

**U.S. House of Representatives
Committee on Science, Space, and Technology**

Space Traffic Management: How to Prevent a Real Life ‘Gravity’

CHARTER

Friday, May 9, 2014
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Purpose

At 10:00 am on Friday, May 9, 2014, the Space Subcommittee will hold a hearing titled “Space Traffic Management: How to Prevent a Real Life ‘Gravity’.” There are currently three agencies that play a primary role in tracking and mitigation of orbital debris that may be hazardous to operational satellites or life and property on Earth, if the debris is large enough upon reentering the Earth’s atmosphere. The Joint Functional Component Command for Space (JFCC SPACE), part of the Department of Defense, is responsible for tracking orbital debris, the Federal Communications Commission (FCC) asserts jurisdiction for mitigating orbital debris from satellites, and the Federal Aviation Administration (FAA) regulates orbital debris from launch and reentry activities. This hearing will explore the roles and responsibilities of the Department of Defense, FAA, and FCC in policing orbital debris, what authorities are currently granted by Congress to federal agencies, and how they coordinate these activities.

Witnesses

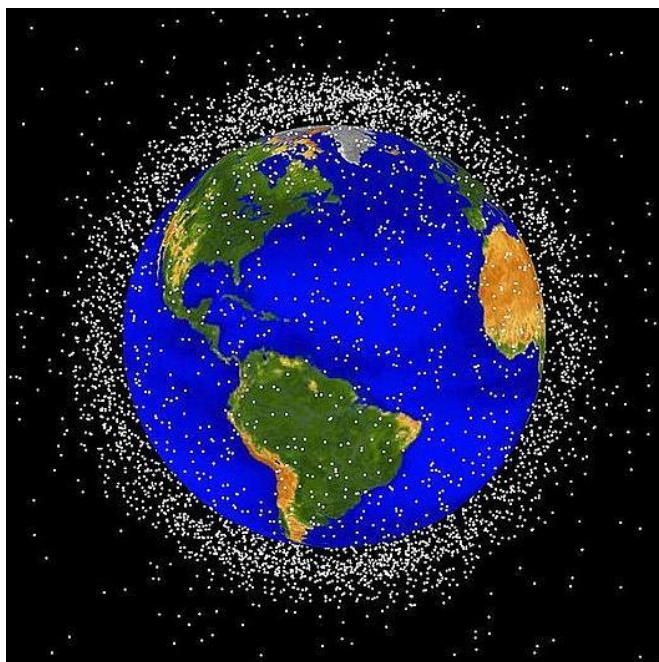
- **Lt. Gen. John “Jay” Raymond** – Commander, 14th Air Force, Air Force Space Command; and Commander, Joint Functional Component Command for Space, U.S. Strategic Command
- **Mr. George Zamka** – Deputy Associate Administrator, Office of Commercial Space Transportation, Federal Aviation Administration
- **Mr. Robert Nelson** - Chief Engineer, International Bureau, Federal Communications Commission
- **Mr. P.J. Blount** – Adjunct Professor, Air and Space Law, University of Mississippi School of Law
- **Mr. Brian Weeden** – Technical Advisor, Secure World Foundation

Background

Recently, concerns about the dangers presented by orbital debris have intensified due to China’s anti-satellite test in 2007, and public awareness of the problem increased due to the popular movie *Gravity* released last fall. The growth of the orbital debris population in key orbits around the Earth presents a series of challenges for the United States and other spacefaring nations. Debris can be caused by any number of things and can range in size from a couple centimeters to entire satellites. Each object, no matter its size, poses a threat to our assets in

space and to the safe transport of humans and payloads in low-Earth orbit and beyond. Objects, as small as a paint fleck at extremely high relative velocities (approximately 17,500 miles per hour), can cause damage.¹

At least two major space debris incidents have occurred since 2000. First is the collision between Iridium-33, a commercial communications satellite, and Kosmos-2251, a decommissioned Russian military communications satellite.² The collision happened at approximately 26,170 mph and is described as a “hypervelocity collision.”³ It is believed that this incident alone caused over 2,000 pieces of debris.⁴



Map of known hazardous objects in LEO. Credit: NASA's Orbital Debris Program Office

The second major incident was China's test of an anti-satellite or ASAT weapon in 2007. This test was meant to demonstrate the capability to destroy a satellite with a kinetic weapon. This test created the largest single debris event in history.⁵ To date, nearly 3,400 pieces of debris associated with this event have been cataloged. According to NASA's Orbital Debris Program Office this debris ranges in size from 5 cm to nearly a meter.⁶

The JFCC currently tracks approximately 23,000 objects in orbit around the Earth. These include 4,000 payloads, of which 1,200 are active.⁷

Joint Functional Component Command for Space

Data gathered by various radar and electro-optical sensors from around the world as well as space-based sensors used to track orbital debris are integrated by JFCC SPACE located at Vandenberg Air Force Base in California. JFCC's mission is largely focused on space situational awareness (SSA).

¹ “Space Debris and Human Spacecraft” retrieved on May 3, 2014.

http://www.nasa.gov/mission_pages/station/news/orbital_debris.html#U2ecJ1c9VZg

² “U.S. Satellite Destroyed in Space Collision” <http://www.space.com/5542-satellite-destroyed-space-collision.html>

³ “Satellite Collision Leaves Significant Debris Clouds” – NASA Orbital Debris Program Office

<http://orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv13i2.pdf>

⁴ “International Space Station Again Dodges Debris” – NASA Orbital Debris Program Office

<http://orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv15i3.pdf>

⁵ Fengyun-1c Debris cloud Remains Hazardous” - NASA Orbital Debris Program Office

<http://orbitaldebris.jsc.nasa.gov/newsletter/pdfs/ODQNv18i1.pdf>

⁶ *Ibid.*

⁷ Briefing from JFCC staff to Committee Staff, April 10, 2014.



Credit: http://www.stratcom.mil/factsheets/11/Space_Control_and_Space_Surveillance/

There are four types of sensors used for SSA; they include phased array radar, conventional radar, electro-optical sensors, and space-based sensors. The data from these sources is integrated and used to provide characterization and predictive data that can help satellite operators avoid collisions.

When JFCC detects a possible close approach, it issues a conjunction summary to inform satellite operators. Approximately 1,400 warnings are issued each day.⁸ Once the warning is issued, JFCC has no authority to require an operator to take any evasive action. The decision to move or not move a satellite is left solely to the discretion of the operator. In the case of commercial satellites, this is often a complex decision that involves considerations beyond the creation of orbital debris. In this regard, there is no “traffic cop” in the orbital space environment with regulatory authority to direct satellite operators to move their satellites to avoid a potential collision. It is the sole discretion of the satellite operator to weigh the risks of such maneuvers.

JFCC currently has agreements with 41 commercial entities to share tracking data on assets in orbit and four sharing agreements with allied countries including Australia, Italy, Japan, Canada, and France.⁹ In addition to government tracking and SSA efforts, in 2009 a group of the largest satellite operators formed the Space Data Association (SDA) to “support the controlled,

⁸ Written Testimony of Lt Gen. John W. “Jay” Raymond before the House Armed Services Subcommittee on Strategic Forces, April 3, 2014.

<http://www.airforcemag.com/testimony/Documents/2014/April%202014/040314raymond.pdf>

⁹ *Ibid.* 7

reliable and efficient sharing of data that is critical to the safety and integrity of satellite operations.”¹⁰

The SDA works to coordinate the movements of various satellites controlled by the operators that participate in the consortium. This provides the members with advanced warning when a satellite moves from one position to another, key information to which JFCC does not currently have access. JFCC can only predict a particular orbit and position based on orbital mechanics and observations from sensors. If an SDA member were to maneuver their satellite, JFCC would recognize the change, but would not have had advanced warning of it.

Federal Communications Commission

In October of 2005, the FCC announced that all current and future applicants for a license to operate a “space station”¹¹ of any kind would need to submit a debris mitigation plan to the commission within 30 days of the announcement. The plan required is highly technical in nature and must address spacecraft hardware design, minimizing accidental explosions, safe flight profiles, and post-mission disposal. The debris mitigation plan is submitted as part of the license application packet used by FCC to grant licenses to radiate, or transmit, to ground stations.

Prior to this rulemaking action, the FCC had only addressed orbital debris in a cursory manner, but never directly commented on the breadth of its authority to regulate it. The Notice of Proposed Rulemaking (NPRM) issued on March 18, 2002 addressed the question of whether or not the FCC had the statutory authority to regulate orbital debris.¹² In the Second Report and Order issued on June 21, 2004, FCC concluded in response to comments on its statutory authority to regulate that:

... adoption of the debris mitigation measures in this Second Report and Order is consistent with our authority and public interest obligations under the Communications Act.... The Communications Act provides the Commission with broad authority with respect to radio communications involving the United States, except for communications involving U.S. government radio stations. The Act charges the FCC with encouraging “the larger and more effective use of radio in the public interest,” and provides for licensing of radio communications upon a finding that the “public convenience, interest, or necessity will be served thereby.” ... Because orbital debris could affect the cost, reliability, continuity, and safety of satellite operations, orbital debris issues have a bearing upon the “larger and more effective use of radio in the public interest.” Thus, orbital debris and related mitigation issues are relevant in determining whether the public interest would be served by authorization of any particular satellite system, or by any particular practice or operating procedure of satellite systems.¹³

¹⁰ Space Data Association. Retrieved on May 5, 2014. <http://www.space-data.org/sda/about/sda-overview/>

¹¹ In the FCC regulations, any object in space that is transmitting on spectrum to a ground station is referred to as a “space station.”

¹² Notice of Proposed Rulemaking, March 18, 2002. IB Docket No. 02-54, FCC 02-80; Section III, Subsection A., Paragraph 30. http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-02-80A1.pdf

¹³ Second Report and Order, June 21, 2004. IB Docket No. 02-54, FCC 04-130; Section III, Subsection A., Paragraph 12. http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-130A1.pdf

While there is certainly a public interest to mitigate orbital debris in a manner that is consistent with the effective and efficient use of public resources, such as the radio spectrum, it is unclear that the FCC is the appropriate regulatory agency to ensure orbital debris mitigation practices are consistent with public safety and traffic management needs. Additionally, Congress has never granted FCC the specific authority to regulate orbital debris. The agency interpreted the broad nature of the Communications Act of 1934¹⁴ as the basis for its regulations, rather than explicit authorization from Congress.

Federal Aviation Administration

As part of its statutory authority to regulate launch and reentry of commercial launch vehicles, the FAA's Office of Commercial Space Transportation has set regulations in place that govern orbital debris mitigation caused by the transportation of a payload to orbit. These regulations require that: "There will be no unplanned physical contact between the vehicle or its components and payload after payload separation and debris generation will not result from conversion of energy sources into energy that fragments the vehicle or its payload. Energy sources include, but are not limited to, chemical, pneumatic, and kinetic energy."¹⁵

The National Space Transportation Policy released on November 21, 2013, directed the FAA to "execute exclusive authority, consistent with existing statutes and executive orders, to address orbital debris mitigation practices for U.S.-licensed commercial launches, to include launch vehicle components such as upper stages, through its licensing procedures."¹⁶ This is generally consistent with current practice for the FAA. While the policy did not represent a departure from the status quo, testimony given by Dr. George Nield, Associate Administrator for Commercial Space Transportation before the House Science, Space, and Technology Committee's Subcommittee on Space demonstrated that FAA was seeking additional regulatory authority with regards to space traffic management.

In testimony before the Committee on February 4th, Dr. Nield stated, "The FAA has begun a dialogue with its stakeholders to explore the need for adjustments to the FAA's statutory authority with the advent of commercial on-orbit space transportation....As the prospects for a greater number of commercial transportation vehicles in space increase, it is time to consider closing the current regulatory and safety gap between launch and reentry."¹⁷ Further, Dr. Nield observed that collisions between orbital debris and spacecraft "pose serious safety risks to persons and property in space and the safe operations of orbital systems"¹⁸ and that "the FAA believes it is time to explore orbital safety of commercial space transportation under the Commercial Space Launch Act licensing regime."¹⁹

¹⁴ The Notice of Proposed Rulemaking (02-80, Paragraph 30) cites 47 U.S.C. § 303 as the mandate for regulating orbital debris. The section requires the FCC to encourage "the larger and more effective use of radio in the public interest." http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-02-80A1.pdf

¹⁵ FAA Regulations § 431.43 (c)(3)

¹⁶ National Space Transportation Policy. November 21, 2013. Retrieved on May 4, 2014 at http://www.nasa.gov/sites/default/files/files/national_space_transportation_policy_11212013.pdf

¹⁷ Testimony before the House Committee on Science, Space and Technology, Subcommittee on Space, February 4, 2014. Page 3. <http://science.house.gov/sites/republicans.science.house.gov/files/documents/HHRG-113-SY16-WState-GNield-201400204.pdf>

¹⁸ *Ibid.*, p. 4.

¹⁹ *Ibid.*

The Commercial Space Launch Act does not explicitly address orbital debris mitigation or space traffic management, and it is unclear how this type of expansion of the FAA’s statutory authority might be implemented. Additionally, experts who have testified before the Committee on this topic have disagreed. At the same hearing, Dr. Henry Hertzfeld testified that the FAA should, “clearly be defined and preferably limited to those issues directly related to launching and reentry.”²⁰

Important Questions for Congress

- Is there a need for a “space traffic cop” with regulatory authority to direct satellite operators to maneuver satellites in situations where collision with orbital debris is highly likely? Or, are the current roles and responsibilities for federal agencies adequate?
- If a space traffic cop is needed, what federal agency is best suited for that role and responsibility?
- Is there a need to designate one particular agency to regulate orbital debris, or is a fragmented and specialized system more reasonable?
- What authorities are necessary to limit orbital debris and mitigate its impact?
- What international obligations does the United States need to take into account when designing a regulatory framework for space traffic management?
- How can the federal government support private sector initiatives such as the efforts of the Space Data Association?

²⁰ Testimony before the House Committee on Science, Space and Technology, Subcommittee on Space, February 4, 2014. Page 3. <http://science.house.gov/sites/republicans.science.house.gov/files/documents/HHRG-113-SY16-WState-HHertzfeld-201400204.pdf>