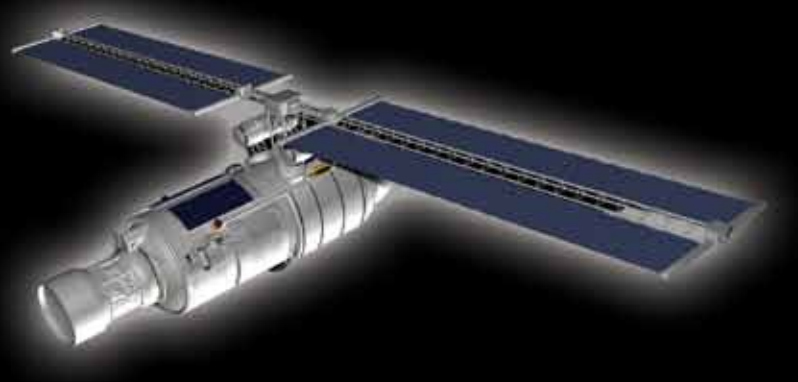


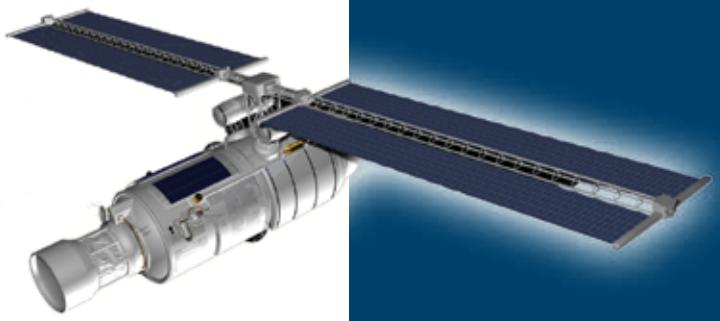
SPACE ISR
IN A CONTESTED ENVIRONMENT

A WHITE PAPER PREPARED BY THE AFCEA INTELLIGENCE COMMITTEE

OCTOBER 2010

AFCEA

Serving Intelligence Professionals and Their Community Since 1981



This paper examines the current status of Space Intelligence, Surveillance, and Reconnaissance (ISR) after 50 years and the strategies we must implement to seize opportunities to excel for the next 50 years. We explore Space ISR in a contested environment, the June 28, 2010, National Space Policy, and positions we should take in the policy and strategy domain to protect our national security interests.

Executive Summary

We recommend necessary investments, paramount among them being improved space situational awareness and investment in technologies that allow us to protect our space assets and gather comprehensive information on all space systems' intents and capabilities. Finally, we advocate that a single accountable organization, presumably within the Defense Department (with support from the Director of National Intelligence (DNI)), must be given resources, responsibility and authority to implement and operationalize National Space Policy.

Space ISR in a Contested Environment

The National Space Policy document states, "The space domain today is becoming increasingly congested and contested, while the international space industry is becoming more competitive." Some discussions add complexity to that characterization of space. Current space involvement in all nations is increasing. At one time, two super powers dominated space activities; now 43 nations own space assets. Even universities design, build, launch, and operate spacecraft. In the mid-80s the United States cataloged 7,000 objects greater than 10 cm in space. That number now is approaching 20,000. More than 1,100 active satellites currently operate in space. The shrinkage in electronics technology has enabled more capability to be packed into smaller vehicles. Those smaller vehicles are more difficult to track. Once, only the U.S. and the U.S.S.R. possessed space-launch capability. Now seven countries (U.S., Russia, China, Europe, India, Israel, Japan) launch spacecraft, and more have programs to join that club (South Korea, North Korea, Iran). The projections of broadened space involvement, including the growth in space platforms, debris, and nations with space capability are all on a significant upward vector.

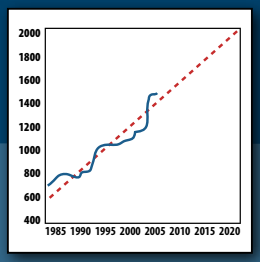
While international and commercial space activities have accelerated, the U.S. commercial and military dependence on space assets has increased even more. Civil aircraft already use GPS navigation to augment or replace land-based navigation technology; within 10 years, the FAA NextGen air- traffic management system will rely foremost on GPS. Natural disaster communications is already based primarily on satellite connectivity. ATMs require space-based timing signals, farmers use GPS for precision agriculture, and direct-to-home broadcast has revolutionized entertainment.

The U.S. military uses space assets for unmanned aerial vehicle (UAV) control, intelligence product broadcast-to-combat forces, precision strike, blue-force tracking, Presidential command and control of nuclear forces, ISR, as well as a host of other critical missions. General Robert Kehler, USAF, commander of Air Force Space Command, has called military space capability a "time machine." Without it, we move back to the way we fought in World War II — huge numbers of Americans deployed in harm's way with a huge logistics tail and huge numbers of casualties.

Our potential adversaries also have noticed our increased reliance on space and are exploring the means to defeat our advantage in this area. We already have seen demonstrations of kinetic energy direct-ascent ASATs; co-orbital ASATs are now easier to implement. We also have seen regional jamming of GPS signals. An online search of "GPS jammers" returns over 75,000 results, all related to commercially available jamming. We are constantly fighting RF interference on our geosynchronous communications satellites, which to date we believe is generally unintentional. Cyber-probing is persistent. A recent Department of Defense publication, "Military and Security Developments Involving the People's Republic of China," states: "In 2009, numerous computer systems around the world, including those owned by the U.S. government, continued to be the target of intrusions that appear to have originated within the People's Republic of China." Also, "...the accesses and skills required for these intrusions are similar to those necessary to conduct computer network attack." Such intrusions target space systems while, at the same time rely on space systems for their effectiveness.

> "The space domain today is becoming increasingly congested and contested, while the international space industry is becoming more competitive."

A Complex Space Environment



The Number of Space Objects is Increasing

Currently, 43 Countries Use Outer Space

Object Size is Decreasing

Countries worldwide are utilizing satellites as small as 2.5 lbs.

The Amount of Space Debris is Increasing

Evolving Threat

- RF Jamming
- High/Low Energy Laser
- Direct Ascent ASAT
- Co-Orbital ASAT
- Physical Attack
- Cyber Attack
- Nuclear Detonation

A Changing Security Environment Necessitates a Shift in How We View Space Assets

Courtesy of Deputy Under Secretary of the Air Force for Space

> ...the U.S. cannot give up its superiority over certain aspects of space without a significant impact to its national security posture.

Nations such as China, Russia, and Iran continue to develop and modernize their space systems. More than 60 nations are engaged in space efforts, and tens of thousands of man-made objects orbit Earth. In such a crowded environment, investments in sensors, tracking, threat assessment and attribution, and other efforts — including information sharing with government, industry, and international partners — are needed.

Critical National Command Authority, warfighter, intelligence, civil, and commercial activities depend upon space support, both government and commercial, to operate successfully. Routine and time-critical activities from detection and response to ballistic missile attack, to local emergency team responses, to personal communications and ATM use would be crippled without support from space systems. Space support has become inextricably interwoven into the fabric of virtually every aspect of life in the U.S. and much of the world.

With our general dependence on space systems acknowledged, this white paper explores thoughts and issues related specifically to the role of Space ISR in the future and its existence in an environment that is characterized as being contested — just one of those elements of future space, albeit one that presents significant challenges to our traditional use and treatment of ISR from space.

Key Questions:

What are the implications of a contested space environment on ISR developers and users?

Are we treating space and our use of space correctly?

Are the future requirements for the use of space by both the Intelligence Community and Defense Department driving us to the same position on Space ISR or to radically different positions?

Should we adopt a strategy and policy position that approaches space differently, for instance, as a kinetic or non-kinetic warfighting domain?

What are the implications of continuing with the current space posture and not making a change?

Background

Traditional Uses of Space For ISR

This country has completed its 50th year using space assets for ISR. The space race created and justified by the nation's approach to the Cold War has resulted in capabilities that now serve the country in the strategic, tactical and civil domains. The traditional uses of space assets to provide worldwide persistent surveillance, presence over denied territory, early warning of plans and intentions, access to information that our adversaries try to deny us, and near instantaneous crisis support have been joined by technical capabilities providing data that are now critical to our warfighters. Space systems today allow people and governments around the world to see with clarity, communicate with certainty, navigate with accuracy, and operate with assurance. In addition, constant investigation into new phenomenologies provides glimpses of future space that increase the benefits and strategic utility of space assets and as a result make space access a necessity for nations around the globe.

Discussion

One premise of this paper is that "space superiority in a contested environment is a national security imperative." As the June 28th National Space Policy states, "The United States considers the sustainability, stability, and free access to, and use of, space vital to its national interests." Additionally, "The United States 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." The Secretary of Defense is chartered to, "Develop capabilities, plans, and options to deter, defend against and, if necessary, defeat efforts to interfere with or attack U.S. or allied space systems." The policy recognizes that the U.S. cannot give up its superiority over certain aspects of space without a significant impact to its national security posture. In a contested environment, the threat to the United States' superior position is affected in many ways. When many nations have the ability to view and listen to the world at large, while limiting our ability to do the same, the information advantage to which we have become accustomed is lessened.

"Knowledge is power" is damaged by global assets that provide the same kind of information to everyone. The need then arises to collect different information in new and unexpected ways. The requirement also arises to disrupt by some means, overt or covert, those data collectors who pose a threat to us. The corresponding necessity is to defend ourselves against those same actions. Designing for, and operating through, a contested environment contains elements of denial, deterrence and protection. In addition, and without advocating an offensive space posture for the country, we still must acknowledge that offensive capabilities in space systems can exist and that offensive measures from the ground already exist. We must examine our policy and strategy in regard to the U.S. developing and using such capabilities while understanding how our space and ground segments perform in the face of others' offensive capabilities. We must then strengthen our defenses in those areas.

First

We must consider the positions we could take in the policy and strategy domain that would aid us in protecting our interests. If we elect as one of our options to treat Space as a warfighting domain from a policy and planning perspective, what must we do? Should we include both kinetic and non-kinetic options in our counter-space-development programs?

To protect ourselves, we must defend our space assets and detect and dissuade those who would do us harm employing the capability for retaliation on our adversaries. Elements of this strategy are:

1. Maintain the U.S. **national security imperative of Space ISR** to ensure that interference is treated as an attack on sovereign territory. Current space policy states, "Purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation's rights."

2. Ensure our **freedom of movement**. We must maintain our assured access to space and freedom of passage in space.

3. **Revise our Space ISR strategy** from an emphasis on a single or limited number of highly capable but vulnerable systems to a strategy that distributes value to enhance survivability while diversifying and multiplying the sources and types of sensors and the information they collect and communicate. We can no longer afford to experience "single string"

or capability "gap" situations. If we augment our systems with commercial assets, allied systems, and finding ride-sharing opportunities for our payloads, it is less likely for a single event to have catastrophic consequences. If we develop a budget and planning system that systematically allows for replenishment of those absolutely critical systems when needed and which, in doing so, accounts for the uncertainty that still characterizes all space initiatives, then we will be able to replace those assets in a timely manner.

4. **Develop new and better technologies** that allow us to protect our space assets. Resilient spacecraft, some even hardened against nuclear attack, become essential. The capability to detect a threat and take an automatic action as a result becomes a requirement for almost every system. Exploration of defensive technologies must be increased dramatically.

5. Emphasize that **space situational awareness** is an essential capability that will enable us to fully understand and cope with the plans and intentions of our adversaries. We must know who and where the bad guys are – space and ground. As emphasized above, we must be able to detect an overt or covert act against one of our assets as well as be able to track the capabilities of other nations in that regard. Our understanding and analysis of our adversaries' capabilities must be increased.

6. Gather much **more data about other space systems**, with regard to their intent and their evolving capabilities. We must maintain track "custody" of space objects throughout their lifetime and migrate from simply cataloging them. Though SBSS dramatically improves our revisit times between observations, we must go beyond the current "white spots in the night sky" mentality.

7. Determine **leadership intentions from the satellite's pedigree**. We need to determine if the vehicle is what it seems or something else. We need to track ownership of space assets and determine when it changes. We need to better understand the technologies that would allow it to be modified in mission terms. Analysis of space systems must rival or surpass analysis of weapons systems.



Second

In the strategy and policy domain, if we also undertake an offensive posture, what are the characteristics of that position and what are the resulting actions?

One alternative is to treat space as a combat arena and in that regard to develop capabilities to find, fix, track, target, engage, and assess. A defensive posture most likely will involve the ability to "find, fix, and potentially track" threats of multiple kinds. On the offensive side, targeting, engaging and eliminating a space asset from the ground is an ability that has already been demonstrated. More sophisticated techniques that disable or interfere with the capabilities of a satellite exist in varying degrees of readiness, but they require much more investment and exploration. The decision to place some of these technologies in space and whether to place limits on them must occur. Much more research is needed to better inform policymakers of the range of options this nation and other nations will have and to recommend the prudent way forward. A path that allows solely for defensive capabilities on space vehicles is not supported by the military doctrine of this nation and is likely to result in vulnerabilities in our national security.

The second alternative suggests a diplomatic approach that involves a return to the treaty era when space was considered an entity that was free for all. Taking advantage of the approaches and concepts used to develop naval treaties can guide our use of space, essentially defining it as analogous to a congested, shared ocean environment. International naval treaties provide right of self defense, transit passage, economic exclusion zones, salvage, and control of hazards to navigation and many of those concepts can apply to a space treaty.

Though the above discussion seems to be providing an "either/or" solution, it may be that the policy answer lies in some distillation of both alternatives.

We believe that today's National Space Policy charts the path for successful operation in this contested and congested environment. Under guiding principles it states: "As established in international law, there shall be no national claims of sovereignty over outer space or any celestial bodies. The United States considers the space systems of all nations to have the rights of passage through, and conduct of operations in, space without interference. Purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation's rights.

The United States 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."

This declaratory policy protects freedom of passage in space, while warning against interference with space systems. Additionally, it charters the U.S. to deter, defend, and if necessary, defeat attacks against our, and allied, space systems.

The Policy charges both the Department of Defense and Intelligence Committee (IC) to develop, acquire, and operate space systems through peace, crisis, and conflict:

"The Secretary of Defense and the Director of National Intelligence, in consultation with other appropriate heads of departments and agencies, shall: Develop, acquire, and operate space systems and supporting information systems and networks to support U.S. national security and enable defense and intelligence operations during times of peace, crisis, and conflict;

And ensure cost-effective survivability of space capabilities, including supporting information systems and networks, commensurate with their planned use, the consequences of lost or degraded capability, the threat, and the availability of other means to perform the mission"

As stated in the Intersector Guidelines section of the policy, to improve the resilience of space systems, the U.S. will:

"Assure space-enabled mission-essential functions by developing the techniques, measures, relationships and capabilities necessary to maintain continuity of services; such efforts may include enhancing the protection and resilience of selected spacecraft and supporting infrastructure;

Develop and exercise capabilities and plans for operating in and through a degraded, disrupted, or denied space environment for the purposes of maintaining mission-essential functions;

Address mission assurance requirements and space-system resilience in the acquisition of future space capabilities and supporting infrastructure."

The policy offers several examples of maintaining continuity of services, reconstitution, allied systems, and commercial systems.

"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."

The robust posture outlined in the statements above provides the basis for the development of a sophisticated strategy that should allow the U.S. to continue as the premier space-faring nation. The translation of policy into strategy and then into implementation is an agenda that must be pursued with urgency for us to determine our future in Space ISR. The group pursuing that agenda should provide a centralized function that simplifies and clarifies strategic initiatives and assigns related implementation actions.

Discussion

Beyond strategy and policy, but in support of the intent to preserve our space superiority, what should we bring to bear to get the results we need now and in the immediate future? In other words, what shorter term actions should we take within our current bounds?

We need to transition from providing solutions to outdated requirements to a world where we again seize the high ground with new sensors and phenomenology, some of which are acquired in complete secrecy. Regardless of the necessity to do so, the National Reconnaissance Office (NRO) has been hampered by its transition to an acknowledged organization, especially in its ability to provide the element of intelligence surprise. On top of that, the NRO is in a position where it is obliged to treat new approaches to intelligence collection as one-offs that are accomplished on the margins of its flagship programs. The critical issue regarding that kind of approach is that we as a nation are left playing a very defensive game. The ability to rapidly deploy new and different collection capabilities that go beyond experimental proofs-of-concept becomes critical in a contested space environment and offers the advantage of requiring constant reassessment of our capabilities by our adversaries.

Beyond new phenomenologies and capabilities, we also need to reaffirm the necessity of space research and development as a means to provide capabilities but also to perform the necessary research and development to increase our awareness of threats and also to increase

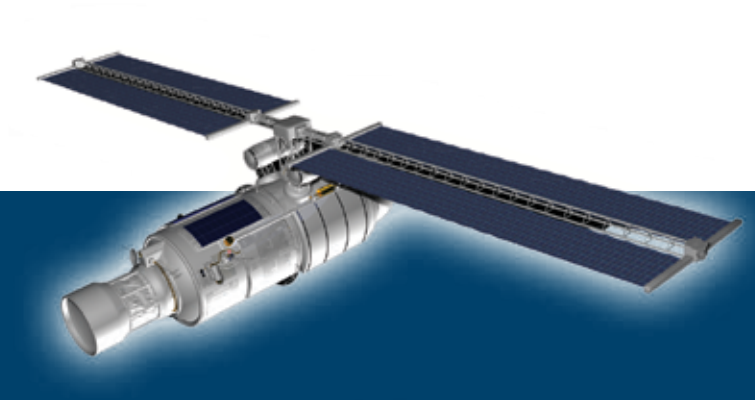
our resilience to threats. In addition, investments that bring new, innovative, and intrusive capabilities quickly to operation will be needed.

We also need strategies for tighter coupling between the NRO, the AF, DARPA and the warfighter to meet tactical needs and to ensure that new capabilities are factored into weapons systems developments early to achieve greater operational integration. And of course, we need better planning to couple space-based capabilities with ground-based exploitation tools, personnel, and resources to ensure value is effectively harvested from initial operating capability to end-of-life. We need to build and launch capabilities that contribute to greater intelligence production and strategic awareness while providing unique and timely support to tactical users worldwide. We need to get products into the hands of our analysts, forces and allies without excessive restrictions and security.

We need to revisit the need for absolute perfection in our launch infrastructure that now has "checkers checking checkers." We can learn from others about their launch processes that enable them to launch on schedule while we suffer with weather delays and interference holds from a boat or plane that comes within five miles of a launch. We should be designing for a launch-on-need to support a reconstitution strategy that is robust. If space is to be contested, we must review our entire infrastructure, correct the design points that are too fragile, have capabilities in the barn, and have the ability to launch them on very short notice.

Summary

The paper has presented discussions of the need to approach Space ISR for the next 50 years in ways that acknowledge where we have been, the changes we have made, the dependencies that exist and will evolve, and the behaviors of other nations as a result of their increased use of space. We have stressed the need for the U.S. to continue investment in and implementation of those capabilities that will allow us to maintain our superior position in space ISR. In addition, we have noted that the fundamental elements of a position that will support the needs of the U.S. in the policy domain for the future do exist within the National Space Policy framework, but that significant decisions that are now squarely under the charter of the Secretary of Defense and involve the development and implementation of strategy are imperative. Those decisions will need to be accompanied by the requisite funding. Also, we believe that a single accountable organization presumably within the Department of Defense (with support from the DNI) must be given resources, responsibility and authority to implement and operationalize National Space Policy. The next 50 years of Space ISR likely will offer us tremendous opportunity to excel. We should pursue that opportunity in an urgent and comprehensive manner.



The Intelligence Committee is AFCEA's major link to the U.S. Intelligence Community and the corporate and other partners who support that community. For 29 years, the Committee has organized symposia and conferences that give industry, government, and the academic community the opportunity to discuss the major challenges facing intelligence and the other components of the national security framework.

The Committee itself consists of 36 members from industry — elected as individuals and not selected to serve as representatives of their companies. Present and past members include former senior officers from all the services and civilians who, in government service, represented the major agencies and departments in intelligence, defense, law enforcement, and homeland security. In addition, representatives from nearly 20 agencies and departments serve, in full compliance with government ethics regulations, as liaisons to the Committee.

In recent years, the Committee has looked for additional ways to enhance the public service value of this remarkable assemblage of talent, experience, and commitment. The White Paper series is an important part of that effort. The current paper represents the 13th in that series. Published in the name of the Committee as a whole, each paper represents significant volunteered effort on the part of members of the Committee, and we wish to acknowledge the prominent roles played in the current paper by members Ms. Carol Staubach, The Honorable Sue Payton, Lt. Gen. John Campbell, USAF (Ret.), Mr. Tom Conroy, with a special thanks to nonmember, but valuable contributor, Mr. Gary Payton.

The AFCEA Intelligence White Paper Series

http://intel.afcea.org