an upper stage and capability to launch an integrated Earth departure upper stage to carry 130 metric tons or more. The goal for full operational capability of the system's core elements is 31 December 2016. It is our intention that such a system have the potential for use by multiple clients, including other agencies and partners.

NASA will develop a multipurpose crew vehicle for use with the Space Launch System, which will continue the Orion crew exploration vehicle's human safety features, designs, and systems.

The authorization gives us increased support for our current programs to develop commercial capability for transporting crew and cargo to space. Our Commercial Orbital Transportation Services (COTS) program currently has two participants—SpaceX and Orbital Sciences Corporation—that are moving forward on such key elements as test launches and engine firings on the path to becoming the first companies to carry cargo for us commercially to the ISS. Increased funding support for COTS could enable us to accelerate some of the milestones and testing. NASA also has awarded contracts to SpaceX and Orbital to deliver cargo to the ISS after the retirement of the space shuttle. NASA will also continue and expects to expand the Commercial Crew Development Program, which currently has five participants involved in developing launch systems and crew vehicles and supporting technology development.

President Obama has correctly concluded that we need to shift the paradigm, encourage innovation and incentivize the private sector to take the lead in getting us to LEO from here out so that NASA can focus on the big picture and make the next innovations happen. This larger role for government has been successful and appropriate throughout our history, and we have transferred many technologies to the private sector during that time.

This shift in the way we operate is a once in a generation course change, but the capabilities that industry has demonstrated give us confidence in the ability of the commercial sector to successfully provide us service to LEO and open up an entirely new segment of the economy. While NASA will provide oversight to commercial companies working on this capability, it no longer needs to own the systems themselves. But, the bottom line is that no one will fly until we are convinced all safety criteria have been met.

Taking the first steps in the bold new missions NASA is proposing, the agency will establish a new space technology program to align mission directorate investments and support long-term needs. This program will complement mission-directorate funded research and support, where appropriate, multiple users. This unified approach coordinates development of technologies and capabilities across the agency.

In line with our work to develop new launch systems, the Kennedy Space Center and the Cape Canaveral AFS in Florida will receive 21st century launch complex upgrades to help them support more users and a wider range of launch opportunities. We are likewise upgrading our launch facilities at the Wallops Flight Facility in Virginia.

The act also authorizes funding for science and aeronautics at the level in the president's request, which provides funding for several priority Earth observation missions, new missions to explore our solar system and peer beyond it, and greater resources

for aeronautics research leading to safer, more efficient, and more environmentally friendly aircraft and air traffic control systems.

In short, the policy and our authorization act put us on a path to transformative technology development and innovative technology demonstrations to pursue more advanced approaches to space exploration. They foster research and development on heavy-lift and propulsion technologies, and seek to modernize our nation's critical launch infrastructure. The goal is to improve US competitiveness in many commercial space arenas, including the launch sector, to improve the space industrial base and increase the nation's economic growth.

The implications of this new paradigm are a way of looking at the generational picture where we are less vehicle-driven and more capability-focused to ensure cross-cutting applicability across missions and users.

But beyond that, this generational shift in the space program reflects a larger momentum to ensure that our nation has a deep well of technological excellence to draw from to meet future challenges, and that it is training future leaders here in this country to meet those challenges. Core components of the NSP and the 2010 NASA Authorization Act require us to create educational opportunities now to inspire the next generation. I can point to specific programs where we are working hard to bring new students to science, technology, engineering, and mathematics careers, but in the final analysis, it is the very missions we make possible through our work that will be one of the strongest draws to these careers. We must continue to innovate and create the opportunities for young people to make a contribution to national goals through these missions. This is a very important piece of the policy—the people side—that is less quantifiable than the metrics of a technology development program but no less crucial.

International contributions and partnerships have contributed significantly to the success of many of our programs and missions—from the ISS elements provided by Russia, Canada, Japan, and the European Space Agency to the stunning success of Cassini-Huygens at Saturn, to instruments we have flown on other nations' satellites. Indeed, the ISS itself is a model of diplomatic success and global cooperation that will endure as one of the program's greatest legacies.

Our space program makes us more than ever a leader in the world, and this new direction will require us not only to innovate, but to collaborate. There are many exciting opportunities coming up—from missions to Mars to many other destinations humans want to visit—that will require new ways of looking at space and new ways of combining our expertise with the resources of other countries, including those that may not have space programs but can make a contribution.

This dialogue is ongoing right now with our international partners at the working level, while we establish our preliminary needs and objectives for the coming years. Then, we will move toward more detailed discussions and consensus building, with both current and non-traditional partners, to lay out a plan for the US and its partners to achieve a steady progression of human missions to increasingly ambitious destinations, ultimately to the surface of Mars.

At its core, America's space program is strong. It has helped us rewrite scientific textbooks in just the past few years. It has created an aerospace industry that is the envy of the world. And it has generated knowledge and technology whose benefits have spread beyond our borders. The NSP's intention is to strengthen that national resource and make it durable and flexible for the future. Like the National Aeronautics and Space Act, it will remain a living document that responds to real-time challenges even as it helps us focus on our aspirations just out of reach.

Maj Gen Charles F. Bolden, Jr., USMC, retired (BS, Electrical Science, US Naval Academy; MS, Systems Management, University of Southern California) began his duties as the 12th administrator of the National Aeronautics and Space Administration in July 2009. He leads the NASA team and manages its resources to advance the agency's missions and goals.

General Bolden's confirmation marks the beginning of his second stint with the nation's space agency. His 34-year career with the Marine Corps included 14 years as a member of NASA's Astronaut Office. After joining the office in 1980, he traveled to orbit four times aboard the space shuttle between 1986 and 1994, commanding two of the missions. Prior to General Bolden's nomination as NASA administrator, he was the chief executive officer of JACKandPANTHER LLC, a small business enterprise providing leadership, military and aerospace consulting, and motivational speaking.

He received an appointment to the US Naval Academy and, after completing flight training in 1970, became a naval aviator. He flew more than 100 combat missions in North and South Vietnam, Laos, and Cambodia, from 1972-1973.

General Bolden later served in a variety of positions in the Marine Corps in California and was assigned to the Naval Test Pilot School at Patuxent River, Maryland. At the Naval Air Test Center's Systems Engineering and Strike Aircraft Test Directorates, he tested a variety of ground attack aircraft until his selection as an astronaut candidate in 1980.

His NASA astronaut career included technical assignments as the Astronaut Office safety officer; technical assistant to the director of Flight Crew Operations; special assistant to the director of the Johnson Space Center; chief of the safety division at Johnson; lead astronaut for vehicle test and checkout at the Kennedy Space Center; and assistant deputy administrator at NASA Headquarters. After his final space shuttle flight in 1994, he returned to active duty with the operating forces in the Marine Corps as the deputy commandant of midshipmen at the US Naval Academy.

General Bolden was assigned as the deputy commanding general of the 1st Marine Expeditionary Force in the Pacific in 1997. In 1998, he served as commanding general of the 1st Marine Expeditionary Force Forward in support of Operation Desert Thunder in Kuwait. General Bolden was promoted to his final rank of major general in July 1998 and named deputy commander of US Forces in Japan. He later served as the commanding general of the 3rd Marine Aircraft Wing at Marine Corps Air Station Miramar in San Diego, California, from 2000 until 2002, before retiring in 2003. General Bolden's many military decorations include the Defense Superior Service Medal and the Distinguished Flying Cross. He was inducted into the US Astronaut Hall of Fame in May 2006.

Preserving the Space Domain for Future Generations

Brig Gen John W. Raymond, USAF
Vice Commander, 5th Air Force and
Deputy Commander, 13th Air Force
Yokota AB, Japan

Mr. Kurt M. Neuman
Senior Strategy and Policy Analyst
Headquarters Air Force Space Command
Peterson AFB, Colorado

Nature, History, and Status of the Space Domain

In January 2007, China launched a sophisticated payload intended to decisively test an antisatellite capability. As the kinetic kill vehicle closed in on the inactive Fengyun-1C weather satellite at more than 18,000 miles per hour,[1] a new era began in space: the era of congestion. The resulting impact created an enormous debris cloud posing hazards to hundreds of operational spacecraft. By mid-September 2010, the debris count had reached 3,037 objects, of which 97 percent still remain in orbit more than three and a half years after the test and are expected to threaten assets in space for the next 20 years.[2,3] The debris from the Fengyun-1C spacecraft now represents over 20 percent of all cataloged objects passing through low Earth orbit.

Two years after this startling test, another disturbing event happened; a "dead" satellite and an active communications satellite collided. The debris field from the impact of Iridium 33 and Cosmos 2251 numbered over 1,750 objects.[4] These two events, taken together, increased the amount of space junk circling the planet by 60 percent.[5] Although more than 4,700 space missions have been conducted since the beginning of the space age, only 10 missions have accounted for one-third of all debris orbiting the earth. Alarmingly, six of these 10 debris-producing events occurred within the past 10 years.[6] It was now painfully obvious that a satellite could be hit by random debris, and has been. This shocking wake-up call sent a message to all space-faring nations that action must be taken if we want to preserve the environment for the benefit of future generations.

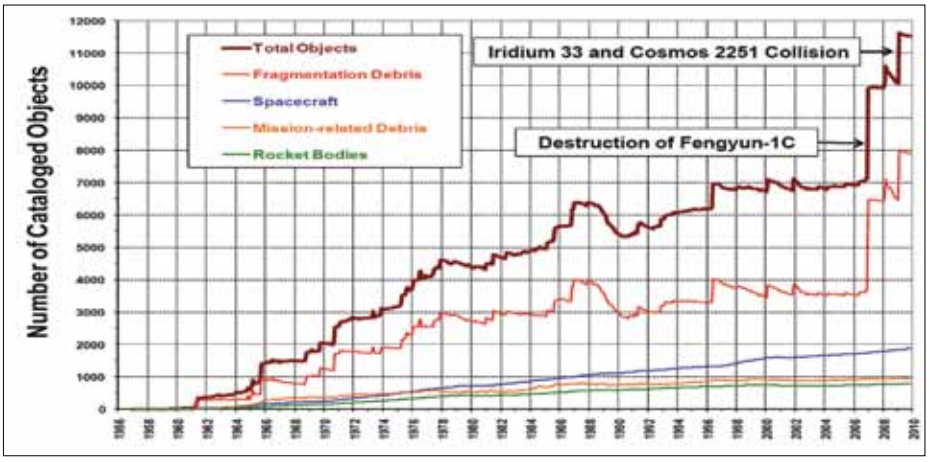


Figure 1. Growth of cataloged objects in low Earth orbit.[7]

Not only is the amount of debris rising exponentially, the number of nations able to access space is growing. Eleven nations or consortia have demonstrated the ability to launch a satellite into space, with three of them, the US, Russia (Soviet Union), and China, having the capability to launch humans into space. Two additional countries, Iraq and North Korea, both claim to have successfully launched a satellite but this has not been confirmed.[8] Brazil and South Korea have each made several launch attempts, but have not had a successful mission. More than three dozen countries have launched their satellites on a foreign booster. Multiple commercial entities, such as SpaceX, Virgin Galactic/Scaled Composites, Air Launch, Kistler, Beal, and Liberty, are developing private launch systems, with both SpaceX and Virgin demonstrating successful systems.[9]

Clearly the rapidly evolving nature and status of the space domain required a call to action. As the global leader in space, the US needed to show commitment to the preservation of the space domain, responsible behavior in space, and establishing acceptable norms of behavior to preserve the domain for future economic and national security benefits. The *National Space Policy of the US of America* signed by President Barack Obama on 28 June 2010, is an important, and positive, step in this direction.

Value of the Space Domain

Services and capabilities provided by space systems are critical in the modern geopolitical and global economic landscape. The US National Space Policy (NSP) states, "Space systems allow people and governments around the world to see with clarity, communicate with certainty, navigate with accuracy, and operate with assurance."[10]

Space is a common domain that provides over $260 billion in benefit to the global economy.[11] It is vital to our national security, provides intelligence information, treaty verification, missile warning, navigation and timing, and secure communications. It enables many of the daily activities we take for granted in the US, from navigating around the city using a mobile phone to picking the right jacket to wear based on the morning weather forecast. If objects in space are threatened, our economy, national security,

and standard of living are likewise in peril. Given that debris in space could last many generations, responsible behavior in space is necessary not only for our generation but for future generations and the benefit of mankind.

The Role of Policy in Preserving the Domain

The US is a member of the Inter-Agency Space Debris Coordination Committee and is a vocal advocate for the United Nations Space Debris Mitigation Guidelines,[12] but the White House recognized that more affirmative action was needed. As the global leader in space, our policy, and actions, must set the example for the world's space activities.

Given this level of activity and the grave consequences of misbehavior to our economic and national security interests, a policy geared toward transparency, confidence building, and international cooperation is critical. NSP, like all government policy, reflects high-level guidance and articulates national goals and objectives, forming a basis for action supporting national intent. Our policy also shapes international perceptions and communicates messages affecting our country's relationships on a global stage.

The new NSP provides a strong commitment to the principles of responsible behavior and the preservation of the space domain:[13]

> It is the shared interest of all nations to act responsibly in space to help prevent mishaps, misperceptions, and mistrust. The US considers the sustainability, stability, and free access to, and use of, space vital to its national interests. Space operations should be conducted in ways that emphasize openness and transparency to improve public awareness of the activities of government, and enable others to share in the benefits provided by the use of space.

Dating back to the Dwight D. Eisenhower administration and the dawn of the space age, US space policy has been based on the principle of peaceful uses of outer space.[14] This approach greatly influenced how space is used and the global perception of the value. The current international legal regime, embodied in the "Outer Space Treaty"[15] signed in 1967, recognizes that "the exploration and use of outer space … shall be carried out for the benefit and in the interests of all countries, irrespective of the degree of their economic or scientific development, and shall be the province of all mankind."[16] Moreover, it declares that "outer space … is not subject to national appropriation by claim of sovereignty."[17] The US also abides by the rules and decision-making procedures calling for registration of space objects and restrictions on weapons of mass destruction in space.[18] The US is committed to these principles and has been a global leader in efforts to protect and preserve the domain.

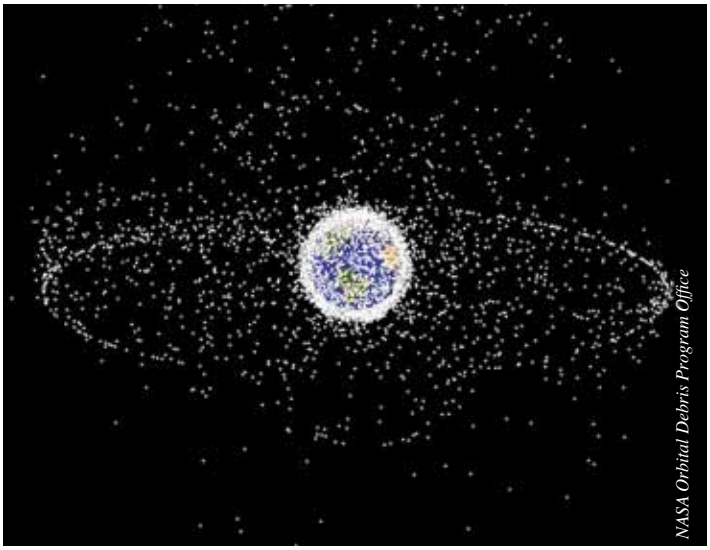


Figure 2. Computer generated image of objects currently being tracked in orbit around Earth. Approximately 95 percent of these objects are debris.

Preserving the Domain

The NSP strengthens stability in space through domestic and international measures to promote safe and responsible operations in space, improved information collection and sharing for space object collision avoidance, protection of critical space systems and supporting infrastructures, with special attention to the critical interdependence of space and information systems; and strengthening measures to mitigate orbital debris.[19] Air Force Space Command (AFSPC) takes this commitment seriously and has multiple on-going efforts to ensure safe operations in space that minimize the potential for debris. Our launch and range operations at Patrick and Vandenberg AFBs adhere to strict safety and environmental standards. All operations are designed from the very beginning to minimize environmental impact should a problem occur. We realize that our space and launch operations are challenging, and we therefore appropriately take extreme measures to protect our people and the environment.

This approach was evident in the intentional destruction of USA-193 in February 2008. This satellite malfunctioned shortly after launch and still carried a full load of hydrazine fuel. Extensive analysis showed there was a high probability that the hydrazine tank could survive the impending re-entry and posed an unacceptably high risk to human life. An emergency mission was undertaken to intercept and destroy the satellite, with mission design specifically focused on minimizing potential space debris. Engineers estimated that more than 50 percent of the debris would re-enter the atmosphere within 45 minutes of the event and that of the debris left in temporary orbit, more than 99 percent would fall out of orbit within one week.[20] No

Given this level of activity and the grave consequences of misbehavior to our economic and national security interests, a policy geared toward transparency, confidence building, and international cooperation is critical.

The international agreements we have in place go a long way toward fostering understanding, promoting transparency, and supporting the mutual interests and foreign policy objectives of all involved.

parts "larger than a football" survived the intercept with all debris larger than one centimeter harmlessly burning up within weeks.[21]

A key aspect of preventing mishaps in space and preserving the domain is a thorough understanding of what objects are in space, or "space situational awareness" (SSA). Shared awareness of space activity is needed for global spaceflight safety and contributes to transparency and confidence building measures. The US is the international leader in SSA capabilities and can use this knowledge to foster cooperative SSA relationships, support safe space operations, and protect US and allied space capabilities and operations. AFSPC continues to explore opportunities for greater cooperation in this area, with key partners already providing access to critical ground sites around the world.

The new NSP assigns the responsibility for the development, acquisition, operation, maintenance, and modernization of SSA capabilities to the secretary of defense. AFSPC broke new ground in SSA data sharing when, pursuant to the fiscal year 2003 National Defense Authorization Act, it initiated a pilot program for the provision of space surveillance services to commercial and foreign entities (CFE). This highly successful program was created in 2004 to focus on safety of orbital flight for government, commercial, and foreign satellite operators in the US and around the world. AFSPC led the execution of the CFE Pilot Program and demonstrated the feasibility and benefit of providing space surveillance data to commercial and foreign space operators. The program successfully "went operational" in 2009, when AFSPC transferred it to US Strategic Command, where it was renamed as the "SSA Data Sharing Program."

AFSPC improved SSA data sharing by expanding and automating processing and analytical capabilities available to the Joint Functional Component Command for Space (JFCC SPACE) at the Joint Space Operations Center (JSpOC). JFCC SPACE is now able to perform basic conjunction assessments on all active satellites (approximately 1,150).[22] This comprehensive approach provides greater opportunity for warning satellite operators of possible collisions and contributes to safer activities in space, for both manned and unmanned systems. As direct result of data provided by the SSA Data Sharing Program, satellite owners and operators worldwide maneuvered 51 times in 2009 to avoid objects that could impact their satellites and create more debris.[23] These measures are the starting point toward reversing the alarming growth in space debris circling the earth.

AFSPC's Role in International Cooperation

The new policy recognizes that space is a global commons and that preservation of the domain calls for international cooperation. The policy states, "All nations have the right to use and explore space, but with this right also comes responsibility. The US, therefore, calls on all nations to work together to adopt approaches for responsible activity in space to preserve this right for the benefit of future generations."

AFSPC is a global command operating in multiple countries and territories around the world, including the United Kingdom, Denmark, Greenland, Australia, Germany, Spain, Diego Garcia, and Ascension Island. Beyond operating overseas ground stations, AFSPC also develops, launches, and operates a variety of satellites that gather information of direct and immediate benefit to the global community. For example, the efforts of our satellite operations crews make it possible for GPS to provide timing and positioning data around the world at no cost to the user. Similarly, missile warning data is provided to friends and allies in diverse regions across the globe through the Shared Early Warning System program. The international agreements we have in place go a long way toward fostering understanding, promoting transparency, and supporting the mutual interests and foreign policy objectives of all involved.

In a prime example of international space cooperation, AFSPC's Schriever Wargame series provides a direct avenue for the US and its partners to share information, develop cooperative plans, and gain a greater perspective on securing and preserving a global domain that affects all nations. Canada, the United Kingdom and Australia have participated side-by-side with the US in the last four Schriever wargames, with a highly successful interaction that has explored greater levels of cooperation, transparency, and information sharing. This is just one of the forums used to explore partnership opportunities and develop closer working relationships on space issues.

Protecting the Future

The US will continue to lead global efforts aimed at minimizing space debris and preserving the space environment for the responsible, peaceful, and safe use for all nations. We continue to leverage space situational awareness information to detect, identify, and attribute actions in space that are contrary to responsible use and the long-term sustainability of the space environment. As a global partner in space, we provide information to owners and operators of space systems to help prevent mishaps, promote transparency and encourage responsible behavior that protects the environment from damage. Given the challenges of an increasingly congested domain, the new NSP charted a path to ensuring long-term viability and continued benefit from the space domain for many generations to come.

Notes:

[1] Shachtman, Noah, "How China Loses the Coming Space War," *Wired Magazine*, 10 January 2008, http://www.wired.com/dangerroom/2008/01/inside-the-chin/.

[2] "Chinese Debris Reaches New Milestone," NASA Orbital Debris *Quarterly News* 14, issue 4, (October 2010).

[3] The Global Commons Project, Final Report, NATO, *Supreme Allied Commander Transformation (SACT),* 18 November 2010.

[4] "Top Ten Satellite Breakups," *NASA Orbital Debris Quarterly News* 14, issue 3 (July 2010).

[5] Ibid.

[6] "Top Ten Satellite Breakups," *NASA Orbital Debris Quarterly News* 14, issue 3 (July 2010).

[7] "Update on Three Major Debris Clouds," *NASA Orbital Debris Quarterly News* 14, issue 2 (April 2010).

[8] Wikipedia online, http://en.wikipedia.org/wiki/Timeline_of_first_orbital_launches_by_country.

[9] Ibid.

[10] President Barack Obama administration, *National Space Policy of the United States of America*, White House, 28 June 2010, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

[11] "The Space Report," Space Foundation, 2010.

[12] Statement by Kenneth Hodgkins, advisor, on Agenda Item 50: International Cooperation in the Peaceful Uses of Outer Space, in the Fourth committee, US Mission to the United Nations, 14 October 2010, http://usun.state.gov/briefing/statements/2010/149450.htm.

[13] *National Space Policy*, 28 June 2010.

[14] Annex to National Space Council Action No. 1553, 21 November, 1956.

[15] The "Outer Space Treaty" is the commonly used term for the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies," and was signed by the US on 27 January 1967 and ratified on 24 May 1967.

[16] Outer Space Treaty (OST), Article I, 1967.

[17] Ibid., Article II, 1967.

[18] Ibid., Article VII, IV, 1967.

[19] *National Space Policy*, 28 June 2010.

[20] NASA, "Space Debris Assessment for USA-193," presentation to the 45th Session of the Scientific and Technical Subcommittee, Committee on the Peaceful Uses of Outer Space, United Nations, February 2008.

[21] "Tracking Debris from US Spy Satellite USA-193; Delays to Rocket Launch," *Universe Today*, 3 March 2008, http://www.universetoday.com/13028/tracking-debris-from-us-spy-satellite-usa-193-delays-to-rocket-launch/.

[22] "Point Paper on Commercial and Foreign Entities (CFE) Program," HQ AFSPC/A3C, 9 February 2010.

[23] Ibid.

Brig Gen John W. "Jay" Raymond, USAF (BS, Administrative Management, Clemson University; MS, Administrative Management, Central Michigan University; MA, National Security and Strategic Studies, Naval War College) is vice commander, 5th Air Force, and deputy commander, 13th Air Force, Yokota AB, Japan. Fifth Air Force exercises authority over US Air Force forces in Japan for organization, resources, personnel, training, and readiness. The command also coordinates joint and bilateral actions with US Forces Japan, US service components, the Japan Air Self Defense Forces, and other Japanese organizations to strengthen bilateral interoperability.

General Raymond entered the Air Force as a distinguished graduate of ROTC at Clemson University in 1984. He has served as a Minuteman missile combat crew commander, instructor, and flight commander, and as executive officer to the 30th Space Wing commander. His staff assignments include HQ AFSPC, Air Staff, and the Office of Secretary of Defense. He has commanded at the squadron, group, and wing levels. In 2007, he deployed to Southwest Asia as director of Space Forces in support of operations Enduring Freedom and Iraqi Freedom. Upon his return, he served as the commander of the 21st Space Wing at Peterson AFB, Colorado.

Mr. Kurt M. Neuman (BS, University of Minnesota; MBA, University of New Mexico) is a senior analyst for AFSPC, specializing in space-related strategic studies and policies. In support of director of plans, programs and analyses, he is responsible for analysis of national, military, and intelligence strategies, doctrine and policy to support development of long range planning products. During his time at AFSPC, Mr. Neuman has directly supported development of the National Space Policy, National Security Space Strategy, Quadrennial Defense Review, Space Posture Review, and Air Force White Paper on Space. In addition, he has been the command's focal point for efforts to improve space governance and management of space activities.

Mr. Neuman previously served as an Air Force officer for 21 years, with assignments in operations research; satellite command and control; launch operations; wargaming and strategy, policy and planning development. Publications include *Securing Freedom in the Global Commons* (Stanford University Press, 2010), *Athena's Scepter: Responsive Space and Global Security* (Eisenhower Institute, 2004), and numerous white papers and technical analyses.

Senior Leader Perspective

Implications of the New National Space Policy

Mr. Charles S. Baker
Acting Director, Office of Space Commercialization
National Oceanic and Atmospheric Administration
Silver Spring, Maryland

On 28 June 2010, President Barack Obama issued the 2010 National Space Policy (NSP), providing comprehensive guidance for all government activities in space, including the commercial, civil, and national security space sectors.

In a word, the 2010 NSP is pro-business and addresses US commercial interests in a number of ways. The principles section of the policy states, "The United States is committed to encouraging and facilitating the growth of a US commercial space sector that supports US needs, is globally competitive, and advances US leadership in the generation of new markets and innovation-driven entrepreneurship."

The first of the six stated policy goals is to "Energize competitive domestic industries to participate in global markets and advance the development of: satellite manufacturing; satellite-based services; space launch; terrestrial applications; and increased entrepreneurship."

At the Department of Commerce, we are especially pleased with the policy's strong emphasis on the development and competitiveness of the commercial space sector—a dramatic shift from previous policies. The new policy recognizes the importance of the long-term commercial development and sustainability of space.

Within the National Oceanic and Atmospheric Administration (NOAA), which is part of the Commerce Department, we also welcome the 2010 NSP's new guidance on environmental stewardship and international cooperation.

Commercial Space Guidelines

As in previous policies, the 2010 NSP includes a set of Commercial Space Guidelines, some of which are familiar and some of which are new guidelines focused on space commerce. The Commercial Space Guidelines are a set of policy directives that help shape the future planning and budgeting at federal departments and agencies.

For the purposes of the policy, the 2010 NSP also includes a definition of the term "commercial" space. This is not the first time the term has been defined in national policy, but it is the first time we have this definition conveniently located within the Commercial Space Guidelines. The new definition is similar to the previous one, defining commercial activity as that where private capital is at risk and nongovernmental customers exist, or could potentially exist.

The guidelines maintain and update several longstanding provisions carried over from administration to administration, while adding some wholly new directives that are important to highlight. The familiar guidelines include the standard direction for departments and agencies to purchase and use commercial space capabilities and services to the maximum practical extent. And to also modify commercial space capabilities and services to meet US government (USG) requirements as an alternative to developing government solutions.

The 2010 NSP extends this direction by encouraging the purchase and use of US commercial space services and capabilities in international agreements as well.

The guideline on developing governmental space systems has been updated to specify that such development should occur only when it is in the national interest and there is no suitable commercial alternative.

The entirely new additions to the Commercial Space Guidelines include the direction that departments and agencies actively explore the use of inventive, nontraditional arrangements for acquiring commercial space goods and services, such as hosted payloads and data buys. The new guidelines also encourage the use of incentives such as prizes and competitions to cultivate innovation and entrepreneurship.

Perhaps the most significant addition from a commercial perspective is the new guidance directing departments and agencies to pursue opportunities for transferring routine, operational space functions to the commercial space sector. While this has occurred in some areas, such as telecommunications and the launching of satellites, there are many other government space activities that may be ripe for commercialization.

Commercial Space Goods and Services

At a National Space Policy level, these are all very encouraging words, but you might ask what is the government actually doing to grow the commercial space sector?

For decades now, the USG has relied heavily on the commercial sector and contractors to achieve its mission areas in space. Indeed, it is because of the investments of the federal government that the commercial space industry has achieved the level of technical and financial prowess that it has today.

As the private commercial space sector has grown and become more mature in certain areas, the USG has begun to move from a "contractor and customer" relationship, one usually

The guidelines maintain and update several longstanding provisions carried over from administration to administration, while adding some wholly new directives that are important to highlight.

As the president's policy makes clear, this country is going to increasingly depend on a robust, innovative, and competitive US commercial space sector to achieve our national priorities in space.

dominated by cost-plus contracts, to purchasing many different types of commercial space goods and services at fixed costs.

For instance, the USG routinely purchases commercial satellite telecommunications services. In fact, in the Department of Defense alone it is estimated that over 80 percent of the satellite communications traffic occurs over commercial services.

The National Geospatial-Intelligence Agency and NOAA purchase commercial electro-optical and radar satellite imagery from both domestic and international companies. These companies also sell imagery to various applications like Google Earth.

Both National Aeronautics and Space Administration (NASA) and NOAA rely on commercial space transportation services to launch satellites into orbit. NASA recently signed a Commercial Resupply Service contract with several companies to transport supplies to the International Space Station (ISS). I would also note that the 2010 NSP directs NASA to seek partnerships with the private sector to enable safe, reliable, and cost-effective commercial spaceflight capabilities and services for the transport of crew to the ISS.

NOAA is currently investigating the benefits and potential opportunities to fulfill the earth observation requirements with emerging commercial space services such as hosting NOAA sensors or instruments on commercial telecommunication satellites or purchasing data from commercial providers.

One key issue for NOAA that might prove difficult to overcome in purchasing data from commercial providers is NOAA's desire for unrestricted data redistribution rights. NOAA wants the ability to redistribute commercially-acquired data to the same community of users who now receive free access to data from NOAA-owned satellites. I would also note that NOAA is prohibited by law from commercializing weather satellites.

The 2010 NSP Commercial Space Guidelines elucidate that the US is committed to promoting and enhancing a robust domestic commercial space sector that will enable the long-term commercial development and sustainability of space.

Workforce and Economic Development

As the president's policy makes clear, this country is going to increasingly depend on a robust, innovative, and competitive US commercial space sector to achieve our national priorities in space. The policy's goal of "energizing competitive domestic industries" will work hand-in-hand with President Obama's national export initiative, which is also a key focus of the Department of Commerce.

Both policies will work together to strengthen the US commercial space industry, create and maintain jobs, cultivate innovation and entrepreneurship, increase exports, and retain a skilled workforce. It is this highly skilled workforce that is essential to fostering a competitive domestic space industry.

At the Department of Commerce, Secretary Gary Locke has already moved forward on efforts to address space workforce issues as co-chair with NASA Administrator Charles Bolden of the president's Task Force on Space Industry Work Force and Economic Development.

To support the task force, President Obama has requested $100 million in fiscal year 2011 to spur economic growth and job creation along the Florida Space Coast and other regions affected by the retirement of the Space Shuttle. The Department of Commerce's Economic Development Administration would disburse funding to various organizations identified through the task force to facilitate its work.

The Department of Commerce and NASA are also gathering important workforce and industrial base data from current Space Shuttle and other program suppliers to benchmark critical skills and capabilities to assist space sector repositioning for future commercial space and other industrial opportunities.

Environmental Satellites

NOAA plays a critical role in the operation of environmental observation satellites that help us forecast the weather, monitor climate change, respond to disasters, and track distress signals from emergency beacons. The 2010 NSP provides guidance for NOAA in the execution of this role.

The policy provides updated guidance to both NOAA and NASA concerning the joint polar satellite system, formerly known as the National Polar-orbiting Operational Environmental Satellite System (NPOESS). NPOESS was a tri-agency program with NOAA, the Air Force and NASA to merge the civil and defense weather satellite programs in order to reduce costs and to provide global weather and climate coverage with improved capabilities above the current system.

The restructured program will continue to ensure uninterrupted, operational polar-orbiting environmental satellite observations with separate civilian and military systems as well as relying on international partners for some data. Utilizing a shared ground system, the Air Force will be responsible for the morning orbit with its own Defense Weather Satellite System and NOAA will be responsible for the afternoon orbit data collections with the Joint Polar Satellite System.

At the Department of Commerce, we believe the restructured program will work better for both government and public customers who rely upon such data.

As important as the polar-orbiting environmental satellite observations are to the nation there are also research and development satellites that have proven very beneficial for forecasting weather and monitoring climate change. The 2010 NSP directs NOAA and NASA to transition these mature research

NOAA will primarily utilize NASA as the acquisition agent for operational civil environmental satellites in support of weather forecasting, climate monitoring, ocean and coastal observations, and space weather forecasting.

and development Earth observation satellites to long-term operations. NOAA will primarily utilize NASA as the acquisition agent for operational civil environmental satellites in support of weather forecasting, climate monitoring, ocean and coastal observations, and space weather forecasting.

At the Department of Commerce, we strongly support the idea of international cooperation. The 2010 NSP encourages stronger international cooperation to help sustain and enhance weather, climate, ocean, and coastal observation from space. And it also reaffirms the US commitment to the full, open, and timely exchange of environmental data across national boundaries.

Of course, NOAA already works closely with many international partners in this arena, but we are happy to see such cooperation highlighted in our official US policy. Such cooperation is essential to NOAA's weather forecasting role and the success of the global Earth observing system of systems being developed to monitor climate change and support other global priorities.

Finally, the 2010 NSP reaffirms the role of the Secretary of Commerce as the regulatory and licensing agent, through NOAA, for the operation of commercial remote sensing satellite systems. There are approximately 10 companies that currently hold commercial remote sensing licenses granted by the Department of Commerce.

Conclusion

The president's space policy takes some bold steps forward for space commerce and provides an updated framework for NOAA's on-going mission in environmental observation.

This new blueprint for the nation's direction in space development and utilization genuinely engages the commercial space sector. For far too long the government has been the primary actor in space but it took those initial investments, as it has in other sectors, to help foster commercial enterprise. Looking to the future, it will take the continued support of government to promote commercial development but only through those commercial endeavors and the creation of new open markets will the development of space be truly sustainable.

The Department of Commerce believes the new policy points us in the right direction, one that will improve our economic competitiveness, create high-skilled, high-wage American jobs, and strengthen environmental safeguards.

We are looking forward to working with the other agencies and stakeholders to implement the policy.

Mr. Charles S. Baker (BA, History and Spanish, University of North Carolina at Chapel Hill) has served as the acting director of the Office of Space Commercialization since December 2008. He is responsible for promoting the interests of the commercial space industry within the federal government.

Mr. Baker was appointed National Oceanic and Atmospheric Administration (NOAA's) deputy assistant administrator for Satellite and Information Services in March 2007. In that capacity, he serves as chief operating officer for NOAA's National Environmental Satellite, Data, and Information Service (NESDIS), an organization with 850 staff members, a budget of nearly $1 billion a year, and 15 satellites on orbit. Within NESDIS, his areas of responsibility include customer service, performance management, satellite operations, processing and distribution of time-critical satellite data, development of new satellite data products, archiving environmental data, information technology, regulation of the US commercial remote sensing industry, human capital management, and regional collaboration.

From 2004 to 2007, Mr. Baker served as chief financial officer and chief administrative officer of NESDIS. In that role, he served as the overall business manager for NESDIS, having responsibility for budget, strategic planning, cost estimating, earned value management, human resources, training, facilities, property accounting, and safety.

From 1987 to 2004, Mr. Baker worked in the Office of the Under Secretary of Defense (Comptroller), for 13 years as a budget examiner and for four years as associate director for investment, his first position in the Senior Executive Service. As associate director, he had oversight of Navy and Air Force research, development, and acquisition budgets totaling nearly $100 billion per year. He provided leadership to a team of budget examiners who conducted program-by-program budget reviews and recommended budget adjustments to the deputy secretary of defense. Following the events of 11 September 2001, Mr. Baker led the formulation of the investment portions of the emergency budget request.

Mr. Baker began his civil service career with the Department of the Navy in 1974, holding a series of positions in the Naval Sea Systems Command, the Naval Supply Systems Command, the Naval Material Command, and the Office of the Navy Comptroller.

Engagement and Sustainability in the 2010 National Space Policy

Dr. James A. Lewis
Senior Fellow and Director
Technology and Public Policy Program
Center for Strategic and International Studies
Washington, DC

National Space Policies (NSP) tend to be formulaic, repeating much of what previous administrations have said about the US role in space. There are common themes in US space policies that have been unchanged over decades, and the fundamental concerns and goals of US space policy have remained largely the same. At the same time, there can be important differences between administrations that a new policy will signal and the 2010 Obama NSP differs significantly from its 2006 predecessor.

The new space policy addresses three problems that have confronted each administration since 1989. The first is the sustainability and expense of the US space enterprise. The second is the need to change international space governance from an informal system largely shaped by two countries to a system for a space environment crowded with satellites and by the contending ambitions of many countries. Finally, and perhaps as a result of the first two problems, there is a growing anxiety over US leadership in space, how it is being challenged, and how it can be preserved.

While there is long-standing continuity in US goals and concerns that makes one space policy much like another, the context for that policy has changed significantly. Technological change and technology diffusion have reshaped space. At least nine nations have the ability to put objects into orbit. Many more, perhaps 50, can build satellites, using smaller, cheaper components and perhaps working with foreign partners. Seven nations, possibly more, have tested asymmetric attacks on satellites—the most dramatic was the clumsy Chinese kinetic kill, but there has been much more activity using electromagnetic spectrum and cyber techniques to degrade satellite performance. Our policies still need to adjust to these changes.

Administrations write national space policies for a public and international audience. This foreign audience's general view of the issuing administration shapes their interpretation of the policy. The message taken from the previous administration's space policy, particularly by international audiences, was a unilateral assertion of dominance.

These foreign perceptions of the 2006 NSP may have been exaggerated by a belief that it was cut from the same cloth as other US military policies, such as the invasion of Iraq and the international actions against terrorism, but foreign perceptions were not essentially wrong. The essential theme of 2006 reflected the forceful unilateralism that underlay foreign and security policy. The 2006 policy asserted US control and the right to deny the use of space to its opponents while rejecting any agreements that might limit US freedom of action—military action—in space.

It could be argued that this theme of US leadership in space (which could appear to foreign audiences as an assertion of dominance) is found in earlier space policies, and the 2006 policy changed only the tone and the weighting of policy by adding emphasis to this aspect. However, in the context of foreign perceptions of American foreign policy, this increased emphasis on dominance and denial was counterproductive in two ways.

First, announcing that the US has the right to untrammeled action in space, including the use of force, to preserve its interests, creates "antibodies," as other nations look for ways to constrain the US. It also legitimizes their own military space programs and shapes other nations interagency debates on space policy and space weapons in ways unfavorable to the US.

From a technical perspective, it may be possible to deny the use of space by opponents, but it would be very difficult and perhaps impossible to prevent them from degrading US freedom of action in space through attacks on the American satellite fleet. Satellites are soft targets. America has many of them. An astute opponent could conclude that the US would have more to lose and come out worse in any exchange once counterspace action commenced.

Second, by renouncing any form of arms control for space, the US yielded leadership in international fora to other nations. It lost the opportunity to find if there were areas where it could "trade" with potential opponents for agreements that could reduce risk to US space assets and interests. The argument that the Reagan administration had rejected space arms control and there was no need to reconsider that decision flew in the face of a vastly changed space domain, which now includes an array of new opponents who are not bound by the informal understandings on conflict avoidance and on appropriate behavior in space that had grown up between the US and the Soviets.

…announcing that the US has the right to untrammeled action in space, including the use of force, to preserve its interests, creates "antibodies," as other nations look for ways to constrain the US.

The legislative changes of the late 1990s that restricted the ability of US companies to sell to foreign customers or cooperate with foreign partners seriously damaged the US commercial space industry and actually helped create foreign competition, as foreign governments increased spending to build space industrial capabilities.

The idea that there are no agreements, no trades, which could be beneficial to the US, can be rejected out of hand. At a minimum, a US failure to engage internationally leaves the field open for potential opponents to shape opinion and, potentially, rules in ways unfavorable to the US. As the nation with the largest fleet of satellites, and being, perhaps, the most dependent on space, we have an asymmetric vulnerability. It is true that a formal treaty would be unverifiable and difficult to implement, but a treaty is not the only vehicle for international agreement.

An effort to gain international acceptance of a norm that stigmatizes attacks on unarmed space assets would be in our interest. Finally, some activities—transparency, regard for law—are easier for the US to undertake than for some potential opponents, giving the US a negotiating advantage, should it choose to take it. It is easier for us to be transparent about our space activities, for example, than it is for Russia and China. This is not to say that negotiations would be easy or quick, or that they would not require some skill, but that the US would gain from the process of engagement.

The Obama administration changed course away from forceful unilateralism. The hallmark of this change can be found in the May 2010 National Security Strategy and its emphasis on "pursuing comprehensive engagement." This emphasis on engagement in the National Security Strategy shapes the NSP, which lays out four major premises to address the problems of sustainability, governance, and leadership. These are:

- An emphasis on engagement and perhaps cooperation.
- The development of principles for responsible behavior.
- An emphasis on commercial and entrepreneurial space activities for innovation and the provision of services.
- A rebalancing of emphasis between manned and unmanned space activities.

The immediate effect of the new space policy is to signal US intentions and shape US international efforts to focus on improved governance, including increased and cooperative space situational awareness, debris mitigation, and codes of conduct for responsible behavior in space. These are all attainable objectives. US engagement in creating a new governance framework for space, based on situational awareness, codes of conduct, and confidence-building measures will get immediate traction. This is different from immediate progress. None of the existing fora for space governance are strong. They will have either to be rebuilt or replaced. The US will need to measure carefully what it will offer against what it would want (and could get) in exchange from potential opponents. A simple metric for negotiation is to say that any code of conduct that wins rapid acceptance probably is not very valuable. A serious code will require countries to move slowly as they assess benefits and potential losses.

Increased space situational awareness will be an important component of being able to verify (to some degree) compliance with any norms or codes of conduct. Since most anti-satellite programs are classified, they are likely to continue in some form or another with or without norms (e.g., there will be a strong temptation to "cheat"), but this is not a new problem in arms control. The current policy that anti-satellite research is allowable, but testing is not, may be the best starting point for any effort to constrain opponents, and situational awareness, by increasing the chances that a test would be detected, could reinforce norms.

A US effort to reshape the space environment through international engagement will produce beneficial outcomes for international space governance and US space operations. However, if we were to predict where the Obama NSP will succeed and where it will face difficulty, the dividing line is between efforts to improve governance, which are likely to show some progress, and efforts to improve sustainability. The US has wrestled with sustainability since the end of the high levels of expenditures on space associated with the Cold War.

Confusion over technology transfer policies has only increased the problem—at the same time we were entering a global economy, the US attempted to fence off a national space industry, with damaging consequences. The legislative changes of the late 1990s that restricted the ability of US companies to sell to foreign customers or cooperate with foreign partners seriously damaged the US commercial space industry and actually helped create foreign competition, as foreign governments increased spending to build space industrial capabilities. There is no real effort to remove these restrictions because there is little recognition of how it in the last fifteen years other nations' access to space technology has increased beyond the point where the US can expect to control it.

Even without counterproductive export legislation, the US would have sustainability problems for its space enterprise. Program management problems hobbled security space for more than a decade, even leading one expert panel to call for the dissolution of the National Reconnaissance Office and the creation of a new national security space organization. National Aeronautics and Space Administration (NASA), trapped in its low Earth orbit commitment to the shuttle and the International Space Station (ISS), left the US with the choice between the world's most expensive launch system and an inability—for the first time in fifty years—to put humans into space. The new

policy, to its credit, recognizes these problems (sometimes implicitly) and attempts to address them.

Any solution to these problems may lie at least in part outside of the scope of space policy. One explanation is that the US ability to manage large, complex programs has declined. This may reflect a national preference for focusing on process rather than outcomes. A comparison of programs today with programs of the 1960s—the golden age of space—show how much more freedom managers had then to spend, to experiment, and to fail. That the time to complete programs has now stretched into years, if not decades, is an indicator of the scope of the problem.

The root of this dilemma is not money. The US spends more on space activities than all other nations combined. Nor is it technological skills. The Jet Propulsion Laboratory and other NASA centers, along with Department of Defense programs, do things in space that no other nation can match. However, false starts, dead ends, and a slow pace have marred too many programs. The fundamental problems are strategy and management. The new space policy does not really come to grips with these fundamental problems, and the most likely result will be a continuation of the lengthy internal debate over management of the space enterprise.

The interim solution to sustainability contained in the new policy is to emphasize commercial space. This may seem counter-intuitive, given the damage to the space industry caused by export controls, but it reflects a larger faith in the administration of the importance of innovation and entrepreneurship—what the policy calls "inventive, nontraditional arrangements." Nimbleness, cost control, and efficiency can be restored in the space enterprise, the policy asserts, by increasing the role of the private sector.

The hope that space entrepreneurs will eventually be able to replace NASA in serving low Earth orbit activities is a bold experiment that no other nation has tried and which is yet unproven. The best outcome would be that the entrepreneurs will be able to man and supply the ISS at a price much lower than the fabulously expensive space shuttle, and that their efforts to cut launch costs will create new processes and technologies without an unacceptable increase in risk. If this effort to engage private entrepreneurship works, it will be a major step towards the vision of commercial space flight. Even if it does not succeed, the cost of the experiment is relatively low, compared to current US manned programs, and may produce technology spin-offs. The test of this policy will come in the next few years, as it becomes clear whether commercial companies have the ability to put people and goods reliably into low Earth orbit.

A related problem—how to rationalize the US launch industry—has confronted every administration for the last 20 years. Some administrations have tried organizational solutions, such as creating a National Space Council, (the Obama NSP does not mention this council, although there has reportedly been discussion of a revived space council in the White House). Other administrations have successfully, pushed consolidation and rationalization of the launch industry. This policy emphasizes the innovation and entrepreneurship found in the private sector as a way to solve the launch conundrum. No policy, in this administration or its predecessors, has addressed the discrepancy between the requirements for government launches, which considerably increase cost, and the effect this has on commercial pricing. The result is that if the US wants a launch industry, it will have to pay for it, and cannot expect it to be self-sustaining or to receive the partial subsidization other nations' launch industries obtain from commercial sales.

The emphasis on entrepreneurial space in the new policy has been controversial, but the most controversial aspect of the policy has been the administration's approach to civil space. By the middle of the Bush administration, it was clear that the US manned spaceflight program was unsustainable. The shuttle consumed an immense amount of resources and confined US manned activities to low Earth orbit. To its credit, the Bush administration made the difficult decision to move away from the shuttle. This was an essential step to free up the resources needed to rebuild US space exploration capabilities.

However, the new direction the Bush administration chose to take proved to be unproductive. The US, in this approach, would recapture the glories of the 1960s by returning to the moon and eventually sending humans to Mars. The effort would be based entirely on US efforts to build a new launch vehicle and new space capsule; and foreign partnership was initially rejected—the NASA administrator once told foreign space attachés in Washington that each nation should build its own highway to the moon, and we could figure out how to cooperate when we got there. The single most difficult problem, however, was that the new "Moon, Mars, and Beyond" policy came too late. The US would face a lengthy and expensive effort to build a new launch capability that would leave it for a period of years without the capacity send humans into orbit or to resupply the ISS.

Given this inheritance, the decision by the Obama administration to encourage entrepreneurial efforts for low Earth orbit makes some sense, but the equally sensible decision to cancel the Constellation program for human space exploration, and the shift in emphasis away from manned programs and towards robotic exploration and Earth observation, ran into immediate problems. Some of these were emotional, with some of the original lunar explorers clamoring against the idea of abandoning a return to the moon. Some were economic, with congressional concerns over cutting back the workforce for human spaceflight.

The hope that space entrepreneurs will eventually be able to replace NASA in serving low Earth orbit activities is a bold experiment that no other nation has tried and which is yet unproven.

The new NSP is artfully vague … earlier Obama actions pointed towards an increased emphasis on unmanned activities that traditionalists found to be both dangerous and wrong, particularly in combination with the new emphasis on entrepreneurial space efforts.

Finding the balance between manned and unmanned space programs is an issue that goes back decades. There is no black or white answer—the nation needs to do both. But for many years, the shuttle/station programs absorbed the bulk of civil space funding, and Constellation and the effort to return to the moon threatened to do the same. The new NSP is artfully vague on this balance, but earlier Obama actions pointed towards an increased emphasis on unmanned activities that traditionalists found to be both dangerous and wrong, particularly in combination with the new emphasis on entrepreneurial space efforts. Faced by strong opposition, the 2010 NSP commits to crewed missions beyond the moon by 2025 and to send humans to Mars by the mid 2030s and return them.

Going to Mars is not really a feasible goal, given the state of our space-faring technologies. It is more interesting to note, however, that the 2010 policy never mentions a return to the moon—the only reference to the moon is the goal of going beyond lunar orbit by 2025. Return to the moon remains a contentious issue. If the Chinese are able, eventually, to land on the moon's surface, the world will perceive it as further evidence of US decline and China's rise. The political implications are more important for US international influence than they are for science. The real issue is not whether China can repeat what the US did 40 years ago, but whether it will be able to create a permanent presence on the moon.

A bolder US policy would have moved from the ISS to the moon as a place to experiment with long-term human presence in space, but this is both expensive and risky, and would require a sustained effort that would necessarily stretch across administrations. It also implies a new space race, with China instead of the Soviets. This is not question for the current policy, but it will be unavoidable in the next space policy if the US and China cannot develop a more cooperative approach.

The issue of cooperation with China is where general guidance on cooperation and engagement is no longer adequate. While the scientific and commercial communities in China may desire cooperation, the military does not. China has military space programs aimed against the US. Bilateral relations in the region show flashes of confrontation, as in the recent Chinese claim that US naval vessels cannot transit waters in its economic zone, even though by international law these are considered open seas. In terms of technology, a cooperative effort would be marked by a flow from the US to China with little in return. These obstacles do not mean that the US should not engage China nor that cooperation may not someday be worthwhile. Although this analogy is imprecise, we are in our security relations with China where we were with the Soviets in the late 1950s, and the US will need to develop a specific strategy of engagement with China to reduce the risk of conflict in space.

The new space policy contains major shifts from its predecessor. It calls for engagement to increase security, using commercial and entrepreneurial space to increase sustainability, and rebalancing the emphasis on manned and robotic space exploration in civil policy. Space policies are general, and one benefit of producing them is that they build some degree of interagency consensus. The challenge for the administration will be in implementing the policy to make progress in governance and sustainability. This is where that interagency consensus, and the policy itself, will be tested.

Dr. James A. Lewis (PhD, University of Chicago, BA, University of Illinois) is a senior fellow and program director at the Center for Strategic and International Studies (CSIS), where he writes on technology, security, and the international economy. Before joining CSIS, he served at the Departments of State and Commerce as a foreign service officer and as a member of the Senior Executive Service. Lewis has authored more than sixty publications since coming to CSIS. His current research includes cybersecurity, innovation, and space policy.

Collective Assurance

Dr. Andrew W. Palowitch
Director
Space Protection Program
Peterson AFB, Colorado

Schriever 10 Wargame. Year 2022. A regional maritime conflict has rapidly escalated into an international crisis. Aggressors seeking to deny intelligence collection and targeting advantage to the adversary have jammed satellite global positioning and communications signals. Direct ascent and on-orbit antisatellite weapons have destroyed optical and radar satellites. Cyber attacks on land-based communication systems have crippled the military infrastructure, which, through collateral effects, has also impacted daily commercial economic activity on a global scale.

Nation-states in the international community, struggling to maintain fundamental economic transactions, military advantage, and continuity of basic services for their citizens, collaboratively engaged to share remaining military, as well as commercial space-based capabilities for their collective security—operating through the crisis.

Emphasis on International Cooperation and Mission Assurance

In his remarks on the new National Space Policy (NSP) at the November 2010 US Strategic Command Space Symposium, Deputy Secretary of Defense William J. Lynn, III identified "four key elements that emerge from the president's policy." Two of these key elements were "a new emphasis on international cooperation" and "an expansion of how we protect space systems in a contested environment."[1]

With a focus on the defense benefits of international cooperation, Secretary Lynn highlighted the added military resilience and capabilities that partnering with allies could provide to the US. Wideband Global Satellite Communication, missile warning, maritime awareness, and a Combined Space Operations Center were presented as current examples where "costs, benefits, and risks could be shared among trusted partners."[2] Complementing military partnerships, commercial partnerships were proposed as an additional mechanism to gain communications and imaging access from a wide range of non-military space systems during military conflict.

A strategy for space system protection was presented that included elimination of space system vulnerabilities, identification of mission alternates, pre-positioning of backups, investment in reconstitution, and the implementation of effective defenses. An integrated national approach that encompasses all these options would have the highest probability of success against a determined adversary. A unilateral national capability to execute defensive actions to protect mission essential functions, should they come under attack, would be required—independent of any potential mission assurance advantages gained from space-based services provided by our international partners.

The combination, however, of effective space mission protection actions with international cooperation would ultimately strengthen our national deterrence posture. Secretary Lynn concluded that "integrating our capabilities with those of our allies and partners can raise the costs of aggression and make it more difficult for a potential adversary to successfully target our systems."[3]

"New Emphasis" or Policy Shift?

Are these key elements of the new NSP really new policy? Or are they just restatements of previous US policy framed differently for international consumption with "new emphasis"?

Of significant note in the new NSP text is the absence of the phrase "freedom of action in space." For the last several decades in both concept and text the US has upheld the principle that we will not be denied any action in space that we determine important to our national security. Did the new administration give this up in June 2010?

With a quick reading of the new policy text it is easy to see that all the aspects of "freedom of action in space" have been retained. They are clearly embedded throughout the document in each of the principles, goals, and guidelines sections. From the top national principles, the US states its "right to conduct operations in space without interference," "deter others from interference and attack," and "if deterrence fails, defeat efforts to attack them."[4]

The difference though between these declarations and similar ones in years past is that with each of these declarations are specific modifiers that encompass "space systems of all nations," "all responsible parties," and "allied space systems."[5] The value towards space mission assurance achieved with international participation is a central theme that the new policy strives to communicate.

But international partnerships for US mission assurance is not new. Whether we have called it that in the past or had actually set this objective as a course of action can be debated.

From the top national principles, the US states its "right to conduct operations in space without interference," "deter others from interference and attack," and "if deterrence fails, defeat efforts to attack them."

The world community certainly cannot afford the development of highly competitive and antagonistic coalitions the equivalent of a historic NATO-Warsaw Pact alignment in space.

We have been doing it. For the past two decades the US has been actively engaged in acquiring commercial space communications and imaging services from international partners, negotiating bi-lateral agreements with allies, sharing weather services, participating in the United Nations sponsored International Telecommunications Union, sharing space data, and cooperating at various international ground sites.

So independent of whether or not the new NSP is charting a new direction for our future or just repackaging for presentation, it may be best to view the new policy elements as an open recognition and final acceptance of existing reality.

Recognition of Existing Reality

This past November the US and Australia signed the Space Situational Awareness Partnership statement of principles to cooperate on space surveillance. US Defense Secretary Robert M. Gates said that discussions over the next several months will focus "on possibly adding ground-based radar sensors in Australia to the US military's space surveillance network."[6] This new chapter in the US Australian partnership was built upon years of bi-lateral cooperation and the recognition that an international partnership was required in order for the US "to fill the gap in tracking objects in space over the Southern Hemisphere."[7]

On a broader military scale, it was demonstrated in Schriever Wargame 2010, which included participants from several foreign countries, that national survival in conflict would only be achieved through cooperative efforts.

Prior to game start the international team—which also included that largest industry participation in game history—collaborated on a joint strategy in the Combined Space Operations Center. Although the game scenario was set in 2022 the participants were acting on their current understanding of space operations in 2010. Furthermore, this understanding of international cooperation for mission assurance was also previously played out in the 2009 Schriever V Wargame. Both wargames concluded with the same results. National security interests were best served with the collaborative sharing of military and commercial space assets to operate through a crisis.

Across the international stage, the rest of the world's space-faring nations are likewise partnering to achieve national security objectives. Although it may be argued that the initial impetus for these developing relationships may be to overcome resource limitations, the overriding justification is collective security assurances.

- At a recent National Defense University conference, Securing Space Assets for Peace and Future Conflict, representatives from several nations including Japan and India described the movement of their respective space programs towards national security objectives driven by perceived threats to their national security.
- On the European front, North Atlantic Treaty Organization (NATO) recently held focused discussions addressing the growing need for collective space and cyber security initiatives.

International cooperative efforts though may not be aligned however with US interests. The Shanghai Cooperative Organization (SCO), the world's largest regional security organization led by China and Russia, is opposed to US unilateralism and intervention in their region. The SCO has conducted multination cooperative military exercises heavily reliant on space-based positioning, communications, and intelligence collection. With its pending acceptance of Iran and Pakistan as full members, the SCO's collective economic and military might are formidable.

Completely independent of any US policy or action, the international space scenario will continue to develop as nation-states determine the best path to ensure their national interests are maintained. International partnerships will continue to be formulated with like-minded nations seeking to establish broader collective space mission assurances with their close allies. Furthermore, under crisis situations, ad-hoc coalitions of the "affected" will rapidly form without any protracted bureaucratic or political organizational posturing as we have seen in several recent space conjunction and interference incidents.

The world community certainly cannot afford the development of highly competitive and antagonistic coalitions the equivalent of a historic NATO-Warsaw Pact alignment in space.

How do we address this complex situation?

A New International Forum

The concept of an organization of all space-faring nations has been widely discussed and debated for many years. Proposed topics for international concurrence include space 'traffic' management, debris mitigation and removal, interference elimination, collective self-defense, the long-term sustainability of space and, the toughest topic of all, weaponization of space.

Proponents of the organizational concept cite parallel achievements in world-wide air traffic control and international maritime law as successful examples for extending traffic control and 'rules of the road' to satellites. With every nation openly supporting the tenant of peaceful use of space, advocates of an all-inclusive body of participants argue that the collective assurance provided by every nation that is vested in space serves as the most effective deterrent against a lone actor or rogue element who may believe there is an advantage in attacking space systems. The present and rapidly growing cross-use of space systems by numerous nations only serves to strengthen this argument.

Opponents of the concept identify numerous issues that preclude a unified world organization. Among these are the existence of several organizations that already address interference, debris, and arms control; wide diversity in participating countries' space-based capabilities that impacts commonality of regulations, asymmetric military, and intelligence collection advantages that are held by the major players that will not be shared; the inability to establish an effective enforcement body; and the perception that nations have already aligned themselves in groups with opposing viewpoints.

A current example of the problems generated by the alignment perception is the movement towards the establishment of a common code of conduct for space. The European Union's (EU) proposal of their space Code of Conduct has been received positively by all those nations involved in the development of the code.

However, two major dissenting sets of countries have been alienated by the EU's lack of inclusion of their interests in the code development process. The developing space countries outside of the EU believe they should have had direct involvement in the code writing process. Russia and China, irked by the rejection of their inputs into the EU draft review process, are sticking even stronger to their competing 2008 United Nations Treaty on Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force Against Outer Space Objects.

An all-inclusive international body developing the Code of Conduct would have been able to seat all the players at the table from the start thus avoiding the situation of one set of countries writing rules for others to abide by without their input. Admittedly seating all the players during the code writing may add several years to the process, but the outcome could be accepted by the majority of the participants. It took over a decade to write the Law of the Sea Treaty, why not put the same effort into a Law of Space Treaty (except do it outside of the United Nations)?

Consequently, despite all the difficulties in the process, the end value of getting everyone of the world's space-faring nations around the table to constructively address critical topics is the best approach. The organization has to be new and distinct from any existing structure and focused on ensuring responsible and peaceful use of space.

The new NSP does not restrict this approach to an all-inclusive international organization. The intersector guidelines on international cooperation specifically call for US leadership in activities to "reassure allies of US commitments to collective self-defense," "augment US capabilities by leveraging existing and planned space capabilities of allies and space partners," and pursue "multilateral transparency and confidence-building measures to encourage responsible actions in and the peaceful use of space."[8]

The major sticking point in this text might be the use of the term 'allies.' It seems almost impossible to conceive that we could disassociate all the complex economic, military, human rights, and political issues from countries that are not considered allies now to allow them to participate in the forum, but there is a mandate for it to be done.

Managing Global Interdependence

In the 2010 US National Security Strategy a 'responsible stakeholder' principle was presented in context of a broader agenda of global institutional reform. Applying this principle in the space arena, in which only a very small fraction of the world's countries are players and a smaller number are emerging participants, requires all nations to engage actively in rule-bound international agreements.

The fundamental US challenge in space today is not managing a balance of power, but managing global interdependence. In a new order, rights and responsibilities will have to be equitably distributed across both existing and emerging space participants for future security.

The vision of the space arena as a multipartner, not a competitive, multipolar environment is a foreign concept to those in the US who worked for years in the space race against the Soviet Union and now may see a newly emerging space race with China.

Once again, it would be naive to believe or propose that in any international space forum that space topics could be completely and unemotionally disassociated from the myriad of issues that currently prohibit close working relationships with several countries. Considering this complexity, the reality of a true multi-partner space environment seems remote. Even on space topics alone we currently engage in rivalry with our allies on commercial satellite market share, frequency allocation, and military and intelligence advantage. But at the same time in all other realms we do balance rivalry and partnership to mutual advantage. Effective partnerships seem even less remote if we remind ourselves that the goal is the long-term sustainability of space for all nations.

The underlying question is whether the value of broad based collective assurance in deterring aggression and preventing open conflict in space is worth the effort, and the potential compromises, necessary to pull it off.

We are at a point in history where we are enjoying relative peace in space. Hanging over our heads though are purposeful interference, the testing of new technological advances, and conflicting military motives which create a cloud of uncertainty in the environment.

Any start now towards the collective assurance goal on a broad international scale is better than putting it off until a cataclysmic event by an aggressor forces us to the table under

Conduct would have been able to seat all the players at the table from the start thus avoiding the situation of one set of countries writing rules for others to abide by without their input.

difficult circumstances or drives a insurmountable wedge into separating highly polarized coalitions.

Collective Assurance—Through Leadership or By Default

The new NSP provides the basis and the direction for the development of international partnerships that will provide deterrence value in times of peace and benefit space mission assurance in times of conflict. However, this reliance on commercial or international partnerships cannot be the justification for ignoring our responsibilities for protecting our own space systems in a contested environment—an even more important key element of the policy. The US must still invest in the elimination of our space system vulnerabilities, identification of mission alternates, pre-positioning of backups, building reconstitution inventory, and implementing effective defenses. But at the same time we must continue to strategically augment our space mission capabilities in a multipartner interdependent world environment.

The path to a solid collective assurance position will be determined by the actions executed by our defense and Intelligence communities—*implementing* the US national security and space policies. We have a choice. We can take a leadership role or we can let it happen randomly as a result of external forces as we have seen in the past. Either way coalitions of nations are going to develop. Better that we strategically shape the relationships in a global construct and have all the space-faring nations working together collectively (as difficult as that might be) than suffer the consequence of competing partnerships aligning, polarizing themselves, and generating uncertainty—the underlying factor behind every war.

With a little forethought and a lot of hard work the next Schriever wargame could be played with all of the major and emerging space-faring nations (including Russia, China, Japan, India, Brazil, and several others) acting together against a rogue actor to ensure continued mutual benefit of the space domain. In this new scenario, deterrence will be significantly more effective and maybe even preclude open conflict and the loss of critical space missions. Acquiring this space mission assurance benefit though in real-life through international partnerships will be challenging … but achievable. The key is US leadership in implementing the new NSP international cooperation and space protection goals together towards full international collective assurance.

The author wishes to acknowledge Lt Col Tom Single for his review and comments of this article.

Notes:

[1] Remarks on space policy at US Strategic Command Space Symposium as delivered by Deputy Secretary of Defense William J. Lynn, III, Omaha, Nebraska, 3 November 2010.

[2] Ibid.

[3] Ibid.

[4] President Barack Obama administration, *National Space Policy of the United States of America*, White House, 28 June 2010, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

[5] Ibid.

[6] Dan De Luce, Agence France-Presse, "US, Australia Sign Space Surveillance Agreement," NSCI News, 8 November 2010.

[7] Ibid.

[8] *National Space Policy*, 28 June 2010.

Dr. Andrew W. Palowitch, (BS, Mechanical Engineering, United States Naval Academy, Annapolis, Maryland; MS and PhD, Bio-Optics, University of California at San Diego; MA, International Relations, Tufts - Fletcher School of Law and Diplomacy) is the founding director of the Space Protection Program. Prior to assuming this role, Dr. Palowitch was the chief technology officer for the Intelligence, Security, and Technology Group, Science Applications International Corporation (SAIC) and a SAIC Technical Fellow. He provided advanced scientific solutions and systems engineering approaches to solve the nation's most difficult intelligence, defense, and homeland security problems.

From 2002 to 2005, Dr. Palowitch was the director of the CIA's Systems Engineering and Acquisition Office and the director of DCI Systems Engineering Center. In these positions he developed systems solutions, guided collection system acquisition, and led operations to guarantee global assured clandestine technical access. He led intelligence community systems engineering activities under direction of the DCI.

From 1998 to 2002, Dr. Palowitch was the chairman and chief executive officer of Dynamics Technology, Inc. He directed physics-based sensor modeling, simulation, and analysis on complex intelligence and defense systems. Dr. Palowitch concurrently managed technical evaluation of DynaFund's international venture capital investments to acquire breakthrough technology.

Previously, from 1996 to 1998, Dr. Palowitch served as the chairman and chief executive officer of Energy Compression Research Corporation, located in San Diego, California. In this position he designed, developed, and manufactured revolutionary light-activated-silicon-switches for advanced defense pulsed power systems and commercial high power electrical distribution systems.

Dr. Palowitch's additional education includes: Senior Executives in National and International Security, Harvard JFK School of Government, 2004; US Government Intelligence Fellows Program, 2003; and Executive MBA Program, Stanford University, 1998 and 2001.

Dr. Palowitch served as a United States Navy Submarine Officer onboard the Presidential Unit Citation awarded USS Parche, SSN 683, from 1982 to 1987.

The New National Space Policy: More is Needed

Col James D. Rendleman, USAF, retired
Space Law, Policy, and Strategy Contributor
Colorado Springs, Colorado

Col Robert E. Ryals, USAF, retired
President and Chief Executive Officer
Point B Defense Associates
Colorado Springs, Colorado

A new 2010 National Space Policy (NSP) has been proclaimed. Its publication was a momentous occasion. The new policy completed interagency coordination in what seemed to be record time. Prize seats at initial briefings to celebrate the occasion were coveted and hard to come by. High-fives among administration staffers, friends, and colleagues, the inside-the-beltway community and academia are just beginning to die down. Contributors are congratulating themselves for crafting the fine words or at least suggesting the sentiments embodied in the final document. After all, the 2006 NSP promulgated by the George W. Bush administration was roundly panned by political opponents as being too direct, too undiplomatic and impolitic, and irreverent to the nuances demanded by the international community. The Bush version of the policy had only been finalized after scores of revisions and then nearly 10 years after the one issued by the Bill Clinton administration.

The 2010 NSP is a quick read. It provides the Barack Obama administration's statement of the "highest priorities for space, and reflects our principles and goals to be used in shaping the conduct of our space programs and activities."[1] It sets forth a number of perspectives one would expect on such an important topic. It identifies US interests vital to secure access to space capabilities that satisfy important communications, navigation and timing, weather, remote sensing, missile warning, and defense needs. It also tips the hat to needs of the US to secure its industrial base, improve the science, technical, engineering, and math expertise of the population, and ensure the professionalism of its space community. Importantly, much of the policy's foundational points are based on principles of international cooperation—*mitigate the dangers of space debris, improve space situational awareness (SSA), achieve collision avoidance,* and *pursue pragmatic bilateral and multilateral transparency and confidence-building measures (TCBM)* to mitigate the risk of mishaps, misperceptions, and mistrust (that could lead to space or terrestrial warfare).

The New Space Policy's Principle Pronouncements are Nothing New. Good!

Contrary to the exhortations of the new policy's enthusiasts, a careful reading of the document shows it merely continues the key principles of national space policy that were crafted long ago during the halcyon days of President Eisenhower's administration. It only moves the discussion forward incrementally. The decision to do this was wise. Revolutionary transmutations in policy and national interests should be driven by major shifts in the international scene, such as those foisted upon decision makers by wars, new countries, breakthroughs in technologies, or other significant events. No such shift or significant event has occurred with regard to the space domain, so the continuing incremental evolution in policy is appropriate.[2]

In 1958, the Dwight D. Eisenhower administration developed the first comprehensive treatment of space policy. The topic was then addressed piecemeal over the next four administrations.[3] President Jimmy Carter released his own comprehensive policy, accompanied by a number of targeted policy pronouncements on more narrow space-related topics. Each president since then has followed suit. These national space policy pronouncements have been carefully considered, and each reflects the spin and priorities of their times—to emphasize desires to fly national security and civil missions on the space shuttle, unhook national security missions from the shuttle system after the Challenger explosion, energize a nascent commercial spacelift and remote sensing industry, encourage global use of the US GPS, and, finally, affirmatively state US interests to protect its access to space capabilities following the September 11 attacks.

The past and new versions of the NSP have emphasized that the sustainability, stability, and free access to, and use of, space is vital to US national interests. They also stress that it is US policy to comply with the four basic international space treaties.[4] Each policy has supported the proposition that all nations have the right to explore and use space for peaceful purposes, and for the benefit of all humanity, in accordance with international law. "Peaceful purposes" allows for space to be used for national security activities.

All past policies emphasize that the US considers its space systems possess the rights of passage through, and conduct of operations in, space without interference. The US has reserved the right to defend itself from threats and attacks against its

The past and new versions of the NSP have emphasized that the sustainability, stability, and free access to, and use of, space is vital to US national interests.

space systems in each of the last three policies in one form or another. It has been longstanding policy that purposeful interference with space systems, including supporting infrastructure, will be considered by the US an infringement *on its rights*. Reflecting the international flavor of the new policy, the new document broadens this assertion by stating that purposeful interference with space systems will be considered an infringement of a *nation's rights*.[5] Consistent with exercising its inherent right of self-defense or lawful collective self-defense, the new policy asserts that US will "deter others from interference and attack, defend our space systems and contribute to the defense of allied space systems, and, if deterrence fails, defeat efforts to attack them."[6]

The new policy also continues the emphasis on addressing the dangers posed by space debris. Warnings about space debris and mitigating its hazards have been part of US national space policies for decades and understandably so. The 1980s saw the US migrating to use only the manned Space Transportation System, also known as the space shuttle, to support its national security and civil spacelift needs. In undertaking this responsibility, National Aeronautics and Space Administration (NASA) concluded that the growing space debris threat endangered its astronauts and therefore commenced studies and analysis to better understand the risk. This concern was then embodied in early national space policies that emphasized the need to mitigate the generation of space debris. Consistent with this long-standing policy, the US has been a strong proponent of activities conducted within the United Nation's Inter-Agency Space Debris Coordination Committee (IADC). The IADC has been used as a vehicle to develop recommended space debris mitigation guidelines and obtain global space community compliance with the techniques space-faring nations should employ when launching, operating, and safely retiring and/or de-orbiting space objects. Unfortunately, compliance has been inconsistent to date.

International Cooperation is an Important "Means to an End," but Obstacles Must be Addressed in a Strategy Implementation

Interest in international space cooperation is not new. International cooperation has been an important and long-standing hallmark of the US national space policies. International cooperation and associated multinational operations have been important components of an effective global engagement strategy to assure access to space capabilities for the US, its allies, and partners. The US engages in a wide range of such activities, not because of their benign nature but rather they are in its best national interests to do so.

US collaborative efforts have been part of the space age since its beginning. Cooperation allows space-faring states to combine resources and reduce risk; improve efficiency; expand diplomatic engagement; and enhance prestige of engaged states, improve political sustainability of space projects, and provide workforce stability.

With the end of the Cold War, space and Earth science research and space exploration activities are no longer constrained by an overarching competition between superpowers. The George H. W. Bush, Clinton, George W. Bush, and now Obama administrations have each attempted to capitalize on the post Cold War opportunities and leverage the expertise of other nations. The US scientific community has entered into a new multi-polar world, creating diverse international space alliances and partnerships. The Obama administration supports this trend by reaching out to growing global space powers like India and China, both emerging economic and engineering powerhouses. It hopes such engagement will shape their future space, engineering and political activities in positive ways. The US has also reached out to old friends. For example, Secretaries of State and Defense, Clinton and Robert M. Gates, have announced the Australians will be more fully integrated into US space situational awareness activities.[7]

The sentiments to support international cooperation and collaboration are growing and evolving, much more so than in past policy declarations. Participants expect international projects will generate a calculus that one plus one will equal three—that diverse resources, skills, and technologies of the partners will provide synergy, adding up to more than the sum of their parts.[8] NASA, commercial, and European space activities have already achieved considerable success with their cooperative endeavors.[9]

Fans of the new policy may think that the number of times "international cooperation" or "cooperation" is mentioned is very important. Yes, the new policy does contain numerous references to "cooperation." Grand pronouncements and simplistic interpretation of the number of references relating to cooperation are not enough. The old and current reality is that cooperative programs are expensive, difficult at times to resource, and many times very hard to manage. Shrewd partners know that the direction to engage in cooperation is not worth much unless tied to real money and programs. Potential and even current partners are thus taking a judicious *wait and see* attitude to the new policy. They have been closely watching the US space politics for well over 50 years and will not act rashly. Changing their business plans to respond to fickle US executive and legislative international cooperative initiatives could be considered too much risk to assume.

Successful international cooperation is not easily achieved. Considering the space debris, SSA, collision avoidance, and TCBM foundational points identified above, the new policy provides no thought guideposts on how to proceed. The new policy cries out for a strategy to obtain these goals.

Knowledgeable diplomats and policy analysts understand that US government agencies do not always support policy directives. This creates uncertainty and unpredictability for potential partners who are considering cooperative ventures with the US. For example, one need only look to the fight over acquiring space imaging via the National Reconnaissance Office (NRO) broad area space-based imagery collection (BASIC) satellite system against using a commercial remote sensing solution. The Office of the Secretary of Defense for Acquisition, Technology, and Logistics objected to the proposed BASIC acquisition suggesting the NRO was not following US Commer-

There is no strategy to link the defense and intelligence communities. As a result, future space programs, plans, and new space concepts will be developed without the overarching strategic guidance a national strategy could provide.

cial Remote Sensing Policy which provided the US would first look to the commercial community to satisfy its remote sensing needs.[10] The NRO position to acquire the system despite the policy eventually prevailed within the interagency.[11] Then Congress interceded, pointing again to the Commercial Remote Sensing Policy. It refused to fund the system.[12] A new space strategy must anticipate comparable bureaucratic foot-dragging to cooperation initiatives and associated reforms.

The implementing strategy must advocate changes in laws and regulations to better enable international cooperation. The Arms Export Control Act and its associated International Traffic in Arms Regulations still stymie US and international interests in cooperation. The strategy must also anticipate that many in the US security community will not see cooperation as a benefit.

The new policy does not adequately confront the point that many US space professionals still have difficulty spelling "international cooperation." They have a historical bias to first look to integrate international capabilities on a US platform, rather than comprehensively plan and employ an integrated approach. A strategy needs to enable the US space community to internalize an appreciation of the opportunities that international cooperative programs offer. One of the authors participated in a recent conference panel presentation on the "role of international cooperation" with senior NASA and industry officials where it was difficult to get the other speakers to discuss or mention *any* international component to their program activities. These officials, while very earnest and capable, felt much more comfortable just talking to the US components of their program portfolios. In due time, a winning international cooperation effort will require the entire US space community to fully embrace the concept.

A National Security Space Strategy is Still Missing.

On seeing and hearing the familiar messages conveyed about the new policy, one is left with a sneaky suspicion that more needs to be said and done to assure US access to much-needed space capabilities. The new NSP cannot serve as a substitute for a space strategy.[13]

Fundamentally, a strategy document should result from a process of identify an organization's *objectives*, identifying and developing *ways and means* to achieve these objectives, and allocating *resources* to implement the plans to achieve the organization's objectives. A strategy is about the *how*. In contrast, a policy is a plan of action to *guide* decisions and actions as they are made in support execution of the strategy. A policy is about the *will and won't do's*. The US is faced with a dilemma. It has a national space policy but no national space strategy.

The new policy could and should direct such a strategy or series of focused strategies be developed, but it does not. As of the writing of this article, no National Security Space Strategy has been issued. There is no strategy to link the defense and intelligence communities. As a result, future space programs, plans, and new space concepts will be developed without the overarching strategic guidance a national strategy could provide. New programs such as operationally responsive space will suffer as a result.

This is not a new complaint. In April 2003, the General Accounting Office (GAO) recommended and the Department of Defense (DoD) agreed that space activities needed to include a national security space strategy tied to overall department-level space goals, time lines, and performance measures to assess space activities' progress in achieving national security space goals.[14]

The National Security Space Office proposed a draft strategy in 2004, but the draft did not survive the interagency coordination process. Various reasons were offered for the failure. The National Security Council requested that the strategy not be issued until the George W. Bush NSP was released in October 2006. However, once that policy was released, changes in leadership in the NRO and within the Air Force delayed effective coordination of the strategy. As could be expected, differences of opinion arose between the defense and intelligence communities over the implementation of the strategy, and cultural differences between the two communities exacerbated the coordination process. No doubt, some within the intelligence community do not want to be constrained by direction on space programs from within the DoD or US Air Force. Similar sentiments have been expressed about the intelligence community by DoD officials. Attempting to divorce themselves from the rancor, some officials mischievously disavowed being part of any coordination process on the draft strategy.[15]

The GAO notes that it is standard practice to have a strategy that lays out goals and objectives, suggests actions for addressing those objectives, allocates resources, identifies roles and responsibilities, and integrates relevant parties. "Until a national security space strategy is issued, the defense and intelligence communities may continue to make independent decisions and use resources that are not necessarily based on national priorities, which could lead to gaps in some areas of space operations and redundancies in others."[16]

Is it possible to successfully develop a usable single "comprehensive" National Security Space Strategy? Perhaps not, and for good reason. The space enterprise has grown so large and complex that no single document can cover it all. For the same reason, there is no single national air or maritime strategy. National security space involves the panoply of military, intelligence, industry, civil, and education communities, and their

sometime disparate interests and needs. Crafting and implementing such a document would impact too large an audience. Obtaining consensus and traction on it would be difficult to obtain. Targeted strategies and policies appear to be better suited to shape programs and behaviors and produce results.

What should be included in a national security space strategy? The challenges associated with possibilities of space conflict and combat are complicated and growing, and the US does not appear fully prepared to address them. Fortunately, space activities today enjoy a peaceful, non-wartime environment. Of course, there are the known exceptions that include satellite communications jamming but they are few and far between. Kinetic antisatellite technologies have been tested, deployed, but not employed in combat. Given the potential threats, preparing for space as a "contested environment" should still be a prudent component of US national strategy and policy.

A comprehensive strategy to respond to threats to space systems is overdue. A classic deterrence and protection paradigm may be satisfactory for a military space strategy, but is incomplete. It will not protect satellite systems against threats posed by space debris. Further, the US may be unsuccessful in dealing on its own with non-state actors or near-peer adversaries. For some potential adversaries, there are no mutual understandings or reliable lines of communication. Leveraging and fielding cooperative situational awareness tools, globally agreed end-of-life protocols, and TCBMs measures may be more effective in responding to these threats. A deterrence and protection strategy only leads to strategic instability, as it is too easy to disrupt, deny, degrade, or destroy US access to space capabilities, and the dangerous and destabilizing technologies that can accomplish these ends are being steadily improved across the globe.

Considering the complexity of the threat and hazard environment, a strategy to assure access to space capabilities should have a number of attributes. Space systems must be protected so they can operate for the short-term and long-term. This involves more than just dissuading, deterring, defending against, and defeating potential adversaries seeking to neutralize, disable, or destroy space systems. By far, the greatest risk to US space assets today comes from the space environment, such as space weather and orbital debris, and then irresponsible actions and accidents caused by other space actors. The global space community should be encouraged to operate safely in a manner conducive to operations by all members. Finally, the strategy must empower the US industrial base to be vibrant and robust, and flex its muscles, to ensure it can deliver space capabilities when needed.

A *space assurance strategy* depends on four mutually supportive elements, or pillars: (1) deterrence and defense; (2) global engagement to include bi-lateral and multilateral TCBMs; (3) situational awareness; and (4) responsive infrastructure.[17] Employing these four pillars should enable US and friendly space-faring nations to continue to perform their missions for the short-term and long-term. The yin and yang of space deterrence and protection will always be an important pillar of space assurance.[18] Global engagement leverages long-standing approaches to secure and protect the space domain through recognized international law, policy, and diplomacy. Situational awareness employs the monitoring of environmental and intelligence factors, and prediction of threats essential to decision making to assure mission success. It enhances global engagement by enhancing transparency. This allows a policy maker or commander to differentiate between purposeful attacks and natural environmental hazards; to anticipate space events and clarify intentions; to reduce the potential for misperception or miscalculation; and to enhance opportunities to avoid disruptive or destructive events. A robust infrastructure enables agile responses to changes in the space environment, to threats, and to assure viability of its systems.

In the end, a US space strategy rooted in classic deterrence and protection constructs does not offer sufficient ways and means needed to assure access to space. Threats of retaliation cannot be credibly employed as a strategy against long-standing, but feckless, allies and friends who operate systems in the space domain, who also act irresponsibly or recklessly. The US is not going to retaliate against an ally for refusing to de-orbit a defunct satellite. In addition, threats posed by space debris and the space environment must be addressed and minimized.

Ultimately, the four tiers of the space assurance strategy provide a needed approach to secure the space domain. The 2010 NSP stopped short of calling for a national security space strategy, but it does recognize the need by directing the secretary of defense and director of national intelligence to:

> Develop and implement plans, procedures, techniques, and capabilities necessary to assure critical national security space-enabled missions. Options for mission assurance may include rapid restoration of space assets and leveraging allied, foreign, and/or commercial space, and non-space capabilities to help perform the mission.…[19]

The policy update has been published. It is time for the heavy lifting of strategy development. No doubt, the "pushing and shoving" and "who's in charge" of the US national security space enterprise will continue throughout strategy development. A single document to address all these competing interests may not be enough, since civil and commercial space interests must also be addressed. Whether encompassed in a single document, or developed through a series of documents, a US National Security Space Strategy needs to be developed and issued.

Notes:

[1] Frank A. Rose, deputy assistant secretary, Bureau of Arms Control, Verification and Compliance, "International Cooperation: Furthering US National Space Policy and Goals," remarks at the USSTRATCOM Space Symposium, Omaha, Nebraska, 2 November 2010. Rose has been serving as point man for the administration on the new policy. He has been traveling to a wide variety of venues to speak to and relate its key messages for the US and global community.

[2] Space warfare zealots might argue the 11 January 2007 Chinese antisatellite (ASAT) intercept was a watershed space security event. Perhaps so, but kinetic ASAT capabilities have been tested and even operational since the late 1960s.

[3] James A Vedda, PhD, "An alternative approach to national space policy," presentation, *AIAA Space 2010*, 30 August 2010.

[4] The four international treaties are: (1) the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (the "Outer Space Treaty"); (2) the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (the "Rescue Agreement"); (3) the 1972 Convention on International Liability for Damage Caused by Space Objects (the "Liability Convention"); and (4) the 1975 Convention on Registration of Objects Launched Into Outer Space (the "Registration Convention"). For various reasons, the US and the other major space-faring States have refused to ratify a fifth international treaty, the 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (the "Moon Treaty").

[5] President Barack Obama administration, *National Space Policy of the United States of America*, White House, 28 June 2010, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

[6] Ibid.

[7] The new agreements reflect the new space policy's provision: "The Secretary of State, after consultation with the heads of appropriate departments and agencies, shall carry out diplomatic and public diplomacy efforts to strengthen understanding of, and support for, US national space policies and programs and to encourage the foreign use of US space capabilities, systems, and services." Ibid, 7.

[8] See "International Cooperation: When 1+1=3," Toshifumi Mukai, *ASK Magazine*, NASA (Summer 2008) 8.

[9] Remarks by Shana Dale at AAS/AIAA Seminar on the Importance of International Collaboration in Space Exploration, 1 November 2006.

[10] The 2003 *US Commercial Remote Sensing Policy*, article II, states, in pertinent part: "The fundamental goal of this policy is to advance and protect US national security and foreign policy interests by maintaining the nation's leadership in remote sensing space activities, and by sustaining and enhancing the US remote sensing industry. Doing so will also foster economic growth, contribute to environmental stewardship, and enable scientific and technological excellence. In support of this goal, the US government will: Rely to the maximum practical extent on US commercial remote sensing space capabilities for filling imagery and geospatial needs for military, intelligence, foreign policy, homeland security, and civil users…." National Security Presidential Directive (NSPD-27), fact sheet, *US Commercial Remote Sensing Policy*, 25 April 2003, 2, http://www.licensing.noaa.gov/files/factsheet.pdf.

[11] See Colin Clark, "Biting Memo Details Intel, DoD Satellite Feud," DoDBuzz, 22 August 2008, http://www.dodbuzz.com/2008/08/22/biting-memo-details-intel-dod-satellite-feud/.

[12] "By canceling BASIC, lawmakers have at least temporarily stopped the NRO from competing against commercial satellite companies, [Charles Vick, senior analyst at GlobalSecurity.org] said Senior Pentagon officials, including acquisition chief John Young, warned last summer that such competition might violate a 2003 presidential directive to use commercial imagery to the 'maximum practical extent.'" William Matthews, "Congress Overrules DoD, Intel Chief on Mapping Sats," *DefenseNews*, 23 October 2008, http://www.defensenews.com/story.php?i=3785081&c=AME&s=AIR.

[13] Alas, what would be the difference between the two, the new National Space Policy and any proposed National Security Space Strategy…? In an article on the spacepolitics.com website citing *Aerospace Daily*, one senior (likeable and very competent) Air Force space official is quoted as saying he thinks that a national space strategy is "a document that would communicate the value of space, inspire the public and generate increased interest and attention from Congress." Sounds more like a marketing plan. See http://www.spacepolitics.com/2008/09/10/a-national-space-strategy/.

[14] "Defense Space Activities: National Security Space Strategy Needed to Guide Future DOD Space Efforts," GAO-08-431R, 27 March 2008, 10 [*sic*], 2.

[15] Ibid, 3.

[16] Ibid, 7.

[17] See generally, James Rendleman, "Space Assurance for the 21st Century," *High Frontier* 5, no. 2 (February 2009): 46-53.

[18] In Chinese philosophy, the concept of "yin and yang" is used to describe how seemingly disjunctive and opposing are interconnected and interdependent, giving rise to each other.

[19] *National Space Policy*, 28 June 2010, 13.

Col James D. Rendleman, USAF, retired (BS, Chemistry, University of North Carolina - Chapel Hill; MBA and MPA, Golden Gate University; JD, Whittier College School of Law; LLM, University of San Diego School of Law). Mr. Rendleman was commissioned a second lieutenant through the Air Force ROTC at the University of North Carolina - Chapel Hill. He served in a wide variety of science and technology, engineering, management. and policy positions within the Air Force laboratories and space acquisition community, Headquarters, Air Force Space Command, the Air Staff, and the National Reconnaissance Office. He is a level-3 space professional and trained director, space forces. He served as study director for The National Academies study of the US Aerospace Infrastructure and Aerospace Engineering Disciplines. An attorney and member of the State Bar of California, Mr. Rendleman engaged in law practice as a partner, solo practitioner, and associate with firms in Los Angeles, San Francisco, and Napa, California. He is a member of the American Institute of Aeronautics and Astronautics' Legal Aspects Aero and Astro Technical Committee and International Activities Committee, and is an elected member of the International Institute of Space Law. He taught management theory for Cerro Coso Community College and Golden Gate University. He also taught space law, policy, command and control, international cooperation, and missile defense for the National Security Space Institute.

Col Robert E. "Rails" Ryals, USAF, retired (BSEE, USAFA; University of Northern Colorado; MA, Naval War College; JD, George Mason School of Law) is the president of Point B Defense Associates, a veteran owned small business. Mr. Ryals has served in a variety of air and space assignments during his military career, as well as supporting Air Force Space Command as a contractor in space control and as an instructor for the past five years at the Space Innovation and Development Center's Advanced Space Operations School. His military career included a combat tour during the war in Southeast Asia, as well as numerous flying tours. He was the director of operations for 7th Air Force in Korea and the 607th Air Operations Group commander. Prior to his retirement in 2001, he was also the dean of students at the Air Command and Staff College, director of the Commander's Action Group for US Space Command, North American Aerospace Defense Command, and Air Force Space Command and the vice commander of the Space Warfare Center. He is a licensed Colorado attorney and a project management professional. He teaches a wide variety of lessons in numerous Advanced Space Operations School courses to include doctrine and policy; command and control; satellite communications, missile warning and defense; and the GPS.

USSTRATCOM Perspective on National Space Policy Implementation through Space Situational Awareness Sharing

Ms. Jessica S. Tok
Space Policy Analyst
US Strategic Command/J513
Offutt AFB, Nebraska

Trends Toward a Congested Domain

The 10 February 2009 collision between an Iridium satellite and a non-operational Cosmos satellite alarmed the space community and highlighted the inherent danger of the harsh space environment. Consequently, during the 2010 US Strategic Command (USSTRATCOM) Strategic Space Symposium, Deputy Secretary of Defense William Lynn, III remarked, "We are approaching a point at which the limitless frontier no longer seems quite so limitless." This statement concisely acknowledged the shift from 40 years of big sky thinking to a dawning realization that the space environment is increasingly congested.[1]

While the Iridium-Cosmos event catapulted the issue of space debris into the public eye, it also reemphasized the growing need for situational awareness to the space community. In the last 43 years since the signing of the Outer Space Treaty (OST), only a few major steps have been made to preserve the ability to explore and use outer space for peaceful purposes. The most notable step to date has been the United Nations' (UN) endorsement of the Space Debris Mitigation Guidelines, a feat that took 13 years of careful coordination started by the promulgation of national-level guidelines by the National Aeronautics and Space Administration (NASA) and culminating in an international standard in 2008.[2] However, simply establishing guidelines to mitigate the future generation of space debris is not the full solution. On-orbit debris already exists and threatens the existing space infrastructure, which the US relies upon for everything from search and rescue to banking and telecommunications.[3] Today, the US government (USG) is taking another vital step in preserving the space environment for all users through USSTRATCOM's space situational awareness (SSA) sharing effort.

The US considers the sustainability, stability, and free access to, and use of, space vital to its national interests.

~ National Space Policy, 28 June 2010

Implementing the National Space Policy

Since 1958, each president has released a National Space Policy (NSP), highlighting the important role of space systems in the US. Following this legacy, President Barack Obama signed the newest version of the Presidential Policy Directive 4, popularly called the "National Space Policy," on 28 June 2010. Among other things, the NSP states that the USG should "[d]emonstrate US leadership in space-related fora and activities," as well as "lead in the enhancement of ... stability and responsible behavior in space."[4]

Fortunately, stability is concomitant with responsible behavior in space. Both the NSP and the UN's OST mention the need for free "use of [outer] space for peaceful purposes." Common sense dictates that the use of space for peaceful purposes can only be fully realized if there is stability. Similarly, stability cannot exist without responsible behavior. Because space is a vital interest to the USG, it has a vested interest in supporting those users who uphold the OST's precept to act in the "common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes."[5] To foster responsible behavior, the USG decided to share an unprecedented amount of data from its vast space object catalog to assist in global spaceflight safety.

Because the Department of Defense (DoD) was the most well-positioned USG space actor with the most accurate space object catalog compiled through the worldwide sensor "space surveillance network" (SSN), the provision of SSA support was a logical outgrowth of USSTRATCOM's mission to perform space operations. Following that reasoning, the DoD role in SSA was clearly defined in the 2010 NSP.

The secretary of defense (SecDef) and the director of national intelligence (DNI) are given the responsibility for "maintain[ing] and integrat[ing] space surveillance, intelligence, and other information to develop accurate and timely SSA" which "shall be used to support national and homeland security, civil space agencies, particularly human space flight activities, and commercial and foreign space operations." However, the NSP reserves the dissemination of SSA information for the SecDef alone, providing that the SecDef, in consultation with DNI and NASA, "may collaborate with industry and foreign nations to … maintain and improve space object data-

…space is a vital interest to the USG, it has a vested interest in supporting those users who uphold the OST's precept to act in the "common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes."

Under the emergency service construct, when space objects meet certain risk criteria for potential collision with another tracked object, USSTRATCOM issues emergency conjunction warnings to satellite owners and operators.

bases ... *and provide services and disseminate orbital tracking information to commercial and international entities, including predictions of space object conjunction*" (emphasis added).

This was a tacit acknowledgment of the DoD leadership in space object tracking and adhered closely to the language from the previous 2006 NSP, which also directed the SecDef to provide SSA support for "the USG … and, as appropriate, commercial and foreign entities." The 2010 NSP lacks the qualifier of "as appropriate," and in response, USSTRATCOM sought authorization to work with every space-related entity on an equal basis. Because the NSP states that SSA information shall be used to support commercial and foreign space operations,[6] one of the ways USSTRATCOM accomplishes this policy objective is by providing high-quality conjunction assessments to all owners and operators.

Through the open and transparent sharing of SSA to other nations and entities, USSTRATCOM seeks to fulfill one of the main goals of the NSP, which is to strengthen stability in space through international measures to promote safe and responsible operations in space.[7]

It is the shared interest of all nations to act responsibly in space to help prevent mishaps, misperceptions, and mistrust.

~ National Space Policy, 28 June 2010

USSTRATCOM Space Situational Awareness Sharing

As a mission and responsibility assigned to the commander of USSTRATCOM, USSTRATCOM supplies three levels of SSA sharing to global space users: basic, emergency, and advanced.

The first level contains basic SSA information about objects in the US space catalog to over 41,000 users from 141 countries through its website, www.space-track.org.[8] This includes two-line element sets (TLE), basic satellite catalog information, and satellite decay and reentry data. TLEs hold significant analytical value for the majority of casual users by allowing relatively accurate long-term propagations for certain orbits.

For those users requiring conjunction assessment and spaceflight safety support, such as satellite owners and operators, USSTRATCOM provides two additional levels of service, emergency and advanced service support. Each day, over 1,000 active payloads are screened against the USG's entire space catalog. Under the emergency service construct, when space objects meet certain risk criteria for potential collision with another tracked object, USSTRATCOM issues emergency conjunction warnings to satellite owners and operators. This level of service is limited to providing "conjunction summary messages" (CSM) and offering re-screenings using owner or operator-provided ephemeris.

The most advanced SSA sharing is accomplished through the "USSTRATCOM SSA Sharing Agreement." This option is meant for those users needing additional support, such as satellite owners and operators or launch providers. After concluding an SSA agreement with USSTRATCOM, entities may receive such supplementary services as conjunction assessment, launch support, deorbit and reentry support, disposal/end-of-life support, collision avoidance support, anomaly resolution, and electromagnetic interference resolution. These analyses are provided by USSTRATCOM's Joint Functional Component Command for Space (JFCC SPACE). JFCC SPACE runs the Joint Space Operations Center, which works with owners, operators, and launch providers to assist with each of these needs. As of December 2010, USSTRATCOM has developed working relationships with 19 companies, and continues to conclude additional agreements as interest in SSA sharing gains momentum.

These burgeoning relationships are dependent on the understanding that sharing SSA information will facilitate everyone's ability to mitigate risks in the shared space environment. Since assuming the responsibility for SSA sharing, USSTRATCOM has rapidly improved the amount and extent of data shared in response to owner and operator feedback.

Most recently, in July 2010, USSTRATCOM started sharing CSMs for objects closely approaching each other in space. Previously, the information provided for owners and operators was a short message indicating time of closest approach and two values, miss distance and relative position of the conjuncting object, which did not give owners or operators enough information to assist with maneuvers. In contrast, CSMs contain the special perturbation data of the two objects,[9] as well as the covariance matrices, or error ellipsoids for both objects.[10] Recognizing the intrinsic value of this new message, USSTRATCOM convened two CSM workshops in Washington, DC and Darmstadt, Germany, in order to educate satellite owners and operators, while dispelling myths and misconceptions about the message. Additional CSM workshops are planned for 2011. The impact has been immediate and significant. Because of the drastic reduction in unnecessary and costly maneuvers, the sharing of CSMs has been described by the head of operational flight dynamics at the Centre National d'Études Spatiales (the French civil space agency) as "the best action ever taken to protect [the] space environment."[11]

At the recent 2010 Strategic Space Symposium, Lt Gen Larry James, commander JFCC SPACE presented some data to underscore the magnitude of the SSA sharing program. In addition to daily screening of the 1,000+ active satellites on orbit, the US SSN performs 1.4 million sensor taskings per week.[12] USSTRATCOM personnel at JFCC SPACE amass stunning statistics, averaging 190 conjunction warnings and assisting with an average of three satellite maneuvers per week.[13] So far

Through this nascent program … every satellite owner and operator now has access to close approach predictions based on the USG's expansive space catalog in order to support safety of spaceflight.

in 2010, 64 satellites have notified USSTRATCOM of planned maneuvers to avoid potential on-orbit collisions based on the SSA information shared.[14]

We have taken responsibility for this program now in USSTRATCOM, and we have renamed it SSA sharing, to emphasize our desire and attempt to share information with the international community and commercial partners interested in space flight safety.

~ General Kevin Chilton, commander USSTRATCOM[15]

Commitment

As of December 2009, USSTRATCOM assumed the SSA sharing responsibilities. Through this nascent program, aided by the release of the NSP, and much difficult and unsung work by many dedicated men and women, every satellite owner and operator now has access to close approach predictions based on the USG's expansive space catalog in order to support safety of spaceflight.

We understand that there will always be concerns about credibility, reliability, accuracy, and transparency in a SSA effort run by a military organization. The impetus is on us to demonstrate our commitment to international cooperation and our dedication to sustainability, stability, and free access to space.

To that end, we will assist satellite owners, operators, and launch providers for safety of flight in order to promote stable and responsible behaviors in space. We will continue to listen closely to user suggestions and comments to help us develop our services. We will strive for better accuracy, improved products, and closer cooperation with other nations and entities. No program is infallible, but through cooperation, we can learn, innovate, and keep space safe for future generations because we understand that "the now-ubiquitous and interconnected nature of space capabilities and the world's growing dependence on them means that irresponsible acts in space can have damaging consequences for all of us."[16]

Notes:

[1] Robert M. Gates, Defense Secretary Robert Gates' Statement on the National Space Policy, 28 June 2010, http://www.defense.gov/spr; this terminology is also alluded to by many third-party sources citing the non-public Interim Space Posture Review, submitted to Congress in March 2010.

[2] NASA, *Orbital Debris Mitigation*, http://orbitaldebris.jsc.nasa.gov/mitigate/mitigation.html; also United Nations, *Report of the Committee on the Peaceful Uses of Outer Space*, Annex (A/62/20).

[3] President Barack Obama administration, *National Space Policy of the United States of America*, White House, 28 June 2010, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf, 1.

[4] *National Space Policy*, 6.

[5] UN, *Outer Space Treaty*, 1967, http://www.oosa.unvienna.org/oosa/SpaceLaw/outerspt.html.

[6] *National Space Policy*, 8.

[7] Ibid., 4.

[8] Lt Gen Larry D. James, commander JFCC SPACE, US Air Force (address, USSTRATCOM Space Symposium, Omaha, Nebraska, 2 November 2010).

[9] Special perturbation is high-accuracy data that "numerically integrates the equations of motions including all necessary perturbing accelerations," which is used for conjunction assessment.

[10] Maj Duane Bird, "Improving Orbital Safety Through Data Sharing," Wingman, Air Force Safety Center, (to be published Spring 2011, draft article provided courtesy of the author).

[11] Monique Moury, head of Operational Flight Dynamics, CNES (e-mail, 8 November 2010).

[12] Lt Gen Larry D. James, USAF, commander JFCC SPACE, biography, http://www.af.mil/information/bios/bio.asp?bioID=7780.

[13] Lt Gen James, 2010 Space Symposium speech.

[14] Ibid.

[15] Gen Kevin P. Chilton, commander, USSTRATCOM, (address, 5th Ilan Ramon Annual International Space Conference, speech, Herzliya, Israel, 27 January 2010)

[16] *National Space Policy*, 1.

Ms. Jessica S. Tok (BS, Biological Science; JD, Law; LLM, Space and Telecommunications Law, University of Nebraska, Lincoln) is a civilian space policy analyst in the space policy branch of the Policy and Doctrine Division, Plans and Policy Directorate for the United States Strategic Command (USSTRATCOM), Offutt AFB, Nebraska. She is responsible for developing space policy and guidance, in addition to formalizing space situational awareness sharing agreements for USSTRATCOM.

Prior to joining USSTRATCOM, Ms. Tok obtained a Master of Law specializing in Space and Telecommunications Law, and worked for the University of Nebraska – College of Law, US Army, US Air Force, and the US District Court of Nebraska. Ms. Tok also served as the editor of the Association of Space Explorers' standing committee on Near Earth Objects' 2009 policy document, "Asteroid Threats: A Call for Global Response." She is admitted to practice law in Nebraska and Iowa.

National Space Policies as Strategic Communication

Ms. Jonty L. Kasku-Jackson
Instructor, National Security Space Institute
Colorado Springs, Colorado

The core of US space policy has remained essentially the same since 1958 although the first document to be called the "National Space Policy" was not signed until 1978 by President Jimmy Carter. From the time of President Dwight D. Eisenhower, the US has insisted on protecting its rights to access and operate in space.[1] Through the decades it has repeatedly recognized the importance of space to its national security. It has insisted that space is for peaceful purposes and resisted any new space arms control regime unless it is equitable and verifiable.

So why does each new administration trouble itself to write a "new" space policy? Part of the answer to that question lies with the idea that policies are codifications of the political goals of an administration. The other part of the answer lies with the fact that policies have many target audiences. Basically, policies are an essential component of an administration's strategic communications. Given that, let us examine the Barack Obama administration's space policy in context of history and the current geostrategic environment.

Previous Space Policies and Strategic Communications (1958-2006)

The Eisenhower administration set the basics of US space policy in reaction to the activities of the Soviet Union (and, incidentally along with the Soviet Union, provided a foundation for the Outerspace Treaty, eventually signed in 1967).[2] This initial policy addressed issues concerning using space for peaceful purposes, assured access to space, US leadership in space and, just as importantly, international acceptance of such activities. At the same time it recognized the potential for military use of space and the possibilities of international cooperation.

From the Eisenhower administration through the Ronald Reagan administration, the Soviet Union (and later Russia) remained the primary foreign target audience of the US space policies. Two key geostrategic factors were considered by these administrations. First, the Soviets had beaten the US into space. The shock to American pride was profound and public fear was high—hence the emphasis on preserving US leadership in aeronautical and space science and technology. Second, Eisenhower wanted to overfly the Soviet Union to verify its offensive missile capabilities and space provided the perfect opportunity to do so. This explains the Eisenhower policy focus on assured access to space and the use of space for peaceful purposes. The administration's policies clearly communicated to both the Soviets and the US population the intent to protect US interests.

US policies continued to reiterate these policy positions. The John F. Kennedy administration introduced the proposed norm that "interference with or attacks on any space vehicle of another country in peacetime are inadmissible and illegal."[3] The Gerald Ford, Carter, and Reagan administrations all drafted space policies that pursued non-nuclear antisatellite (ASAT) capabilities as a hedge against Soviet ASAT capabilities.[4] Each set of policies continued to communicate the US intent to protect its interests in space—by force if necessary.

As the Soviet Union began to decline, US focus began to change. Although George H. W. Bush's space policies supported continuation of the Strategic Defense Initiative and development of ASAT capabilities, they also reflected the beginning of a shift in focus to the commercial space sector. During this time the policies began to require the US government to utilize commercial space services and goods to the "fullest extent feasible."[5] This shift in focus was most pronounced during the Bill Clinton administration when one of the administration's stated goals was to support and enhance US industrial competitiveness. The Landsat Remote Sensing and GPS policies encouraged commercialization of those systems in pursuit of that goal.[6] The Clinton administration faced an increasing number of countries able to build, launch, and operate satellites. Those countries were proving a threat to the US space industry, and the Clinton policies were designed to communicate the administration's commitment to encouraging a robust commercial industry to both foreign and domestic audiences.

After 9/11 US policy focus shifted once again toward security. However, the G. W. Bush administration faced a substantially more diverse geostrategic environment. Not only were there now almost 40 states operating in space, but commercialization meant that non-state actors could purchase a wide variety of space-based imagery products, communicate over satellite links, and use the US GPS for navigation—all of which could be used to attack the American homeland. Correspondingly, the strategic communication sent via the G. W. Bush administration's space policy was more strident and once again focused on protecting US national security interests in space itself. It was this policy that stated freedom of action in space was "as important to the US as air power and sea power."[7]

The 2010 Obama Administration Space Policy and Strategic Communication

Although the Obama administration still faces the same threats as the G. W. Bush administration, it had to consider another equally significant "threat" when drafting its space policy. China has not only become one of the major space-faring nations, able to manufacture, launch and operate satellites, it

has also become one of only three nations to place a human in space. China is also well on its way to becoming an economic powerhouse and has significant economic and political ties throughout the world. As it continues its "peaceful rise" to power in the Pacific region, China challenges US influence in the area. The Obama administration is faced with the choice of trying to either contain China or to cooperate with China. Containment would serve to preserve existing US influence and counter China's influence. Cooperation could serve to align the two countries' interest and create a balance in the region that could facilitate the development of a stable multi-polar geostrategic environment.

Conventional wisdom states the US is critically dependent on space capabilities and asymmetrically vulnerable to the loss of those capabilities. It would seem irrational to cooperate with China and other countries in an arena in which the US is so seemingly vulnerable. On the other hand, there are areas of space activities that seem to be sufficiently neutral, or at least low threat, to consider partnerships. The Obama administration appears be building on that concept and seems to be using its 2010 US National Space Policy to support a strategic communication of engagement and cooperation in the international arena. Although the policy still addresses use of space for peaceful purposes, assured access to space, and US leadership in space, the tone has changed significantly from the strident, even bellicose tone of the G. W. Bush space policy. Instead of the previous highly individualistic tone evinced by the majority of US national space policies, this policy specifically uses community-based language. For example, the policy still states "The US considers the sustainability, stability, and free access to, and use of, space vital to its national interests." However, the preceding sentence states "*It is the shared interest of all nations* to act responsibly in space to help prevent mishaps, misperceptions, and mistrust." [emphasis added] The principles section of the policy also contains the following language:

"As established *in international law*, there shall be no national claims of sovereignty over outer space or any celestial bodies. The US 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."[8] [emphasis added]

Previous policy stated: "*The US rejects* any claims to sovereignty by any nation over outer space or celestial bodies, … the US will view purposeful interference with its space systems as an infringement on *its rights*.[9] [emphasis added]

The language of the newest policy is clearly intended to communicate the willingness of the Obama administration to engage the international community and seek global solutions in the space arena rather than acting unilaterally regardless of the views of other nations. This is in part recognition of the increasing multipolarity of the world and in part a recognition of the fragility of the space domain. Much of this policy focuses on debris mitigation, which the US cannot address on its own.

Even though the tone of this policy is specifically crafted to support the Obama administration's strategic communication of international engagement, the content of the policy itself still warns that the US considers space to be vital to US national interests, the US will protect its access to and freedom of action in space, and a competitive commercial space sector is vital to continued US progress in space. Essentially, the content of this newest policy has not deviated significantly from the content of the Eisenhower policies. However, the strategic communication now returns to the potential Eisenhower foresaw—the possibility of international cooperation in space that would be of benefit to the US.

Notes:

[1] National Security Council (NSC) Action 1553, "US Policy on Control of Armaments. "It is the purpose of the US … to seek to assure that the sending of objects into outer space shall be exclusively for peaceful and scientific purposes and that under effective control the production of objects designed for travel in or project through outer space for [offensive] military purposes shall be prohibited."

[2] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

[3] National Security Action Memorandums (NSAM) 156, "Space policy and Intelligence Requirements."

[4] National Security Decision Memorandum (NSDM) 345, "US Antisatellite Capabilities," signed by President Ford, PD/NSC-37, "National Space Policy", signed by President Carter, National Security Decision Directive (NSDD)-42, "National Space Policy"(1982) and NSDD-293, "National Space Policy" (1988), signed by President Reagan

[5] NSDD-293, "National Space Policy," (1988), signed by President Reagan; National Security Presidential Directive (NSPD)-1 "National Space Policy," (1989); NSPD-2 "Commercial Space Launch Policy, (1990); NSPD-3, "US Commercial Space Policy Guidelines," (1991); NSPD-4 National Launch Strategy, (1991), signed by President G. H. W. Bush.

[6] National Science and Technology Council (NSTC)-3, Landsat Remote Sensing Strategy, (1994), signed by President Clinton

[7] NSPD-49, "US National Space Policy," 2006, signed by President G. W. Bush.

[8] President Barack Obama administration, *National Space Policy of the United States of America*, White House, 28 June 2010

[9] NSPD-49, 2006.

Ms. Jonty L. Kasku-Jackson (BA, Liberal Arts, Oregon State University; Juris Doctorate, New England School of Law) is an instructor at the National Security Space Institute (NSSI) in Colorado Springs, Colorado. She is the Space 300 area integrator and is responsible for instruction and curriculum development for the NSSI's Space 300 course which is offered to department senior space professionals. She teaches in the geopolitical, acquisition, and integration subject areas for Space 300. She also instructs in the contested environment subject area for Space 200 which is offered to mid-level Department of Defense space professionals. Ms. Kasku-Jackson previously worked at Air Force Space Command/A3 where she worked launch and range issues. She also worked as an intelligence analyst at the National Air and Space Intelligence Center where she was the branch chief for foreign materiel exploitation.

The National Space Policy: Sustainability and Cooperation in a Congested, Competitive, and Contested Domain

Col Daniel A. Dant, USAF
Chief of Staff of the Air Force Fellow and
Director of Space Policy
Under Secretary of Defense for Policy
Pentagon, Washington, DC

Back in 1966, the year I was born, the world was a very different place … and so was space. America's budding space program had one competitor—the Soviet Union. Aside from the obvious national goal of putting a man on the moon, our national security space efforts centered around nuclear deterrence—nuclear command and control; indications and warning; and space-based intelligence to characterize the "missile gap." Attacks on our space capabilities were discouraged by their links to nuclear warfare—"attack our satellite ≈ threaten our nuclear capability = we strike" … the math was simpler, albeit scarier, in the Cold War.

Commercially, the US did not have much more going on in space than "Tang," the astronaut's drink of choice. However, our space industrial base had little to no competition and enjoyed unrivaled priority for national resources. One year later, 1967, the legal framework to shape minimum behaviors in the domain was crafted at the United Nations—the "Outer Space Treaty," which still endures today as the preeminent treaty on space. Likewise, the foundational principles published by the Eisenhower administration in the first National Space Policy (NSP) also endured, as if written in stone and unwitting to the ever-changing national security space strategic context, until now.

The 2010 NSP is significant for many reasons. While many of the foundational principles dating back to "Ike," still remain, the new policy nonetheless accounts for a drastically changed domain and context. Surprise, the US is not the only nation with space capabilities; in the past few decades, space capabilities have become available to many nations, private corporations, and non-state actors. In 1995, the US enjoyed nearly 75 percent of worldwide satellite export sales. In the ensuing 10 years, multiple actors joined the race and the US dropped to less than 25 percent of worldwide satellite export sales.[1] Each new entrant into space, be they commercial or national—or both, seeks to attain prestige, wealth, information, or security from space capabilities. This upward trend of space players will continue.

Today, more than 60 nations or commercial entities have satellites in space. Nations and consortia in Europe have emerged as global leaders in the development of space technologies and applications that support civil, commercial, intelligence, and military use—many of these entities place a premium on dual-use space capabilities. In the past 10 years, China has developed significant space capabilities to include the testing of an antisatellite (ASAT) weapon in 2007 and a missile interceptor test in space in January 2010. Russia still maintains considerable space infrastructure.

Above all else, the president's new NSP recognizes that the once limitless and benign space domain has strategically shifted. We are now faced with a congested, competitive, and contested space domain.[2]

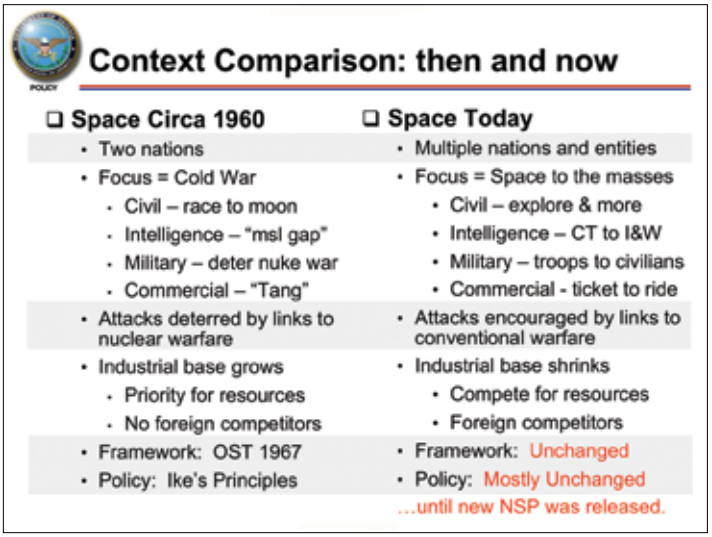


Figure 1. Space circa 1950 compared to space today.

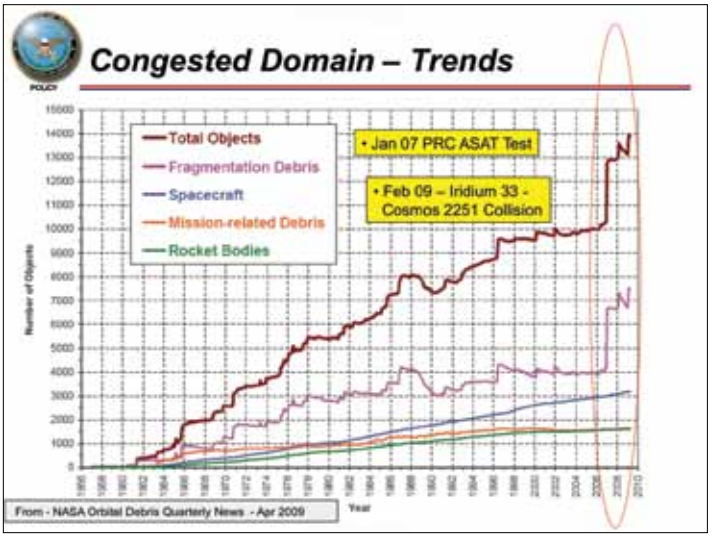


Figure 2. Congested domain trends.

Figure 3. The space domain is increasingly competitive.

Congested. There are over 21,000 objects in the current space catalog and over 1,100 active systems on orbit. In addition to more countries joining the domain with on orbit assets, space debris is building to the point that it could jeopardize useable orbital regimes in the not too distant future. The Chinese ASAT in 2007 created over 3,037 pieces of debris.[3] In February 09, Iridium 33 (a commercial satellite) and COSMOS 2251 (a Russian communications satellite, inactive since 1995) collided in low Earth orbit. This collision created approximately 1,750 pieces of debris in low Earth orbit.[4] The shuttle has maneuvered to miss this debris and national security systems have expended valuable fuel to avoid additional collisions with debris. At over 17,000 miles per hour, a seemingly harmless paint chip becomes a potentially devastating projectile. We are also creating some of that debris ourselves. We will likely issue waivers for many of our evolved expendable launch vehicle launches due to surpass our own debris mitigation standards.

Competitive. The domain is also increasingly competitive, often at the detriment to market share for US companies and opportunities lost for our industrial base. Foreign countries, which are less concerned with export controls than the US, are making money in the international market with satellites, sub-components, and launch activities. We are falling behind. Every country we do not cooperate with becomes a potential competitor. Sometimes, those competitors represent the potential to contest our advantages in the domain.[5]

Contested. Contesting access to space services has become common place in the domain—our global commons lacks rules. In recent years, Iran has jammed commercial satellites to censor news to their public. This trend is not new. In 2002, Falun Gong reportedly jammed and hijacked television on Chinese communications satellites; in 2003, Iran jammed Telestar-12 and Iraq jammed GPS signals during Operation Iraqi Freedom; Libya reportedly jammed Telestar-12 in 2005; Iran launched an experimental satellite in 2009 and North Korea attempted a space launch. This contested environment is threatened by both reversible and nonreversible capabilities, kinetic and nonkinetic effects. From spectrum jamming to hard kill of satellites, the threat is real.

Based on this recognized shift in the strategic context, a recent body of national security and space-related policies and strategies, namely the 2010 NSP, has come to the same conclusion—*America can no longer go it alone in space*.

The Obama administration's new NSP, released on 28 June 2010, endeavors to ensure that space remains viable for future generations. "Specifically, the NSP sets forth the challenge to make space sustainability a priority through global engagement and cooperation, as well as through responsible space behav-

Figure 4. Contesting access to space services has become common place in the domain.

ior. However, the policy's ultimate success will depend on how the rest of the US government interprets and implements the principles contained within the NSP. Furthermore, its efficacy is tied to both how much cooperation the US receives internationally, and what bilateral and multilateral transparency and confidence-building measures are undertaken."[6]

Sustainability for a congested domain. The NSP states, "The US considers the sustainability, stability, and free access to, and use of, space vital to its national interests."[7] In so stating this key principle, the US charges all space-faring nations, and those which wish to join us in the domain, to collaborate and cooperate on preserving the space domain. Preserve it from what? Debris and chaos. How? Responsible behavior.

The NSP gives many debris mitigation guidelines, including:

> Lead the continued development and adoption of international and industry standards and policies to minimize debris, such as the United Nations Space Debris Mitigation Guidelines;
>
> Develop, maintain, and use space situational awareness information from commercial, civil, and national security sources to detect, identify, and attribute actions in space that are contrary to responsible use and the long-term sustainability of the space environment;
>
> Continue to follow the US Government Orbital Debris Mitigation Standard Practices, consistent with mission requirements and cost effectiveness, in the procurement and operation of spacecraft, launch services, and the conduct of tests and experiments in space;
>
> Pursue research and development of technologies and techniques, through the administrator of the National Aeronautics and Space Administration and the secretary of defense, to mitigate and remove on-orbit debris, reduce hazards, and increase understanding of the current and future debris environment; and,
>
> Require the head of the sponsoring department or agency to approve exceptions to the US Government Orbital Debris Mitigation Standard Practices and notify the secretary of state.

The president's policy clearly takes a much needed stand on debris as a sustainability issue for which all responsible nations must account for and cooperate to mitigate. This is a step in the right direction, but it is not enough. In addition to confronting the ever-growing debris in our congested domain, we must also seek to establish "rules of the road" or norms of behavior in the domain. The Office of the Secretary of Defense is working closely with the National Security Council, State Department, Directorate of National Intelligence, other government agencies, and most importantly, our friends and allies, to foster discussions and ideas on norms of behavior in space as well as other transparency and confidence building measures. The president pointed us in the right direction … now it is up to us to walk the path.

Cooperation for contested and competitive domain. The NSP also recommits us to cooperate in space: "The US hereby renews its pledge of cooperation in the belief that with strengthened international collaboration and reinvigorated US leadership, all nations and peoples—space-faring and space-benefiting—will find their horizons broadened, their knowledge enhanced, and their lives greatly improved." In addition, the policy specifies that the US endeavors to leverage national security space to "expand international cooperation" in order to "extend the benefits of space; further the peaceful use of space; and enhance collection and partnership in sharing of space-derived information."[8]

This represents a subtle but significant shift in policy. Some argue, including many international partners I have spoken to, that our previous policies paid a certain degree of "lip service" to cooperation and were best described as bellicose. Moreover, these policies were underwritten by an informal strategy of "space dominance" which called for discouraging and restraining others to our benefit. This methodology was lost neither by our allies nor our rivals. Clearly, that scheme of maneuver has not worked, evidenced by the increasing competition in the domain, higher incidents of denied access in space, and decline in the American space industrial base, especially second and third tier companies.

A perceptible result of cooperating in space, and thus converting competitors to collaborators, is that it gives space-faring partners a stake in pursuing responsible behavior and increases their willingness to cooperate in space (or at least lessens the chances of hostile or irresponsible actions in space).[9] Once again, the president, in both substance and tone, has started us on the right path with the new NSP by re-energizing international cooperation. It is now up to the Department of Defense (DoD), led by and in close coordination with the State Department via a whole of government approach, to translate our advantages in space to active leadership of the coalition of responsible space-faring nations.

Part of the successful equation must recognize and take advantage of our commercial strengths; our space industrial base is a key element in cooperating to lessen the effects of a contested and competitive domain. The NSP offers a major thrust in this area. The policy states, in an entire section devoted to the commercial sector, "to promote a robust domestic commercial space industry, departments, and agencies shall" (10 other relevant passages not included):

> Purchase and use commercial space capabilities and services to the maximum practical extent when such capabilities and services are available in the marketplace and meet US government requirements.

Unless you are a student of national space policies, you may not have noticed this commercial sector guidance is also ordered ahead of the national security space sector in the president's new policy—unlike previous policies. As a collaborator on the new policy, I can attest this was by design. In the myriad interagency discussions while formulating this policy, it was widely accepted that promoting and enhancing our industrial base and commercial capabilities must be foundational to our approach to solidifying US leadership in space.

In my many discussions with commercial partners, they consistently argue that export controls represent the most significant hurdle to improving our industrial base.

The policy also recognizes the "self-imposed folly" of our export control regime … which has handicapped our industry for far too long.[10] The White House has launched a completely separate presidential export control review to overhaul how we do business; they key is "fewer but higher walls;" that is, focusing on protecting our truly unique capabilities but applying common sense to protecting readily-available state of the world technologies. In my many discussions with commercial partners, they consistently argue that export controls represent the most significant hurdle to improving our industrial base. Numerous studies support their claims. We simply must do better and the NSP recognizes this compelling fact.

No doubt, cooperation, with both commercial and international partners, represents a momentous chance to deter contesters in the domain and make our industry more competitive in a $240+ billion market … in so doing, enhancing the foundational elements of our national security space leadership.[11]

How much efficacy can a 14 page document achieve in moving the US bureaucracy towards a new vision for space? I would contend, a great deal of impact. In my estimation, even though I have only scratched the surface of the changes in tone and substance in the 2010 NSP, it is nonetheless the most significant change in national space policy in the past 50 years. President Barack Obama lays out several principles and goals, if implemented properly and followed up with appropriate supporting strategies, will fundamentally change our approach to leveraging the space domain for decades to come. DoD is doing just that. Immediately on the heels of the NSP, DoD and the director of national intelligence began work on a national security space strategy which will capitalize on the president's policy and direct the necessary approaches to achieve a safer, more stable, and more secure space domain.

Space is increasingly congested, competitive, and contested; the NSP is predicated on this elemental change in the strategic context. In crafting this visionary policy, the president has shifted our national focus to confront congestion with order and responsible behavior and oppose competition and increasing instances of contested access with greater cooperation to create resilience and lead the coalition of space-faring nations. The ball is in our court to implement this policy with focused and thoughtful strategies and using a whole of government approach—we can do no more … and we should never wish to do less.

Notes:

[1] Center for Strategic and International Studies, Study on the Space Industrial Base, 2010.

[2] National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, *Orbital Debris Quarterly News* 13, issue 2 (April 2009), 10.

[3] "Chinese Debris Reaches New Milestone," NASA Orbital Debris *Quarterly News* 14, issue 4, (October 2010).

[4] "Top Ten Satellite Breakups," *NASA Orbital Debris Quarterly News* 14, issue 3 (July 2010).

[5] Threat continuum provided by NASIC.

[6] Victoria Samson, director, Secure World Foundation Washington Office, "The 2010 Obama Space Policy: Sustainability, International Engagement and Stability in Space," 29 September 2010.

[7] PPD-4, 2010 National Space Policy, 28 June 2010, 3.

[8] Ibid.

[9] Samson, "The 2010 Obama Space Policy."

[10] Deputy Secretary of Defense William J. Lynn, III National Space Symposium speech, April 2010.

[11] Extrapolated from Futron's "State of the Satellite Industry Report," for the Satellite Industry Association, June 2010, 2-22.

Col Daniel A. Dant, USAF (BA, Political Science, East Carolina University, North Carolina; MA, Human Resource Management, Webster University, Missouri; MA, Military Operational Art and Sciences, Air University, Maxwell AFB, Alabama; MA, National Security Studies, National Defense University, DC) is a chief of staff of the Air Force fellow and the director of space policy for the under secretary of defense for policy. Prior to assuming his current duties, he was a student at the National War College. Colonel Dant was commissioned in the Air Force in 1990 as a distinguished graduate of the East Carolina University ROTC program. After a tour as an intercontinental ballistic missile instructor and evaluator, he transitioned to space operations as a flight commander for the Pave Paws warning radar in Cape Cod, Massachusetts. Colonel Dant was then one of 50 US Air Force captains selected for the prestigious Air Force Intern Program at the Pentagon. He interned on the Air Staff in the Directorate of Operational Requirements, for the Office of the Secretary of Defense in strategy and requirements, and attended a masters program at George Washington University. Colonel Dant then completed the US Air Force Weapons School course at Nellis AFB, Nevada. As a space weapons officer, he served on the Air Force Space Support Teams at Schriever AFB, Colorado, where he deployed numerous times to integrate space capabilities in to theater operations. After a tour as the chief of safety for the 21st Space Wing, Colonel Dant served as the commander, 4th Space Control Squadron, Holloman AFB, New Mexico. His unit was responsible for delivering defensive and offensive counterspace capabilities and space situation awareness, as appropriate, to rapidly achieve flexible and versatile effects in support of global and theater campaigns. In addition to his current assignment, Colonel Dant's staff assignments include duties as the commander of the weapons and tactics flight for the 21st Space Wing and speechwriter for the commander of Air Force Space Command (AFSPC), Commander-in-Chief North American Aerospace Defense Command, and Commander-in-Chief, US Space Command. He also served as the aide-de-camp to the commander, AFSPC.

Colonel Dant has been identified for assignment as commander, 460th Space Wing.

Emerging Dynamics of the New Space Policy

Mr. Trevor Brown
PhD Candidate, Auburn University
Auburn, Alabama

The economic momentum of Eastern states is translating into exceedingly consequential developments for their respective military and civil space programs. While American military and civil space programs may spend nominally more than these states, the favorable purchasing power parity ratios these states enjoy mean that they are able to make greater technological gains with what is lesser investment in real terms. In actual fact, the technological momentum of the American space program is decelerating in comparison to the East as the American space program becomes increasingly privatized. Furthermore, as the space programs of Eastern states rise the orbital environment will become increasingly complex for both the National Aeronautics and Space Administration (NASA) and the Air Force. The Barack Obama administration has sought to engage these trends by pursuing policies that seek to further amplify the American private space sector and increase coordination among international space participants.

In regard to the East, India's economic success is leading to important military activity in Earth orbit. With its new found resources India has expanded its missile defense program to include the development of lasers and an exoatmospheric kill vehicle that could be combined to produce a weapon to destroy enemy satellites.[1] Such work has been underway in India for years and is directly correlated to the technological advances that India's economic growth has engendered. Russia's economic re-emergence is also enabling it to upgrade its space capabilities and once again materialize as a formidable player in the cosmos. In the coming decade Russian oil and natural gas wealth is likely to continue the trend of double digit annual increases for the Russian space budget. With these revenue streams Russia is pondering a range of nuclear powered spacecraft, including military satellites, nuclear power plants, and space tugs.[2] All the while a veil of secrecy is falling over the Russian space program, which is being reconfigured in ways sure to cause difficulty for US geo-strategic designs.[3]

Yet however significant these advances may be, it is a booming China that is currently making the greatest strides in military technology for the medium of space. The 2007 Chinese direct ascent antisatellite (ASAT) test has been well documented and received much fanfare, as has their 2010 missile intercept in space. But in addition to these, the Chinese have invested in increasingly sophisticated space capabilities of a very serious nature. One of which is the Shenlong space plane,[4] another is their advances in quantum teleportation. Looming particularly ominous is the apparent Chinese effort to conduct an automated rendezvous of two spacecraft, Shijian-12 and Shijian-6F, in low Earth orbit. As there was no indication that this rendezvous was connected to China's manned space program, the prospect has been raised that the exercise might be an effort to develop satellite inspection and ASAT capabilities.[5]

That China is now proliferating such platforms and conducting such operations is evidence that the military technical gap between the US and China is closing fast. What is more, China's space program is dominated by young aerospace engineers who could propel the nation's advancements past the US, which faces difficulty in replacing its aging aerospace work force.[6] And although American military officials may not be believe that China has mastered the command, control, communications, computers, intelligence, surveillance, and reconnaissance to effectively employ an anti-ship ballistic missile, it is only a matter of time and resources before they do—two things of which China is undoubtedly long on. Indeed, China's economy has been growing at a 10 percent annual clip for decades. If the trend holds, eventually China's economy will grow so large that the Chinese will have more resources than the US to invest in space. When this scenario finally occurs, the US will be permanently disadvantaged not only in the medium of space but in all military theatres.

In the face of this challenge the American economy is stagnating, causing US Treasury revenues to falter. As a result, stewardship of the national space program is less a question of political philosophy for the Obama administration, and more a question of resources. Given the dire economic challenges facing the US, other national economic programs have become a much higher priority than the national space program. A direct consequence is considerable pressure on the budgets of both NASA and the Air Force. As such, NASA and the Air Force are likely to face unpleasant budget cuts to their most prized programs in the future.

What is more, China's space program is dominated by young aerospace engineers who could propel the nation's advancements past the US, which faces difficulty in replacing its aging aerospace work force.

The space policy announced by the Obama administration in the summer of 2010 seeks to energize domestic industries as a means of multiplying a national space effort that would otherwise be constrained by a lack of government resources. A significant portion of the policy was devoted to commercial space guidelines ranging from government use of commercial capabilities to the development of prize competitions.[7] The major difference with previous policies is that the new policy

By itself, the policy of encouraging the private sector to play a greater role in space is a prudent one, as true space power must be more than a mere institution, it must be based upon the character and pursuits of a people and run to the core of their national life.

allows for some degree of government investment in commercial space ventures through the "reasonable portion of the investment risk" clause. By comparison, the Bill Clinton space policy prohibited the use of direct federal subsidies. The Obama policy furthers public-private efforts such as NASA's Commercial Orbital Transportation Services program, where NASA is helping fund the development of new launch vehicles and spacecraft to transport cargo to the International Space Station (ISS).[8]

The Obama administration is steadily reducing the scope of both NASA and the Air Force's missions in space, instead relying more and more on the private sector for its national space effort. One example is the Obama administration's aforementioned preference for private sector transportation to the ISS, as opposed to undertaking the development of NASA spacecraft. The Obama administration is also considering outsourcing Earth monitoring applications as critical sensory capabilities for satellite systems such as the National Polar-orbiting Operational Environmental Satellite System and Geostationary Operational Environmental Satellite-R were cut during the Bush administration and adequate plans to replace them have been unforthcoming.[9] But of gravest concern is the issue of orbital debris. The process of removing orbital debris would be extremely significant to all military space activities as the platforms used to conduct such operations could be dually used in ASAT operations. Debris removal thus has major national security implications and there is little question that these operations should remain within the purview of the Air Force.

By itself, the policy of encouraging the private sector to play a greater role in space is a prudent one, as true space power must be more than a mere institution, it must be based upon the character and pursuits of a people and run to the core of their national life. However, a centralized effort in space on the part of both NASA and the Air Force is necessary in order to hasten the development of comprehensive capabilities critical for supporting future generations of space platforms. If government support for a national space program withers, cracks will appear in the blocks that future capabilities are built upon.

It is lamentable that the NASA commercial crew development arrangement is more accurately a reflection of a lack of government resources rather than the product of a burgeoning private sector space effort. Nevertheless, as the resources available to the Obama administration are inadequate for the maintenance of the US' edge in space, the national space effort is increasingly in need of greater initiative by the private sector. In lieu of a vigorous centralized space program, it is all the more imperative to continue pursuing policies that will stimulate the private sector and solidify the underpinnings of the nation's space power.

Regardless, the situation in space may unravel if the US economy continues to stagger. Should this disturbing economic trend persist, the US will be under significant threat, as the economic momentum of the East is allowing rival states to proliferate increasingly sophisticated space systems that could eventually surpass American space capabilities. In response to this emerging predicament the Obama administration has pursued a space policy with a more internationally cooperative and conciliatory tone than the previous space policy, which is unsurprising given the Obama administration's philosophical emphasis on multilateral international cooperation. The Bush space policy offered few specifics on international cooperation. The Obama policy, in comparison, broadens the scope of potential areas of cooperation to include navigation, space nuclear power, and space situational awareness.[10] Additionally, President Obama has "said the US will seek partners in space to improve and share environmental data, information leading toward disaster mitigation, and surveillance of space for debris."[11]

Still, it is very difficult to see how such a partnership would work in regard to China, as it would be too much of a security risk to involve China in any high-profile programs. In space, there is always a possibility for cooperation, particularly when it comes to scientific missions, but when it comes to applications-oriented or strategically important programs it is too difficult to cooperate with China because there is too much at stake.[12] A US partnership with India would be a different story altogether. The Obama policy will facilitate further US technology transfers to India in exchange for the use of Indian launch vehicles for US payloads. The Obama policy also explicitly mentions the potential for government to government agreements on transfers of sensitive technology. This will likely be the case for US-India cooperation in missile defense.[13]

In contrast with India, the new Obama policy has left Japan uncertain about the status and integrity of certain US space programs. Japan's close alignment with George W. Bush's vision of space cooperation and lunar exploration generated significant discussion in Japan about how to justify exploration of the moon. As it would happen, this was all in vain due to the cancellation of the Constellation program.[14] Nevertheless, Japan remains one of the preeminent space powers with whom future cooperation is highly desirable for the US.

Yet irrespective of any international overtures attempted to stabilize an increasingly precarious space environment, the US should not become complacent in the past performance and security of its space assets as the country's marginal economic prospects will surely constrain space development in future years. At the same time, the seemingly ever increasing economic prospects of Eastern states will allow more and more of them to proliferate space systems that will complicate the medium of space and even pose an outright threat to vital US

assets. It would be ideal if the US economy recovered and allowed the US government to provide full and unwavering support for a centralized national space program that would serve as the foundation for the private sector to build upon. However, the US government remains constrained by difficult choices between financing for the space program and other national initiatives. Therefore, the Obama administration is likely to continue pursuing policies that will seek to amplify the efforts of the private space sector in the hope that these will in turn multiply the total force of the national space effort.

Notes:

[1] Peter B. de Selding, "India Developing Means to Destroy Satellites," *Space News*, 4 January 2010, http://www.spacenews.com/military/india-developing-anti-satellite-technology.html.

[2] Staff writers, "Putin to Discuss Russian Space Program with Industry Officials," *Space Daily*, 20 July 2010, http://www.spacewar.com/reports/Putin_To_Discuss_Russian_Space_Program_With_Industry_Officials_999.html.

[3] Staff writers, "Back in the Space Race: Russian Revival Raises New Questions," *Space Daily*, 17 October 2007, http://www.spacedaily.com/reports/Back_in_the_space_race_Russian_revival_raises_new_questions_999.html.

[4] Richard D. Fisher Jr., "…And Races Into Space," *The Wall Street Journal*, 3 January 2008, http://online.wsj.com/article/SB119929971650862693.html.

[5] Dwayne Day, "This Space Intentionally Left Blank: The Limits of Chinese Military Power," *The Space Review*, 23 August 2010, http://www.thespacereview.com/article/1685/1.

[6] Becky Iannotta, "China's Space Capability Could Surpass US, Panel Warns," *Space.com*, 16 October 2008, http://www.space.com/missionlaunches/081016-sn-china-surpass.html.

[7] Jeff Foust, "A Change In Tone In National Space Policy," *The Space Review*, 6 July 2010, http://www.thespacereview.com/article/1660/1.

[8] Ibid.

[9] Alexis Madrigal, "US Climate Satellite Capabilities in Jeopardy," *Wired*, 2 June 2010, http://www.wired.com/wiredscience/2010/06/us-climate-sats/.

[10] Jeff Foust, "A Change In Tone In National Space Policy."

[11] "New US Space Policy Sets Global Agenda," *UPI*, 29 June 2010, http://www.upi.com/Business_News/Security-Industry/2010/06/29/New-US-space-policy-sets-global-agenda/UPI-33171277838907/.

[12] Peter J. Brown, "Asia Takes Stock of New US Space Policy," *Asia Times*, 16 July 2010, http://www.atimes.com/atimes/South_Asia/LG16Df02.html.

[13] Ibid.

[14] Ibid.

Mr. Trevor Brown (BA, Indiana University; MS, Nanyang Technological University, Singapore) is currently a PhD candidate at Auburn University with a focus on political, economic, and military strategy for the medium of space.

Eliminating the Alternatives: A Strategy for Aligning National Commitment and National Reliance in Space

Maj James E. Smith, USAF
Chief, Mission Area Architecting Branch
Policy and Integration Division
Requirements Directorate
Air Force Space Command
Peterson AFB, Colorado

By all indications, the US is the nation most dependent on its space systems. ~ Space Security 2010[1]

Introduction: The Inflection Point, Strategic Congruence, and Misperception of Choice

The nation's strategic reliance on space has reached an inflection point—a point at which strategy must be changed to avoid the risk of future decline.[2] The ever increasing relationship between space reliance and national security has driven the US to this point of inflection. Whereas only decades ago, space assets provided important but non-critical support to the development and execution of America's national policies, today space has become "inextricably woven into the fabric of … national security."[3] Achieving congruence between strategy and adopted level of reliance thus becomes critical to ensuring the future security of the nation.

Reaching consensus on a space strategy to best ensure the future security of the nation has not been an easy task, however. Absent an immediate threat, many, including author Mr. Michael Sheehan, argue a status quo cooperative space strategy will suffice: "It is preferable to maintain the current cooperative and non-weaponised space environment, since it meets all the US' requirements."[4] President Barack Obama's call to the nations of the world to "work together to adopt approaches for responsible activity in space" suggests the White House also finds status quo cooperative strategies preferable for maintenance of national security.[5] Others, including some senior military leaders, contend national security can best be maintained through decreased national reliance on space assets—thus reducing the impact should cooperation fail and others challenge that reliance.[6] A third less preferred and clearly less politically palatable option also exists—increase commitment to match reliance by achieving "command of space."[7]

Ironically, while theorists, politicians, and senior leaders continue to debate the nation's future strategic direction in space, the debate is, for all practical purposes, irrelevant. Despite the perception of available options, no true choice exists to be made. Electing to maintain the cooperative status quo is outside the nation's control and the opportunity to scale back the nation's space reliance is long past. Only one truly viable alternative exists for sustaining national security—full commitment to the command of space. Selection of this option, however, will never be driven by acceptance of the strategy's merits but rather through elimination of the viability of all other options. The required national command of space will not be achieved through rational, debate-driven selection of such a strategy as the best approach for sustaining national security. Instead, as other options are discredited, the nation will eventually realize command of space is the only option.

Approach: Selection through Elimination

Figure 1 provides a framework for assessing this dilemma and illustrates the methodology behind this approach. Assuming the nation has reached the notional inflection point, the question becomes: Along which path should the US elect to

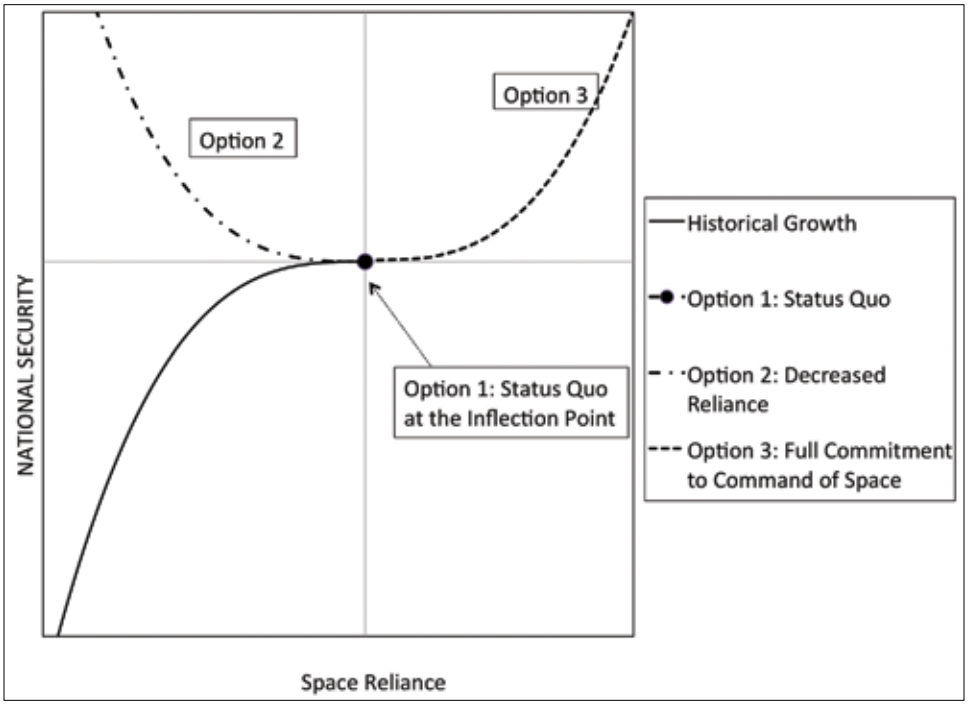


Figure 1. Options for national space reliance strategies.[8]

The fact that the US is now "more dependent on space than any other nation," greatly increases the benefit to be had by defection of another party and greatly weakens the viability of a continued national strategy founded upon cooperation.

move if it even elects to move at all?

Traditional responses to this strategic question have sought to defend motion along a specific path as more preferable than motion along alternative paths. Such approaches have two fundamental shortcomings. First, arguing the comparative merits of one option against the others rapidly devolves into an irresolvable opinion contest. Second, such approaches assume viability of motion in all directions. By arguing neither lack of movement (the status quo) nor movement into the upper left quadrant (decreased reliance) exist as feasible alternatives for sustaining current levels of national security, this approach overcomes these shortcomings and highlights command of space as the only viable option for selection as the nation's space strategy.[9]

The Status Quo

As Sheehan suggests, the "preferable" solution would be to maintain the status quo—a "cooperative and non-weaponised space environment."[10] The nation has postured itself at the forefront of world power through decades of increasing reliance on space. While for many states, space exists as a "crucial force multiplier," for the US, space usage has gone "well beyond this and (become) a force enabler."[11] Importantly, this increasing reliance on space and associated power gain were achieved through a cooperative strategy in space. If such a cooperative strategy worked in the past, why has it lost viability now?

The theory of realism explains the relative success of cooperative strategies to date. Under the premises of this theory, states are self-interested actors pursuing their own interests in an anarchic international environment.[12] Cooperative space strategies worked in the past because such cooperation was in the best interest of the states involved—primarily the US and the Soviet Union. Sheehan concludes, "Space cooperation appeared because it ultimately came to be seen as serving the newly emerging interests of both countries."[13] Similarly, Professor Everett Dolman argues, "It is difficult to isolate a single case of cooperation … without finding a basis in competition."[14] In the end, cooperative strategies succeeded because those cooperating perceived a benefit in continuing to do so.

Building on this notion, cooperative strategies contain inherent risk that other parties will defect if greater benefits can be had through non-cooperative methods, even in space. As Mr. John J. Klein suggests, "World history indicates that states with significant interests will protect their interest no matter where they lie."[15] The fact that the US is now "more dependent on space than any other nation," greatly increases the benefit to be had by defection of another party and greatly weakens the viability of a continued national strategy founded upon cooperation.[16] If another nation could best achieve its interests through defection from the existing international space regime, national reliance on a cooperative strategy would do little to stop them. More importantly, a decision by the US to maintain the status quo would be rendered irrelevant, and the resultant collapse of the cooperative regime clearly outside the nation's control.

Decreased Reliance

If the US cannot choose to eliminate the possibility of another nation's defection, perhaps the national space strategy should instead focus upon decreasing space reliance—thereby mitigating the consequences should a defection occur. Unfortunately, just as with status quo strategies, the option to decrease reliance is beyond the nation's control. Decades ago reversal of the nation's reliance might have been a possibility, but the growth in the "range and pervasiveness" of activities in space has resulted in a demand which cannot be reversed.[17] As former Under Secretary of the Air Force, Mr. Peter Teets, correctly surmised, "Having come to rely on the unhindered use of space, Americans will demand no less in the future."[18]

Thomas P. Hughes's concept of technological momentum best explains the inability of the nation to choose to back away. Hughes argues that after "prolonged growth," technological systems acquire momentum.[19] This momentum is the result of "organizations and people committed by various interests to the system."[20] As vested interests and technological growth combine, control over the technological development weakens to the point that the technology itself appears to be "autonomous"—the vested interests become too large to counter.[21]

Such is the fate of space today. Independent of any perceived national choice to the contrary, vested interests cannot be overcome. Most noticeable are the interests of the military: "Practically every piece of information used by the … military today is either derived from or transmitted through space."[22] This reliance extends beyond "the strategic level of planning … down to the operational and tactical level warfighters" creating a vast pool of vested interests.[23] If members of this pool were limited to the military, perhaps a reversal of demand would be a possibility. However, as Klein highlights, space-based technologies have "enter(ed) homes, businesses, schools, hospitals, and government offices" creating vested interests across every aspect of national life.[24] The resultant momentum has turned space into a "military and economic center of gravity" from which backing away is no longer a possibility.[25]

The Risk of Commanding Space

If the nation is unable to mitigate the consequences of a defection by either backing away from its reliance on space or by controlling the probability of another's defection, it is

left with only one option whereby the risk to its "vital national interest(s)" in space can be mitigated.[26] The only truly viable choice the nation can make to preserve current security levels is to match commitment to space with the nation's ever increasing reliance—that is, strive for command of space. Why then has the nation failed to act in this direction?

Paradoxically, in mitigating the risk of defection, a new and potentially greater risk is introduced in the form of destruction of the domain, itself. Seemingly more so than other domains, space is fragile. As a result, "deployment of certain technologies into this…environment" may result in what Dr. James C. Moltz terms "negative security implications."[27] In short, introduction of the wrong kind of weaponry into the domain may result in the destruction of the domain for anyone's use.

The risk of a command strategy resulting in decreased security drives a reluctance to vary from the status quo. Leaders who have "generally acted to protect the space environment in order to preserve their continued use of space" are understandably reluctant to perturb the current state of affairs if doing so might threaten that environment or its continued use.[28] Until the risk of doing nothing outweighs the perceived risk to the environment from taking action, these leaders and the vested interests they represent will continue to hedge their bets with the mantra that space is "too valuable to be used for war."[29]

Resolving the Dilemma

How then is the US to proceed? Decreasing reliance is not viable. A status quo cooperative strategy may be overcome at any time through the actions of another. The only choice the nation can realistically make—pursuing full command of space—is viewed as a choice too risky to be made. Is acceptance of decreasing national security the only foreseeable outcome?

Fortunately, the future is not necessarily inevitable national decline. Built upon the preceding analysis, the following strategy would overcome the continued reluctance and lead to national acceptance of full commitment to the command of space.

- *Eliminate fragility concerns by strongly committing to strategies that protect both the national space assets and the space domain:* The "manner in which weapons are deployed" shapes the risk inherent in command strategies.[30] Reduce risk by pursuing command strategies that are not based upon environmentally threatening weapons. Openly highlight this decision and induce others to join a new regime founded upon eliminating domain-harming space weapons. As Dolman suggests, make seizing military control of low Earth orbit a priority, thereby controlling entry to space and significantly reducing the impact if other nations persist in attempts to violate the new regime.[31]
- *Cease attempts to publicly justify command of space strategies:* Full command of space will not result from deliberate adoption of such a strategy, but rather through a realization that no other viable options exist. Discussions of "unilateral space dominance" only cause opposition to surface, further delaying movement in the needed direction.[32] Highlight the current failure of other strategies rather than seeking to justify the theoretical future success of a command strategy.
- *Take advantage of the system's momentum to discredit decreased reliance strategies:* A belief that the nation can elect to reduce reliance on space will persist until proven otherwise. Paradoxically, only through pursuit of such a strategy can this belief be discredited. In the short term, pursue a full spectrum of alternative solutions to space capabilities, thereby inducing parties with vested interests to clamor against the implications of such a strategy. Use the momentum of the system to discredit decreased reliance strategies and allow movement in the direction the nation needs, but will not elect, to go.
- *Bringing all defections out of obscurity thereby eliminating the perceived viability of the cooperative regime:* Discontinue standard operating procedures which continually cloak other nation's defections in varying layers of security. Acknowledge the fact that space is already a contested environment. Failing to highlight this fact as often and broadly as possible allows opponents of the command strategy to perpetuate the façade that continued cooperation is a viable national choice. Sheehan suggests elimination of the façade—a "decision to cross the threshold"—is most likely to be "contingent on the actions of other states."[33] Ensure other states' actions, especially defections, are widely known, thereby eliminating the viability of continuing cooperative strategies and accelerating the decision to "cross the threshold."[34]

Conclusion

Achieving command of space through purposeful elimination of all other options as outlined in the steps above is, admittedly, a non-traditional approach. Some will likely even frame such an approach as deceitful or disingenuous. If a command strategy cannot stand on its own merits, they will contend, it should not be pursued. Unfortunately, with so much at risk, there is much to lose in continuing the incessant debate. If national success is to continue beyond the current inflection point, all other potential strategies must be rapidly discredited both in practice and in theory. "The American people have a narrowing window of opportunity," correctly claims Moore.[35] Not, however, a narrowing window for ensuring "space remains a domain free of conflict," as he insists.[36] Rather, the window

Leaders who have "generally acted to protect the space environment in order to preserve their continued use of space" are understandably reluctant to perturb the current state of affairs if doing so might threaten that environment or its continued use.

If national success is to continue beyond the current inflection point, all other potential strategies must be rapidly discredited both in practice and in theory.

is closing on continued national security. Before the window closes, the nation must seize upon command of space—not because it is the best choice but because it is the only one.

Notes:

[1] Spacesecurity.org, *Space Security 2010*, (Kitchener, Canada: Pandora Press, 2010), 121.

[2] The term "Strategic Inflection Point" was coined by Andy Grove of Intel to describe the period of change that affects an organization's competitive position: http://dictionary.bnet.com/definition/strategic+inflection+point.html.

[3] Michael Sheehan, *The International Politics of Space, Space Power and Politics* (New York: Routledge, 2007), 117.

[4] Ibid., 19.

[5] President Barack Obama administration, *National Space Policy of the United States of America*, White House, 28 June 2010, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

[6] Michael Hoffman, "Schwartz Warns Against Dependence on GPS," *Air Force Times*, 25 January 2010.

[7] John J. Klein, *Space Warfare: Strategy, Principles, and Policy, Space Power and Politics* (London ; New York, NY: Routledge, 2006), 60.

[8] Source: Author's original work. Note these curves are intended simply to highlight the family of possible relationships between each option's reliance on space power and the resulting impact on national power. An infinite number of sub-options would drive changes to the specific parameters of each curve (slope, curvature, etc.) but the general relationship between space reliance and national power would remain the same. The specific parameters of each curve are therefore deemed irrelevant to this strategic level analysis.

[9] Note that two other options also exist—movement back into the bottom left quadrant (i.e., decreased reliance and decreased national security) or movement into the bottom right quadrant (increased reliance but decreased national security). It is assumed that nation states are rational actors whose sole purpose is to ensure the state security. Purposefully electing to take action that weakens national security would run contrary to this purpose and therefore these options are not extensively addressed.

[10] Sheehan, *The International Politics of Space*, 19.

[11] Ibid., 108.

[12] Kenneth Neal Waltz, *Theory of International Politics* (Boston, MA: McGraw-Hill, 1979), 88, 95, 113.

[13] Sheehan, *The International Politics of Space*, 63.

[14] Everett C. Dolman, *Astropolitik: Classical Geopolitics in the Space Age, Cass Series--Strategy and History* (Portland, OR: Frank Cass, 2002), 173.

[15] Klein, *Space Warfare: Strategy, Principles, and Policy*, 42.

[16] Ibid. 7.

[17] Ibid., 35.

[18] Sheehan, *The International Politics of Space*, 120.

[19] Thomas P. Hughes, "The Evolution of Large Technological Systems," in *The Social Construction of Technological Systems : New Directions in the Sociology and History of Technology*, ed. Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch (Cambridge, Mass.: MIT Press, 1987), 76.

[20] Ibid., 76.

[21] Ibid., 76.

[22] Sheehan, *The International Politics of Space*, 92.

[23] Klein, *Space Warfare: Strategy, Principles, and Policy*, 7.

[24] Ibid., 7.

[25] Gen Richard B. Myers, quoted in Mike Moore, *Twilight War: The Folly of US Space Dominance* (Oakland, CA: The Independent Institute, 2008), 45.

[26] Sheehan, *The International Politics of Space*, 94.

[27] James Clay Moltz, *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests* (Stanford, CA: Stanford Security Studies, 2008), 65.

[28] Ibid., 46.

[29] Ibid., 126.

[30] Klein, *Space Warfare: Strategy, Principles, and Policy*, 145.

[31] Dolman, *Astropolitik: Classical Geopolitics in the Space Age*, 157.

[32] Moore, *Twilight War: The Folly of US Space Dominance*, 96.

[33] Sheehan, *The International Politics of Space*, 123.

[34] Ibid., 123.

[35] Moore, Twilight War: The Folly of US Space Dominance, xvi.

[36] Ibid., xvi.

Maj James E. Smith, USAF (BS, Astronautical Engineering, US Air Force Academy; MS, Aeronautics and Astronautics, Massachusetts Institute of Technology; MA, Airpower Art and Science, US Air Force School of Advanced Air and Space Studies) currently serves as chief, Mission Area Architecting Branch, Policy and Integration Division, Requirements Directorate, Air Force Space Command (AFSPC). In this position he is responsible for the development, standardization, and integration of requirements architectures across the entire spectrum of AFSPC space and cyber capabilities.

Major Smith entered the Air Force as the top graduate of the US Air Force Academy in 1997. A core developmental engineer, his subsequent career spans space acquisition, operations, and staff positions across the military, intelligence, and joint communities. Previous assignments include: chief, Space Operations Division and later, assistant operations officer, Space Operations Squadron, Aerospace Data Facility-Colorado, Colorado; chief, Space Control Demonstration Operations Flight and later wing executive officer, Space Superiority Systems Wing, Los Angeles AFB, California; and chief, GPS Spacecraft System Analysis, 2nd Space Operations Squadron, Schreiver AFB, Colorado. Major Smith is a 2003 graduate of the Air Force Intern Program and a 2010 graduate of the Air Force's School of Advanced Air and Space Studies.

Administering the 2010 National Space Policy: Lessons from History and Recommendations for the Future

Capt Albert C. Harris, III, USAF
Chief, Special Events Team
Combat Operations Division
614th Air and Space Operations Center and
Joint Space Operations Center
Vandenberg AFB, California

This article will describe how the architecture and continuous evolution of the US space program enabled the new 2010 National Space Policy (NSP). It will also display some of the challenges that stood in its way. The challenges were vast, and few in 1958 thought that after the Cold War, two world powers and adversaries would stand together in a relatively strong partnership for the peaceful use of space. The evolution of US space policy facilitated this cooperation, and understanding how this unfolded requires a brief review of the foundational structure that produced the government architecture for space. This article will provide recommendations for both the civil, and the military space programs. It will recommend that improving Air Force space doctrine, as well as commercialization of key mission areas, will better enable the objectives of cooperation and freedom in space, as set out in the 2010 NSP.

EVOLUTION OF US SPACE POLICY

Building the Architecture for the US Space Program

The National Astronautics and Space Administration (NASA) act of 1958 laid the architecture for the US civil space program. The objective for this newly established architecture advocated for the peaceful use of outer space, yet, it was not that the US chose to pursue space for peaceful purposes; it was chosen for them.[1] For instance, a Soviet bomber crossing US air space would undoubtedly provoke war; however the launch of Sputnik by the Soviets and its relatively unchallenged orbit over the US, set a precedent that displayed acceptance of satellite over flights. This lack of over flight restrictions, among other things, catered to the interests of both nations as one could freely look down on the other from space. This enabled the concept of freedom in space. However, even though NASA was leading the peaceful use of space for the US, the security dilemma of the Cold War publicly placed NASA at the front lines in terms of conflict with the Soviets.

The space architecture for both the US and the Soviets were accelerated by the Cold War security dilemma. In 1978 Robert Jervis wrote, "Many of the means by which a state tries to increase its security decrease the security of others."[2] In the Cold war, the US and the Soviet Union used propaganda as ammunition to bolster one nation's security over another. As one nation obtained the upper hand in space exploration, the other felt politically and militarily vulnerable. The security dilemma fueled threats against the national interests of both the US, and for the Soviets, which in turn fueled the urgency to mature their respective space programs.

Fortunately, as NASA obtained a significant upper hand on the Soviets by leading the US space program to the moon, the security dilemma did not prevent the Soviets from cooperating in space. With the leadership of the US, the international community, including the Soviets, agreed on the 1967 Outer Space Treaty.[3] This set the foundation for international cooperation in space. Subsequently, President's John F. Kennedy, Lyndon B. Johnson, and Richard M. Nixon led continuous negotiations with the Soviets, as evident in the president's respective national security memorandums outlined in table 1. Despite negotiations and movements toward cooperation in space, the Soviets were still

President	Selective Space Policy Initiatives	Significance
Eisenhower	NASA Act of 1958	Established NASA
Kennedy	US - USSR cooperation (national security action memorandum [NSAM] 129, 156, 172, 183, 192, 271)	Emphasized disarmament and cooperation in space with the Soviet Union, and paved the way for the Outer Space Treaty
	Project MERCURY manned space flight (MA-9) (NSAM 237)	Presidential authorization for space vehicle and astronaut recovery in foreign territorial waters
Johnson	US - USSR Cooperation (NSAM 285)	Emphasized disarmament and cooperation in space with the Soviet Union
	Review of alternative communications, navigation, missile and space tracking, and data acquisition facilities (NSAM 300)	The president expresses concern on US/allied space/missile tracking facilities on foreign soil with unstable governments
	Policy concerning US assistance in the development of foreign communications satellite capabilities (NSAM 338)	Policy statement regarding the use of the Defense Satellite Communications System
Nixon	US - USSR cooperation (national security decision memorandum [NSDM] 70)	Emphasized cooperation in space with Soviet Union
Ford	US-Japan space cooperation (NSDM 306)	Paved path toward strong relationship between US and Japan in regards to space
	Enhanced survivability of critical US military and intelligence space systems (NSDM 306)	US policy response to Soviet ASAT programs
	US anti-satellite capabilities (NSDM 345)	US policy response to Soviet ASAT programs

Table 1. Presidential space policies from Eisenhower to Ford.[4]

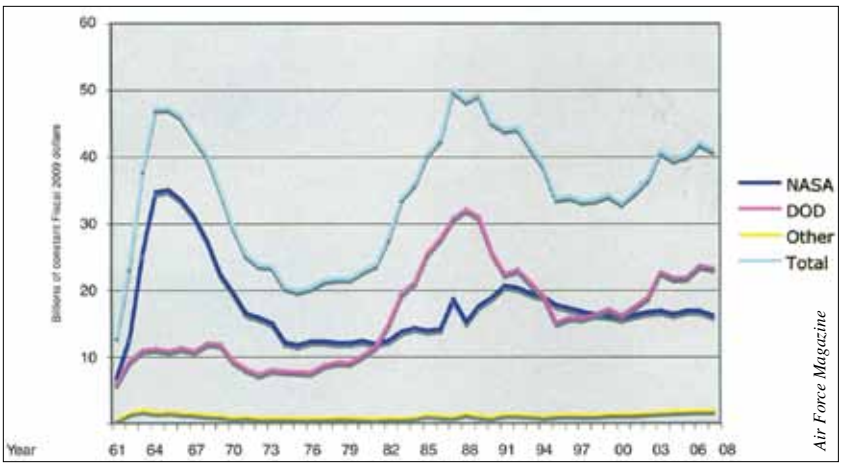


Figure 1. Space Budgeting.[5]

a military threat, as evident in President Gerald Ford's response to Soviet antisatellite ambitions. Therefore, the US shifted its focus from space exploration, and focused on the architecture of its military space program.

Although the NASA act of 1958 established the architecture of the civil space program, the architecture of military space developed in the shadows of NASA. Consequently, positions on cooperation in space from NASA overshadowed military leaders who advocated for improving military space capabilities. In his 1961 speech to congress, General Bernard A. Schriever testified; "I think we have been inhibited in the space business throughout the "space for peace" slogan."[6] His concerns, which were true for other military leaders as well, would spur debate as the Air Force frantically argued for more funds to enable a more effective military space program.

Figure 1 complements the frustrations General Schriever spoke of in the 1960s. During the incredibly expensive Apollo program, the majority of the space budget went toward NASA. As the Apollo program came to a close, the bubble in NASA's budget decreased as the US shifted its focus on its military space architecture. This increase in funding for the Department of Defense (DoD) enabled acquisitions of new military space systems. In order to bolster the effectiveness of military space, DoD needed a service to lead the acquisition of those new space systems.

Twelve years after the establishment of NASA in 1958, DoD directive 5160.22 established the Air Force as the lead agent for space development, procurement, and deployment. This helped to shift the majority of the space budget from NASA and to DoD.[7] Although it was rescinded in the 1970s, the directive bolstered research and development for military space programs, and advocated for Air Force leadership in space. With the Air Force now leading the military space program, and NASA leading the civilian space program, it became clear that over arching policy was needed to more efficiently administer US initiatives in space. President Jimmy Carter was the first to develop this over arching policy, linking the two competing space programs, and establishing the first comprehensive NSP.

Toward the end of the Cold War, President Carter implemented several initiatives that resulted in considerable changes in the US Space Program. Table 2 displays some of those initiatives. In March of 1977, President Carter wrote a top secret (now declassified) Presidential Review Memorandum to his National Security Council:

> "I am concerned that the US does not have a coherent NSP guiding our civil, military, and national intelligence space programs. I, therefore, direct that the Policy Review Committee thoroughly review existing policy and prior efforts, and formulate a statement of overall national goals in space, the principles which should guide US government and private use of space and related activities"[8]

Less than a year later, President Carter published the first comprehensive space policy of the US, combining the architecture of the civil, and military space programs into one overarching policy focusing on cooperation and freedom in space. The president then expanded on the newly established policy to complement the direction of civil space operations. The principals of cooperation and freedom in outer space remained relatively consistent throughout future iterations of the NSP. As illustrated in table 3, US presidents succeeding Carter continued to mature the direction of the US space program.

The evolution of space policy continued after the Carter administration. Through his National Security Decision Directives, President Ronald Reagan issued over 10 directives dealing with space. President George H. W. Bush continued some of Reagan's space initiatives but replaced the disbanded National Aeronautics and Space Council—which helped shape space policy from the inception of the NASA Act until 1973—with the National Space Council. The National Space Council enabled President Bush to issue space policy through NSP directives which mainly focused on issues with the space launch industry. However, President Bill Clinton disbanded the National Space Council and absorbed its functions in the National Science and Technology Council which issued numerous Presidential Decision Directives during his administration. Finally, President G. W. Bush refined the US space program even further through his National Security Presidential Directives, expanding on policies set forth by Clinton.

With presidential leadership, the US space program maintained its commitment toward cooperation. Tables 1, 2, and 3 are not all inclusive, but display how the US space program matured since President Dwight D. Eisenhower. Many events such as the Cold War, and new space technologies drove US presidents to continuously mature its civil space program. Likewise, military leaders adapted to presidential guidance on space and established military doctrine to meet the overall objectives of the NSP. US commitment toward cooperation in space was challenged by

President	Selective Space Policy Initiatives	Significance
Carter	National space policy (Presidential Directive [PD] 37)	First major comprehensive US space policy
	Civil and further national space policy (PD 42)	Elaborated on civil space policy
	Civil operational remote sensing (PD 54)	Set guidelines for civil remote sensing operations

Table 2. Space Policies by President Carter.[9]

President	Selective Space Policy Initiatives	Significance
Reagan	Space Transportation System. (National Security Decision Directive [NSDD]-8)	Established policy for the space shuttle
	National space policy (NSDD 42)	Comprehensive space policy
	Commercialization of Expandable Launch Vehicles	Policy on commercial use of military launch systems, and advocated for commercial launch vehicles
	National space policy (NSDD 293)	Comprehensive space policy
Bush	National space policy directives and charter (National Security Directive [NSD] 30/National Security Presidential Directive [NSPD]-1)	Comprehensive space policy
	Commercial space launch policy (NSPD-2)	Policy for international commercial launch activities
	US commercial space launch policy guidelines (NSPD-3)	Policy for domestic commercial launch activities
	National Space Launch Strategy (NSPD-4)	Comprehensive guidelines for the US launch industry
Clinton	National space transportation policy (Presidential Decision Directive/ National Science and Technology Council [PDD/NSTC] 4)	Focused on improving launch capabilities and gave permission for federal agencies to use international launch services
	National space policy (PDD/ NSTC 8)	Comprehensive space policy
G.W. Bush	US space exploration policy (NSPD 31)	Established policy for revisiting the Moon, in preparation for the exploration of Mars
	US space transportation policy (NSPD 40)	Significantly expanded and updated NSTC-8
	National space policy (NSPD 49)	Comprehensive space policy

Table 3. Space Policies from Presidents Reagan through G. W. Bush.[10]

the security dilemma of the Cold War. The task at hand now is to continue to solidify that commitment, a challenge President Barack Obama will have to endure.

CHALLENGES AND RECOMMENDATIONS FOR ADMINISTERING THE 2010 NATIONAL SPACE POLICY

Solidifying Cooperation: Building a Robust US Commercial Launch Industry

One of the many ways to display cooperation in space is to successfully launch satellites of other nations. If a nation can trust another with a multi-million dollar investment, then that display of trust inherently shows a commitment for cooperation. Although President H. W. Bush's launch strategies in the 1990s attempted to prevent it, the US had a relatively slow start in the commercial launch industry. This is not because the US lacks commitment on cooperation, but because policy has been slow to effectively address commercial launch activities, as evident by the history of US commercial launches. Despite efforts of past presidents, it has been unsuccessful in leading commercial launch activities on the international scale.

Even though the US is a leader in the overall commercial space industry, there is definite room for improvement, as illustrated by figure 2. For instance, the Russians are capitalizing on US dominance in commercial satellite manufacturing by launching the majority of those commercial satellites; generating approximately $742 million in revenues in 2009 for Russia, as compared to $258 million in revenues in the 2009 for the US.[11] In 2009, the US executed 24 launches with only four transporting commercial satellites. At the same time, the Russians executed 29 launches with 10 being commercial satellites. Many of the launches in Russia transported US owned commercial payloads.[12] The majority of space launches in the US are military or US government owned. Although many US military, or government satellites can be used for commercial purposes such as the GPS, one cannot help to notice the irony in the fact that the Russians launch a considerable amount of commercial satellites with American companies being a major customer.

Fortunately, Russian success in the commercial space launch industry does not spark Cold War like security concerns. In fact, it bolsters cooperation as it is in the best interest of both nations. Therefore, the evolution of US space policies has relatively solidified cooperation between the once cold war rivals. It is well known that the US and Russia are space partners not only in the commercial space sector, but also in human spaceflight. The US should bolster its commercial space sector, and become the new leader in commercial launch activities. The 2010 NSP advocates for this. Thus, the computation of these facts leads to the first recommendation.

Recommendation #1: The US should continue its commitment for cooperation in space, and bolster its commercial space launch sector.

In order to help promote its values and principals toward freedom in space as outlined in the 2010 NSP, the US should bolster its commercial space launch sector. One of the many possibilities of doing so is by increasing commercial launch activities within the US. In other words, America needs to promote a "launched in the USA" strategy to gain leadership in the global commercial launch industry. Although US commercial launch activates are increasing as new companies such as the Space Exploration Technologies Corporation enter the arena, the US is still far behind the commercial launch activities of the Russians. As figure 2 displays, the Russians are launching a significant number of US commercial satellites, therefore the US needs to seek out the leadership role as it has in many other sectors in the space industry.

Unfortunately, as the US increases its space activities, history would suggest that the security dilemma could once again surface. This may not be the case between the US and Russia. However it could be the case between the US and space faring nations who do not completely adhere to the principals of cooperation. If the US policy worked with the US's most formidable competitor during the Cold War, then it should work with any nation capable of reaching space today. Nonetheless the security dilemma is real, and military administrators of space policy should codify lessons learned throughout history, in the pursuit of protecting the peaceful use of space.

Keeping Up with Policy; Maturing Military Space Doctrine

The continuous evolution of US space policy posed a challenge to the military space program. With its new leadership role

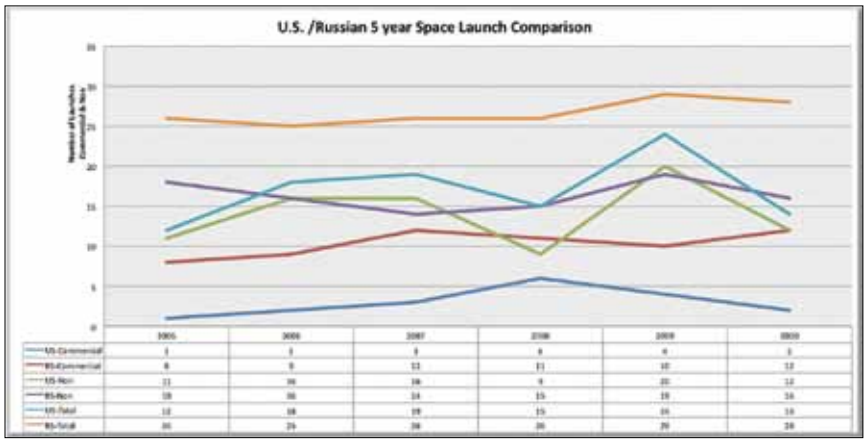


Figure 2. US/Russian Launch Comparison as of 1 December 2010.[13]

in military space, the Air Force was slow to codify and evolve its plan to support US space initiatives. The Air Force's plan to lead the US space program, its space doctrine, are sets of beliefs and principals that provides guidance toward achieving the objectives of the US space program. After the publication of DoD Directive 5160.22, it took the Air Force 12 years to publish Air Force Manual (AFM) 1-6, its first doctrine document dedicated solely to space. When AFM 1-6 was rescinded, it was replaced with Air Force Doctrine Document (AFDD) 4 which was eventually renumbered as 2-2, Space Operations. The next major change to space doctrine occurred when a draft of joint space doctrine, Joint Publication (JP) 3-14, was released in 1999, and then published in 2002. JP 3-14 was the first of its kind in joint doctrine. Its influence facilitated the expansion of AFDD 2-2 to AFDD 2-2.1, Counterspace Operations which was initially published in 2004. In late 2010, AFDD 2-2 and AFDD 2-2.1 where renumbered to AFDD 3-14 and 3-14.1 respectively.

DoD's establishment of joint space doctrine was a major step in evolving the military space program. Since then, JP 3-14 has evolved as it was revised in 2002, then revised again in 2009.[14] As far as Air Force space doctrine, it too evolved as AFDD 3-14 was published again in 2001 and 2006.[15] However, the 2010 NSP states that DoD must "develop and implement plans, procedures, techniques, and capabilities necessary to assure critical national security space-enabled missions."[16] As evident by the continuous evolution of JP 3-14, DoD has shown leadership in its plans, procedures, and techniques for space operations. As DoD's executive agent for space, the Air Force has been slow to mature its plan to respond to threats in a multi-polar space world. Its doctrine for counterspace operations AFDD 3-14.1, which details space warfighting responsibilities, has not been significantly updated since its introduction in 2004.[17]

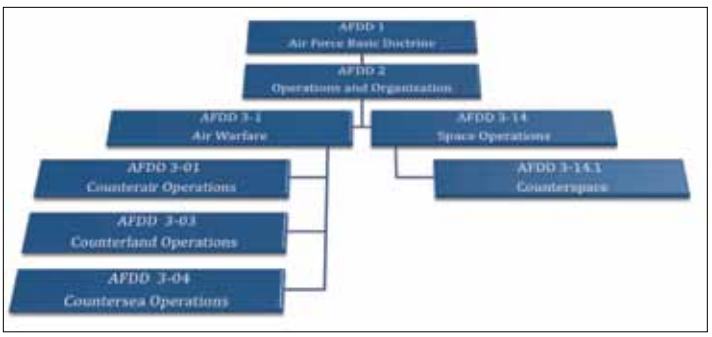


Figure 3. Current US Air Force air doctrine.

Air Force counterspace doctrine was published to display the Air Force's plans, procedures, and techniques in accomplishing the objectives laid out in President Clinton's 1996 NSP. It is difficult to imagine that the plans, procedures, and techniques have remained the same seven years later. AFDD 3-14.1 as it stands does not incorporate major changes in the machinery of military space policy such as the establishment of a Joint Functional Component Command for Space, nor does it address best practices laid out in the 2006 AFDD 3-14, or the 2009 JP 3-14. Although AFDD 3-14.1 provides a solid doctrinal base for counterspace operations, it fails to adequately address the current operational art of current counterspace operations.

When comparing the operational art of space operations with that of air operations, one could not initially come to the conclusion that the Air Force clearly defines and codifies its beliefs in terms of space doctrine. AFDD 3-14.1 specifically discusses the space mission areas of space control, space support, space force application, and space force enhancement. However, when compared to air doctrine, the Air Force uses an entire document to present each of the principals and beliefs of air operations. This figure displays the challenges the Air Force faces with space doctrine. Granted, air operations have been around for a long time, but space operations have evolved at an incredible pace. It is interesting that joint space doctrine, along with baseline Air Force space doctrine, has relatively kept up with frequent changes in space policy; but the doctrine for the employment of space forces has not. This leads to the last recommendation.

Recommendation #2: In order to defend freedom and cooperation in space, and as DoD's executive agent for space, the Air Force must rethink how it codifies the operational art of space operations.

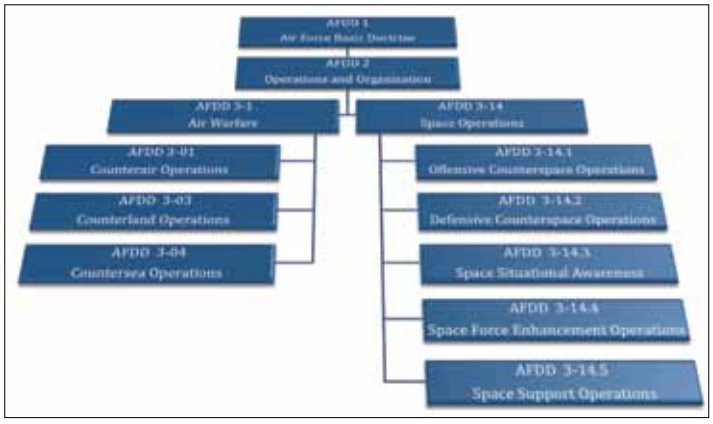


Figure 4. Proposed US Air Force space doctrine.

Air Force space doctrine needs to be reconsidered not to mirror the complexities of air doctrine, but to enable more complete thought in the principals and procedures of the space mission areas as outlined in NSP, and to accurately portray the current operational art of space. First, the Air Force must consider how it employs space operations, and the lessons learned throughout the

years while space policy has evolved. These lessons and codified beliefs should be incorporated into overarching space operations doctrine, AFDD 3-14. Furthermore, instead of lumping and quickly addressing counterspace in one document, the Air Force should codify its lessons learned, and update its beliefs and principals of counterspace in three separate doctrine documents, adequately addressing the updated operational, conceptual, and legal considerations of, offensive counterspace operations (AFDD 3-14.1), defensive counterspace operations (AFDD 3-14.2), and space situational awareness (AFDD 3-14.3). Finally, the Air Force must consider codifying lessons learned from years of employing space forces in support of the war-fighter in one doctrine document (AFDD 3-14.4), and the years of space support operations in another (AFDD 3-14.5). With these changes, the Air Force can better prepare its forces for the challenges posed in a new multi-polar space environment, and better lead the protection of the principals of the US space program.

CONCLUSION

The 2010 NSP incorporates many goals and principals of previous space policies, but despite challenges from new space faring nations, continues to display commitment for cooperation. From 1958 to 2010, US space policy matured while advocating American principals and goals in the peaceful use of outer space. Granted, the Cold War security dilemma fueled most of the mistrust between the US and Russia on space issues, the Cold War also proved that working toward cooperation in space can help mitigate these concerns and perceptions. The 2010 NSP advocates for commercialization, and promotes cooperation with current and new space faring nations as they successfully achieve orbit. A major step in doing so is by renewing its efforts in commercialization of key space missions, especially in the launch industry.

Since the Cold War, new competitors and allies in the pursuit of activities in space such as Europe, Canada, Japan, Israel, China, and many others, became space fairing nations. However, few of the new space nations do not play by the cooperative principals agreed by the once Cold War rivals. Since DoD directive 5160.22 placed the Air Force in a leadership role for space, it has been relatively slow to mature its counterspace doctrine as the Air Force overcame challenges presented by the new multi-polar space arena. In order to defend freedom and cooperation in space, and as DoD's executive agent for space, the Air Force must rethink how it codifies the operational art of space operations and update its space doctrine to more effectively lead DoD's future space efforts.

The combination of these two recommendations, one for the civilian space program, and one for the military, will help space professionals in administering the 2010 NSP.

Notes:

[1] United States of America, *The National Aeronautics and Space Act*, 29 July 1958.

[2] As cited in Richard K. Betts, *Conflict after the Cold War: Arguments and Causes of War and Peace*, 3rd ed. (Longman, August 2007), 312.

[3] Department of State, Outer Space treaty of 1967, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, http://www.state.gov/www/global/arms/treaties/space1.html.

[4] Federation of American Scientists, Presidential Directives and Executive Orders, http://www.fas.org/irp/offdocs/direct.htm.

[5] Tamar A. Mehuron, "2009 Space Almanac," *Air Force Magazine 92, no. 8* (August 2009): 54.

[6] David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership* (Washington: US Government Printing Office, 2002), 101.

[7] Benjamin S. Lambeth, "Mastering the Ultimate High Ground: Next Steps in the Military Uses of Space," RAND, 2003, 24.

[8] President Jimmy Carter, "A Coherent US Space Policy," National Security Council, Washington, DC, 28 March 1977, http://www.marshall.org/pdf/materials/836.pdf.

[9] Federation of American Scientists.

[10] Ibid.

[11] Federal Aviation Administration (FAA), "Commercial Space Transportation: 2009 Year in Review," January 2010, http://www.faa.gov/about/office_org/headquarters_offices/ast/media/year_in_review_2009.pdf.

[12] Ibid.

[13] FAA, 2009 Year in Review; FAA, "Commercial Space Transportation: 2008 Year in Review," January 2009, http://www.faa.gov; FAA, "Commercial Space Transportation: 2007 Year in Review," January 2009, http://www.faa.gov; FAA, "Commercial Space Transportation: 2006 Year in Review," January 2007, http://www.faa.gov/about/office_org/headquarters_offices/ast/media/2006YIR.pdf; FAA, "Commercial Space Transportation: 2005 Year in Review," January 2006, http://www.faa.gov; FAA, Semi-Annual Launch Report, May 2010. http://www.faa.gov; FAA, Semi-Annual Launch Report, October 2010. http://www.faa.gov

[14] Joint Publication 3-14, "Space Operations," 6 January 2009, http://www.dtic.mil/doctrine/jpoperationsseriespubs.htm.

[15] Air University, LeMay Center for Doctrine Development and Education, http://www.cadre.maxwell.af.mil/main.htm.

[16] *National Space Policy of the US of America,* 2010, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

[17] AFDD 2-2.1, "Counter Space Operations," 2 August 2004, http://www.dtic.mil/doctrine/jel/service_pubs/afdd2_2_1.pdf.

Capt Albert C. "AC" Harris, III, USAF (BA, Music, University of Kentucky; MS, International Relations, Troy University) is currently the chief of the Special Events Team, Combat Operations Division, 614th Air and Space Operations Center and Joint Space Operations Center (JSpOC), Vandenberg AFB, California. He currently leads a team responsible for the planning, execution, and combat assessment of atmospheric reentries, assured access, and foreign and domestic space launches worldwide in support of 14th Air Force objectives, and the Joint Functional Component Command-Space's (JFCC SPACE) operations support to US Strategic Command's objectives. As the subject matter expert for launch operations, he coordinates directly with NASA, worldwide space launch agencies, the intelligence community, and others to provide timely and accurate recommendations to the commander JFCC SPACE.

Captain Harris entered the Air Force in 2004 through University of Kentucky ROTC. His past assignments include deputy flight commander and missile combat crew commander for the 564th Missile Squadron, and weapons safety manager for the 341st Missile Wing, Malmstrom AFB, Montana. While assigned to the JSpOC, Captain Harris has served in many positions including space battle manager, team lead for space situational awareness (SSA) procedures/SSA operations instructor, deputy chief of JSpOC operations procedures, and chief of launch operations.

Captain Harris is a graduate of the Advanced Space Operations School's Advanced Orbital Mechanics Course, and is a doctorial student at Capella University studying public administration with an emphasis on space policy. He is scheduled to be published later this year in the *Air and Space Power Journal*.

National Space Policy: The Challenge of Implementation

Mr. Richard DalBello
Vice President
Legal and Government Affairs
Intelsat General Corp

Much of the response to President Barack Obama's newly-announced space policy has been focused on the administration's changes to NASA's human exploration program. Lost in the somewhat-emotional debate over the funding of human spaceflight has been the space policy's impact on the Department of Defense's (DoD) relationships with other space-faring nations and the commercial industry. The Obama space policy recognizes that as more and more countries develop space capabilities, the US government (USG)—and the DoD in particular—will need to play a stronger role in defining the rules for responsible behavior in space and strengthening international partnerships.

Space policies are not laws. Although they provide some guidance to agencies, they do not assign budgets, establish programs, or obligate Congress. They are, instead, written to be directional and aspirational, and, in a tradition that goes all the way back to President Dwight D. Eisenhower, serve to focus the nation's thinking about this one area of American expertise. Because of the holistic and ecumenical nature of space policy documents, they also tend to have a 'something for everyone' character that can be confusing and, occasionally, internally inconsistent.

The Obama policy articulates the administration's overarching vision for the future of the US space program. As expected, it provides support for exploration, national security, international cooperation and commercial activities. Overall, the new policy covers much the same ground, and in much in the same manner, as the presidential policies that have preceded it. But the Obama policy departs from its predecessors in a few key focus areas. In particular, the policy emphasizes that:

- ***The space environment is rapidly changing*** and these changes will require a corresponding change in our actions.
- ***Greater international cooperation is desirable***, including leveraging the existing and planned space capabilities of allies.
- ***"Responsible operations in space" are critical*** and this will necessitate improved information collection and sharing to avoid collisions and to protect critical space systems.
- ***The government should increase its reliance on commercial space activities*** and consider innovative approaches such as public-private partnerships, hosting government payloads on commercial spacecraft, and purchasing of data products.

This article concludes that the Obama policy adds an important new dimension to the nation's space policy dialogue but that significant work needs to be done to achieve the articulated goals. In particular, the calls for greater international cooperation, better data sharing, and increased reliance on the commercial sector have yet to be translated into significant programs or initiatives.

Focusing on the Need for Change

For decades, the US and the Soviet Union maintained a near total monopoly on access to and the exploitation of space. Now, many more countries have access to space and new transportation capabilities suggest that the number will continue to expand rapidly. Although vast, near-Earth space is ultimately a finite resource that must be managed. This is particularly true with respect to the more desirable orbits for communication and remote sensing. Radio frequency spectrum, long acknowledged by experts to be a scarce resource, has been under significant pressure lately to accommodate new terrestrial and space actors and applications. The Obama space policy embraces the belief that rapid and significant change in the space environment has created an urgent need for nations to work cooperatively together to ensure that the space environment is preserved for future generations.

The theme of change can be found in the space policy's introduction:

> The legacy of success in space and its transformation also presents new challenges. When the space age began, the opportunities to use space were limited to only a few nations, and there were limited consequences for irresponsible or unintentional behavior. Now, we find ourselves in a world where the benefits of space permeate almost every facet of our lives.… The now-ubiquitous and interconnected nature of space capabilities and the world's growing dependence on them mean that irresponsible acts in space can have damaging consequences for all of us.[1]

Since the release of the policy, the theme of change has been discussed frequently by administration officials. For example, when addressing the United Nations' Committee on Disarmament in July of 2010, Deputy Assistant Secretary of State Frank Rose said:

> "…the new space policy recognizes the transformation of the space environment as well as the evolution of our utilization of space … The transformation of the space environment also presents challenges. The interconnected nature of space capabilities and the world's growing dependence on them mean that

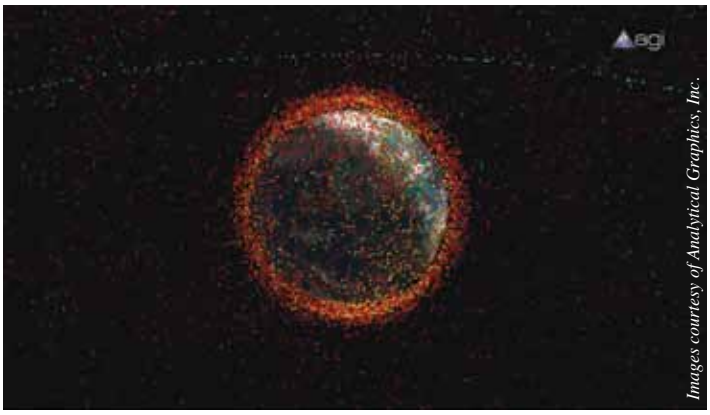


Figure 1. Tracked space debris in Earth orbit.

> irresponsible acts in space can have damaging consequences for all of us. Furthermore, decades of space activity have littered Earth's orbit with debris. As nations and commercial enterprises continue to increase activities in space, the possibility of another collision, increases correspondingly.[2]

In a similar vein, in December of 2009, the European Union issued a draft code of conduct for outer space activities which also is predicated on the assumption that space activities have grown sufficiently complex to warrant additional governmental attention.[3] The code was designed to encompass civilian and military uses of space. Key features of the text include a voluntary commitment to refrain from intentionally harming space objects; measures to control and mitigate space debris; and, mechanisms for cooperation and consultation. The European Union is now holding consultations to encourage other countries to embrace these principles.

Accepting that the space environment is undergoing a rapid transition, it is still unclear what steps countries and the international regulatory community should take in response. US and European officials seem to be taking prudent steps in initiating a broad, international dialogue about this issue while declining to suggest specific bureaucratic or international regulatory solutions. Like the 'rules of the road' that developed to govern the conduct of nations on the high seas, 'rules of the road' for space are best developed, over time, in response to real problems and with the guidance of long experience.

Enhancing International Cooperation

The Obama space policy calls for increased international cooperation and suggests that the US is open to the possibility of leveraging the space assets of allied nations. Today, it is routine for US forces to work and fight alongside the military forces of other nations. As illustrated by our actions in Iraq and Afghanistan, coalition operations in response to global challenges are increasingly becoming the norm. When deploying US forces with those of other countries, the interoperability of communication and information systems becomes a critical concern. Therefore, the "interdependence" of military and intelligence-gathering space systems would seem to be a logical goal. However, history has demonstrated that fostering space system "interdependence" is an exceedingly complex goal to implement. Developing processes to achieve international consensus and funding for select space systems, while maintaining operational constructs that do not constrain national freedom of action, is challenging indeed.

This is not the first time that this idea has been contemplated. Writing over a decade ago, in words that sound familiar, Deputy Under Secretary of Defense Robert Davis, said:

> International cooperative efforts offer a real chance to enhance interoperability, stretch declining defense budgets, and preserve industrial capabilities. The US Department of Defense thus is renewing its efforts at international cooperation. Cooperation can range from simple industrial subcontracting relationships to … bilateral and multilateral programs. It may also include: … operational standards and protocol agreements; basic science and technology research and development projects; product and data sharing; joint system operations; and personnel exchanges.[4]

The goals articulated by Under Secretary Davis were certainly worthy ones; however, the lack of progress on these goals over the last decade—even during a time of enhanced coalition warfare—is evidence of the complexity of their implementation.

Typically, concepts for space system interdependence seem most attractive when budgets are in decline. Recent global financial events, decades of deficit spending, and the cost of fighting multiple wars have placed a great strain on the US economy and defense budget. The defense budgets of our closest allies have also been under considerable strain. Over the next few years, the US and its allies will likely be challenged to do more with fewer resources. In this environment, there will be great pressure to find ways to cooperatively design, development, and acquire new defense space systems. The Obama space policy seeks to respond to this situation by suggesting that the US will seek to "leverage the existing and planned space capabilities of our allies."

Although this is certainly a worthy goal, it is likely to prove difficult to implement. First, savings from joint or multiagency programs are often hard to achieve because collaborative development programs are inherently more complex and often result in higher overall costs than independent projects. This fact was reinforced recently by a study by the National Research Council (NRC). The NRC concluded:

> Multiagency collaboration [is]… often intrinsically complex and, therefore costly, and … developing these missions typically results in additional complexity and cost. Advocates of collaboration have sometimes underestimated the difficulties and associated costs and risks of dividing responsibility and accountability between two or more partners; they also discount the possibility that collaboration will increase the risk in meeting performance objectives.[5]

Second, there is rarely perfect alignment between the strategic and operational objectives of international partners. To date, the US has taken the global leadership role in developing and deploying new military communication and imagery technology. These development programs have been in support of,

and have fundamentally redefined, the way that the US plans and fights in a conflict. Not all of the friends and allies share our operational or warfighting strategies.

Finally, shared management of programs that are essential to the US warfighter raises significant operational questions. A good example of this is the current discussion over the future of the US GPS system and the European Galileo navigation system, which is currently under development. Comments by some Administration officials after the release of the space policy seemed to open the door to possible international cooperation on the existing GPS satellite constellation, which is operated by the US Air Force and serves military and commercial users world-wide.[6] This idea would seem to have some obvious merit in that it could reduce the US financial burden of supporting a peace-time global navigation network. However, it is unclear what operational constraints such a cooperative pact would have should the US ever engage in a conflict with a technologically equal opponent.

There are a number of ways, short of seeking system interdependence, in which a goal of increased reliance on international capabilities might be implemented. First and simplest, the USG can purchase foreign space capabilities and services when they exist, are cost-effective, and meet US objectives. For example, the USG currently buys Radarsat imagery from MDA Corporation of Canada and X Band and ultrahigh frequency (UHF) band communications from Paradigm Communication Systems in the United Kingdom. The US also buys communication services from a wide range of foreign commercial satellite operators. To the extent that such purchases avoid the large and ongoing expense of maintaining additional global networks, they are a prudent investment and, in a limited way, support the overall goal of increased cooperation and interdependence.

Another, more significant way for the USG to engage in collaboration with others countries is to encourage them to invest in the US military systems. The Australian Defense Force's decision to invest the US Wideband Global Satellite (WGS) system is one example of this trend. In 2007, Australia agreed to pay for construction of the sixth WGS satellite in exchange for specified access to the entire WGS system. According to press reports, the US is actively engaged with international allies to replicate the Australian deal with other willing participants.[7] This cooperative approach certainly has merit but has yet to be fully reconciled with the space policy's desired goal of increased reliance on commercial satellite service providers. This subject will be discussed in greater detail below.

In addition to encouraging investment in US satellite systems, the USG can also make reciprocal investment in the space systems of other countries. For example, the US recently entered into a bilateral agreement with the Australian Defence Force (ADF) by which US forces will have access to the ADF's 18-channel UHF payload to be launched on the Intelsat IS-22 satellite in early 2012.[8] In compensation for the near-term access to the ADF payload, the ADF will gain access to DoD's future Mobile User Objective System constellation of satellites.

In summary, the space policy's goal of seeking opportunities for selective space system interdependence with partners and allies is a worthy one. However, past experience would indicate that implementing this goal is likely to be a slow and incremental process. This process, although encouraged by near-term funding constraints, is likely to only be successful where the long-term strategic and operational objectives of the partners are closely aligned.

Data Sharing to Ensure Responsible Operations in Space

Data sharing is a theme that is repeated throughout the space policy. This paper will focus on data sharing as it specifically relates to sharing between the private commercial operators and governments and will examine the sharing of satellite position data to ensure safety of flight.

Major commercial satellite operators routinely share information with each other about their flight operations. The data exchange usually consists of the latest location information, near-term maneuver plans, transmission frequencies, and contact information for further discussion. Intelsat, for example, operates a fleet of more than 50 satellites. In response to business opportunities and changing market needs, Intelsat regularly replaces satellites and relocates satellites in orbit. To change the orbital location of a satellite, Intelsat must delicately move a minibus-sized, multi-ton object, traveling thousands of kilometers per hour, through the crowded geostationary arc, avoiding the potential for collisions with, or disturbing the radio communications of, any of the more than 250 other commercial communications satellites in that orbit.

With the exception of the initial grant of approval by a national regulator, this entire process is managed without governmental regulation or oversight, using rules developed through experience and implemented by consensus among the commercial operators themselves. This process has been used effectively and without incident since the commercial satellite communications era began in the 1960s. This remarkable example of international and inter-company cooperation and self-reliance is premised on a simple realization that the results of a collision could be catastrophic.

Data sharing is possible because operators continuously and accurately track the locations of their own satellites. Most operators also incorporate information from the US Joint Space Operations Center when analyzing potential close approaches between satellites or between satellites and trackable space debris. The basic information (referred to as two-line element [TLE] data) used in this process is available to authorized users of the USG's "spacetrack.org" website.

There are drawbacks to the current close-approach monitoring process. In addition to a lack of standards for TLE modeling, TLE data does not have the required accuracy for credible collision detection. An operator that relies on TLE data must increase the calculated collision margin to avoid potential close approaches, therefore increasing the number of maneuvers. Maneuvers based on inaccurate data can waste fuel, shorten the life of satellites, and in some cases can introduce uncertainties that decrease the safety of space operations. In most cases,

threats identified using basic TLE data are downgraded after coordination with other operators or further evaluation with more precise orbital data. TLE data also lacks reliable planned maneuver information, which limits the usefulness of data for longer-term predictions.

Adding complexity to this problem is the fact that there is no single standard for representing the position of an object in space. Operators characterize the orbital position of their satellites differently depending on the software used for flight operations. In addition, there is no single agreed-upon protocol for sharing information, and coordinating operators must be prepared to accommodate the practices of other operators. To do this, operators must maintain redundant file transfer protocols and tools to convert and reformat information so that it is consistent with other software systems for computing close approaches. Some operators write their own software tools for monitoring and predicting the close approach of other spacecraft, while others contract with third parties for this service. Therefore, separate tools for each operator are necessary to exchange data. The magnitude of the effort to maintain space situational awareness grows quickly as the number of coordinating operators increases. Further, not all satellite companies participate in close-approach monitoring due to lack of financial resources or appropriately skilled technicians.

Since TLE data is relatively imprecise, US Strategic Command (USSTRATCOM) has been working to develop a procedure for granting operators access to information that goes beyond the basic TLEs.[9] USSTRATCOM recently authorized Joint Functional Component Command for Space (JFCC SPACE) to share conjunction summary messages (CSMs) with satellite operators whose satellites have been identified as closely approaching another space object.[10] CSMs contain vector and covariance data computed using Special Perturbations theory and are, therefore, more accurate than the TLE data.

In response to the recognition that better and broader inter-operator information sharing is desirable and to augment the services available from the Air Force, a number of satellite operators recently began a broad dialogue on how to best ensure

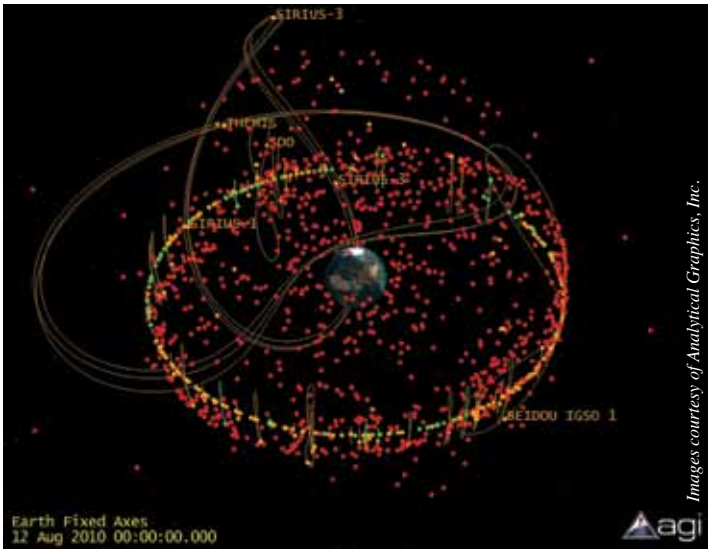


Figure 2. Space Data Association satellites.

information sharing within the satellite communications industry. As a result, the major satellite operators have formed the Space Data Association (SDA), which is an interactive repository for commercial satellite orbit, maneuver, and payload frequency information.[11] The principal goal of the SDA's Space Data Center is to promote the safety of space operations by encouraging coordination and communication among its operator members. Satellite operators maintain the most accurate information available on their fleets in the data center systems; augment existing TLE data with precise orbit data and maneuver plans from the operator's fleets; and retrieve information from other member operators when necessary. As a result, the data center:

- Enhances safety of flight.
- Provides efficient, timely, accurate conjunction assessments for members.
- Reduces false alarms, missed events.
- Minimizes member time and resources devoted to conjunction assessment.
- Establishes common format conversions and a common information repository.
- Provides radio frequency interference geolocation and resolution support, allowing operators to more rapidly find and address interference sources.
- Encourages the evolution of best practices for members.

The SDA has offered to augment USG sensor data with more precise operator-generated data to improve the accuracy of conjunction monitoring. The SDA could also provide a standardized method and focal point for operators to share information and facilitate communications between satellite operators and the USG. At present, because of a range of policy, technical, and security concerns, JFCC SPACE is unable to routinely accept satellite position data from the SDA.

By creating the SDA, commercial industry took a giant step towards accomplishing the Obama space policy goal of "promoting safe and responsible operations in space" and "improved information collection and sharing for space object collision avoidance." The fact that the USG has been unable to fully capitalize on this industry sponsored and funded initiative serves to undercut the goals of the space policy. Solving the problem of government/industry data sharing and the role of the SDA should be a key objective of those seeking to implement the Obama policy goals.

Government Reliance on the Commercial Sector

The Commercial Space Guidelines make up the single longest section of the space policy and certainly one of the most detailed. In pursuit of the goal of "promoting a robust domestic commercial space industry," the departments and agencies are directed to undertake a remarkably specific array of tasks. They are to:

- Purchase and use commercial space capabilities and services to the maximum practical extent when such capa-

bilities and services are available in the marketplace and meet USG requirements;
- Modify commercial space capabilities and services to meet government requirements when existing commercial capabilities and services do not fully meet these requirements…;
- Actively explore the use of inventive, non-traditional arrangements for acquiring commercial space goods and services to meet USG requirements, including measures such as public-private partnerships, hosting government capabilities on commercial spacecraft, and purchasing scientific or operational data products from commercial satellite operators in support of government missions;
- Develop governmental space systems only when it is in the national interest and there is no suitable, cost-effective US commercial or, as appropriate, foreign commercial service or system that is or will be available;
- Refrain from conducting USG space activities that preclude, discourage, or compete with US commercial space activities…;
- Pursue potential opportunities for transferring routine, operational space functions to the commercial space sector where beneficial and cost-effective…;
- Cultivate increased technological innovation and entrepreneurship in the commercial space sector through the use of incentives such as prizes and competitions;
- Ensure that USG space technology and infrastructure are made available for commercial use…;
- Minimize, as much as possible, the regulatory burden for commercial space activities….

Although this section is the most extensive and specific, it is the area where—at least from the perspective of the commercial satellite industry—the least progress has been made.

Notwithstanding the space policy's guidance, within the DoD, the question of whether it is more prudent to buy military satellites or to lease commercial capacity is still an ongoing subject of discussion and debate. This debate continues even though some of the communications satellites that DoD procures are nearly identical to the commercial satellites currently providing the vast majority of DoD satellite communication (SATCOM) traffic in Afghanistan and Iraq. As was mentioned above, the USG is also actively marketing participation in its military WGS system to interested allies.[12] The WGS system, though certainly capable, does not include any of the exotic protections, such as anti-jam or nuclear hardening, which typically characterize a protected military communication satellite. So, in a sense, the USG's marketing activities are in direct competition with the commercial industry.

On first review, it is difficult to square current SATCOM acquisition practices with the rather emphatic terms of the commercial space policy. The simplest explanation is that the policy contains conflicting goals. The policy does encourage the use of commercial systems, but it also encourages the pursuit of "appropriate cost- and risk-sharing among participating nations in international partnerships." The space policy does not provide guidance on how to resolve this dispute, so the challenge will be to develop an implementation plan that balances these conflicting objectives.

One good place to start would be to clarify the role that commercial operators will play in future military satellite architectures and to appropriately fund that role. To this day, with the partial exception of the Navy, the US military services—even though they rely on commercial SATCOM for critical operations—do not routinely budget for these services but prefer, instead, to buy them with supplemental funds supplied by Congress for the war effort. Similarly, commercial satellite operators do not have a specific mission designated in DoD's communication architecture. This lack of a mission means that commercial operators are, for the most part, selling generic satellite capacity developed for the commercial marketplace to military users whose satellite needs are growing more and more specific.

Figure 3. Intelsat 14 is a communications satellite owned by Intelsat located at 45° West longitude, serving the Americas, Europe, and African markets.

Nowhere is this truer than in the role that the commercial satellite industry has played in supporting the dramatic increase in use of unmanned aerial vehicles (UAV). The success of early UAVs drove the demand for more UAV flights and more and better onboard sensors suites, which, in turn, drove the need for more satellite capacity. Once the data is collected, it must be dispersed for action. The quickest way to do this in theater is via satellite. This raises a fundamental question for the future: should the DoD create an enduring

role for commercial industry in meeting long-term UAV requirements, or should it mount a multi-billion dollar campaign to replace existing commercial terminals and satellite capacity with new military satellites and antennas?

In many ways, this debate echoes the now more than a decade-long debate regarding the role of the commercial remote sensing industry in meeting the basic mapping mission of the USG. For years, the imagery community debated whether the commercial sector could be granted an enduring role in collection of certain types of imagery data. After much anguish, several presidential policies, innumerable Pentagon and intelligence community reviews and numerous Congressional directives, the answer on remote sensing has finally been determined to be "yes." It now seems clear that commercial remote sensing will play a distinct role in the government's acquisition of medium resolution data.

There is much in the commercial space policy that is creative and forward looking. One in particular is the policy's guidance to explore the "use of inventive, nontraditional arrangements for acquiring commercial space goods and services to meet USG requirements, including measures such as public-private partnerships, hosting government capabilities on commercial spacecraft, and purchasing scientific or operational data products from commercial satellite operators." However, a simple and practical starting point would be to declare, as a matter of policy, that the commercial sector will be the primary means to meet some specific portion of the UAV satellite requirement and then to fund this commitment appropriately. The private sector is prepared to invest heavily in satellites that can respond to DoD's changing SATCOM needs if the government is prepared to build a partnership for the future.

Conclusion

Success in both commercial and government space programs throughout the world has meant that new demands are being placed on the space environment. This has resulted in orbital crowding, an increase in space debris, greater demand for limited frequency resources, and the proliferation of sometimes conflicting military and commercial activities. The successful management of these issues will require a strong partnership between government and industry, new procedures for data sharing, and the careful, experienced-based expansion of international law and diplomacy.

As DoD's satellite communication needs continue to change and grow, new partnerships and commitments must be developed that harness the creativity and resources of the private sector and the international partners of the US. A good first step in the implementation of this goal would be to define the appropriate role that each of the major partners will play in a preferred future satellite communication architecture and then to fund that architecture consistent with available resources.

Notes:

[1] President Barack Obama administration, *National Space Policy of the United States of America*, White House, 28 June 2010, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf.

[2] Statement of Frank A. Rose, deputy assistant secretary, Bureau of Verification, Compliance, and Implementation, US Department of State, to the *Conference on Disarmament Geneva*, Switzerland, 13 July 2010.

[3] Council of the European Union, *Council Conclusions and Draft Code of Conduct for Outer Space Activities*, Brussels, 17 December 2008, http://register.consilium.europa.eu/pdf/en/08/st17/st17175.en08.pdf.

[4] Statement of Robert V. Davis, deputy under secretary of defense (space), US Department of Defense to the *Second Annual Space Strategy And Architecture Symposium Internationalization Of Space: Increasing Cooperation With Our Allies*, 11-12 February 1997.

[5] National Research Council, *Assessment of Impediments to Interagency Collaboration on Space and Earth Science Missions*, (Washington, DC: The National Acadamies Press, 2010), http://www.nap.edu/catalog.php?record_id=13042#description.

[6] Andy Pazstor, "New Space Policy Call for Global Cooperation," *Wall Street Journal*, 28 June 2010.

[7] Turner Brinton, "US Talks with Allies About Buying into WGS," *Space News*, 10 September 2010.

[8] Peter B. de Selding, "Australian, US Forces To Share UHF Satellite Capacity: Agreement Involves US Mobile User Objective System and Narrowband Payload on Intelsat Craft," *Space News*, 29 April 2010.

[9] CFE was a pilot replacement for the NASA program sharing orbital data with non-USG users from 1960s-2003. The Air Force Space Command executed the CFE Pilot Program under the authority granted by Congress in November 2003 (FY04 NDAA) and extended (in FY07 and FY09) to 30 September 2010. Since 2003, the CFE program has provided registered users (documented by an on-line registration agreement) access to basic orbital data via an online web site (www.space-track.org). Further, CFE offered additional limited collision avoidance support using specific request procedures for a limited set of users pursuant to bilateral agreements.

[10] Statement of Major Duane Bird, USAF, US Strategic Command to *AMOS Conference*, September 2010.

[11] See: www.space-data.org.

[12] Brinton, "US Talks with Allies About Buying into WGS."

Mr. Richard DalBello (BS, Political Science, University of Illinois; LLM, McGill University; JD, University of San Francisco) is responsible for managing Intelsat General's legal team, for leading its government relations and public policy efforts, as well as representing Intelsat General before numerous US and international policy bodies.

With more than 20 years of experience, Mr. DalBello is well-known in satellite communications and government circles. He served previously as president of the Satellite Broadcasting and Communications Association, and for more than three years as the president of the Satellite Industry Association. The SIA is the voice of the US commercial satellite industry on policy, regulatory and legislative matters. Earlier, Mr. DalBello was general counsel for Spotcast Communications Inc., and vice president of government affairs, North America, for ICO Global Communications, a provider of mobile satellite communications services. He also served for four years as the assistant director for aeronautics and space in the White House's Office of Science and Technology Policy.

The National Space Policy: High Tech Requires High Touch

Dr. Darren S. McKnight
Technical Director
Integrity Applications, Inc.
Chantilly, Virginia

Executive Summary

Proven business optimization techniques can be used to improve national level policy formulation and execution. This article examines the National Space Policy (NSP) as an example of how the innovation value chain (IVC), a proven workforce productivity methodology, can be applied to enhance policy success. The innovation value chain is a sequence of activities prescribed to produce meaningful results in the execution of a complex effort: *establish a goal* then practice sound *communications* to lay the foundation for *cooperation* that establishes the context for *collaboration* to enable *innovative* execution. The NSP discusses cooperation and collaboration extensively, yet without the precision required for successful execution. The trust and clarity established early in the innovation value chain coupled with using 'people verbs' are critical to establishing the accountability that will insure policy formulation likely to be accepted by its constituents and executed by responsible parties. The NSP formulation could have benefited from the application of the IVC but the use of the IVC may still positively influence the execution of the NSP.

Scope

The goals and principles of the NSP are reviewed in detail relative to the innovation value chain but the guidelines sections are not scrutinized in this article. The priority of this article is to highlight the importance of using business approaches that are systematic yet personal for policy formulation and execution. The observations and recommendations in this article may be easily applied to enhance the guidelines sections of the NSP; the execution of the NSP; and to improve other policy and organizational efforts.

Introduction

The 2010 NSP has been compared to the 2006 NSP and examined to predict its implications for the future.[1] The concern about orbital debris, the focus on international cooperation, and a subtle leadership tone are key major characteristics of the 2010 NSP. However, there have been no discussions about whether the 2010 NSP provides an implementable framework modeled on commercial business practices. Indeed, the potential success of the NSP should be measured relative to business norms since the business of space operations is critical to the future of US national security and its economy. The accountability in business flows from the *executives* through the *employees* on to the *stockholders*. Sound policies provide language to identify how actions by people in each of these groups relate and affect organizational outcomes. Without this linkage, it is unlikely that large, diverse groups of people will act in complementary ways. Similarly, in the national policy process, accountability must flow from the *government* to *industry and academia* and then finally to *citizens*. Constituents at all of these levels need to be addressed, considered, and involved in a quality, executable policy just as actions of executives, employees, and stockholders must be synchronized to implement a business strategy effectively.

Innovation Value Chain

In 2004, while serving as director of science and technology strategy of SAIC, I established the IVC which prescribes activities required to enhance workforce productivity and enable innovative technical operations, as shown in figure 1.[2] A critical theme permeating the IVC is that all four phases are performed by people. Therefore, in any approach to enhancing organizational performance, one must use 'people verbs' (i.e., actions that people take, not activities that organizations do). For example, when asked to "align their efforts with strategic objectives" it is difficult to expect that people will know what behavior will satisfy this policy. However, if they are told to "listen, learn, and write things down when attending interdepartmental meetings" they have clear actionable behavior to model.

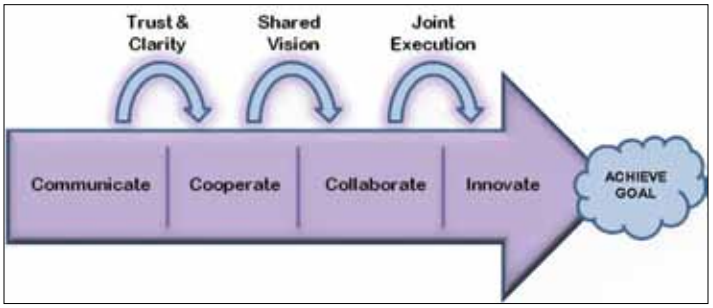


Figure 1. The IVC provides a logical sequence of people-centric activities to empower organizational effectiveness in attaining strategic goals.

When applying the IVC it is important to first establish a clear, relevant, achievable, and challenging goal. This provides a common motivation for all other activities, accountability for all constituents, and a metric for success.

The introduction to the 2010 NSP states:

> Our goal is the capacity for people to work and learn and operate and live safely beyond the 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 here on Earth. ~ President Barack Obama, 15 April 2010

The goal in this quote by the president is challenging in both its ambiguity and scope. First, it is unclear whether long-term manned presence in space will actually "strengthen America's leadership here on Earth." Second, this high-level goal does not clearly match the individual goals detailed later. A policy that will energize people to act with a shared vision must be logical in its thought process, relevant in its intent, and inspirational in its implementation. A quote by Margaret Wheatley, organizational consultant and author, highlights this point:[3]

> Thinking is the place where intelligent actions begin. There is no distance between thinking and acting when the ideas mean something to us. When we look thoughtfully at a situation and understand its destructive dynamics, we act to change it. Governments and organizations struggle with implementation since inside any bureaucracy there's a huge gap between ideas and actions. But this is because we don't care about those ideas. We will not take risks for something we do not believe in. But when it's your idea, a result of thinking, and we see how it might truly benefit our lives, then we act immediately on any promising notion.

The NSP does contain additional goals. These are in the table below with comments regarding their efficacy:

Goal	Comments
1. Energize competitive domestic industries.	This has the potential for a tangible objective: improve the economy of citizens and, thus, their well-being.
2. Expand international cooperation on mutually beneficial space activities.	This is an enabler for other more results-oriented objectives.
3. Strengthen stability in space.	This is a very important goal that is unclear in its intent and scope. How this relates to the other goals is also not made evident in the NSP.
4. Increase assurance and resilience of mission-essential functions.	This is a very important objective and is similar to goal #3 in its operational focus.
5. Pursue human and robotic initiatives	This goal focuses on enabling technologies much like goal #2. There is a reference to fostering new industries that would be better placed with goals #1 and #3.
6. Improved space-based Earth and solar observation.	This presents a tangible, relevant benefit to constituents.

Table 1. The 2010 NSP goals cover a wide spectrum of areas.

These goals are sufficiently vague, and their interdependencies unclear, producing many possible interpretations as to how they could be satisfied. There is a need to prioritize and create a relationship between the objectives to inspire a simple, powerful shared vision and the beginning of traceability between peoples' actions and organizational outcomes. Later in the article, an alternative goal statement will be proposed which embodies the essence of the IVC.

Communicate: Once the goals are established, the sequence of people-centric activities of the IVC begins. Communicating expectations, motivations, and common goals in a memorable way for all constituents is critical to success. The US NSP should clearly describe what the US will do while related policy statements explain how this approach is consistent with international strategies and will set an example for other countries.

The figure below outlines actions performed and products resulting from this stage as originally envisioned for use in business operations. Yet, without modification, these are all also largely applicable to government policy development and execution efforts.

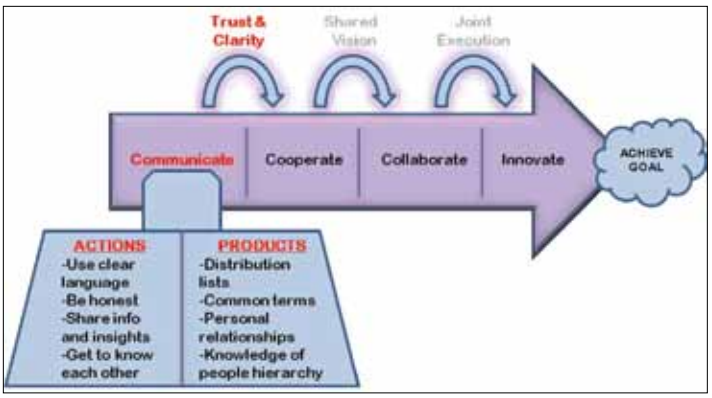


Figure 2. The typical actions and products from the communications foundation of the IVC should produce trust and clarity amongst constituents.

Many terms in the NSP are not defined or have multiple interpretations. If key words in the goals are interpreted differently the natural consequence will be confusion and suboptimal implementation of the policy. The words below are a sampling of important terms that need to either be defined or replaced with 'real-world' words. This list is not exhaustive, but rather, shows that communication of a policy starts with careful word choice.

- *Transparency:* Appears to be purposely ambiguous and, as such, does not support the development of trust and clarity. The implication is that we should not have any hidden agendas in our actions. Alternatively, the US should be honest and share all information that is required to ensure achievement of the policy goals.[4]
- *Confidence-building:* Implies that someone is more of themselves, but 'who' is more confident and 'why'? More explicitly, one might say that if we build trust between the US and other spacefaring countries by clearly stating motivations and assumptions upon entering discussions then the fact that we are dealing honestly (i.e., establishing trust) with all nations will be a byproduct.
- *Sustainability:* Is so complex that there is a recently released Dictionary of Sustainable Management that captures the complexity of this word in 122 pages.[5]

When we want to inspire people to do things then we should use 'people verbs' to describe the desired behavior. The NSP did do this well in the guidelines (i.e., actions) sections for commercial space activities and job responsibilities for several key US government actors. Similarly, in the principles section, the challenge of 'responsible behavior' evokes a compelling message, especially as it mirrors word use applied by the Administration to the Chinese antisatellite event in 2007.[6]

Implementers of the NSP within the Department of Defense are acting on this need for more precise terminology by strengthening the export control function related to the NSP by "replacing vague, catch-all terms with objective, specific criteria."[7]

Cooperate: During the next phase of the IVC, the community leverages the trust and clarity developed in the communication phase to focus on *listening* and *sharing*. The *American Heritage Dictionary* defines cooperation as, "an association of persons for mutual benefit." Indeed, the result of this phase is a shared vision—reinforcing accountability between individuals' actions and organizational goals.

In the preamble to the principles section, the NSP states that "in the spirit of cooperation, the US will adhere to, and proposes that other nations recognize and adhere to, the following principles…". While the "spirit of cooperation" is a good start, what is needed is action. As the section states accurately, the US will only be perceived as cooperative if we *act* cooperatively.

The figure below lays out some simple business tasks that are considered cooperative actions—these should be emphasized early in the discussion of the NSP internationally and with a focus on "acting our way into a new way of thinking" rather than trying to "think our way into a new way of acting."[8]

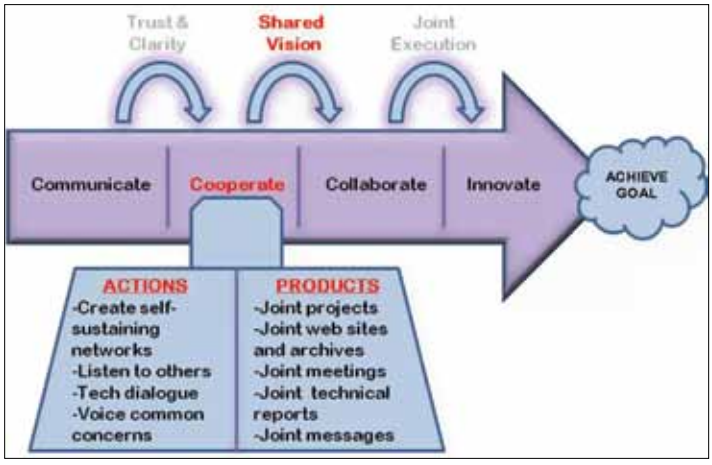


Figure 3. The shared vision expected to form by the end of this phase may include both policy development and execution activities.

The current administration has embraced a cooperative foreign policy style with an obvious interest in listening to many countries and organizations with whom previous administrations have not engaged. However, it is not evident that this tactic will be used in the implementation of the NSP. In addition, meetings without trust and clear terminology are merely a series of 'feel good' gatherings unlikely to move the community closer to collective success.

Real 'cooperation' takes time and effort. While 'active' listening sounds contradictory, the ability to focus on other peoples' needs/wants (over our own) and incorporate them into a shared approach to a problem does take energy and finesse. Cooperation is not simply the lack of arguing and competing but rather the preparatory efforts needed for individuals across diverse organizations to be willing to collaborate in positive ways.

Collaborate: While the words cooperation and collaboration appear 16 times within the 2010 NSP, there is no hint as to the specific constituent behavior the NSP hopes to encourage. The primary action during the collaboration phase of the IVC is to adjust schedules and resource expenditures based upon the joint activities with others. The relationships between parties should have advanced beyond mere access to shared information stores (i.e., websites, trip reports, etc.) to cost-share and resource allocation arrangements.

This stage leverages messaging, repository, and discovery tools and applications to empower learning. Advanced web technologies, such as widgets, wikis, and blogs, may be applied to aid in collaboration. All these tools contribute to the potential for joint execution directly leading to our end state—innovative results. However, if a group of constituents rush to having collaborations where messages, insights, data, and products are easily shared amongst parties without an establishment of trust and a shared vision, increased awareness may just as easily serve to undermine eventual joint execution and success, rather than help it.

Think of the negative application of the use of social networking tools such as Facebook when users do not have positive shared intentions—the knowledge of peoples' lives can be used against them rather than providing a context for healthy relationships—a desired outcome of social networking.

An example of collaboration by the US Strategic Command is the potential expansion of the Joint Space Operations Center, the source of accurate on-orbit conjunction warnings, into a Combined Space Operations Center that would have extensive international participation.

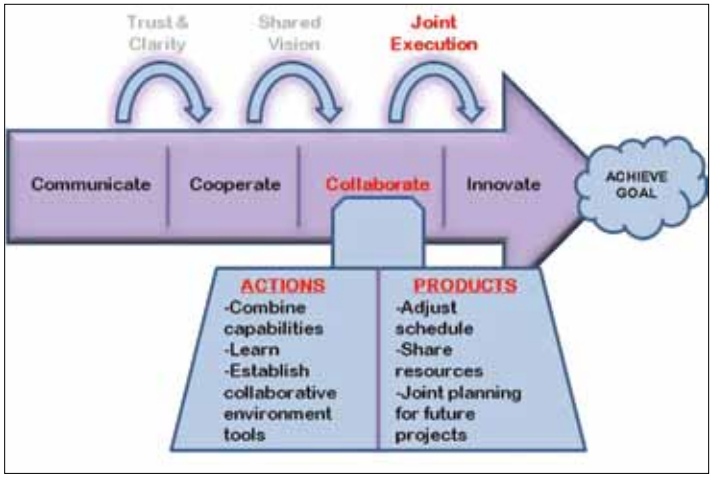


Figure 4. Collaborative activities provide the impetus to execute activities in support of a well-stated policy efficiently and effectively.

Many ideas that will make policy implementation a success will result from in-tune dialogue leading to joint execution. Commercially, some of the most successful ventures, such as eBay, garner the vast majority of their innovations from collaborative discussions with their partners and customers.[9]

Innovation—Strategic Execution: Innovation is not necessarily about 'new' items but about creating more valuable results more efficiently (i.e., improved outcomes while simultaneously consuming fewer resources). During this last phase productivity is enhanced, the borders between previously segregated groups are dissolved, and organizational performance is maximized. These benefits do not come easily; they are the result of all the work in the previous phases.

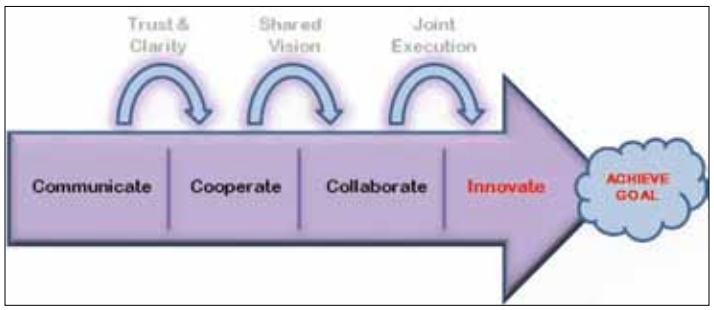


Figure 5. Achieving the goals of the NSP will naturally occur if effort is placed on the phases leading to this point—it will even be difficult to derail success at this point with the proper foundation.

Throughout the course of the IVC, but especially during execution, the need for cognitive diversity within the community to solve difficult problems is paramount—lawyers, economists, analysts, policymakers, engineers, scientists, and so forth must work together to solve these inherently multi-disciplinary problems. The development and execution of the NSP is especially challenging due to the diversity and complexity of issues that must be addressed when dealing with the space environment, aerospace hardware, legal/regulatory context, and global economics.[10]

Successfully executing strategy through sound policy requires tough, often uncomfortable choices. Most policy and technical situations with which we deal are opportunity-rich and solution-rich, making the ability to decide *what not to do* more critical than selecting what to do. Mr. Steve Jobs, chief executive officer of Apple, has said, "People think focus means saying 'yes' to things you've got to focus on. But that's not what it means at all. It means saying 'no' to the 100 other good ideas."[11]

New National Space Policy Goal Statement

I propose the following alternative set of goals for the NSP based upon the basic tenets of the IVC:

> Space activities by the US should provide a benefit to all Americans. There are three primary ways in which our investment in resources and manpower will bring value to citizens of the US and the world.
>
> 1. *Provide a catalyst for economic growth*. Participation in markets that leverage space-based assets or are required to design, build, launch, and operate satellites shall be empowered by our increased activity in space. Actions shall be taken to: increase investment capital in firms looking to contribute to space missions, improve related advanced technology development infrastructure within the US, pursue retrieval of extraterrestrial rare Earth resources, and accelerate the ability of companies to use capabilities developed for space-based applications for ground-based uses. The administration will strive to increase expenditures in each of these areas each year for the next five years. Just as our terrestrial-based economy has a global dimension, the US understands that it must work with the global community in reaping the economic benefits of space.
>
> 2. *Increase efforts supporting space-based Earth and solar observation*. Enhance funding and other support to activities that use space-based observation to: improve the quality of life of all citizens by increased understanding of global climate patterns; upgrade warning, response, and recovery from man-made and natural disasters; enhance agricultural production efficiency; optimize development and deployment of sustainable energy alternatives; and map water resources to improve water availability to citizens worldwide. These efforts shall be supported at increasing levels with a goal of 25 percent more funding over a five-year time frame.
>
> 3. *Establish zero-increase goal in man-made space hazard*. Perform requisite technical, regulatory, and policy analysis and modeling to determine the means by which hazards from man-made effects on space operations can be controlled to go no higher than they will be in 2012. While this largely addresses catastrophic effects from potential orbital debris encounters and offensive space operations, it should also include mission-degrading effects from debris, frequency interference, cross-contamination of space systems, space system reliability technologies and methodologies, and so forth.
>
> To support the first two goals, space systems must be able to perform their missions as designed (i.e., goal #3); therefore, the controlling of the risk from man-made and natural sources is imperative for the US and all spacefaring countries so that they can continue to leverage space operations to improve the quality of life on Earth.

Appreciative Inquiry

When looking to invigorate truly cooperative and collaborative international space activities it is instructive to apply a Harvard Business School technique called appreciative inquiry—catching oneself doing something right and learning from that process.[12] While there have been many successful international space projects, there is probably no effort more successful than the International Space Station (ISS). The sequence of goal-setting, communication, cooperation, collaboration, and innovation started in 1984 when President Ronald Reagan invited others to participate in his newly approved space station program. While this only initiated informal discussions, it got scientists, engineers, managers, and policymakers to discuss common themes and complementary capabilities among countries also pursuing space station programs.

Russia and the US were both feeling financial pressure when trying to deploy large scale space stations in the 1990s and so began the Shuttle-Mir program through which the two space

powers routinely interoperated the space shuttle and the Russian space station Mir. This provided an ongoing learning experience that laid the groundwork for a successful international space station program. The ISS now has 14 pressurized modules with nearly 1,000 cubic meters of volume—more than is available in a Boeing 747. The ISS is operated cooperatively by five national space agencies (from the US, Russia, Japan, Canada, and the European Space Agency) while citizens from 15 different countries have visited the station.[13]

The cooperation resulting in the highly successful achievements of the ISS may have been partially driven by a need for cost-sharing but the trust and clarity of purpose honed during the early stages of community interaction provided the catalyst to keep the multi-national team progressing through their own version of the IVC. This international collaborative success should be examined as it relates to the practical execution of the NSP.

Conclusion

The NSP should not focus solely on cooperation and collaboration—these are only part of the answer. With clear, relevant, achievable, and challenging goals plus a coherent framework for how they relate to each other and to the actions that people and organizations must undertake, the US may progress through the IVC with its international partners so that all parties will benefit. This work will be hard and will require activities that are not currently deemed critical but they are necessary to build the trust that will result in efficient joint execution. While the NSP provides a long list of actions in the intersector guidelines and sector guidelines sections, these activities will be more powerful if they logically flow from a clear goal statement that we all believe in. Using the NSP and the IVC as our guides, the US can maintain and enhance its space leadership role and provide for the betterment of Americans and citizens worldwide.

Notes:

[1] John Mariel, "US National Space Policy Comparison: Comparing the 2010 National Space Policy to the 2006 National Space Policy," Space Foundation, November 2010; Jeff Foust, "A Change In Tone In National Space Policy," The Space Review: Essays and Commentary About the Final Frontier, 6 July 2010; Victoria Samson, "The Obama Space Policy, 2010," Satmagazine.com, November 2010; Merriam Webster Collegiate Dictionary, 11th Edition, 2009; Laure Paquette, *Analyzing National and International Policy* (Rowman Littlefield, 2002).

[2] Kathy Harris, "Masters of Innovation: How the Leaders Stay Ahead of the Game," Gartner IT Symposium, San Francisco, California, April 2007, 22-26; Kathy Harris, "Case Study: SAIC Innovates From Success," Gartner Research ID No. G00146822, 23 March 2007.

[3] Margaret Wheatley, "Can We Reclaim Time to Think?," *Shambhaia Sun*, September 2001.

[4] The administration's form of transparency relies heavily on the premise that more information sharing is better. However, sometimes too much information may actually lead to poorer decisions and a less clear understanding of the situation. See reference: Richard Heimann, "Data Paradox – Information Sharing Incongruities in the Intelligence Community," imaging notes, Fall 2010.

[5] Nathan Shedroff, *Dictionary of Sustainable Management* (Presidio MBA, San Francisco, 2009).

[6] Pat Frakes, "Analysis of the National Space Policy of the US of America," IAI internal memo, October 2010.

[7] William J. Lynn, III, Remarks on Space Policy at USSTRATCOM Space Symposium, Omaha, Nebraska, 3 November 2010.

[8] Larry Bossidy and Ram Charan, *Execution: the Discipline of Getting Things Done* (Crown Business Books, 2002).

[9] John Sviokla, "Reinventing Innovation: Creating a Discovery Organization, Not a Department," *Diamond Cluster Viewpoint*, Winter 2004.

[10] Should one want to consider other business practices to apply to policy formulation and execution, Robert Simons of the Harvard Business School has proposed seven questions to optimize strategic execution. See reference: Robert Simons, "Seven Strategy Questions: A Simple Approach for Better Execution," Harvard Business School Faculty Research Symposium, 20 May 2010.

[11] Lauren Keller Johnson, "Four Practices for Great Performance," HBS Working Knowledge, 23 August 04; "Exploit What You Do Best," *Harvard Management Update* 8, no. 8 (August 2003).

[12] Marcia Smith," NASA's Space Station Program: Evolution and Current Status," Testimony before the House Science Committee, 4 April 2001; International Space Station Overview, http://www.shuttlepresskit.com/ISS_OVR/index.htm, February 2009.

A special thanks is extended to Frank Di Pentino, Alicia Santoliquido, and Vic See for reading and providing constructive criticism on multiple versions of this article.

Dr. Darren S. McKnight (BS, Engineering Sciences, US Air Force Academy; MS, Mechanical Engineering, University of New Mexico; PhD, Aerospace Engineering Sciences, University of Colorado) is currently technical director for Integrity Applications, Inc. (IAI) based in Chantilly, Virginia. He is focused on space systems/environment analysis, sustainable energy modeling, innovation practices, visualization solutions, and data analytics. Dr. McKnight directly supports several customers ranging from developing technology solutions for space-related challenges to enhancing innovation practices for large organizations.

Before coming to IAI, Dr. McKnight served as senior vice president and director of science and technology strategy at Science Applications International Corporation and chief scientist at Agilex Technologies. His responsibilities included technical collaboration corporate-wide, strategic technology investments (including independent research and development), and validating innovation methodologies.

Dr. McKnight has served recently on the National Academy of Sciences' committee for the assessment of NASA's Orbital Debris Program, Defense Science Board Summer Study on 21st Century Strategic Technology Vectors, National Science Foundation's Industry Expert Panel on Industrial Research and Development, Harvard Business Review Advisory Council, National Knowledge and Intellectual Property Management Task Force, and IBM's Global Innovation Outlook Team. He has coauthored two technical books (*Artificial Space Debris* and *Chemical Principles Applied to Spacecraft Operations*) and a youth soccer coaching book – *Soccer is a Thinking Game*.

Industry Perspective

What's New in the New National Space Policy?

Mr. James D. Rochier
Principal Director
US Strategic Command Directorate
The Aerospace Corporation
Omaha, Nebraska

The *National Space Policy (NSP) of the US of America* released on 28 June 2010 has a new attitude—cooperative and accommodating. It retains fundamental principles found in all previous policies and does not retreat even a little on the precepts of sovereign rights, open passage, and interference-free operations. It even incorporates some of the issues raised in its immediate 2006 predecessor and reiterates the US position that space capabilities are vital national interests. Those who looked for dramatic shifts in space policy with the new 2010 release will have to wait a bit longer, but there is likely to be some "delta-V" in the near term, even if it's not a plane change. And there are a couple of new priorities, too.

Policy statements serve a variety of purposes. They communicate the country's intentions not only to those who are expected to implement them (members of the executive branch of government including federal departments, agencies, and the military) but also to Congress, to the international community, and to the public at large. Balancing the messages for so many audiences can be challenging so national policy, whether space or otherwise, can feel a little squishy to those of us who are more comfortable dealing with hard facts in the physical sciences. Policymakers spend a great deal of energy considering, and even arguing, what may appear to others to be semantic or trivial aspects of the language, the concepts, and even the principles of policy statements. As you may see from a quick comparison of the latest NSP, sometimes the differences are more about attitude, feeling, or tone, than about content.

When the new 2010 space policy was released, several organizations and individuals developed comparisons to the 2006 space policy.[1] The comparison published by Mariel John of the Space Foundation provides a relatively straightforward description of those differences.[2] John notes that there are many similarities between the two versions, there are a few additions, some items have been dropped, there are changes in order (perhaps implying priority), and there is a fairly consistent change in tone throughout. In essence, the new policy embraces less forceful language, refers less often to specific US interests, and refers far more often to international, global, and universal principles. It also encourages and plans for greater private and international collaboration to achieve advances in space science, technology, and security.

The 2006 policy uses the term "cooperate" six times; the new 2010 policy uses the term 15 times. The 2010 policy closes the introduction with a pledge of cooperation and opens the section on principles with the phrase "In this spirit of cooperation, the US will adhere to, and proposes that other nations recognize and adhere to…"[3] On the other hand, the term "interest" is used nine times in the 2006 document, all referring to national or US interests, whereas, the 2010 document uses it only two times where US interests are asserted as in the 2006 document and twice referring to shared and mutual interests. The new space policy is a kinder, gentler policy. However, it does not eliminate most of the key principles, including the use of space systems for national and homeland security activities, and reasserts our right to self-defense including defeat of efforts to attack them.[4] Interestingly, one 2006 key principle: "The US will seek to cooperate with other nations in the peaceful use of outer space to extend the benefits of space, enhance space exploration, and to protect and promote freedom around the world" is not repeated as a key principle in the 2010 policy, but clearly its meaning has been applied throughout. Another key principle dropped is US opposition to any constraining new legal regimes.

A national policy issued by the president is a set of principles and goals, and in the case of the new space policy, also includes a roadmap to accomplish those goals. Of course, our government was purposefully designed with checks and balances to incorporate conflicting interests and priorities so policy goals may not be common to all parts of the government or the public, and implementation of the roadmap may not always be straightforward. Congressional funding of specific programs, or failing to fund others, has a critical impact on which parts of the policy become reality. And of course, a given president's goals may be unfinished at the end of his term and the new president may have different goals. A written policy may heavily influence where the nation heads, but it is really the collection of activities achieved related to that policy that constitute the nation's "actual" policy. As Mr. Jeff Kueter has eloquently stated:

> The policy signals principles and goals, but ultimately, actions, reflected by budgets, decision about programs and technical investments, and position taken in bilateral and multilateral settings, will determine the character of US space policy.[5]

Balancing the messages for so many audiences can be challenging so national policy, whether space or otherwise, can feel a little squishy to those of us who are more comfortable dealing with hard facts in the physical sciences.

The new policy, like any, can steer programs, projects, and plans, but only to the degree that it can influence the generation or cancellation of funding for those programs, projects, and plans.

In fact, actions say more about the real policy than the policy statements themselves. Even before the new space policy was issued, there were some changes evident. The human spaceflight program at NASA, for instance, was made aware of a shift in policy away from then-current plans when the president announced cancellation of the Constellation program in favor of a still somewhat imprecise alternative using commercially developed crew launch systems to reach the space station. (Constellation was NASA's development of a new manned spacelift system to replace the shuttle and reach the moon and beyond.) In subsequent speeches, the president emphasized that the goals of visiting the moon and nearby asteroids with a human orbit of Mars by the mid-2030's were not changed however, only the means to achieve them. This adjustment was announced several months before the new policy document was issued, so the document really just codifies the already implemented policy. The new manned space exploration goals are, in fact, spelled out explicitly in the new policy and congressional funding actions so far match the new plan.[6]

The new policy, like any, can steer programs, projects, and plans, but only to the degree that it can influence the generation or cancellation of funding for those programs, projects, and plans. Even so, the policy does serve to at least outline what the president and his administration want to do, or to not do.

US Space Policy "Remarkably Consistent"[7]

The first public policy statements regarding space came from the Eisenhower administration immediately following the launch of the Soviet Sputnik I, the first satellite successfully deployed by humans. At the time, the US feared the Soviets in general, and their early successes in the space-race greatly exacerbated that fear. The Eisenhower administration actually began a discussion on the potential value of a small satellite a couple of years earlier, but most of those discussions were (then) classified. In that first written space policy, National Security Council (NSC) 5520,[8] the primary military applications envisioned for a space program were (1) advancement of missile technology, (2) understanding of the ionosphere and its impact on military communications, and probably most significant, (3) the potential value of reconnaissance from space. This concept has had long-standing implications for subsequent space policy, including international agreements such as the *Outer Space Treaty* of 1967.[9] The US desire to retain freedom of overflight for our spy satellites molded early policy; how much may be debated but there can be no argument that it has always played an important role in decision-making. Due to this influence, along with other factors (including physics and finances), there are more things constant throughout the history of US space policy than different. In fact, many of the original principles have found their way into all presidential space policy statements, with policy changing more through growth and evolution than through dramatic revolutionary transformation. Historian Cargill Hall observed (prior to both the 2006 policy and the new policy):

> … for 50 years, between 1955 and 2005, a few basic principles have undergirded US space policy, principles enumerated in presidential NSC space directives from Eisenhower to Clinton. During this period they have remained remarkably consistent, with the US pledged to freedom of space, that is, free access to and unimpeded passage through space for satellite of all nations and to the exploration and use of space for peaceful purposes for the benefit of all mankind.[10]

He goes on to identify four enduring principles—(1) free access and unimpeded passage; (2) rejection of any claims to outer space or celestial bodies; (3) three separate but related governmental space programs (civil, military, and intelligence) and; (4) space systems are property of each nation and interference is infringement on sovereign rights.[11] In my view, updating that observation in light of both the 2006 and 2010 policies would not change it. In fact, those same fundamental principles have continued for another half-decade, so far.

When Policy Did Matter

Very few things stand out from my own childhood more than the Project Apollo missions of the late 1960s and early 1970s. With my family, I watched every launch and listened intently to the radio as we moved closer and closer then finally, *we* did it. I was not alone—millions of Americans did the same. One of former President John F. Kennedy's most famous speeches earlier in that decade called on the US to achieve in space the unimaginable.[12] That speech amounted to a declaration of a new element of space policy. His profound statement of such an unambiguous goal served to focus the nation and its technical resources on that famous single challenge and ultimately guided the nation's civil space program to achieve incredible success. To achieve the unimaginable remains a benchmark for precision in policy statements, even outside of the space community. While the US has a long history of both written and informal space policies, none so far have had the same immediate impact. How the latest NSP will fare in changing the vector of space activities remains to be seen.

For most of history, mankind's "space policy" was pretty limited—"look up in wonder"—followed eventually by "use it as a navigational tool." As scientific advancements offered more detailed study, an emerging national goal of finding ways to employ space for the good of mankind materialized. Policy is permitted, and sometimes driven, by what we are capable of, or at least capable of imagining. Modern US space policy was

initially formulated in the wake of World War II and concurrent with the birth of the Cold War. It was influenced dramatically by the desire to be able to watch the Soviet Union which appeared to be ahead of us on several technological fronts.

Several policymakers who participated during those early years have noted that the Kennedy announcement was probably so successful due to the alignment of technology, politics, and need. It is not likely that all of the necessary elements will align so well again in the foreseeable future. The space enterprise is no longer the sole domain of two large governments as it once was; today there are many governments engaged in space activities, and commercial ventures have formed all around the globe. Also, at that point in time space policy was truly nascent—formally written only five years previous. It is now more than a half-century old. No policy, including this one, will change things as dramatically ever again.

In 2006, Mr. Hall wrote an exceptional history of space policy and the context around which many policy decisions were made.[13] Hall is emeritus chief historian at the National Reconnaissance Office and much of his context surrounds the debate: protect with weapons in space *or* keep the domain weapons-free for the sake of spy satellites? The US desire to observe Soviet activities was so powerful that it was willing to bend (even violate) international law with overflights of spy aircraft. The physics of spaceflight presented an opportunity to craft a different international paradigm, one in which it was legal to spy from above, as long as the spy platform was in Earth-orbit—the objective difference being that it was not possible to control a satellite well enough to avoid overflight of any particular spot of ground. In order to initiate and maintain this new philosophy, the presidents and their advisors were willing to concede other potential military advantage that might come from controlling space. This decision was likely made a bit easier by the fact that we did not actually have technology that made controlling space feasible. However, despite agreements and informal understandings, neither the Soviets nor the US fully restrained from advancing those technologies, under the mutual assumption that the other would do so and would then have a destabilizing advantage. For the most part, those early counter-space programs were not orbital, and there is a belief that ground-based antisatellite systems are less objectionable than space-based systems. The Outer Space Treaty prohibits deployment of weapons of mass destruction in space but there is no current legal construct prohibiting orbital *protective* space systems. It has long been US policy to protect its freedom of access to space by avoiding a space weapons race. There have been, however, exceptions in policy to date such as former President Ronald Reagan's Strategic Defense Initiative which, on paper, included space-based interceptors and possibly lasers. Due to high costs, technical challenges, and political considerations, plans were subsequently scaled back to the ground-based interceptors of today's missile defense system. Space remains a "sanctuary from weapons," in part, to provide for freedom of operation of our space-based intelligence, surveillance, and reconnaissance capabilities. Some, however, believe that this is a temporary lull in the inevitable march to the ultimate high ground. How does the new space policy fit into their view? It certainly does not give them much. There is an alternative view of the reasoning that got us to this point in history, though it does not argue where we are today.[14] The premise is that space is still free of space-based arms largely because of the technical, resource, and strategy challenges of building space weapons, not simply because US and other leaders have always chosen the high moral ground in order to avoid a space-weapons race to protect our spy satellites. The implication, perhaps, that whenever and wherever those obstacles are overcome, then the race will be on. Does the new policy change that debate? I think it intends to try.

The Differences and What They Mean to Space Protectors

While it is interesting to see how the new policy compares to all its precursors, the primary interest now is how the new policy may change the current course of activities. First, as mentioned before, in comparison to the prior 2006 policy there is much more the same than different. The four key principles remain, though in a modestly softer spirit. The new aspects of the 2010 space policy are subtle changes in some cases, but actually quite a bit is just new. The following are three areas that I think are most significant.

Transparency and confidence building: International cooperation is a consistent theme across many of the current Administration's policies, and it certainly is in the new space policy. Virtually throughout the document there is a call for increased cooperation, bilateral, and multilateral engagements. This appears to be backed by policy actions outside of the document as well; significant international engagement has increased across the government agencies involved in national space issues.

Space situational awareness and debris: In a section titled "Persevering the Space Environment and the Responsible Use of Space," the new policy has considerable language devoted to understanding, mitigating, and controlling space debris. The 2006 document included a short guidance section on debris, which is mostly still there, but the new policy includes the phrase "[p]ursue research and development of technologies and techniques … to … remove on-orbit debris.…" The new policy also uses a new phrase: "responsible behavior," which we have heard used in discussions about the differences between how the Chinese conducted their antisatellite missile tests and how the US demolished an errant satellite to prevent hazardous re-

The space enterprise is no longer the sole domain of two large governments as it once was; today there are many governments engaged in space activities, and commercial ventures have formed all around the globe.

Although there are new items in the new space policy, it really builds very modestly on the firm foundation of the five decades of prior space policy statements and captures the same core principles and goals.

entry. Debris from the Chinese intercept will be on orbit for a very long time; the vast majority of debris from the US event has already decayed or will in a very few years. It looks like the new policy has elevated the importance of monitoring actions in space in order to motivate "responsible behavior." A new guideline is included that directs the secretary of defense (in consultation with other agencies) to develop collision warning measures, and here *allows* collaboration with industry and foreign nations. Space situational awareness and debris activities have a strong reason to expect continued support from the current administration, particularly when they include partnerships.

Space protection: The 2010 policy continues the precept of our right to defend our interests against interference or attack. It specifically directs the secretary of defense to ensure cost effective survivability and to develop plans and capabilities to deter, defend against, and defeat efforts to interfere with or attack our systems (or US allies).[15] However, the 2010 words are not as aggressive—the 2006 policy included activities to deter others from even developing interference or attack capabilities. It appears that programs and projects that have a clearly protective nature will be well supported, those that are less clearly defensive in nature, may not.

Although there *are* new items in the new space policy, it really builds very modestly on the firm foundation of the five decades of prior space policy statements and captures the same core principles and goals. The key to what impact the new policy will have is in how the current administration, Congress, and the implementing agencies prioritize and pursue those principles and goals. For the moment, the nation appears to be on a path toward hoped-for green pastures and still waters, but with a notice to keep an eye out for an angry bear or a passionate dragon along the way.

Notes:

[1] National Security Presidential Directive-49, *US National Space Policy*, signed by President G.W. Bush, White House, 31 August 2006, http://www.whitehouse.gov/sites/default/files/microsites/ostp/national-space-policy-2006.pdf.

[2] Mariel John, "US National Space Policy Comparison," The Space Foundation, Colorado Springs, Colorado, 29 June 2010, http://www.spacefoundation.org/docs/USNationalSpacePolicy-2010vs2006.pdf.

[3] President Barack Obama administration, *National Space Policy of the United States of America*, White House, 28 June 2010, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf, 3.

[4] Ibid.

[5] Jeff Keuter, "Evaluating the Obama National Space Policy: Continuity and New Priorities," The George C. Marshall Institute, Washington, DC, July 2010.

[6] The NASA FY11-13 authorization bill that became law on 11 October 2010 is a compromise that keeps the president's proposals largely intact. However, at the time of this writing, there is no FY11 appropriations bill yet, so we still don't know if the funding will be a reasonable match to the policy.

[7] Richard H. Buenneke et al., "National Space Policy: Does it Matter?" Washington Roundtable on Science and Public Policy, Washington, DC, The George C. Marshall Institute, 12 May 2006.

[8] James S. Lay, Jr., NSC 5520, "US Scientific Satellite Program," Dwight D. Eisenhower Presidential Library and Museum, 20 May 1955, as reproduced in Stephanie Feycock, "National Security Space Project: Presidential Decisions: NSC Documents," The George C. Marshall Institute, Washington, DC.

[9] Treaty On Principles Governing The Activities of States in the Exploration and Use of Outer Space, Including The Moon and Other Celestial Bodies, signed at Washington, London, Moscow, 27 January 1967; entered into force 10 October 1967.

[10] Buenneke, "National Space Policy: Does it Matter?," 8.

[11] Ibid.

[12] "President John F. Kennedy's Special Message to the Congress on Urgent National Needs," 25 May 1961, "…I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth."

[13] R. Cargill Hall, "Military Space and National Policy: Record and Interpretation," The Marshall Institute, Washington, DC, 2006 with comment by Dr. Robert Butterworth.

[14] Ibid.

[15] *National Space Policy*, 28 June 2010, 14.

Mr. James D. Rochier (BS, Electrical Engineering, University of Texas at Arlington; MS, Electrical Engineering, University of Texas at Arlington) is a principal director with The Aerospace Corporation, where he manages and directs their US Strategic Command Directorate in Omaha, Nebraska, including support at the Joint Functional Component Command for Space at Vandenberg AFB, California. In that role, he oversees analysis and operational support for the spectrum of national security space systems, their integration into joint warfighting plans and operations as well as the development of capability needs and program advocacy positions. Mr. Rochier joined the Aerospace Corporation in 1997 after retiring from the US Air Force. He has also worked at Space and Missile Systems Center, the National Air and Space Intelligence Center, and Headquarters, Air Force Space Command where he supported development of Space Control requirements and program initiation and development for a variety of space defense systems.

Air Force Space Policy: Highlights from the First Half-Century, 1948-1998

Dr. Rick W. Sturdevant
Deputy Command Historian
HQ AFSPC History Office
Peterson AFB, Colorado

Dr. David N. Spires
Senior Instructor, Department of History
University of Colorado at Boulder
Boulder, Colorado

Formulation of US Air Force (USAF) space policy has a long, interesting history. Generally speaking, such policy has followed pronouncements of national and Department of Defense (DoD) space policy and has conformed derivatively to it. This is not to suggest, however, that the USAF itself has not taken the initiative, on occasion, to advance its own interests with carefully crafted policy statements. Highlights from the first 50 years of USAF space policy-making exemplify this. We offer them simply as background for the focus of this *High Frontier* on more current policy issues.

The USAF had existed less than four months as an independent service when General Hoyt S. Vandenberg, its first vice chief of staff, issued its first official space-related pronouncement. In January 1948, he signed a "Statement of Policy for a Satellite Vehicle" that declared, "The USAF, as the service dealing primarily with air weapons—especially strategic—has logical responsibility for the satellite." This staked the Air Force claim to space leadership, which the service's leaders would defend fiercely during the inter-service rivalries of the 1950s.

Acquisition of an intercontinental ballistic missile accelerated with creation of the Western Development Division (WDD) in 1954, and USAF leaders understood a rocket capable of carrying a nuclear warhead through outer space could launch a military satellite into Earth orbit. Consequently, in February 1956, WDD officially gained responsibility for Weapon System 117L, the first USAF satellite program. On 19 February 1957, Maj Gen Bernard A. Schriever, WDD commander, delivered a pre-Sputnik keynote address titled, "ICBM—A Step Toward Space Conquest," at the first Air Force Office of Scientific Research Astronautics Symposium in San Diego, California, where leading representatives from industry, research institutions, academia, and the military had convened to review scientific and technological progress in astronautics and chart the way forward. Schriever speculated, "In the long haul our safety as a nation may depend upon our achieving 'space superiority.'" For that, his superiors in Washington, DC, severely reprimanded him, because President Dwight D. Eisenhower's administration wanted to establish the "peaceful use of outer space" as national policy and, therefore, to avoid references to military use of outer space, lest the press or general public misconstrue them.

Eisenhower's strategy contained two essential principles: space for peaceful purposes and freedom of space. In effect, he perceived space as a global commons and had no intention of "weaponizing" it. Furthermore, the wastefulness of interservice rivalry associated with rocket and satellite development offended his frugal sensibilities. For these reasons, he signed legislation establishing the civilian National Aeronautics and Space Administration. Despite the USAF failure to win leadership of the national space program, some senior generals remained skeptical about the national space strategy. General Thomas S. Power, Strategic Air Command commander in chief, wrote confidentially in August 1958 to General Thomas D. White, USAF chief of staff, regarding "Strategic Air Command Space Policy." Focusing on "primacy of the offensive," Power believed "offensive space weapons provide a dimensional extension in system capability for the accomplishment of the strategic air warfare mission—the mission remains constant." To that end, he claimed the presence of humans in orbiting spacecraft was the essential ingredient for full exploitation of the space domain, just as humans in bomber cockpits were essential for full exploitation of the air domain.

Within a few months, General White and other senior USAF officers began using publicly a new term—"aerospace"—to describe an indivisible operational arena for which their service had responsibility. The aerospace concept long would remain at the center of USAF leaders' efforts to defend their service's prerogatives in space, even though many realized the fundamentally different nature of, and operational differences within, the air and space domains. In April 1964, for example, General Curtis E. LeMay, USAF chief of staff, approved a summary of "USAF Space Objectives" based on the aerospace concept that became the service's primary policy statement for the next 13 years.

On 9 May 1977, USAF Chief of Staff General David C.

Focusing on "primacy of the offensive," Power believed "offensive space weapons provide a dimensional extension in system capability for the accomplishment of the strategic air warfare mission—the mission remains constant."

General Gabriel said, "The Air Force affirms that its exclusive responsibilities in space include the duty to protect the right to free use of space by providing space control (i.e., space superiority) as defined in the Air Force Space Plan."

Jones, prompted by the growing importance of military space and organizational disarray, issued the first official statement on "Air Force Space Policy" since General LeMay's summary in 1964. In his cover letter, General Jones asserted that the "increasing reliance on space operations has been accompanied by a growing threat to the free use of space." The policy document itself stated that USAF responsibilities included a "duty to protect the free use of space by providing needed space defense capabilities." This document, together with President James E. Carter's directives on space, provided the framework for important USAF organizational and doctrinal deliberations that culminated with the establishment of a major command for USAF space operations in September 1982.

That organizational action, combined with publication of a new USAF manual on space doctrine in October 1982, provided the basis for Chief of Staff General Charles A. Gabriel to issue on 1 July 1983 an updated, expanded version of General Jones's 1977 policy letter. General Gabriel said, "The Air Force affirms that its exclusive responsibilities in space include the duty to protect the right to free use of space by providing space control (i.e., space superiority) as defined in the Air Force Space Plan." Further asserting USAF dominance over the Army and Navy in space, General Gabriel bluntly stated the USAF would assume responsibility if national security requirements justified development of space-based weapons.

The Space Shuttle *Challenger* disaster in January 1986, combined with new challenges from the DoD, US Space Command, Strategic Defense Initiative Organization, Army, and Navy regarding USAF space dominance, compelled the latter to reassess thoroughly its role in the military space community and the role of space within the USAF itself. A June 1987 "White Paper on Air Force Space Policy" described the most significant challenges to USAF space leadership and the service's failure to realize the lofty objectives set forth in General Gabriel's July 1983 letter. The white paper recommended alternatives and concluded, "A new Air Force policy statement with appropriate implementing instructions and milestones is required." Specifically, it recommended the USAF declare that it would be, as a matter of policy, "lead service for space" and would "provide space defense, force application, space support and multi-user space force enhancement forces for employment by US Space Command." This white paper sparked the convention of a blue-ribbon panel in autumn 1987 to reassess the USAF role in space and precipitated Air Staff work on revision of General Gabriel's policy letter.

New USAF space policy guidelines issued on 2 December 1988 by Secretary of the Air Force E. C. "Pete" Aldridge, Jr., and Chief of Staff General Larry D. Welch backed away somewhat from Gabriel's aggressive assertion of responsibility for virtually all DoD space activities. They scoped the still-broad USAF aspirations more realistically. The guidelines included three basic tenets: (1) spacepower would be as decisive in future combat as airpower was in the present; (2) the USAF must prepare for the evolution of spacepower from combat support to the full spectrum of military capabilities; and (3) the USAF should make a solid corporate commitment to integrate spacepower throughout the full spectrum of USAF capabilities. Furthermore, the policy envisioned the responsibilities of the USAF in space as encompassing four areas: (1) space control, which included acquisition and operation of antisatellite (ASAT) capabilities, plus integration of those capabilities with improved space surveillance; (2) force application, which involved acquisition and operation of space-based ballistic missile defense (BMD) assets and BMD/command, control, and communications management in the event a BMD deployment decision occurred; (3) force enhancement, which included acquisition and operation of space-based systems for navigation, meteorology, tactical warning and attack assessment, nuclear detonation detection, multi-user communications, and space-based means for space surveillance, while continuing to support a "multiservice approach to conducting space surveillance and for providing mission-unique, space-based communications"; and (4) space support, which continued the service's longstanding provision of launch and common-user, on-orbit support for DoD. While reassuring the Army and Navy that it did not view its right to space as exclusive and that the other services could build space systems for their unique requirements, the USAF sought to capitalize on its heritage as the principal provider of space forces for national defense.

The 1988 USAF policy statement set the course for a two-track approach to space in the 1990s. One track aimed to integrate and normalize space within the service, and the other track sought to gain recognition as the lead service, if not the DoD executive agent, for space. Progress along both tracks benefited greatly from the obvious contributions of space systems in Operations Desert Shield and Storm during 1990 to 1991. To move beyond the traditional strategic concept of aerospace and emphasize the utility of space operations for warriors at the theater and tactical level, Chief of Staff General Merrill A. McPeak articulated a new USAF mission statement in a June 1992 speech at Maxwell AFB, Alabama. Henceforth, he declared, air and space would be treated as co-equal domains for which the USAF had primary military responsibility.

General McPeak appointed Lt Gen Thomas S. Moorman, Jr., vice commander of Air Force Space Command, to chair a Blue Ribbon Panel on space late in 1992. Its charter included a review of USAF space policy, organization, and infrastructure for the purpose of charting the service's role in space during

the early 21st century. The panel's final report made many of the same points as the 1988 policy statement with respect to ASAT, BMD, and military space support. It also went further on several key policy-related issues, including one in which the USAF should "seek designation as the single manager for DoD space acquisition." By October 1994, Secretary of the Air Force Sheila E. Widnall released a policy letter on roles and missions in which she argued that the increasing importance of space to warfighting, balanced against declining budgets and a fragmented space acquisition process, made it logical for DoD to take advantage of USAF expertise and designate her service as the DoD executive agent for space. Resistance from the other services and alternative solutions temporarily thwarted Dr. Widnall's proposal, however, in favor of inter-service and interagency cooperative measures in the space arena.

As the 20th century drew to a close and USAF leaders contemplated their service's space future, they undoubtedly found some tea leaves easier to read than others. The facts and, consequently, the policy-related impacts of events such as a brief reversion to the traditional concept of aerospace as a singular domain (2000), release of an extremely influential report by the Commission to Assess US National Security Space Management and Organization (2001), devastating terrorist attacks on the World Trade Center and Pentagon (2001), large-scale military operations in Afghanistan and Iraq (2001–2003), a new statement that added "cyberspace" to the mix of USAF missions (2005), and a successful Chinese ASAT test (2007) remained largely unforeseen and unpredictable.

These and other events significantly affected the USAF perspective on space in the first decade of the 21st century. Civilian and military leaders alike continued to pursue adjustments to different types of threats in a post-Cold War world. With reference to the acquisition of space systems, the secretary of defense designated the secretary of the Air Force as the DoD executive agent for space in June 2003, only to retract that responsibility in March 2005, then reinstate it in November 2010. Given the presence of an increasing number of nations in space, some strategists would argue it was more a congested and contested domain than a peaceful commons. With the growing reliance of US military forces on space systems for efficient, effective warfighting, USAF leaders increasingly would emphasize space situational awareness, space protection, and the ability to achieve both air and space superiority in combat operations.

Note:

For further information on the historical evolution of USAF space policy, see David N. Spires, *Orbital Futures: Selected Documents in Air Force Space History*, 2 vols. (Peterson AFB, Colorado: Air Force Space Command, 2004).

Dr. Rick W. Sturdevant (BA, History, University of Northern Iowa; MA, History, University of Northern Iowa; PhD, University of California, Santa Barbara) is deputy command historian, Headquarters Air Force Space Command, Peterson AFB, Colorado. He joined the Air Force History and Museums Program in April 1984 as chief historian, Airlift Information Systems Division, Scott AFB, Illinois, and moved one year later to the Chidlaw Building near downtown Colorado Springs as chief historian, Space Communications Division (SPCD). When SPCD was inactivated in 1991, he moved to the HQ AFSPC history office and became deputy command historian in 1999.

An acknowledged expert in the field of military space history, Dr. Sturdevant appears frequently as a guest lecturer on space history topics and is author or co-author of chapters or essays in *Beyond the Ionosphere: Fifty Years of Satellite Communication* (1997); *Organizing for the Use of Space: Historical Perspectives on a Persistent Issue* (1995); *Golden Legacy, Boundless Future: Essays on the United States Air Force and the Rise of Aerospace Power* (2000); *Air Warfare: An International Encyclopedia* (2002); *To Reach the High Frontier: A History of US Launch Vehicles* (2002); *The Limitless Sky: Air Force Science and Technology Contributions to the Nation* (2004); *Encyclopedia of 20th-Century Technology* (2005); *Societal Impact of Space Flight* (2007); and *Harnessing the Heavens: National Defense through Space* (2008). His articles and book reviews have appeared in such journals as *Space Times*, *Journal of the British Interplanetary Society*, *Air & Space/Smithsonian*, *Quest: The History of Spaceflight Quarterly*, *Air Power History*, *High Frontier: The Journal for Space & Missile Professionals*, and *Journal of the West*. He sits on the editorial board of *Quest* and on the staff of *High Frontier*.

Dr. David N. Spires (PhD, University of Washington) is a senior instructor in the Department of History at the University of Colorado at Boulder who taught at the US Air Force Academy during his military career. He specializes in military, space, and German history. His book publications include *Patton's Air Force: Forging a Legendary Air-Ground Team* (2002), *A Theater in Conflict and Transition: United States European Command Operations During the Tenure of General George A. Joulwan, 1991-1997* (2004), *Active Engagement and Preparedness: United States European Command Operations During the Tenure of General Wesley K. Clark, 1997-2000* (2004), *Orbital Futures: Selected Documents in Air Force Space History* (2004), *and Beyond Horizons: A Half-Century of Air Force Space Leadership* (2007).

Book Review

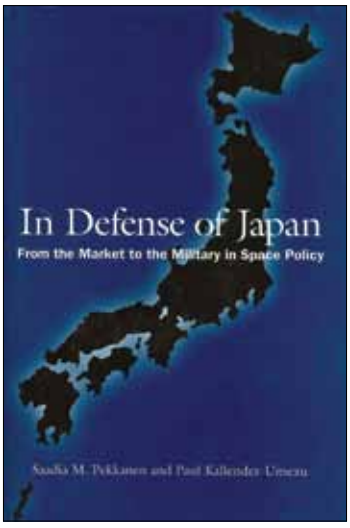
In Defense of Japan: From the Market to the Military in Space Policy

In Defense of Japan: From the Market to the Military in Space Policy. By Saadia M. Pekkanen and Paul Kallender-Umezu. Stanford, California: Stanford University Press, 2010. Tables. Figures. Appendices. Notes. Index. Pp. xxx, 378. $55.00 Hardcover ISBN: 978-0804700634

News reports in October 2010 described how, as practice for the real-world threat posed by North Korea, a Japanese destroyer fired an SM-3 interceptor missile to successfully destroy its target 100 miles over the Pacific Ocean. This event certainly signaled Japan's intent to work collaboratively with the US on ballistic missile defense, but it failed to expose a more extensive, fundamental shift in how that nation seeks to ensure its future security. To understand the latter, *In Defense of Japan* provides a relatively current, book-length starting point. Its co-authors, University of Washington professor of law and international studies Dr. Saadia M. Pekkanen and award-winning science journalist Paul Kallender-Umezu, show how Japan has become a military space power.

Constrained by the terms of peace after World War II, the Japanese initially avoided developing missiles for military purposes. They focused instead on building an indigenous civil space program, beginning with the launch of a Pencil rocket in 1955. Two events in 1969 created the institutional context for development of Japan's space industry: first, the Diet's Peaceful Purposes Resolution, which bounded the nation's future space activities exclusively to peaceful purposes; and second, establishment of the National Space Development Agency to bring coherence to the implementation of Japan's space policy. For the next three decades, despite enormous structural changes in global politics and economics, Japan's official space policy consistently reflected civilian use and international cooperation in space. At the same time, it emphasized increasing the sophistication of key technologies related to spaceflight.

By the beginning of the 21st century, however, what Pekkanen and Kallender-Umezu term "a market-to-military trend" became an increasingly apparent challenge to the principles that long had governed Japanese defense policies. In 2000, a shakeup in the policymaking structure for science and technology signaled a pivotal shift to realign space policy by moving the space industry into the national security arena. The government's release in 2004 of a detailed space plan for the next decade cemented the "tilt toward the militarization of space policy." Subsequent deliberations within the National Space Strategy Planning Group led by Takeo Kawamura resulted in a purposeful initiative to free Japan's space industry from the institutional and legal structures, both domestic and international, that long had attempted to constrain the militarization of Japan's space assets.



While so-called "government players" certainly have had a significant role in the market-to-military reorientation of Japan's space industry, the authors of *In Defense of Japan* place corporate interests or "private players" at the heart of this change. Pekkanen and Kallender-Umezu identify and elaborate on the "key private companies whose economic fortunes have risen and fallen in the highly competitive space business." Over time, these companies accumulated an impressive set of world-class, space-related technologies. Finding nowhere to sell high-quality, sometimes cutting-edge products in the commercial sphere, Japan's leading space industrialists saw increasing possibilities for marketing them in the military sphere. By systematically examining, in separate chapters, the evolution of Japanese launch vehicles, satellites and spacecraft, and emerging technologies, the authors build a convincing case for how technological capabilities developed strictly for the peaceful use of outer space provide a strong, dual-use foundation for Japan's current and future military space activities.

The authors assess the interplay and relevance of several contested, theoretical paradigms—realist or constructivist in orientation—to understanding the advancement of space technologies in Japan's national defense. Parallel to the vigorous academic debates surrounding the applicability of these theories, they find "controversies over constitutional limits and interpretation that are more pragmatically relevant in the real world." All of this provides a "rich context" for framing their particular approach, which focuses on the economic interests of Japanese industrialists and corporate leaders in contemporary geopolitical context. The result is a relatively empirical exposition of the evolutionary militarization of Japan's space policy and space-related technologies.

In Defense of Japan draws substantively from an impressive number and variety of sources, as the notes indicate. From conference papers and journal articles to government reports and scholarly books, the authors siphon a wealth of factual detail to document the market-to-military trend. Citations for newspapers, trade magazines, and websites—both English- and Japanese-language—occur more frequently as the story approaches relatively current events. Interviews with Japanese government officials and industrial leaders augment the most recent sources. Combined with the tabular presentation of historical facts and statistics throughout the narrative, an abundance of explanatory annotations adds useful depth and breadth to the book. Anyone interested in reading a thoroughly researched, up-to-date, English-language treatise on the dual-use nature of Japan's evolving space activities need look no further than this particular volume, which might serve as a model for historically grounded analyses of other national space policies and programs.

Reviewed by Dr. Rick W. Sturdevant, deputy command historian, HQ Air Force Space Command.

U.S. AIR FORCE

AIR FORCE SPACE COMMAND

We are interested in what you think of the ***High Frontier*** Journal, and request your feedback. We want to make this a useful product to each and every one of you, as we move forward to professionally develop Air Force Space Command's space and cyberspace workforce and stimulate thought across the broader National Space Enterprise. Please send your comments, inquiries, and article submissions to: HQ AFSPC/PA, *High Frontier* Journal, 150 Vandenberg St, Suite 1105, Peterson AFB, CO 80914-4020, Telephone: (719) 554-3731, Fax: (719) 554-6013, Email: afspc.pai@peterson.af.mil. To subscribe: hard copy, nsage@sgis.com or digital copy, http://www.af.mil/subscribe.

AFSPC/PAI
150 Vandenberg St.
Ste 1105
Peterson AFB, CO 80914
Telephone: (719) 554-3731
Fax: (719) 554-6013

Air & Space Power Journal:
www.airpower.maxwell.af.mil/airchronicles/apje.html