



Promoting Cooperative Solutions for Space Security

SSA Sharing Program SWF Issue Brief

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EXECUTIVE SUMMARY

As Earth orbit grows more congested, the need to track space objects and provide information about activities in space becomes increasingly critical for a number of reasons, including helping to prevent collisions or debris-caused damage. This information is known as space situational awareness, or SSA. Currently, the U. S. military has the most advanced SSA capability and maintains the most extensive and public catalog, though it is not complete. The United States has been sharing SSA information since the 1950s, but only in recent years did it start to formalize this sharing process.

In 2004, the Commercial and Foreign Entities (CFE) Pilot Program was created to encourage data-sharing in the realm of SSA with the overarching goal of ensuring safe operations in space. Originally, U.S. Air Force Space Command oversaw the CFE Pilot Program and administered its website, Space-Track.org (Space Track). In 2009, as part of an overall effort to consolidate SSA efforts in the U.S. government, U.S. Strategic Command (USSTRATCOM) assumed responsibility for the program, renaming it the SSA Sharing Program.

Under USSTRATCOM, the Joint Functional Component Command for Space (JFCC-SPACE) performs the SSA mission. JFCC-SPACE is responsible for the Joint Space Operations Center (JSpOC), which uses the Space Surveillance Network (SSN) to gather, catalog, and analyze the SSA data. Currently, over 21,000 objects in space are tracked regularly by JSpOC. The SSA Sharing Program gives non-U.S. government entities access to some of that data as well as some services and products based on it and provided by JSpOC.

The majority of the data shared through the program is made available on Space Track in the form of Two-Line Element sets (TLEs), which give the rough orbital position of space objects. In addition to the TLE catalog, JSpOC maintains another catalog commonly referred to as the High Accuracy Catalog. While the High Accuracy Catalog is not made available publicly, it is used for many tasks inside JSpOC such as conjunction assessment and reentry prediction. Some of these products and services, in turn, are made available to non-USG entities through the SSA Sharing Program.

Almost anyone can become a Space Track user and access information on the website, but to receive further analysis based on the unavailable High Accuracy Catalog, such as launch support and conjunction assessment, an entity must become a SSA Sharing Program partner and enter into an agreement with USSTRATCOM. Under such an agreement, both the U.S. government and program partner are prohibited from redistributing the SSA data without prior consent from the Department of Defense. Since the satellite collision of early 2009, the United States contacts all satellite owner-operators in the event of a potential conjunction, regardless of whether or not they are program partners. As of March 2010, 50 avoidance maneuvers had been performed as a result of information shared through the SSA Sharing Program.

Recent announcements and policies in the United States have emphasized the importance of the SSA Sharing Program as part of a greater effort to enhance international cooperation in space activities. Moreover, the quality and quantity of SSA data gathered by the U.S. military will increase soon thanks to several investments in improving and expanding space surveillance capabilities. Other logistical changes aim to streamline the data-sharing process and further improve the SSA Sharing Program.

Despite the benefits afforded by the program and ongoing improvements, there are still several concerns and complaints surrounding the SSA Sharing Program. Non-U.S. government users and partners worry about the program's links to the U.S. military, as well as the reliability, accuracy, and credibility of the information shared. Some within the United States worry about the cost and liability burden of providing SSA services unilaterally, as well as potential national security issues like revealing orbital positions of satellites used for intelligence-gathering. There are several alternatives to the SSA Sharing Program, made available by a variety of providers ranging from other national governments to commercial partnerships. All but one of these alternative sources of SSA sharing have explicitly stated their willingness to collaborate with the United States to achieve an overall superior source of readily-available and widely-accessible SSA data and information.

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Acronyms

AGI – Analytical Graphics, Inc.
AFB – United States Air Force Base
AFSPC – United States Air Force Space Command
CA – Conjunction Assessments
CFE – Commercial and Foreign Entities
COLA – Collision Avoidance
CSM – Conjunction Summary Message
CSSI – Center for Space Standards and Innovation
DoD – United States Department of Defense
ESA – European Space Agency
FY – Fiscal Year
GEO – Geo-synchronous Orbit
IOC – Initial Operation Capability
ISON – International Scientific Optical Network
JFCC SPACE – Joint Functional Component Command for Space
JSpOC – Joint Space Operations Center
KIAM – Keldysh Institute of Applied Mathematics
NASA – National Aeronautics and Space Administration
ODR – Orbital Data Request
OIG – Orbital Information Group
RDTE – Research, Development, Testing and Evaluation
SBSS – Space-Based Space Surveillance satellite
SCC – Space Control Center
SDA – Space Data Association
SOCRATES – Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space
SSA – Space Situational Awareness
SSN – Space Surveillance Network
STRATCOM – United States Strategic Command
TLEs – Two-line Element Sets
USAF – United States Air Force
USG – United States Government

INTRODUCTION

As Earth orbit grows more congested, the need to track space objects and provide information about activities in space becomes increasingly critical to prevent collisions or debris-caused damage. This process is known as space situational awareness, or SSA. Currently, the U. S. military has the most advanced SSA capability and maintains the most extensive catalog, though it is not complete. In 2004, the United States created a program (originally known as the CFE Pilot Program, now known as the SSA Sharing Program) to enhance the SSA information available to commercial and foreign entities in an effort to prevent harmful events in outer space and improve its own SSA. Although the U.S. government (USG) has been sharing SSA data at some level for decades, this new effort has seen increased attention and funding as a result of significant, recent events that highlighted the fragility of Earth orbit.¹ Despite this increased importance, the SSA Sharing Program has not been exempted from various concerns about its role in the wider debate on space and national security.

HISTORY

The U.S. military has tracked a wide array of space objects for decades and has made some of this information public through NASA's Orbital Information Group (OIG) beginning in 1958.² In recent years, the U.S. military has started to update and formalize this data-sharing to address new concerns. Authorized by legislation and established by order of President George W. Bush in 2004, the Commercial and Foreign Entities (CFE) Pilot Program operated with the "overarching goal...to engage the U.S. on the world stage to encourage international cooperation and transparency with foreign nations and/or consortia on space activities that are of mutual benefit." This meant that the United States would "provide SSA information to...mission partners [in order] to protect manned spaceflight, prevent on orbit collisions, and minimize the debris field surrounding the Earth."³

On Jan. 3, 2005, U.S. Air Force Space Command (AFSPC) launched the CFE Pilot Program website (www.space-track.org), hereafter referred to as Space Track. Space Track took over the role of providing SSA information to the public from the NASA OIG website.⁴ The Space Control Center (SCC), then operated by the 1st Space Control Squadron and located in Cheyenne Mountain, Colorado, produced the

¹ On Jan. 11, 2007, China successfully tested an anti-satellite (ASAT) weapon by firing a modified ballistic missile at the inoperable Chinese Fenguyun-1C polar-orbiting weather satellite. The debris created from this event produced an estimated 150,000 pieces of debris, putting at risk countless other space objects. Just one year later, on Feb. 10, 2007, an active communications satellite (Iridium-33) operated by U.S. commercial satellite operator Iridium collided with an inactive communications satellite (Cosmos-2251) formerly operated by the Russian Ministry of Defense. The collision produced nearly 1,500 pieces of trackable debris, a number which does not account for the numerous other pieces too small to track (*Space Sustainability* booklet. Secure World Foundation, 2010.). These two events not only greatly multiplied the amount of debris in crowded orbits, and thus multiplied the risk of damage to other space assets, but they also helped lay to rest the up to that time popular notion of "Big Sky Theory," which posited that because the space domain is so vast, two objects are unlikely to collide and fosters the false assurance that SSA is a non-urgent issue.

² Spillar, Lt. Col. Charles and Maj. Mike Pirtle. "Commercial and Foreign Entities (CFE) Pilot Program Status Update and Way Ahead." Paper presented to Advanced Maui Optical and Space Surveillance Technologies Conference, Sep. 1-4, 2009.

³ Ibid.

⁵ Ibid.

SSA data made available to CFE partners on Space Track.⁵ The SCC and 1st Space Control Squadron were integrated into the Joint Space Operations Center (JSpOC) at Vandenberg Air Force Base (AFB), California, in the first half of 2007.⁶

In 2006, the Commander, USSTRATCOM, designated the Joint Functional Component Command for Space (JFCC-SPACE) as the single point of contact for USSTRATCOM's space operations and as such, JFCC-SPACE performs the SSA mission and liaises with non-USG entities.⁷ Under JFCC-SPACE, JSpOC directs and coordinates the detection, identification, cataloging, and tracking of all man-made objects in Earth orbit, and provides some of this data in support of the SSA Sharing Program.⁸ JSpOC is a "synergistic command and control weapon system"⁹ that is manned by military, civil, and contractor personnel, representing all four U.S. military branches as well as three Allied nations (Great Britain, Australia, and Canada).¹⁰ In the event JSpOC is unable to complete its SSA duties, the U.S. Air Force's 20th Space Control Squadron/Detachment 1 located in Dhalgren, Virginia, has been identified as its back-up.¹¹

In October 2009, U.S. Strategic Command (USSTRATCOM), headquartered at Offutt Air Force Base, Nebraska, assumed responsibility for the CFE Pilot Program.¹² The U.S. position was that data sharing policy should be set by USSTRATCOM, not AFSPC, effectively inspiring the transfer of operational control in an overall effort by the Department of Defense (DoD) to consolidate SSA efforts.¹³ The name of the program was changed from the CFE Pilot Program to the SSA Sharing Program during this transfer (see [announcement](#)) because partners felt the previous title implied they were passively consuming information from the U.S. government. AFSPC continues to fulfill its Title 10 responsibilities to operate, train, and equip as a force provider to the SSA Sharing Program.

The SSA Sharing Program aims to "create transparency of satellite information" and "promote space flight cooperation and safety"¹⁴ by enhancing the availability of this information to partners. As of the end of 2009, there were 39,000 user accounts from 110 countries on Space Track,¹⁵ which was publishing information on roughly 15,000 individual objects in orbit.¹⁶

⁵ "SGI Systems Help U.S. Air Force Space Command Detect, Track, Identify, and Catalog Man-Made Objects in Space." *PR Newswire*, June 10, 2007, <http://www.prnewswire.com/news-releases/sgi-systems-help-us-air-force-space-command-detect-track-identify-and-catalog-man-made-objects-in-space-71265747.html>.

⁶ "Space unit to move from Cheyenne Mountain." *Air Force News Service*, Sept. 16, 2006, <http://www.af.mil/news/story.asp?storyID=123027166>.

⁷ "USSTRATCOM Space Control and Space Surveillance Fact Sheet." U.S. Strategic Command, www.stratcom.mil/factsheets/space. Accessed July 3, 2010.

⁸ *Ibid.*

⁹ "Factsheets: Joint Space Operations Center." Vandenberg AFB, www.vandenberg.af.mil/library/factsheets/factsheet.asp?id=12579. Accessed June 30, 2010.

¹⁰ Hoy, Staff Sgt. Raymond. "DOD's eye in the sky supporting troops on the ground." *Air Force News Service*, April 17, 2009, http://www.stratcom.mil/news/article/77/dods_eye_in_the_sky_supporting_troops_on_the_ground.

¹¹ "USSTRATCOM Space Control and Space Surveillance Fact Sheet," *ibid.*

¹² Spillar and Pirtle, *ibid.*

¹³ Sprenger, Sebastian. "Change sparks review." *Inside the Air Force*, March 6, 2009, http://www.stratcom.mil/news/article/62/change_sparks_review.

¹⁴ Helms, Susan. "Space Situational Awareness." PowerPoint presented to United National Committee on Peaceful Uses of Outer Space (COPUOS) meeting, June 3, 2010.

¹⁵ Spillar and Pirtle, *ibid.*

¹⁶ Helms, *ibid.*

LEGISLATION

The SSA Sharing Program is documented in the following pieces of legislation and U.S. Code:

1. H.R. 1558: National Defense Authorization Act for Fiscal Year 2004. Established “Space surveillance network: pilot program for provision of satellite tracking support to entities outside United States Government.” Passed into law on Nov 24, 2003. See language here: [Section 913](#).
2. H.R. 2647: National Defense Authorization Act for Fiscal Year 2010. Established “Space situational awareness services and information: provision to non-United States Government entities.” Passed into law on Oct 28, 2009. See language here: [Section 912](#).
3. 10 USC 2274: Space surveillance network: pilot program for provision of satellite tracking support to entities outside United States Government. Jan. 2004. (Original code)
4. 10 USC 2274: Space situational awareness services and information: provision to non-United States Government entities. Feb. 1, 2010. (Current code)

FUNDING

Funding for the SSA Sharing Program stems from various sources. Collection of the SSA data made available through the SSA Sharing Program is funded primarily through U.S. Air Force research, development, test and evaluation (RDTE) budget requests (see [tables](#)),¹⁷ while the actual maintenance of Space Track and support for the program’s partnerships and other logistics are financed through both AFSPC’s and JSpOC’s budget. Both JFCC-SPACE and JSpOC are funded through USSTRATCOM’s budget.¹⁸ During recent years, SSA programs have been allotted increased amounts of funding within the Defense Department’s budget requests. From Fiscal Year (FY) 2009 to FY 2010, the request for SSA funding increased at least \$100 million.¹⁹ From FY 2010 to FY 2011, the requested SSA budget increased 70 percent to roughly \$900 million.²⁰

HOW IT WORKS

The SSA Sharing Program gives non-U.S. government-affiliated entities²¹ access to some of the data collected by the Space Surveillance Network (SSN), a global network of 29²² optical telescopes and

¹⁷ Black, Samuel and Victoria Samson. “Space Security Programs of Interest in the FY 2010 Department of Defense Budget Proposal.” The Henry L. Stimson Center and the Secure World Foundation, http://www.stimson.org/space/pdf/Space_Security_Programs_in_FY10_Budget.pdf. Accessed July 3, 2010.

Black, Samuel and Victoria Samson. “Space Security Programs of Interest in the Fiscal Year (FY) 2011 Department of Defense Budget Proposal.” Secure World Foundation, http://www.secureworldfoundation.org/siteadmin/images/files/file_465.pdf. Accessed July 3, 2010.

¹⁸ “USSTRATCOM Space Control and Space Surveillance Fact Sheet,” *ibid*.

¹⁹ Black and Samson. “Space Security Programs of Interest in the FY 2010...,” *ibid*.

Black and Samson. “Space Security Programs of Interest in the Fiscal Year (FY) 2011...,” *ibid*.

²⁰ *Ibid*.

²¹ U.S. government or government contractors are required to have a U.S. STRATCOM Form-1 and a GCSS-AF Form 41 on file with JFCC SPACE in order to access SSA data. These forms are only valid for one year (“Factsheets: Joint Space Operations Center.” Vandenberg AFB, www.vandenberg.af.mil/library/factsheets/factsheet.asp?id=12579, June 30, 2010). They request data directly from Vandenberg AFB and not through www.space-track.org (“Space Track – Orbital Data Request Process.” Space Track, www.space-track.org/orbitaldatarequestprocess.html. Accessed June 30, 2010).

²² Number of telescopes/radars may differ by source due to different methods of counting.

radars (see map below), as well as some services and products based on that data.²³ (See [map](#).)

The majority of the data shared by the United States through the program is made available on Space Track in the form of Two-Line Element sets (TLEs),²⁴ which give the orbital position of space objects. Other data and analysis products provided through Space Track include Satellite Catalog Messages, Project Tip Messages, Satellite Decay Messages, Predicted Decay Forecasts, Satellite Box Scores, and Satellite Reports.²⁵ In short, Space Track provides information on the current and historical orbital positions of human-made space objects while also providing some analysis on future positions and object decay, close-approaches, and potential collisions.

In addition to the TLE catalog, JSpOC maintains another catalog commonly referred to as the High Accuracy Catalog. Object positions in the High Accuracy Catalog are much more precise and include covariance data that provides detailed knowledge for better analysis. The High Accuracy Catalog is used for many tasks inside JSpOC such as conjunction assessment and reentry prediction, but it is not made available publicly.²⁶ However, some products and services based on the High Accuracy Catalog's data are available to non-USG entities through the SSA Sharing Program. Moreover, at the Conjunction Support Message Workshop in July 2010, USSTRATCOM revealed plans to provide covariance data for conjuncting objects in the future.²⁷

Almost anyone can become a Space Track user by submitting a simple form on the website, agreeing to the terms of the User Agreement, and receiving login information. This will give a user access to TLEs, Satellite Catalog data, and Satellite Decay & Reentry Data.²⁸ To receive launch support and CA, an entity must become a SSA Sharing Program partner and enter into an agreement with USSTRATCOM.²⁹ Applying for such an agreement is done by telephoning or sending an email to a USSTRATCOM point of contact whose information is available on Space Track.³⁰ Once an agreement has been signed by both parties, the partner can then request SSA information not found on Space Track through an Orbital Data Request (ODR).³¹

Current U.S. law prohibits Space Track users, SSA Sharing Program partners, and the USG from redistributing or sharing program information with any third-party.³² Partners who wish to redistribute data from Space Track or the SSA Sharing Program must submit a Request for Redistribution, also done by filling out an ODR. Requests for Redistribution require the partner to disclose the purpose, necessity,

²³ Weeden, Brian. "Billiards in space." *The Space Review*, Feb. 23, 2009, <http://www.thespacereview.com/article/1314/1>. For more detailed information on the SSN, visit www.au.af.mil/au/awc/awcgate/usspc-fs/space.htm.

²⁴ Weeden. "Billiards...", *ibid*.

²⁵ "Space-Track – New Account." Space Track, www.space-track.org/perl/new_account.pl. Accessed June 30, 2010.

²⁶ Weeden. "Billiards...", *ibid*.

²⁷ Ianacone, Amy, "614 AOC/COD Conjunction Assessment," PowerPoint presented at the Conjunction Support Message Workshop, July 21-22, 2010.

²⁸ "Space-Track User home." Space Track, www.space-track.org/perl/home.pl. Accessed Aug. 10, 2010.

²⁹ "Space-Track – Orbital Data Request Process." Space Track, www.space-track.org/orbitaldatarequestprocess.html. Accessed June 30, 2010.

³⁰ Weeden. "Billiards...", *ibid*.

³¹ "Space-Track – Orbital Data Request Process," *ibid*.

³² See H.R. 2647, Sec. 2274 below.

frequency, and recipients of such redistribution³³ and are approved on a case-by-case basis. Two notable entities that have been granted grandfather redistribution rights are Celestrak (www.celestrak.com) and Heavens Above (www.heavens-above.com). These providers redistribute the SSA information made available on Space Track on their own sites, but supplement it with their own analysis and additional information.³⁴

Under the procedures implemented after the Iridium-Cosmos satellite collision of Feb. 10, 2009, JSpOC conducts daily CA screenings of all operational satellites for close approaches with other objects. When a potentially dangerous close approach between a satellite and another object is discovered, the spacecraft owner/operator(s) is notified within 72 hours and decides whether or not a collision avoidance maneuver (COLA) is justified. A close approach must be within one kilometer and less than 200 meters radial miss distance in low Earth orbit or within five kilometers in deep space to warrant contact with an owner-operator.³⁵ JSpOC notifies all owner-operators directly except for those in China or Russia, who are contacted via their embassies.³⁶ Although the screenings and warnings are done regardless of SSA Sharing Program partnership, program partners have access to more detailed warning messages and receive additional information from JSpOC to aid in the COLA process.³⁷

BENEFITS OF PROGRAM

The SSA Sharing Program now provides information on roughly 15,000 objects in low Earth orbit to countless foreign entities, both public and private.³⁸ As of March 2010, 50 avoidance maneuvers had been performed as a result of CA provided by the SSA Sharing Program. Each day on average the SSA Sharing Program shares information on 20-30 close approaches and completes five owner-operator notifications.³⁹

RECENT CHANGES AND UPDATES

Going forward, the SSA Sharing Program intends to strengthen and expand cooperative partnerships with other governments, data-sharing with partners, and the sharing of operator contact information.⁴⁰ Future program improvements include forging cooperative partnerships with foreign governments authorized by the commander of USSTRATCOM,⁴¹ providing more data to partners, and sharing owner-

³³ "Space-Track – Orbital Data Request Process," *ibid.*

³⁴ Weeden, Brian. "The numbers game." *The Space Review*, July 13, 2009, <http://www.thespacereview.com/article/1417/1>.

³⁵ Ianacone, *ibid.*

³⁶ Helms, *ibid.*

³⁷ Bird, Duane Maj. Comments given to conference "Improving Our Vision IV: Linkages and Opportunities," co-hosted by Secure World Foundation, Inmarsat, the Eisenhower Center for Space and Defense Studies, and Intelsat, June 21-22, 2010.

³⁸ Payton, Gary E. "Presentation to the Senate Armed Services Committee, Strategic Forces Subcommittee on Military Space Programs in Review of the Defense Authorization Request for Fiscal Year 2011 and the Future Years Defense Program." Statement, March 10, 2010.

³⁹ Bird, *ibid.*

⁴⁰ Helms, *ibid.* For a detailed explanation of how JSpOC screens and conducts these assessments, see Weeden's article, "Billiards in space" in *The Space Review*, Feb. 23, 2009, <http://www.thespacereview.com/article/1314/1>.

⁴¹ Comments and presentations given to conference "Improving Our Vision IV: Linkages and Opportunities," co-hosted by Secure World Foundation, Inmarsat, the Eisenhower Center for Space and Defense Studies, and Intelsat, June 21-22, 2010.

operator contact information to facilitate communication.⁴²

On June 28, 2010, President Barack Obama announced and released a new U.S. National Space Policy (NSP). In line with an overarching emphasis on international cooperation, several components of the new policy indicate that the United States is committed to continuing and expanding the SSA Sharing Program. One of the possible areas for cooperation is “space surveillance for debris monitoring and awareness.”⁴³ Another policy component focuses on “strengthen[ing] stability in space through...improved information collection and sharing for space object collision avoidance.”⁴⁴ According to a White House press release, the policy commits the United States to “[enhancing] its space situational awareness capabilities and [to cooperating] with foreign nations and industry to augment...shared awareness in space.”⁴⁵

The quality and quantity of information made available through the SSA Sharing Program may improve soon as the U.S. military’s SSA capabilities expand. For example, on September 25, 2010, the U.S. Air Force launched a \$500 million Space-Based Space Surveillance (SBSS) satellite from Vandenberg AFB in California. This satellite will provide the U.S. Air Force with the first uninterrupted and unobstructed optical observation of Earth orbit and the debris located there. This is the first satellite of its kind to be solely dedicated to SSA.⁴⁶ Some have suggested hosting SSA payloads on commercial satellites to expand SSA capacity and “boost the number of sensors aloft.”⁴⁷ Moreover, the S-Band Space Fence project is proceeding, with Lockheed Martin winning the concept development contract in late June 2009.⁴⁸ The S-Band Space Fence will enable uninterrupted tracking from Earth of many more objects, including significantly smaller ones, with greater precision than currently possible.⁴⁹ However, it is unknown how much these improvements will improve the low accuracy TLEs available on Space Track.

Logistical changes aim to improve the SSA Sharing Program in several ways. JSpOC is currently developing a Conjunction Summary Message (CSM) that will become the standard warning message sent to owner-operators in the event of potentially dangerous close approaches. At the moment, the CSM is undergoing a trial period and awaiting U.S. government approval. A workshop held July 21-22, 2010 brought together technical experts from AFSPC and JSpOC with SSA Sharing Program partners to learn how to use the CSM. In addition, plans are underway to update the IT infrastructure used by JSpOC, as the original system was designed for different purposes and is not entirely suitable for the SSA Sharing Program.⁵⁰

Most of the recent announcements and changes affecting the SSA Sharing Program strive to improve and expand its services. Despite this, there are no plans to share the High Accuracy Catalog with entities

⁴² Helms, *ibid.*

⁴³ United States. White House Office of the Press Secretary. “Fact Sheet: The National Space Policy.” June 28, 2010, <http://www.whitehouse.gov/the-press-office/fact-sheet-national-space-policy>.

⁴⁴ *National Space Policy of the United States of America*, June 28, 2010.

⁴⁵ United States. White House Office of the Press Secretary, *ibid.*

⁴⁶ Elliott, Dan. “Satellite to monitor junk.” *Associated Press*, July 5, 2010.

⁴⁷ Butler, Amy. “EADS Astrium Sees Limited SSA Cooperation.” *Aviation Week*, July 20, 2010, http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=space&id=news/asd/2010/07/20/10.xml.

⁴⁸ Wesel, Mark. “Lockheed Martin Awarded Concept Development Contract for U.S. Air Force Space Fence.” Lockheed Martin, June 30, 2009, http://www.lockheedmartin.com/news/press_releases/2009/063009_LM_AirForce_SpaceFence.html.

⁴⁹ Black and Samson. “Space Security Programs of Interest in the FY 2010..,” *ibid.*

⁵⁰ Comments and presentations given..., *ibid.*

outside the U.S. government.⁵¹

ISSUES, CONCERNS, AND COMPLAINTS

The SSA Sharing Program is the only program of its kind and scope and has provided countless benefits to those who use it. Despite the positive aspects of the program and how far it has advanced since the USG began sharing SSA data over 50 years ago,⁵² the program faces many issues, concerns, and complaints ranging from dissatisfaction with the quality and timing of information it provides to concerns about national security.

Because the SSA Sharing Program is administered by the U.S. military, it comes with an assortment of limitations and restrictions. The limited information provided through the program can be untimely and inaccurate.⁵³ The only positional information currently available on Space Track, in the form of TLE sets, is imprecise and unsuitable for CA and COLA. For example, on the day of the Iridium-Cosmos collision, analysis using the TLE sets predicted a 600 meter miss, and the conjunction was not even on CelesTrak's top ten closest conjunctions for the day.⁵⁴ JSpOC does not rely on the TLEs because of this potential for inaccuracy and instead uses the High Accuracy Catalog for its own analysis. Unless the USG releases more precise data, satellite owner-operators will not be able to reliably conduct their own CA and COLA and must continue to depend on JSpOC to protect their space assets.

Moreover, when TLEs and other program data were shared through NASA's OIG, there were no redistribution restrictions. Under the CFE Pilot Program, and now the SSA Sharing Program, users are not allowed to redistribute SSA data without explicit approval from the U.S. Department of Defense.⁵⁵ The U.S. military also reserves the right to terminate user accounts, and thus deny access to SSA data and information, without prior notice or explanation.⁵⁶

In addition to these issues of limitation and restriction, some users express concern about relying on a program run by a national military. They contend that such an arrangement can lead to conflicts of interest for foreign nationals, governments, and commercial entities. Furthermore, current legislation regarding the program shields the United States from any liability associated with the information it shares.⁵⁷ The USG does not want to assume any responsibility for providing, or failing to provide, it. This affiliation with the U.S. military and lack of accountability casts some doubt on the credibility and reliability of the information provided through the SSA Sharing Program.

These user concerns are accompanied by anxieties within the U.S. military and government. Some within the United States fear that the association between the SSA Sharing Program and the U.S. military undermines U.S. national security. In sharing information on orbital positions to foreign and commercial users, they worry about the program's potential to compromise confidential or sensitive

⁵¹ Ibid.

⁵² Spillar and Pirtle, *ibid.*

⁵³ Sprenger, *ibid.*

For example, newly-launched or –maneuvered GEO payloads will remain in their old TLEs until they arrive at their new position or stop maneuvering (Brian Weeden).

⁵⁴ Weeden. "Billiards...," *ibid.*

⁵⁵ See H.R. 2647, Sec. 2274.(c) below.

⁵⁶ "Space-Track – New Account," *ibid.*

⁵⁷ See H.R. 2647, Sec. 2274.(g) below.

data about satellites that supply key U.S. military needs, specifically those related to intelligence and reconnaissance.

Similarly, commercial satellite owners and operators previously worried that data shared through the program would reveal proprietary “trade secrets” that could give competitors an advantage. Commercial operators, particularly of communications satellites, vigorously protect information about their satellites’ transponder configurations and operational status. Since some of the data they share with the U.S. government could be shared with other partners, these companies were concerned that they would have no say over what information was being disclosed and to whom. This particular concern has been allayed because current SSA Sharing Program agreements restrict the United States and its program partners from disclosing information to third parties.

Additionally, the SSA Sharing Program, which is currently provided free-of-charge to users, comes at a price to the United States, albeit fairly small given the benefit. Given current budget pressures, some wonder if this unilateral initiative is cost-effective and/or worthwhile. According to legislation, the United States could charge for these SSA services to replenish the same DoD accounts that support the program,⁵⁸ but it has not yet chosen to do so. If a fee was instituted as a means of financing the program, it could dis-incentivize users from relying on it, especially if the fee was assessed on U.S.-based users whose taxes currently finance the program. They may prefer to use an alternative source of SSA information instead. Since SSA Sharing Program partners provide data on their space assets to the United States as part of the agreement, their defection from the program could harm the quantity and quality of data available to the United States.

Some retort that the costs accrued by the United States in running the SSA Sharing Program are negligible. Many aspects of SSA, from the SSN to JSPOC, would continue to operate even if the program did not exist. Furthermore, with all space assets on orbit valued at approximately \$200 billion,⁵⁹ the direct, additional costs of running the SSA Sharing Program are relatively inconsequential when considering how much it protects. Additionally, the costs of conducting CA and COLA for all operational satellites come as a direct result of the USG’s choice to not release the High Accuracy Catalog for national security reasons. If satellite owner-operators or other entities had access to the more precise data, they could conduct CA and COLA themselves and relieve the U.S. military of that burden.

ALTERNATIVES

While the SSA Sharing Program is the most comprehensive and widely-accessible SSA source currently available, alternatives do exist and are growing in number and capabilities. These alternatives come from a variety of providers, ranging from collaborative commercial endeavors to offerings from foreign space agencies. While the concept of privately-provided SSA information and analysis has been discussed, there is currently no viable business case for it. These other SSA options need not be viewed as competitors of the SSA Sharing Program, but can instead be seen as potential complements, especially since accurate SSA requires fusing multiple types of information from multiple entities.

⁵⁸ See H.R. 2647, Sec. 2274.(d) below.

⁵⁹ Sterner, Eric. “Beyond the Stalemate in the Space Commons.” *Contested Commons: The Future of American Power in a Multipolar World*. Ed. Abraham M. Denmark et al. Center for a New American Security. January 2010. P. 108.

Center for Space Standards and Innovation (CSSI)

CSSI is the research arm of Analytical Graphics, Inc., a software company that develops and deploys advanced space, defense, and intelligence applications.⁶⁰ There are two SSA services affiliated with CSSI: CelesTrak and SOCRATES.

A member of CSSI, Dr. T.S. Kelso, runs CelesTrak, a website that provides “educational materials and standard data to the space community such as two-line element sets, Earth orientation parameters, solar weather data, geomagnetic indices, precision orbit ephemerides, and associated models and documentation.”⁶¹ As mentioned above, CelesTrak is one of the entities that redistribute TLE sets from Space Track (along with the website Heavens Above). CelesTrak also generates its own data and provides supplemental analysis of Space Track data, including lists of satellite constellations and active satellites.⁶²

CSSI also maintains the Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space (SOCRATES) program which offers “a free list of top 10 possible conjunctions by maximum probability and minimum range publicly on the website.”⁶³ SOCRATES-GEO and SOCRATES-LEO are partnerships in which CSSI receives data from many satellite operators on nearly 300 satellites in GEO and LEO respectively.⁶⁴ CSSI combines the publicly available TLE sets and owner-operator-provided data and uses SOCRATES to produce CA and COLA services for participating satellite owner-operators.⁶⁵

European Space Situational Awareness Programme

In November 2008, the European Space Agency (ESA) decided to explore the possibility of developing its own SSA capacity from 2009-2011.⁶⁶ If confirmed, the European Space Situational Awareness Programme will primarily serve European needs, but is also intended to enable Europe to contribute more to international cooperation on SSA.⁶⁷

In its initial stages, the European SSA Programme will rely on data provided by existing tools and facilities such as NeoDys, Spaceguard, European Asteroid Research Node, ESA’s Optical Ground Station, European national research telescopes, amateur telescopes, and European national military radars.⁶⁸ The European SSA Programme would eventually equip Europe with an indigenous SSA capacity, including ground- and space-based sensors, data centers for its three segments of Surveillance and Tracking, Space Weather, and Near-Earth Objects, a management system to coordinate all data centers

⁶⁰ “About AGI.” Analytical Graphics, Inc. (AGI), 2010, <http://www.stk.com/about-agi/>.

⁶¹ “Tools Used by CSSI.” CSSI, 2010, <http://www.centerforspace.com/tools/>.

⁶² Weeden. “Billiards...,” *ibid*.

⁶³ “Tools Used by CSSI,” *ibid*.

⁶⁴ Weeden, Brian. “International Civil Space Situational Awareness.” PowerPoint presented to Scientific and Technical Subcommittee, United Nations Committee on the Peaceful Uses of Outer Space, Feb. 9-20, 2009. Kelso, T.S. “Two Years of International Cooperation on Conjunction Mitigation.” PowerPoint presented to 8th US-Russian Space Surveillance Workshop, April 19-23, 2010.

⁶⁵ Weeden, Brian, Suzanne T. Metlay, and Ray A. Williamson. “Space Weather and International Civil Space Situational Awareness.” PowerPoint presented to NOAA Space Weather Week, April 28, 2009.

⁶⁶ “ESA – ESA Spacecraft Operations – SSA Preparatory Programme.” European Space Agency, Dec. 5, 2008, http://www.esa.int/SPECIALS/Operations/SEMDPU3Z2OF_0.html.

⁶⁷ Drolshagen, G., D. Koschny, and N. Bobrinsky. “The Near-Earth Objects Segment of the European Space Situational Awareness Programme.” PowerPoint presented to Meteoroids 2010 Conference, May 24-28, 2010.

⁶⁸ *Ibid*.

and data distribution, and service centers to deliver data products and warnings to program users.⁶⁹ ESA will operate the program and provide services to users “according to a well-defined set of rules, referred to as governance and data policies,”⁷⁰ with a tailored policy for each of its segments.⁷¹

In no way does the European Programme intend to replace the current cooperative arrangements between ESA and some European states with the United States. Rather, ESA intends for the program to enhance “the Agency’s long-standing cooperation with the USA” and to seek cooperation with other space-faring nations in the future.⁷² Some doubt that the European SSA Programme will ever take root because of the individual security concerns of some ESA members. They believe member states will prefer to pursue bilateral cooperation with the United States for its SSA needs over an ESA option.⁷³

International Scientific Optical Network (ISON)

The International Scientific Optical Network (ISON) was initiated in 2001 by the Keldysh Institute of Applied Mathematics (KIAM) and the Pulkovo Astronomical Observatory of the Russian Academy of Sciences. The network’s initial goals were slightly different, but since May 2004, it has sought to improve knowledge about human-made debris in high altitude orbits, primarily GEO, and obtain as clear and complete a picture of these orbits as possible.⁷⁴ Its main goal is “providing an open source of information about space objects as accessible for scientific analysis.”⁷⁵ The network relies on international cooperation among several scientific institutions from a handful of nations, with KIAM remaining the principle coordinator.⁷⁶ It receives its data from 25 optical telescopes located at 18 facilities around the world.⁷⁷

According to the ISON website, the network is different from the traditional space surveillance systems belonging to national military structures, such as the USG SSN. ISON is simply a “scientific community of people having joint interest and common understanding of [the] importance of...solving scientific task[s] while other space surveillance systems are large dedicated military units with all [the] appropriate features.” While ISON differs in these ways, it is similar to the SSA Sharing Program in that it produces orbital predictions, solutions, and analysis, but asserts that the different models it uses can produce higher quality data than the SSA Sharing Program. ISON also states that since it lacks military ties, its data is more open, free, and complete than the data provided via the SSA Sharing Program.⁷⁸

Space Data Association (SDA)

The Space Data Association (SDA) is an international SSA data-sharing organization formed in 2009 by the three largest commercial satellite companies: Inmarsat, Intelsat, and SES.⁷⁹ SDA is a private sector

⁶⁹ “ESA – Space Situational Awareness – Core Activities.” European Space Agency, http://www.esa.int/esaMI/SSA/SEM3BNIK97G_0.html. Accessed July 1, 2010.

⁷⁰ Ibid.

⁷¹ Comments and presentations given..., *ibid.*

⁷² “ESA – Space Situational...,” *ibid.*

⁷³ Butler, *ibid.*

⁷⁴ “F.A.Q. / ISON – Space Debris and Spacecraft.” International Scientific Optical Network, <http://isonteam.com/faq/>. Accessed July 1, 2010..

⁷⁵ Molotov, I., V. Agapov, E. Akim, and S. Sukhanov. “ISON: Existing Structure, Tasks, Characteristics and Further Development.” PowerPoint presented to 8th US-Russian Space Surveillance Workshop, April 18-23, 2010.

⁷⁶ “F.A.Q. / ISON...,” *ibid.*

⁷⁷ Weeden et al, “Space Weather...,” *ibid.*

⁷⁸ “F.A.Q. / ISON...,” *ibid.*

⁷⁹ “SDA News.” Space Data Association, <http://www.space-data.org/sda/>. Accessed July 1, 2010.

initiative that aims to standardize and compile SSA data in a uniform and confidential format and share this information with its members. SDA members submit data in a "black box" format to the SDA, which in turn furnishes standardized, anonymous, and relevant information to affected members.⁸⁰ Unauthorized sharing and usage of SDA-provided data is met with severe repercussions. SDA's liability for incorrect analysis is limited to a financial responsibility of £10.⁸¹

Membership is open to any interested party, with three membership categories: Executive Members comprised of leading satellite companies, Standard Members comprised of all other satellite companies, and Associate Members comprised of any other contributing institutions or entities.⁸² The SDA is incorporated on the Isle of Man in the United Kingdom. Technical administration is managed by AGI and logistics are handled by ManSat Corporation.⁸³ The SDA's Space Data Center reached Initial Operating Capability (IOC) at the end of July 2010. Talks are already underway between SDA and JSpOC, ISON, and the European SSA Programme about potential data-sharing partnerships and collaboration.⁸⁴

CONCLUSION

The United States has shared some elements of its impressive SSA capacity with non-USG entities for decades, but only since 2004 has it formalized this information-sharing into an official program. Motivated by the satellite collision of February 2009, the United States started seriously expanding services for satellite safety based on that information to a broad range of actors. Despite these changes, the program still faces an array of complaints, concerns, and issues related to its credibility, reliability, accuracy, costliness, and its potential to undermine U.S. national security. There are several SSA alternatives available, but almost all intend to work alongside or in conjunction with the SSA Sharing Program to improve and enhance SSA worldwide.

⁸⁰ DalBello, Richard and Michael Mendelson. Keynote address to Space Law and Policy 2010, May 11, 2010..

⁸¹ Comments and presentations given..., *ibid.*

⁸² *Ibid.*

⁸³ DalBello and Mendelson, *ibid.*

⁸⁴ "Space Data Center Reaches Initial Operations." PR-USA.NET, http://pr-usa.net/index.php?option=com_content&task=view&id=445711&Itemid=33. Accessed August 11, 2010.

APPENDIX

“Air Force’s CFE Pilot Program becomes USSTRATCOM’s SSA Sharing Program,” by Deputy Under Secretary of the Air Force for Space Program Mr. Gary E. Payton
Link to full text: <http://www.airforce-magazine.com/SiteCollectionDocuments/Testimony/2010%20docs/031010payton.pdf>

“Over the last year, the JSpOC has transitioned the Air Force’s commercial and foreign entities (CFE) pilot effort into USSTRATCOM’s SSA Sharing Program. This involved growing the capability to monitor and conduct conjunction assessments for all U.S. government, commercial, and foreign active satellites, over 1,000 systems. As a result, the SSA Sharing Program screens for collisions daily, and has a formalized information sharing process that reports potential conjunctions to commercial and foreign satellite owners and operators.”

H.R. 1558: National Defense Authorization Act for Fiscal Year 2004

Link to full text: <http://www.sigir.mil/applyinghardlessons/pdf/2004NDAA.pdf>

Became 10 USC 2274: Space surveillance network: pilot program for provision of satellite tracking support to entities outside United States Government. Jan. 2004.

Excerpt regarding SSA:

SEC. 913. PILOT PROGRAM FOR PROVISION OF SPACE SURVEILLANCE NETWORK SERVICES TO NON-UNITED STATES GOVERNMENT ENTITIES.

(a) IN GENERAL- Chapter 135 of title 10, United States Code, is amended by adding after section 2273, as added by section 912(a), the following new section:

Sec. 2274. Space surveillance network: pilot program for provision of satellite tracking support to entities outside United States Government

(a) PILOT PROGRAM- The Secretary of Defense may carry out a pilot program to determine the feasibility and desirability of providing to non-United States Government entities space surveillance data support described in subsection (b).

(b) SPACE SURVEILLANCE DATA SUPPORT- Under such a pilot program, the Secretary may provide to a non-United States Government entity, subject to an agreement described in subsection (d), the following:

(1) Satellite tracking services from assets owned or controlled by the Department of Defense, but only if the Secretary determines, in the case of any such agreement, that providing such services to that entity is in the national security interests of the United States.

(2) Space surveillance data and the analysis of space surveillance data, but only if the Secretary determines, in the case of any such agreement, that providing such data and analysis to that entity is in the national security interests of the United States.

(c) ELIGIBLE ENTITIES- Under the pilot program, the Secretary may provide space surveillance data support to non-United States Government entities including the following:

(1) State governments.

`(2) Governments of political subdivisions of States.

`(3) United States commercial entities.

`(4) Governments of foreign countries.

`(5) Foreign commercial entities.

`(d) REQUIRED AGREEMENT- The Secretary may not provide space surveillance data support to a non-United States Government entity under the pilot program unless that entity enters into an agreement with the Secretary under which the entity--

`(1) agrees to pay an amount that may be charged by the Secretary under subsection (e); and

`(2) agrees not to transfer any data or technical information received under the agreement, including the analysis of tracking data, to any other entity without the express approval of the Secretary.

`(e) RULE OF CONSTRUCTION CONCERNING PROVISION OF INTELLIGENCE ASSETS OR DATA- Nothing in this section shall be considered to authorize the provision of services or information concerning, or derived from, United States intelligence assets or data.

`(f) CHARGES- (1) As a condition of an agreement under subsection (d), the Secretary may (except as provided in paragraph (2)) require the non-United States Government entity entering into the agreement to pay to the Department of Defense such amounts as the Secretary determines to be necessary to reimburse the Department for the costs of the Department of providing space surveillance data support under the agreement. (2) The Secretary may not require the government of a State or of a political subdivision of a State to pay any amount under paragraph (1).

`(g) CREDITING OF FUNDS RECEIVED- Funds received for the provision of space surveillance data support pursuant to an agreement under this section shall be credited to accounts of the Department of Defense that are current when the funds are received and that are available for the same purposes as the accounts originally charged to provide such support. Funds so credited shall merge with and become available for obligation for the same period as the accounts to which they are credited.

`(h) PROCEDURES- The Secretary shall establish procedures for the conduct of the pilot program. As part of those procedures, the Secretary may allow space surveillance data and analysis of space surveillance data to be provided through a contractor of the Department of Defense.

`(i) DURATION OF PILOT PROGRAM- The pilot program under this section shall be conducted during the three-year period beginning on a date specified by the Secretary of Defense, which date shall be not later than 180 days after the date of the enactment of this section.'

(b) CLERICAL AMENDMENT- The table of sections at the beginning of such chapter is amended by adding after the item relating to section 2273, as added by section 912(b), the following new item:

`2274. Space surveillance network: pilot program for provision of satellite tracking support to entities outside United States Government.'

H.R. 2647: National Defense Authorization Act for Fiscal Year 2010

Link to full text: <http://www.govtrack.us/congress/billtext.xpd?bill=h111-2647>



Became 10 USC 2274: Space situational awareness services and information: provision to non-United States Government entities. Feb. 1, 2010.

Excerpt regarding SSA:

SEC. 912. PROVISION OF SPACE SITUATIONAL AWARENESS SERVICES AND INFORMATION TO NON-UNITED STATES GOVERNMENT ENTITIES.

(a) In General- Section 2274 of title 10, United States Code, is amended to read as follows:

‘Sec. 2274. Space situational awareness services and information: provision to non-United States Government entities

‘(a) Authority- The Secretary of Defense may provide space situational awareness services and information to, and may obtain space situational awareness data and information from, non-United States Government entities in accordance with this section. Any such action may be taken only if the Secretary determines that such action is consistent with the national security interests of the United States.

‘(b) Eligible Entities- The Secretary may provide services and information under subsection (a) to, and may obtain data and information under subsection (a) from, any non-United States Government entity, including any of the following:

‘(1) A State.

‘(2) A political subdivision of a State.

‘(3) A United States commercial entity.

‘(4) The government of a foreign country.

‘(5) A foreign commercial entity.

‘(c) Agreement- The Secretary may not provide space situational awareness services and information under subsection (a) to a non-United States Government entity unless that entity enters into an agreement with the Secretary under which the entity--

‘(1) agrees to pay an amount that may be charged by the Secretary under subsection (d);

‘(2) agrees not to transfer any data or technical information received under the agreement, including the analysis of data, to any other entity without the express approval of the Secretary; and

‘(3) agrees to any other terms and conditions considered necessary by the Secretary.

‘(d) Charges- (1) As a condition of an agreement under subsection (c), the Secretary may (except as provided in paragraph (2)) require the non-United States Government entity entering into the agreement to pay to the Department of Defense such amounts as the Secretary determines appropriate to reimburse the Department for the costs to the Department of providing space situational awareness services or information under the agreement.

‘(2) The Secretary may not require the government of a State, or of a political subdivision of a State, to

pay any amount under paragraph (1).

'(e) Crediting of Funds Received- (1) Funds received for the provision of space situational awareness services or information pursuant to an agreement under this section shall be credited, at the election of the Secretary, to the following:

'(A) The appropriation, fund, or account used in incurring the obligation.

'(B) An appropriate appropriation, fund, or account currently available for the purposes for which the expenditures were made.

'(2) Funds credited under paragraph (1) shall be merged with, and remain available for obligation with, the funds in the appropriation, fund, or account to which credited.

'(f) Procedures- The Secretary shall establish procedures by which the authority under this section shall be carried out. As part of those procedures, the Secretary may allow space situational awareness services or information to be provided through a contractor of the Department of Defense.

'(g) Immunity- The United States, any agencies and instrumentalities thereof, and any individuals, firms, corporations, and other persons acting for the United States, shall be immune from any suit in any court for any cause of action arising from the provision or receipt of space situational awareness services or information, whether or not provided in accordance with this section, or any related action or omission.

'(h) Notice of Concerns of Disclosure of Information- If the Secretary determines that a commercial or foreign entity has declined or is reluctant to provide data or information to the Secretary in accordance with this section due to the concerns of such entity about the potential disclosure of such data or information, the Secretary shall, not later than 60 days after the Secretary makes that determination, provide notice to the congressional defense committees of the declination or reluctance of such entity.'

(b) Clerical Amendment- The table of sections at the beginning of chapter 135 of such title is amended by striking the item relating to section 2274 and inserting the following new item:

'2274. Space situational awareness services and information: provision to non-United States Government entities.'

(c) Effective Date- The amendments made by this section shall take effect on October 1, 2009, or the date of the enactment of this Act, whichever is later.

From Fiscal Year 2010 Department of Defense Budget Proposal

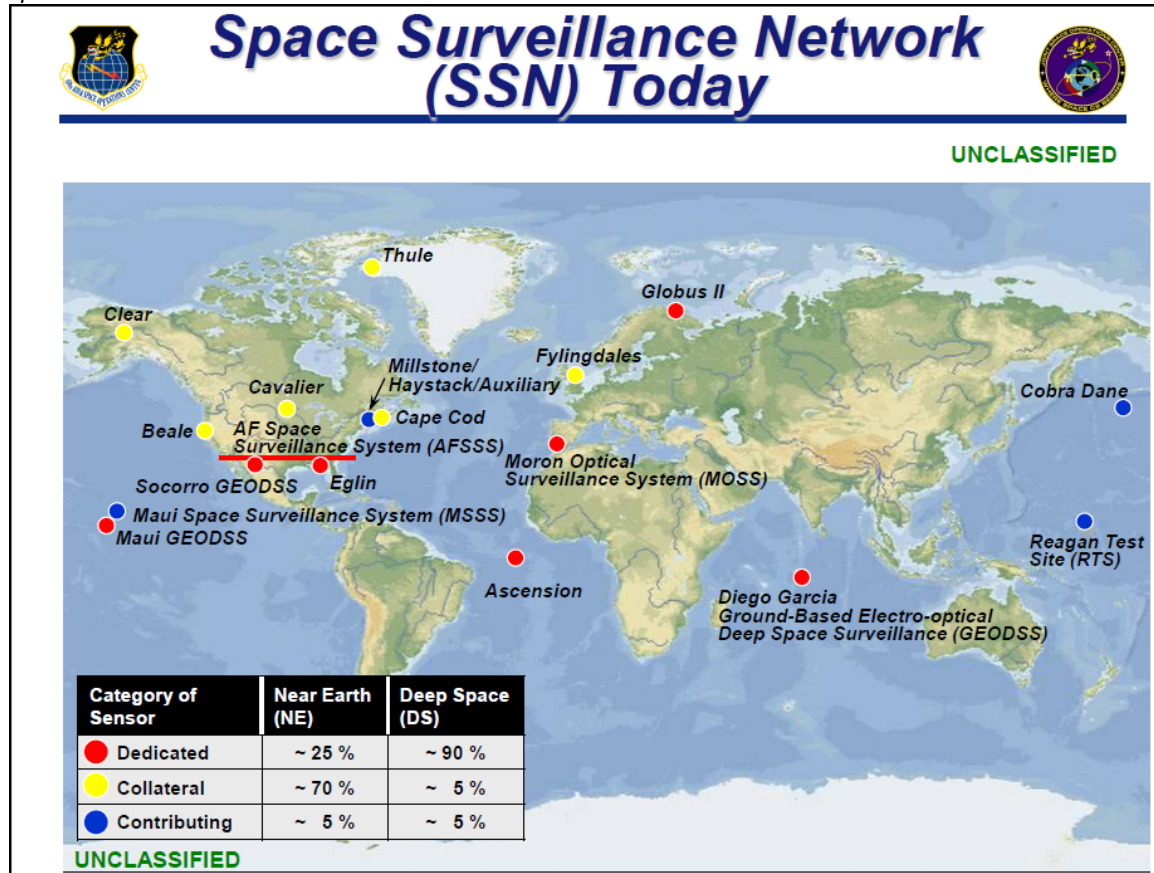
Project Name	Organization	Budget Document	Program Element (Name)	Actual Spending in FY08	Estimated Spending in FY09	Proposed Spending in FY10
<i>Space Situational Awareness</i>						
2611 Technology Insertion Planning and Analysis: Space Situational Awareness	U.S. Air Force	RDT&E Vol. 2	0603438F (Space Control Technology)	4.899	13.120	4.526
A006 Space-Based Space Surveillance	U.S. Air Force	RDT&E Vol. 2	0604425F (Space Situation Awareness Systems)	169.167	120.039	177.104
A008 Integrated Space Situation Awareness	U.S. Air Force	RDT&E Vol. 2	0604425F (Space Situation Awareness Systems)	23.347	44.220	0.000
A009 Space Fence	U.S. Air Force	RDT&E Vol. 2	0604425F (Space Situation Awareness Systems)	13.848	45.007	90.228
A012 Net-centric Sensors and Data Sources	U.S. Air Force	RDT&E Vol. 2	0604425F Space Situation Awareness Systems)	0.000	0.000	18.357
A037 Space Surveillance Telescope	U.S. Air Force	RDT&E Vol. 2	0604425F (Space Situation Awareness Systems)	0.000	0.000	6.895
A038 SSA Environmental Monitoring	U.S. Air Force	RDT&E Vol. 2	0604425F (Space Situation Awareness Systems)	0.000	0.000	15.550
A017 Sensor Service Life Extension Programs	U.S. Air Force	RDT&E Vol. 3	0305940F (Space Situation Awareness Operations)	38.679	15.579	54.648
Maui Space Surveillance System	US Air Force	RDT&E Vol. 1	0603444F (Maui Space Surveillance System)	41.357	36.339	5.813

From Fiscal Year 2011 Department of Defense Budget Proposal

PE	FY09 Actual	FY10 Estimate	FY11 Total Est.	FY12 Estimate	FY13 Est.	FY14 Estimate	FY15 Est.	Cost to Complete	Total Cost
<i>Space Situation Awareness Systems</i>									
0604425F Space Situation Awareness Systems Total	211.266	238.377	426.525	508.529	496.975	495.509	232.199	Continuing	Continuing
65A006: Space-Based Space Surveillance	143.139	144.242	185.915	210.011	186.282	127.520	7.337	Continuing	Continuing
65A008: Integrated	42.620	0	0	0	0	0	0	Continuing	Continuing

PE	FY09 Actual	FY10 Estimate	FY11 Total Est.	FY12 Estimate	FY13 Est.	FY14 Estimate	FY15 Est.	Cost to Complete	Total Cost
Space Situation Awareness									
65A009: Space Fence	25.507	60.228	164.790	242.023	264.949	334.928	204.202	Continuing	Continuing
65A012: Net-centric Sensors and Data Sources	0	18.357	24.435	10.447	12.982	12.424	7.217	Continuing	Continuing
65A037: Space Surveillance Telescope	0	0	1.947	0	0	0	0	Continuing	Continuing
65A038: SSA Environmental Monitoring	0	15.550	49.438	45.778	32.762	20.637	13.443	Continuing	Continuing
0305940F Space Situation Awareness Operations Project 67A017: Sensor Service Life Extension Programs (is entirety of PE)	15.579	53.805	43.838	26.744	31.486	81.568	69.969	Continuing	Continuing

Space Surveillance Network



Map from Capt. Amy Ianacone, "614 AOC/COD Conjunction Assessment", PowerPoint presented at the Conjunction Support Message Workshop, Washington, DC, 21-22 July 2010.