EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20502

August 14, 2017

The Honorable John Thune
Chairman
Committee on Commerce, Science, and Transportation
United States Senate
Washington, D.C. 20510

The Honorable Lamar Smith
Chairman
Committee on Science, Space, and Technology
United States House of Representatives
Washington, D.C. 20515

The Honorable Ted Cruz
Chairman
Subcommittee on Space, Science, and Competitiveness
United States Senate
Washington, D.C. 20510

The Honorable Brian Babin
Chairman
Subcommittee on Space
United States House of Representatives
Washington, D.C. 20515

Dear Chairman Thune, Chairman Smith, Chairman Cruz, and Chairman Babin:

This letter is submitted in fulfillment of a reporting requirement contained in the National Aeronautics and Space Administration Transition Authorization Act of 2017 (Public Law 115-10). In addition to authorizing appropriations and outlining high-level policy direction for NASA in 2017, the law directs the Office of Science and Technology Policy (OSTP) to deliver a report on the status of an orbital debris mitigation strategy required by the National Aeronautics and Space Administration Authorization Act of 2010 (Public Law 111-267) (hereafter, "2010 NASA Authorization").

Specifically, Section 839(b)(2) states:

"(2) Mitigation strategy.--Not later than 90 days after the date of enactment of this Act, the Director of the Office of Science and Technology Policy shall submit to the appropriate

committees of Congress a report on the status of the orbital debris mitigation strategy required under section 1202(b)(2) of the National Aeronautics and Space Administration Authorization Act of 2010[1] (42 U.S.C. 18441(b)(2))."

Background

After more than 50 years of space exploration, orbital debris has become an increasing concern in the near-Earth environment. The U.S. Space Surveillance Network tracks more than 23,000 objects and maintains orbits of 17,000 objects larger than approximately 10 centimeters (cm)[2]; additional observations have indicated that the number of objects larger than 1 cm may number 500,000, and there could be on the order of 100 million objects down to 1 millimeter (mm) in size. The high impact speed between objects in orbit (average collision speeds can be greater than 10 kilometers per second for objects in low-Earth orbit (LEO)[3]) means that even debris as small as 0.2 mm can pose a realistic threat to crewed and robotic missions. The severity of impact and resulting damage increases with debris size or mass.

Existing orbital debris mitigation measures adopted by Federal agencies and the international community are aimed at keeping the expected growth of the orbital debris population to acceptable levels, especially in LEO (where many satellites and human-tended activities take place), although these measures are not designed to stop that growth entirely. Current U.S. Government orbital debris mitigation guidelines were derived from the 2001 U.S. Government Orbital Debris Mitigation Standard Practices (ODMSP). These practices were developed by NASA and DOD and, after coordination with the U.S. aerospace community, approved by Federal departments and agencies.

The ODMSP outlines four principles to minimize the growth of orbital debris. These principles are:

- Minimize or eliminate the debris released during normal operations. Any debris larger than 5 mm that will remain in orbit more than 25 years should be evaluated and justified based on cost effectiveness and mission requirements.
- Minimize accidental explosions. This step includes limiting the risk to other space systems from accidental explosions both during normal operations and after completion of normal operations. Operators should demonstrate either that there is no credible failure mode or that there are procedures in place to limit that possibility, and stored energy (e.g., batteries) should be depleted at the end of the mission so that none can contribute to an explosion.
- Minimize opportunities for collisions. Operators should select orbital configurations for spacecraft to limit the probabilities of collisions with large objects during the orbital lifetime of a mission and with debris smaller than 1 cm that will cause loss of control and loss of post-mission disposal capability. Tethered systems should consider ways to minimize the impact of both intact and severed tethers.

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[1] *"(2) INTERAGENCY EFFORT.—For purposes of carrying out this subsection, the Director of OSTP, in coordination with the Director of the National Security Council and using the President's Council of Advisors on Science and Technology coordinating mechanism, shall develop an overall strategy for review by the President, with recommendations for proposed international collaborative efforts to address this challenge."*

[2] "Orbital Debris Quarterly News" Vol. 21, Issue 2 NASA May 2017. Available online at http://www.orbitaldebris.jsc.nasa.gov/Quarterly-news/pdfs/ODQNv21i2.pdf

[3] Low-earth orbit refers to the region up to 2,000 kilometers {(km) (1,200 miles) above the Earth's surface.

- Dispose of spacecraft and launch vehicle components at the end of mission life. Three methods are recommended for disposal: atmospheric reentry, maneuvering to a storage orbit, or retrieval of the spacecraft. The reentry option should limit the lifetime to no longer than 25 years after completion of mission and ensure that the risk of human casualty on reentry to less than 1 in 10,000. If placing the spacecraft in a storage orbit, that orbit should not cross standard LEO, medium-Earth orbit[4] (MEO), or geostationary orbit[5] (GEO) paths. Retrieval should take place as soon as practical after completion of the mission.

Each of the five primary Federal entities that work in the orbital debris arena — National Aeronautics and Space Administration (NASA), Department of Defense (in particular, the U.S. Air Force and the U.S. Strategic Command), Federal Aviation Administration (FAA), Federal Communications Commission (FCC), and National Oceanic and Atmospheric Administration (NOAA) — sets out guidelines that align with the ODMSP and are based on the specific roles that the organization plays. NASA and DOD are non-regulatory agencies that have space debris guidelines implemented within each organization consistent with the ODMSP. FAA, FCC, and NOAA are regulatory agencies that maintain orbital debris rules that commercial operators are required to follow; operators submit a company's plans to meet these rules as part of the licensing process. Specifically, FAA has issued regulations for commercial launch vehicles, FCC has regulations for commercial transmitting spacecraft, and NOAA issued regulations for commercial remote-sensing spacecraft, all of which promote orbital debris mitigation. NOAA also operates satellites. Each regulator agency applies ODMSP principles through the federal rulemaking process and advances the rules as applicable with the goal to apply appropriate ODMSP principals to commercial space activities.

Actions Taken in Response to the 2010 NASA Authorization

At the request of Congress through the 2010 NASA Authorization, OSTP convened an *ad hoc* interagency working group (IWG) to explore the development of a strategy. The group examined the current guidelines for mitigation of orbital debris and reviewed the practices of U.S. launch providers to assess adherence to the guidelines for orbital debris mitigation. The group found at the time that the existing guidelines were working with sufficient compliance to slow the accumulation of orbital debris in the space environment.

Within the IWG, there was general agreement that Federal agencies should continue to pursue the larger objectives of ensuring long-term sustainability of the space domain and retaining the ability to conduct space operations. The group considered several ongoing efforts to achieve these objectives, including continuing to limit the further creation of orbital debris in the space environment and continuing to limit space-borne objects from colliding as well as ongoing debris mitigation regulation updates by the FCC and FAA. The group generally agreed that the best mitigation approach is to prevent the creation of debris in the first place, but for existing debris, tracking and characterization of the debris environment through improved space situational awareness (SSA) is critical to avoid contributing further debris through on-orbit collisions.

[4] Medium-Earth orbit refers to the region with an altitude between that of LEO, and a geostationary orbit; altitudes above Earth's surface range from 2,000 km (1,200 miles) to 35,786 km (22,236 miles), although a commonly used MEO orbit is around 20,000 km (12,000 miles) for the Global Navigation Satellite Systems.

[5] Geostationary orbit has an altitude of 35,786 km (22,236 miles) above the Earth's equator such that its orbital speed is the same as the rotational speed of Earth.

The IWG considered ongoing efforts to promote international cooperation to advance space environment stabilization, including through organizations such as the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) and the Inter-Agency Space Debris Coordination Committee (IADC). These forums provide opportunities for promotion of best practices across the international community for space debris mitigation in the shared space environment. The IWG also discussed the policy, legal, and international conditions to allow for active debris removal, a complex policy and operational domain due to the dual-use nature of debris-removal actions. All of these topics were thoroughly discussed at the interagency level as part of the deliberations for mitigation of orbital debris, although a specific and comprehensive strategy was not developed.

In addition to the work of the IWG, OSTP staff engaged with members of the President's Council of Advisors on Science and Technology (PCAST), an advisory group of the nation's leading scientists and engineers who directly advise the President and the Executive Office of the President, to assess PCAST's interest in a deeper exploration of the issue. PCAST ultimately chose not to take on the topic of orbital debris for an independent study by the committee.

Recent Activities

In more recent years, the Federal agencies have continued to strengthen their efforts on orbital debris mitigation through a variety of avenues. For example, DOD is continuing to improve its space situational awareness (SSA) capabilities in order to detect, characterize, and track orbital debris. This includes improving technologies and techniques to detect and track objects, as well as improved modeling capabilities for prediction and warnings of collisions. In addition, conversations are ongoing within and outside of the Federal government about the appropriate agency responsibilities and future frameworks for space traffic management for domestic civilian and commercial spacecraft.

Internationally, NASA is a founding member of the IADC and continues to work with the other 12 member agencies to improve the understanding of the orbital debris environment through radar and optical measurements, conduct hypervelocity impact studies to advance the protection of operational spacecraft against debris impacts, model the space environment to quantify the benefits of mitigation and remediation, and identify improvements to existing mitigation guidelines.

The State Department represents the United States in negotiations in UN COPUOS and at the June 2016 plenary, COPUOS agreed to a first set of guidelines on long-term sustainability of outer space activities.[6] The guidelines include several elements relevant to orbital debris mitigation: consideration of a number of elements when developing, revising or amending, as necessary, national regulatory frameworks for outer space activities; supervising national space activities; improving accuracy of orbital data on space objects and enhancing the practice and utility of sharing orbital information on space objects; promoting the collection, sharing and dissemination of space debris monitoring information; and investigating and considering new measures to

[6] Report of the Committee on the Peaceful Uses of Outer Space (A/71/20). Fifty-ninth session July 2016. Available online at http://www.unoosa.org/oosa/oosadoc/data/documents/2016/a/a7120_0.html .

manage the space debris population in the long term. Implementation of these guidelines is underway.

Thank you for the opportunity to update the Congress on this important issue.

Sincerely,

Ted Wackler, PE
Director (Acting)
Office of Science and Technology Policy

Cc:

The Honorable Bill Nelson
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United States Senate
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The Honorable Eddie Bernice Johnson
Ranking Member
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