SUBCOMMITTEE ON SPACE AND AERONAUTICS
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

HEARING CHARTER

Space Situational Awareness: Guiding the Transition to a Civil Capability

May 12th, 2022
10:00 a.m. Eastern Time
Hybrid: 2318 Rayburn House Office Building and Online via Zoom

PURPOSE

The purpose of the hearing is to consider testimony regarding planning for the transition of certain space situational awareness services and information to a civil capability, among other issues.

WITNESSES

- **Dr. Matthew Hejduk**, Senior Project Leader, The Aerospace Corporation
- **Dr. Moriba Jah**, Associate Professor, Aerospace Engineering and Engineering Mechanics Department, Mrs. Pearlie Dashiell Henderson Centennial Fellowship in Engineering, Oden Institute for Computational Engineering and Sciences, The University of Texas at Austin
- **Mr. Andrew D'Uva**, Senior Policy Advisor, Space Data Association
- **Mr. Kevin M. O'Connell**, Founder, Space Economy Rising, LLC
- **Dr. Mariel Borowitz**, Associate Professor, Sam Nunn School of International Affairs, Ivan Allen College of Liberal Arts, Georgia Institute of Technology

OVERARCHING QUESTIONS

- *What should be the goals and objectives for an evolvable civil space situational awareness capability?*
- *What is needed to ensure an effective transition of certain space situational awareness services and information from the Department of Defense to a civil government entity or entities?*
- *What are the potential challenges in transitioning space situational awareness services and information to a civil capability, and how should those challenges be addressed?*
- *To what extent is research and development important to the future of a civil space situational capability and an eventual space traffic coordination framework?*

BACKGROUND

Over the past decade, the space industry has grown and changed significantly, particularly with the rapid increase of commercial and private activity in low-Earth orbit (LEO). With the advent of megaconstellations, often involving thousands of satellites, and new global players launching CubeSats and small satellites into Earth's orbit, operating in the space environment is becoming more complex. The locations and predicted positions of active satellites, defunct satellites, and space debris must be considered in order to avoid collisions and maintain safe operations. Given this evolving landscape, space situational awareness (SSA) is becoming an essential means to ensuring the safety and sustainability of the space environment.

SSA refers to the location and projected location of space objects, including both operational satellites and orbital debris; the avoidance of potential collisions between objects; and the mitigation of collision risks to space assets and human spaceflight activities. The operating environment pertains not only to the location of objects with respect to potential collisions, but also the environmental effects of space weather on space objects and how they move through space. SSA is distinct from but related to what is referred to as space traffic coordination (STC), which uses SSA data and information as input into safety decisions for on-orbit operations.

Currently, the Department of Defense (DOD) has the role of collecting space object location data, maintaining a catalog of space objects, processing space object data to characterize the space environment, determining the potential for collisions, and disseminating notices of potential collision risks to space operators.[1]

U.S. Government SSA Data Collection and Tracking System

The DOD Combined Space Operations Center (CSpOC) uses radar and optical telescopes to track space objects and actively maintains a public catalog of these objects. Figure 1 shows how the number of active payloads is dwarfed by a number of defunct objects, such as rocket bodies, debris from satellite breakups and collisions, and inactive satellites. At present, DOD's public catalog reports over 44,000 space objects, of which only about 5,600 have been publicly verified as active payloads.[2] Statistical models

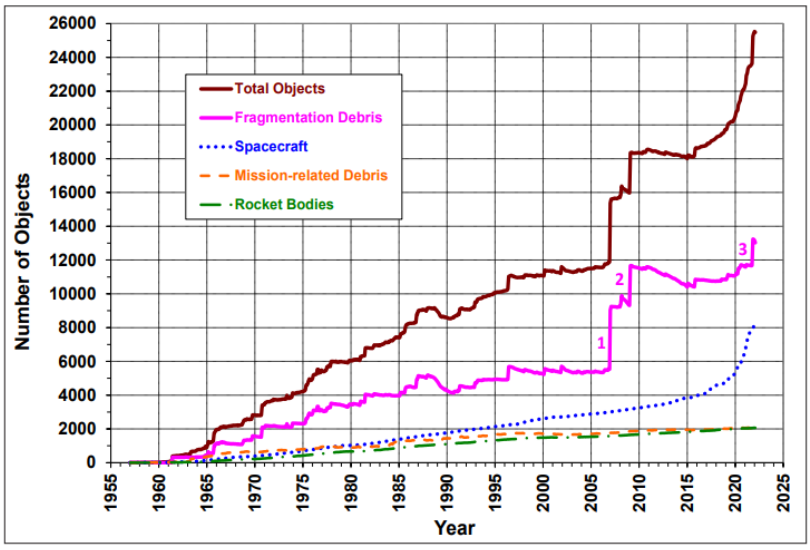

Figure 1. Number of Objects in Earth Orbit by Object Type. Source: Orbital Debris Quarterly Newsletter, Volume 26, Issue 1, March 2022. https://orbitaldebris.jsc.nasa.gov/quarterly-news/pdfs/odqnv26i1.pdf

[1] Title 10 United States Code, Section 2274
[2] https://www.space-track.org/auth/login

estimate that there are over 36,000 space objects larger than 10 centimeters (cm) and 1,000,000 objects between 1cm and 10cm in orbit around the Earth, however DOD's Space Surveillance Network is not capable of tracking the smallest objects, particularly those below 10cm.[3,4]

The number of objects being tracked by the DOD has been rising, due to the increasing number of objects in space and the ability of commercial and non-U.S. capabilities to track them.[5] Commercial and international data, when combined with DOD SSA data, can provide more frequent observations of space objects than the DOD system alone and can improve the accuracy of SSA information for satellite operators.[6] Furthermore, several commercial SSA companies have emerged to support government and private sector satellite owner/operators in identifying and tracking potential collisions and supporting potential collision avoidance maneuvers.[7] With an increasing number objects in the catalog and the availability of non-government SSA data and services, among other factors, SSA and the process for detecting, processing, and alerting operators of potential collisions becomes more complex.

Space Policy Directive-3, National Space Traffic Management Policy

In June 2018, The Trump Administration issued Space Policy Directive-3, or SPD-3, the National Space Traffic Management Policy. SPD-3 was issued to promote space safety as means of maintaining U.S. leadership in space. The policy identifies principles, goals, and guidelines on managing the integrity of the space operations environment; roles and responsibilities for space situational awareness and space traffic management; and provides other relevant guidance. SPD-3 also recognizes the need to transition certain space situational awareness data and information services to a civil entity. Specifically, SPD-3 states: "To facilitate…enhanced data sharing, and in recognition of the need for DoD to focus on maintaining access to and freedom of action in space, a civil agency should, consistent with applicable law, be responsible for the publicly releasable portion of the DoD catalog and for administering an open architecture data repository."[8]

SPD-3 also provided guidance on agency roles and responsibilities, including that,

- "The Secretaries of Defense and Commerce, in coordination with the Secretaries of State and Transportation, the NASA Administrator, and the Director of National Intelligence, should cooperatively develop a plan for providing basic SSA data and basic STM [Space Traffic Management] services either directly or through a partnership with industry or academia";
- The Secretary of Defense would maintain the authoritative catalog of space objects; and
- "The Secretary of Commerce, in coordination with the Secretaries of State, Defense, and Transportation and the NASA Administrator, and the Director of National Intelligence,

[3] NASA, Orbital Debris Quarterly Newsletter, Volume 26, Issue 1, March 2022. Available at: https://orbitaldebris.jsc.nasa.gov/quarterly-news/pdfs/odqnv26i1.pdf
[4] https://www.esa.int/Safety_Security/Space_Debris/Space_debris_by_the_numbers
[5] https://www.popularmechanics.com/space/satellites/a25562991/pentagon-declassifying-space-traffic-data/
[6] Institute for Defense Analysis, Science and Technology Policy Institute, "Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)", April 2019
[7] *Ibid.*
[8] Space Policy Directive-3, National Space Traffic Management Policy. Issued on June 18, 2018.

> shall develop standards and protocols for creation of an open architecture data repository to improve SSA interoperability and enable greater SSA data sharing."

In addition, SPD-3 stated the importance of science and technology for SSA and STM: "Members of the National Space Council, or their delegees, shall coordinate, prioritize, and advocate for S&T [Science and Technology], SSA, and STM, as appropriate, as it relates to their respective missions. They should seek opportunities to engage with the commercial sector and academia in pursuit of this goal."

Congressional Activities

Over recent Congresses, legislative proposals have been introduced toward a civil capability for SSA services and information; however, Congress has not yet granted a civil agency with the authority for certain civil SSA responsibilities.

Congress has appropriated funding to initiate work on civil SSA activities. The explanatory statement for the Consolidated Appropriations Act, 2021, included language directing the Office of Space Commerce, within the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, to begin work on prototype for a civil SSA data system, and provided appropriated funding for the effort:

> *Within the funding provided, the agreement directs NESDIS* [National Environmental Satellite, Data, and Information Service] *and OSC* [Office of Space Commerce] *to initiate a space traffic management (STM) pilot program, in collaboration with industry, the Department of Defense, the Federal Aviation Administration, NASA, and other Federal partners, as appropriate, to develop STM technical prototypes, initiate an open architecture data repository* [OADR]*, and perform STM demonstrations and experiments….*[9]

The Consolidated Appropriations Act, 2022 appropriated the Office of Space Commerce with $16 million, an increase of $6 million over the 2021 enacted appropriation, and included direction for the Office of Space Commerce to continue work on advancing space traffic management and SSA capabilities in collaboration with industry and Federal partners.[10]

Office of Space Commerce Open Architecture Data Repository

On February 11, 2022, NOAA publicly announced and demonstrated a cloud-based prototype Open Architecture Data Repository (OADR), which was developed in collaboration with Federally-funded Research and Development Centers (FFRDCs) and academia. The prototype has been tested against 20,000 space objects in collaboration with DOD, NASA, and the commercial sector.[11] A completed system, once operational, is anticipated to process SSA data

[9] Explanatory Statement Submitted by Mrs. Lowey, Chairwoman of the House Committee on Appropriations, Regarding the House Amendment to the Senate Amendment to H.R. 133, Consolidated Appropriations Act, 2021; Congressional Record Vol. 166, No. 218 Issue and Section: December 21, 2020 - House (Vol. 166, No. 218)

[10] Explanatory Statement Submitted by Ms. DeLauro, Chair of the House Committee on Appropriations, Regarding the House Amendment to the Senate Amendment to H.R. 2471, Consolidated Appropriations Act, 2022; Congressional Record Vol. 168, No. 42

[11] National Oceanic and Atmospheric Administration. "Media Briefing: Open-Architecture Data Repository (OADR)" February 11, 2022. Available at: Media Briefing: Open-Architecture Data Repository (OADR) - YouTube

and provide notifications to space operators on potential collisions. According to NOAA, an initial operational capability is anticipated by 2024 and a full operational capability is planned for 2025.

In addition, NOAA's Office of Space Commerce has taken initial steps to understand the availability of commercial data sources of space situational awareness data that can fill gaps in existing government facilities for tracking space objects, including debris, especially in the southern hemisphere, and the ability to task such tracking sensors. The Office issued a NOAA Space Object Commercial Data Request for Information in February 2022 and subsequently, in April 2022, noticed its intent to purchase low Earth orbit object tracking data and SSA support.[12]

NASA Role in SSA

NASA has a long history of carrying out SSA in the interest of mitigating the risk to its own assets of potential collisions with debris and active satellites. The NASA Conjunction Assessment and Risk Analysis (CARA) program is an Agency-level program required for all operational robotic operational assets. To support NASA teams, the CARA program maintains an interface with DOD to receive close approach information, monitors and assesses potential collision threats, and advises NASA robotic mission teams on potential avoidance maneuvers.[13] In addition, Mission Control at NASA's Johnson Space Center works with DOD to assist NASA's human spaceflight managers in monitoring potential conjunctions, developing conjunction avoidance maneuvers, and conducting risk assessments of the International Space Station (ISS) and ISS visiting vehicles and human exploration vehicles, whether with or without crew.[14]

In December 2020, NASA released the *NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook.* The handbook reflects the goal of SPD-3 in developing safety standards and best practices, outlines NASA's own best practices in risk assessment and mitigation for space safety, and provides best practices regarding spacecraft and satellite constellation design, launch preparation and activities, and on-orbit collision avoidance.[15] For owners and operators of spacecraft, the handbook is intended to offer approaches for lowering collision risks and operating safely and sustainably in space. For providers of SSA information or conjunction assessment services, the handbook offers information to augment or improve upon existing capabilities for the benefit of the entire space industry.

[12] Department of Commerce. *Notice of Intent: Low Earth Orbit (LEO) Space Object Commercial Data.* General Services Administration. Available at: https://sam.gov/opp/5f4eea2cd55145ce990e2777be2fcfd5/view
[13] NASA. "CARA: Conjunction Assessment Risk Analysis", Available at: https://satellitesafety.gsfc.nasa.gov/CARA.html
[14] NASA Procedural Requirements NPR 8715.6B
[15] NASA. *NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook.* 2020 (Report No. NASA/SP-20205011318). Available at: https://nodis3.gsfc.nasa.gov/OCE_docs/OCE_50.pdf