The Testimony of Secure World Foundation

House Committee on Science and Technology
Subcommittee on Space and Aeronautics
Hearing

"Keeping the Space Environment Safe for Civil and Commercial Users"

Tuesday, April 28 2009 - 10:00 PM – RHOB 2318

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Secure World Foundation is pleased to provide this written statement to the Sub-Committee on Space and Aeronautics in its consideration of the role of space situational awareness in supporting the long term sustainability of activities in outer space. In order to continue to reap the substantial benefits provided by activities in Earth orbit, the United States will need to find a satisfactory way to enhance space situational awareness.

The current space environment and the value of space situational awareness

On February, 10, 2009, the communications satellite Iridium 33 was passing over Siberia on its way up over the North Pole and then southwards a journey that had taken place without incident every one hundred minutes for the past eleven years, four months, and twenty-seven days of its mission providing satellite telephone services. That day, it experienced a sudden, violent shock and then fell silent. Iridium operators later learned that Iridium 33 had collided with another space object, a Russian communications satellite that had ceased operation years earlier. The two spacecraft had approached each other at speeds faster than any human eye could have ever followed.

If we desire to continue to reap the immense benefits that space can provide, we must take steps to preserve the Earth's orbital environment. A key concern is the threat of loss of utility of key orbits because of a proliferation of space debris. The unavoidable first step to this preservation is to determine what is in Earth orbit and where it is going: space situational awareness (SSA). Space situational awareness is not a new concept - it has been an important part of military space activities for many years. But like many other space applications, such as global positioning data and satellites communications, there is also a growing need for SSA in the civil world.

The fundamental difference between civil SSA and military SSA is in the types of information that it provides. Civil space situational awareness only needs to focus on the location of an object in Earth orbit and a point of contact for that object, along with environmental information about space weather. The additional military requirements of determining function, intent, and capabilities and limitations are not necessary for civil uses.

Imagine that you are in a car, driving down the road on a clear and sunny day. In this situation, the driver has excellent situational awareness and has all the information needed to operate the vehicle in a safe and efficient manner. However, if the windows are blacked out the situation becomes much different. Even if the driver is using a GPS device to display the car's position on the road the driver has no information about either the locations or movements of the other cars.

This environment of highly limited information is the same in which many of the satellites in Earth orbit are operated today. The owner or operator of a particular satellite usually has excellent knowledge about the position of that satellite in space, but little to no information about the locations of other objects around them. This situation was the root cause behind the collision of two satellites in February - the owner of the Iridium satellite, which could have potentially maneuvered it out of the way, did not know about the impending close approach.

This collision produced close to one thousand pieces of space debris larger than four inches, which are currently being tracked by the US military. Although still a serious incident, this number could have been significantly higher had the two satellites collided with more than what seems to have been a glancing blow.

The debris generated by the February 10th collision is just a small fraction of the overall debris population. Over 18,000 pieces of debris are being tracked in Earth orbit by various militaries, scientists, and amateur observers around the globe. Much of this population will stay in orbit for decades and even centuries. This debris, which is the result of placing and operating objects in orbit, will pose an ever more challenging threat to our continued use of space, including for commercial benefit and exploration.

Space is a vast domain, yet there are only a few regions from which we derive the majority of the scientific and economic benefits. These regions are limited natural resources, and our use of them can have long lasting negative effects on their utility. SSA is crucial not only to understanding the effects of humanity's activities in space but also in minimizing the costs those effects have on future space activities.

The value of space situational awareness to human spaceflight and use of outer space for scientific and commercial benefit

Globally, outer space provides many services that are crucial to both the US and global economy and to increasing our scientific knowledge. Collisions between objects in orbit not only lead to potential disruptions in these services but also leave debris in orbit. This debris raises the economic costs of future operations in space by increasing the measures satellite operators must take to protect their assets. These measures include more frequent maneuvers, which expend fuel and can cause service outages as well as potentially increasing manufacturing and launch costs.

Space situational awareness is also crucial for the safety of human space flight. On March 12th, 2009, the crew of the International Space Station (ISS) was forced to prepare for an emergency evacuation inside the Soyuz spacecraft in response to an unexpected close approach by a piece of debris from the 1993 US launch of a Global Positioning Satellite. This was followed by another close approach by a piece of debris from an expired Russian satellite on March 16th. On March 22nd, the docked Space Shuttle Orbiter and ISS were forced to change orbit to avoid an extremely close piece from a Chinese rocket booster launched in 1999.

The remote sensing satellites that make up NASA's primary Earth observation A-Train constellation and provide invaluable data for climate and resource management also have dealt with the issue of satellite collisions. In June of 2007, the $1.3 billion Terra satellite was forced to change its orbit to avoid a piece of Chinese debris and in July 2007 the CloudSat satellite maneuvered to avoid a near miss with an Iranian remote sensing satellite.

Likewise, operators of commercial satellites in geostationary orbit 22,000 miles above the Earth are on a constant lookout for debris. Their satellites must stay within a fairly narrow assigned slot, both to maintain a fixed position for their customers on Earth and to prevent possible collisions with other satellites operating nearby. Natural forces continually pull these satellites in different directions, forcing all geostationary satellite operators to perform periodic maneuvers to maintain their precise positioning. Many times these maneuvers are made without precise knowledge of the location of neighboring satellites.

For US strategic, commercial, civil and scientific objectives, improved space situational awareness of all parties is essential to ensure the viability of US interests in space in the long-term.

The importance of increasing SSA capacity

As the number of actors in space has risen dramatically in recent years, there is a pressing need for space situational awareness information for all space-faring States. The fallout from a hypothetical on-orbit collision between the satellites of two emerging space states with limited access to SSA information will unavoidably place US space assets at risk. Access to SSA information, along with the capacity to interpret it for all space actors, both emerging and developed, can significantly enhance the safety of US space assets. Improved operational practices through SSA will hopefully help to prevent future collisions and other debris causing incidents.

Unfortunately, most actors in space do not have the resources or capacity to provide their own space situational awareness information necessary to make safe and secure decisions regarding activities in space. The few States that do have the resources to provide this information are often limited by national security or military restrictions from sharing it with other actors.

Accurate tracking of all objects in Earth orbit from the ground requires a geographically distributed network of both radar and optical telescopes. Such a network is very expensive to create and maintain. The United States military currently has the world's best SSA network, but it still has significant limitations as a result of the lack of coverage in areas where the United States does not have a presence. Additionally, from an organizational perspective, this network does not currently have the financial resources, capacity or requirement to provide the necessary SSA data and resources for civil and commercial purposes globally Upgrades to this network are planned and underway by the US military but are subject to fiscal constraints that may cause delays or reductions in desired capabilities.

The United States is not alone in its capacity to provide SSA data. Many other States possess a limited SSA capability, usually not more than a few radar or optical telescopes. Taken separately, these sensors only provide spot coverage and very limited capacity. However, if the data from these existing sensors were combined, they would provide a large fraction of the capabilities necessary for global coverage. Thus, some level of international data sharing would increase SSA capacity without the expense of building additional sensors.

In addition to global sensor coverage, space situational awareness must include data from commercial satellite owner-operators, as they have positional data on their satellites that is more accurate than any ground-based sensor could obtain. These commercial operators have very precise information about the locations of their own satellites, but little to no information about other satellites, dead satellites and other pieces of debris that float through their slots. Their positional data complements the

ground-based tracking of debris and also reduces the workload requirements for the tracking networks, freeing up capacity to focus on inactive satellites and debris.

Concluding Thoughts and Summary of Key Points

Secure World Foundation's main goal is to improve SSA for all space actors as a matter of safety and long term sustainability of outer space activities for ***all*** actors. In this regard, we do not necessarily support any specific means of accomplishing this goal over another. Nevertheless, Secure World Foundation believes that the long term sustainability of outer space activities will in time require a broad international approach to space situational awareness.

To sum up our key points:

- SSA is vital to the continued long term use and sustainability of Earth orbit
- There are civil and commercial requirements and uses for SSA data, the U.S. military currently does not have the resources to provide this service
- An SSA system needs to combine multiple data sources, including ground and space-based sensors, satellite owner-operators, and space weather data
- While some elements of the SSA system can and should be done unilaterally, there are multiple options for international participation and engagement
- The key benefit to international participation in SSA is greater capability for relatively low cost, by combining existing sensors and data sources

About Secure World Foundation

Secure World Foundation (SWF) is headquartered in Superior, Colorado, with offices in Washington, D.C. and Vienna, Austria. SWF is a private operating foundation dedicated to the secure and sustainable use of space for the benefit of Earth and all its peoples.

SWF engages with academics, policy makers, scientists and advocates in the space and international affairs communities to support steps that strengthen global space security. It promotes the development of cooperative and effective use of space for the protection of Earth's environment and human security.

The Foundation acts as a research body, convener and facilitator to advocate for key space security and other space related topics and to examine their influence on governance and international development.