

Challenges to Future U.S. Space Control

By Terrence Smith

Space Control can be defined as the ability to maintain strategic and tactical military superiority through the continued and uninterrupted use and protection of national Space-based assets while denying, degrading, or manipulating the military use of an adversary's Space-based assets. Space control is a mixture of defensive and offensive measures implemented to ensure successful achievement of national objectives and is particularly important during periods of increased international tensions or hostilities. The capabilities required to accomplish the Space control mission are surveillance, protection, prevention, and negation.

The employment of Space-based assets, the utilization of Space asset products or services by the U.S. military since the 1980s has received worldwide attention by friendly, neutral, and hostile nations. Today, a growing number of countries, including third world countries, are accessing Space-based assets. This growth includes terrorist groups who are now utilizing Space assets in their attempts to give them a political (i.e. through direct television broadcast systems) or military advantage in their geopolitical situations (i.e. through the use of telecommunication systems or purchase of satellite imagery for target planning).

History of U.S. Space Control

Until recently, the United States has been able to achieve and maintain its technological superiority in Space through its continued investment in and development of national Space programs accompanied by the fact that there were few competitors or partners in Space. Until recently, Space control for the United States was an issue limited in focus primarily to the assets and capabilities of the former Soviet Union and the Peoples Republic of China, both of which have active military Space programs. Initially, the "Space

race" for dominance in Space was limited to the former Soviet Union and the United States. China was added as they acquired intercontinental range ballistic missile capabilities and their associated technologies from the former Soviet Union. Space control was black-and-white at this time, satellites were either "ours" or "theirs" and we knew where our satellites were. With the increase of additional participants in Space, it is no longer an issue of "black" or "white"; now there are a growing number of "grey" systems.

In recent years, the number of Space service providers or users has grown. There are now many countries and commercial consortiums with growing roles in providing services and products from indigenously developed, launched, and controlled Space-borne assets. However, the fact that a country does not have its own launch systems, satellite control facilities, or satellites, does not prohibit their access to Space. Commercial agreements now provide access to Space-based resources to those who are willing to pay. As a result, the significant technological edge that the United States had achieved and maintained up to as recently as the Gulf War may be eroding as the products and services from foreign national and commercial assets achieve capabilities closer to those of the U.S. Space systems, or at least to the point where they now have military significance. The growth of international relationships emerging from cooperative Space agreements will increase the complexity and difficulty of future Space control for the United States.

U.S. DoD Dependence on Satellites

The U.S. military is more dependent on Space-based assets than any other military on earth. The mission of the national Space programs includes launching military satellites designed to: 1) provide worldwide command,

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control, and communications between deployed elements and their respective command structures, 2) provide extremely precise navigational aid to maneuvering military forces and guidance assistance to advanced weapon systems and 3) conduct Reconnaissance, Surveillance, and Target Acquisition (RSTA) of enemy military bases, assets, and deployments. The RSTA element of the national military Space program permitted the collection of various types of intelligence in order to rapidly assess a potential adversary's military current order of battle and capabilities, and to provide insight into their intentions or to provide warning of impending hostile action. As the level of technology and the capability of satellites increases, these assets will continue to be increasingly more important to all aspects of U.S. military operations.

Satellite support is critical to the U.S. military, especially taking into account the fact that the United States could be and often is conducting military operations in several different theaters at any one time. These theaters of operations can be located on opposite sides of the globe from one another. U.S. military satellites provide increased flexibility while increasing overall efficiency and effectiveness of U.S. military forces, operations, and weapon systems.

Increased weapon system accuracy was a direct result of U.S. military satellite integration both through precision location assessments of targets and the use of global positioning system constellation information for weapon system course correction and guidance to the intended target. This capability has been studied in depth by many foreign powers in an effort to increase their own military capabilities. The demands on the limited number of U.S. Space-based assets are growing as their services and products become increasingly integrated into U.S. military operations. The loss of any of the current U.S.

Space-based capabilities would have an immediate affect on the U.S. warfighting capabilities and effectiveness.

As dependence and reliance on RSTA satellites has increased, the other more traditional or "lower tech" intelligence disciplines have been neglected. The loss of Space-based RSTA capabilities would have significant impact on U.S. operations and would be difficult to rapidly augment or substitute using strictly terrestrial assets. Protection of U.S. Space-based assets will be of the highest priority for U.S. Space control policy, doctrine, and tactics.

'Commercialization of Space'

Space is becoming increasingly accessible as countries with well developed national Space programs view commercial Space launches and provision of satellite access for countries with less developed or nonexistent Space programs as viable source of income. The revenue opportunities are a direct result of an increase in worldwide demand for access to Space-based services or products. The primary areas of Space commercialization include telecommunications, imagery, weather, and precision satellite-aided navigation.

Telecommunications has shown the greatest growth in the commercial arena and many countries with mature Space launch capabilities are offering their services to countries with less reliable or no Space launch capability to place a satellite into earth orbit for another country or commercial entity. The expenses associated with the development and maintenance of Space capabilities encourage international "partnering." Through these arrangements both can benefit while sharing the cost.

Increase in Dual-Use Satellites

While many current and future Space assets are not strictly military in nature, all commercially avail-

Future satellite trends will probably include the miniaturization of the Space-based platforms or their components which translates into longer life in orbit by permitting more Space on the satellite to be committed to fuel reserves. Eventually there could be “microsatellite” constellations deploying enhanced imagery visit times which could augment intelligence collection during increased tensions.

able Space-based capabilities are cause for concern to U.S. and friendly military forces since they all have inherent dual-use application and therefore relate directly to national security. Designs for commercial and military satellites are increasingly similar and the gap between their respective capabilities is closing. Often, the developers of a nation's Space platforms are also the same developers for commercial platforms. Satellite imagery and telecommunications are two of the most obvious examples of dual-use capabilities for both commercial and military application as the capabilities of commercial satellites like SPOT, IKONOS, and EROS reach militarily significant capabilities (resolutions approaching one meter) and are commercially available through near-real time access. This is an area of growing concern due to possible direct integration of this product into military strike planning.

There are currently no real controls over the end-users of these products other than those imposed by the service or product providers. The increase in worldwide demand will ultimately result in an increase in the number of satellite systems in orbit, the number of product and service providers, and finally, the number of users. All of these have an immediate impact on the U.S. capability to perform Space control simply by increasing the degree of

difficulty in accurately identifying product service providers, their satellite systems, and their end-user consumers.

Satellite services and products are becoming increasingly difficult to distinguish between military and commercial. This relationship goes back to the very inception of national Space programs where civilian contractors worked for the government to develop a variety of Space platforms. These contractors often are the same companies that later went on to build Space vehicles for commercial enterprises. In fact today one of the largest customers for the U.S. commercial telecommunication industry is the U.S. Department of Defense. This type of government-commercial provider relationship is spreading throughout the world.

Commercial satellite technologies with dual-use potential are proliferating which will lead to an increase in the number of countries attempting to integrate them into strictly military systems. This will be particularly attractive to countries with a lower technological base and/or limited funds for indigenous research and development efforts.

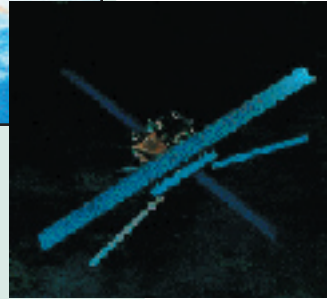
Emerging Satellite Technology

There are several areas where satellite technology growth will further complicate

U.S. Space control efforts. Future satellite trends will probably include the miniaturization of the Space-based platforms or their components which translates into longer life in orbit by permitting more Space on the satellite to be committed to fuel reserves. Eventually, there could be “microsatellite” constellations deploying enhanced imagery visit times which could augment intelligence collection during increased tensions.

Improvements to satellite sensors (i.e., miniaturization of components) will permit placing satellites in orbit which employ multiple sensors on a single platform. Another area where component miniaturization is being used is in reducing the weight and size of telecommunication receivers — which have already made it more difficult to locate the users, and if necessary target them, due to receiver system mobility.

Other satellite improvements will continue in the following areas as a result of ongoing research and development efforts worldwide: propulsion and propellants; electrical power supply; structures and materials; greater satellite autonomy “thinking” satellites; communications, command, and control; antennas; synthetic aperture radars; electro-optical sensors; signal processing; radiation hardening; and ground processing of satellite data.



Conclusions

There are many challenges the United States will face in the near future when it comes to developing an ability to conduct effective Space control. Increasing numbers of Space services providers as the “commercialization of Space” continues will be one of the most challenging issues. These participants will be in addition to the traditional countries capable of conducting Space activities with a primary military mission (Russia, China, France, etc.). A growing number of these providers will be multi-national in nature and may be based in countries friendly, neutral, or hostile to the United States. In fact, a commercial enterprise may be comprised of members from any or all three of the aforementioned country categories. It will become increasingly difficult for the United States to identify who are the services providers and who are the end-users. The increase of objects in earth’s orbit will add to the difficulty in tracking, identifying an object or satellite as threat or non-threat, determining its mission, discriminating target satellites from other Space-based vehicles, targeting, and engaging these systems.

The United States will have to develop and maintain indefinitely sufficient assets to constantly track, monitor, or engage all of the Space-borne objects as the num-

bers continue to increase and at the same time protect its own assets.

Another concern for Space control will be — once a “threat” satellite has been identified — to develop rules of engagement in order to deny, degrade, or deceive the ‘threat’ system’s intended users without affecting satellite assets being used by friendly forces or nations, non-combatants, or neutral entities. The United States will need to develop tactics and methods that can be employed while being consistent with national security directives and policies, and in compliance with international agreements.

Assessments will need to be made to determine an offensive tactic or method that would be the most effective in a given situation for engaging a “threat” platform, its links, or its associated ground stations.

The technology to support offensive Space control operations may have to be developed, and if capabilities exist outside the United States, assessments will have to be conducted to determine who has it, its potential impact on U.S. Space systems, and whether the technology is proliferating.

As more entities (countries and commercial enterprises) become involved in Space activity, the technology associated with Space platforms will likely proliferate and the technological superiority the

United States once enjoyed over adversaries may erode. The satellite technologies and systems associated with signal reception are spreading which leads to another area of concern for the United States in controlling the unauthorized use of or access to national Space-borne assets.

The issues presented here show the growing complexity and difficulty the United States will face in trying to develop and maintain Space control in a very dynamic and rapidly changing environment. Both defensive and offensive capabilities have to be taken into consideration in order to protect national assets and if necessary to counter “threat” Space-based systems and capabilities.

Terrence Smith supports the U.S. Army Space and Missile Defense Command in the Office of the Deputy Chief of Staff for Intelligence in Huntsville Alabama. Previous assignments include serving as an analyst with DoD contractors, and at the U.S. Army Aviation and Missile Command where he provided support to various U.S. Army Air and Missile Defense programs. He is former active duty Navy.

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