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DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE

HOUSE SCIENCE, SPACE AND TECHNOLOGY COMMITTEE

U.S. HOUSE OF REPRESENTATIVES

SUBJECT: THREATS FROM SPACE: A REVIEW OF U.S. GOVERNMENT EFFORTS TO TRACK AND MITIGATE ASTEROIDS AND METEORS

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Chairman Smith, Ranking Member Johnson, and Members of the Committee, thank you for the opportunity to appear before you today to discuss Air Force Space Command's role in monitoring activity in the space domain. Space situational awareness underpins the entire spectrum of space activities and Air Force Space Command's focus is on providing forces and capabilities to United States Strategic Command (USSTRATCOM) to detect, track, identify and characterize human-made objects that orbit the Earth. Our efforts contribute to the collaborative, multiagency endeavor required to ensure comprehensive space situational awareness for the Nation.

***Air Force Space Command Roles and Responsibilities***

Air Force Space Command presents space forces and capabilities to USSTRATCOM through the Fourteenth Air Force. The Commander, Fourteenth Air Force, Lieutenant General Susan Helms, is dual-hatted as the Commander, Joint Functional Component Command for Space (JFCC SPACE) and is responsible for executing USSTRATCOM's space operations mission.

JFCC SPACE's Joint Space Operations Center (JSpOC) is the avenue through which JFCC SPACE commands and controls space forces and it is the epicenter of the space situational awareness mission. The JSpOC is also the means by which JFCC SPACE coordinates space situational awareness with other agencies. For example, National Aeronautics and Space Administration (NASA) orbital safety analysts reside within the JSpOC 24 hours a day to collaborate on orbital safety threats to human space flight.

***Detecting and Tracking Human-Made Objects in Space***

For definitional purposes, the Air Force considers an object as being near-Earth if it takes less than 225 minutes to complete its orbit around the Earth. That is roughly 5,800 kilometers in altitude. All else is characterized as deep-space.

All entities that operate in the space domain are increasingly concerned about orbital debris. Past practices, as well as recent events, both accidental and purposeful, have created a troublesome debris environment in low Earth orbit. In 2007, the People's Republic of China performed an anti-satellite test which successfully struck its target, one of their defunct weather satellites. In 2009, an active Iridium communications satellite and a non-operative Russian Cosmos satellite accidentally collided. Each of these near-Earth incidents resulted in thousands of pieces of debris large enough to track. As of March 1, 2013, we continue to track 2,160 pieces from the Iridium-Cosmos collision alone. Additionally, in 2012, a Russian BRIZ-M upper stage malfunctioned with a significant quantity of propellant remaining. This upper stage eventually exploded and we are now tracking almost 150 pieces of debris from this event. More troubling is that our modeling tells us that each event produced thousands more pieces of debris which are too small for our sensors to reliably track. At orbital velocities, these small objects still represent catastrophic potential threats to fragile spacecraft. Each subsequent collision, explosion or break-up leaves more debris in space, increasing the potential for further collisions and even more debris, a chain reaction that could exponentially increase the risk to activities in space.

To support national security space operations in an environment of increasingly adverse environmental conditions, the JSpOC collects and processes data from a worldwide network of radar and optical sensors, as well as a dedicated space surveillance satellite. Each day the JSpOC creates and disseminates over 200,000 sensor taskings. The sensors then return nearly 500,000 observations to the JSpOC for processing. JSpOC operators use this data to maintain a high accuracy catalog of space objects and perform over 1,000 satellite collision avoidance screenings daily. These operations form the basis of the United States' space situational awareness capability, which is then shared with other operators in the national security, civil and commercial sectors of space operations.

***Size of Objects and Distance Detected***

The JSpOC directs space surveillance sensors to track objects in space ranging in size from as small as a softball to as large as the International Space Station. Today, the JSpOC tracks approximately 23,000 objects in both near-Earth and deep-space, but there is an estimated half million plus human-made objects in Earth orbit that we are not tracking. The number of objects reliably catalogued by the JSpOC is expected to rise by as much as four or five times by 2030 due to the steady growth in the on-orbit population, as well as the planned fielding of improved sensor capability.

The systems Air Force Space Command supports were designed and fielded to meet requirements specific to national security missions. Some track objects in near-Earth orbit while others are focused on deep-space, primarily geosynchronous orbit; however, we can on occasion support other orbit profiles. For example, when the NASA Stardust spacecraft returned to Earth from collecting samples of the coma of a comet in 2006, we were able to modify certain parameters of existing models and use space surveillance sensors to track the Stardust sample return capsule in its parabolic return-to-Earth.

***Technologies and Processes***

As previously stated, Air Force Space Command sensors were developed to track man-made objects in Earth orbit. The Nation's current capability to track asteroids, which orbit the sun, is largely driven by NASA. Air Force developmental telescopes are used by the Massachusetts Institute of Technology's Lincoln Laboratory to find and catalog asteroids under contract to NASA. And in some cases, the JSpOC can task space surveillance sensors to help track close approaches by asteroids and help predict potential collisions with Earth-orbiting objects. For example, during the recent Asteroid 2012 DA14 event, the JSpOC used orbit data for it from NASA's Near Earth Object Program Office at the Jet Propulsion Laboratory to screen for potential collisions with man-made objects in Earth orbit.

The current sensor tasking and data processing system used by the JSpOC to accomplish the space situational awareness mission was designed in the 1980s, fielded in the early 1990s and is nearing its capacity limits and end-of-life. We are in the process of fielding the next generation system, the JSpOC Mission System (JMS). With its open, service-oriented architecture, the JMS will supply the automation necessary to make better use of the tremendous volume of sensor data available. It will also enhance the Commander, JFCC SPACE capability to conduct space operations in a much more efficient and much safer manner.

### ***Conclusion***

Space situational awareness is foundational to civil, military and commercial space activities. Air Force Space Command forces and capabilities to detect, track, identify and characterize man-made objects in Earth orbit support the larger collaborative effort to maintain space situational awareness for the Nation.