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INTRODUCTION:

Good Morning fellow Maui workshoppers. I am very pleased and honored to be here to hopefully contribute to the important discussions of this workshop. What I hope to contribute is not the results of months of research, nor clever, math-based techniques to improve the predictability of propagated orbits. What I hope to do today is provide an operational perspective—that is, the users perspective—to energize this body of scientists, researchers and esteemed admirers of space problems to help us move forward. As Paul stated in his introduction of me, I work at JFCC SPACE. For our purposes, it is the organization located at the distant end of theory and in the middle of applications.

United States Strategic Command, and particularly my organization, JFCC SPACE, is very interested in this discussion as we have been charged by our national leadership to provide SSA for the Nation and our international partners. This responsibility is similar to monitoring shipping activities on the high seas, otherwise known as what we call “maritime domain awareness.” Similarly, this space situational awareness responsibility requires us to gather the requisite understanding of all resident space objects, the potential hazards to on-orbit assets, whether these hazards are created by man or Nature, as well as the monitoring and predicting of space weather and its impacts to operating in space. Bottom Line: we have a lot of work left to do, and I believe together, the world's two leading space-faring nations
can rise to this challenge.

GROWTH IN SPACE:

It is imperative that all of us understand and appreciate the environment in which we are operating, especially with the significant growth in the number of complex space systems and the challenges created by this increasingly crowded and congested operational environment. For example, on that historic October day in 1957, the celestial skies were as pristine and uncongested as the Maui beaches—and therefore devoid of operational necessity to screen for potential conjunctions or coordinate maneuvers, and share space situational awareness information—basically, there wasn’t any to share. Fast forward to 1980, the U.S. was tracking approximately 4,700 objects in space; 280 of those objects were active satellites. Today, in 2010, we're tracking more than 23,000 objects; of which approximately 1,100 are active. So, in 30 years, the volume of space traffic has grown four fold—and I would posit that the operational necessity to share space situational awareness data has increased well beyond the four-fold increase in the number of objects, and will continue to grow in importance with each thundering space launch.

In fact, I would like to discuss United States Strategic Command’s assigned role in monitoring the space domain, or what we call space situational awareness, or SSA for short. SSA is a very complex responsibility that requires more than just continual monitoring of the environment. This awareness is essential to owners and operators of spacecraft as well as to decision makers to enable predictions or appropriate responses to risks and dangers. It requires inputs from every available entity, including ground stations, satellites, weather stations, and especially owners and operators. As the number of objects in space continues to expand, an effective picture of the space operating environment can only be achieved by sharing information for our mutual benefit. On average, between the 1100 active satellites, 30 conjunctions
warrant increased scrutiny each day, and of these, five close approaches demand close coordination between out gatherers of SSA and operators of spacecraft.

The Commander of United States Strategic Command has delegated responsibility for the SSA task to the Commander, Joint Functional Component Command for Space. The Commander has a 24/7 operations center through which he gathers, maintains and reports SSA. This center is known as the Joint Space Operations Center, referred to as the JSpOC, and is tasked with the day-to-day operational command and control responsibility of planning, tasking, directing and assessing our geographically-dispersed space surveillance network assets.

A tangible product of this daily network is our Satellite Catalog, which we make publicly available--free of charge--through the website: www.dot.space.dash.track.org. The reason we publish our satellite database is to make satellite positional and orbital information publicly available, primarily for safety of spaceflight purposes. We maintain this database so that we can apply this knowledge, that is, conduct collision avoidance calculations and ultimately, if required, provide a notification of potential close approaches to the appropriate government and/or commercial owners/operators of spacecraft.

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The United States Strategic Command took a hard look at its internal collision avoidance and prediction processes following the Iridium - COSMOS satellite collision that occurred a little more than one year ago (February, 2009). At the UNCOPUOS session in June 2009, Major General Susan Helms, the Director of Plans and Policy at United States Strategic Command, provided information on this review. Since then, we have made internal process improvements, acquired additional computational
capability, and added additional personnel. These changes have improved the Command’s capacity to track objects in space as well as its capability to predict potential close satellite approaches that might pose a hazard to active spacecraft. And, although these internal improvements have enabled us to go from only screening Department of Defense satellites to being able to screen all active satellites against every object in the satellite catalogue daily, it is not enough for today's and tomorrow's complex space environment.

We have also increased our capacity to provide this information in a timely and operationally-relevant manner to owners and operators around the world. And these improvements, where as they are noteworthy, they, too are not enough.

A large portion of the catalogued objects in our space surveillance network is space debris, shedding light on the fact that it is in every space-faring entity's interest to adopt the UNCOPUOS guidelines for the mitigation of orbital debris. Debris from collisions, depending on orbital characteristics, could stay in orbit for decades and, as such, represents a gathering danger and risk to active satellite operations. For example, the Iridium-COSMOS collision produced 2,079 pieces of trackable debris. As of 13 January 2010, 57 pieces have de-orbited, but 2,022 remain in orbit. In addition, the Joint Space Operations Center continues to identify additional pieces of previously untracked or uncorrelated debris from this collision during routine analysis.

In December 2009, United States Strategic Command assumed oversight responsibility for sharing SSA services with Commercial and Foreign Entities, previously called the CFE program. The renamed “SSASharing” program offers the opportunity for international and commercial partners interested in safety of space flight operations and information sharing to collaborate with us to help improve space situational awareness. Our goals with this program are to provide transparency into satellite positional
information and promote space flight cooperation and safety through collaborative and constructive partnerships.

The SSA Sharing program consists of two services: a basic service available to anyone in the world with an internet connection; and advanced services available to entities under a negotiated agreement. The basic service is provided through the website that I mentioned earlier, www.dot.space-dash.track.dot.org.

The database contains a listing of historical and current Two Line Element Sets, or TLEs, that provide satellite positional information and orbital parameters.

The website also provides Satellite Decay and Reentry Data and procedures necessary to request additional services that are not provided on the website. All of this data on the website continues to remain available to users free of charge.

The second aspect of the SSA Sharing program is a more detailed cooperative partnership with satellite owners and operators and potential international partners in order to establish a two way exchange of information. It is this second element of the program that begins to resolve the challenging issues of operating in today’s highly congested and operationally complex space environment. As detailed today, it will not prevent another collision of space objects; however, it is a critical point of departure for establishing a collaborative culture in coordinating operations of national and commercial interest in the space domain, and perhaps even most importantly, energizing the international community of scientists, academicians, and researchers to focus their efforts on the next phase of requirements for SSA.

Additional collaboration efforts are currently under review and development and may include: collision avoidance in support of space launch operations; conjunction assessment to support planned maneuvers; de-orbits, re-entries, and disposals. Entering
into a cooperative international agreement for SSA collaboration is a new aspect of this program that enables us to work closely with our partners to improve space flight safety.

It is common to say that the first time you meet the fire chief should not be at the scene of a devastating fire. This analogy is true, too, for emergency notification of space flight activities. The process is easier if we have established a cooperative partnership, utilize a common lexicon and terms of reference, and, figuratively speaking, have the necessary understanding of where the bedrooms and children are in the house prior to arrival on scene. We endeavor to do this through the development of written agreements and daily practices.

FUTURE

As we move forward with the SSA Sharing Program, we, that is, The United States and Russia, need to seize this grand, and perhaps fleeting opportunity to exert leadership on the future of operations, and the development of applications, in the space domain. Afterall, if Iridium-Cosmos could happen to the US and Russia, space collisions can, and likely will, happen to anyone operating in space. With this in mind, our USSTRATCOM team has begun reaching out to international and commercial partners to seek a dialogue and agreement for information exchange. However, as I have stated, avoiding collisions is critical, and knowing with confidence and accuracy where space objects are and where they are going to be is absolutely foundational for all other applications, yet it is not the only component of SSA. Not all that long ago, though, many people thought SSA both began and ended with simply tracking objects and creating a catalog of the objects. As we have come to understand, the cycle of SSA includes tracking objects, characterizing the capabilities of these objects, attributing the actions to the rightful objects and understanding the intent of the owner or operator of the object.
If we, as a world community of space-farers and space explorers, are to truly progress to commonplace space tourism, while preserving and balancing the use of space for all nations and commercial and civil entities, then we need to rapidly evolve our SSA applications, we have to be smarter. For example, in a study of 439 cities with transportation congestion systems, travel delays were reduced by an average of 700,000 hours annually. A study by the US department of energy found that consumers with smart meters saved 10% on their power bills and cut usage by 15%. My point is, data is being captured today as never before. However, data by itself isn't useful, it is inundating, unless you can extract usable and actionable information from it. With the right tools, perhaps developed by members of this body, we can be smarter and provide calming information where only mind-boggling data previously existed. I call this constellation intelligence, or "constelligence."

In my personal opinion, constelligence includes developing the following applications:

- high accuracy decay and reentry prediction of uncontrolled objects;

- electromagnetic interference deconfliction and resolution

- precise asteroid orbital predictions

- rapid orbit propagation due to spacecraft anomalies;

- real-time space weather/solar environment impacts to space objects.

Other applications could include:

- worldwide laser synergy and/or deconfliction;

- optimal designs for efficient spacecraft disposal; and
- space and missile launch warnings

The good news is, all of these constelligence applications would be based on the foundational spatetrack work already completed. And enhanced relationships and partnerships with members of the space community--additional foundational work already initiated by Strategic Command and commercial entities alike--will assist in rapidly bringing smarter operations to the space community.

Thank you for the opportunity to engage with the esteemed members of this workshop. I look forward to taking part in further dialogue and collaborative opportunities for the betterment of all peaceful users of space. And I look forward to your questions. Thank you.