



December 30, 2022

BY ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
45 L Street, N.E.
Washington, DC 20554

Re: *SpaceX Semi-Annual Report*

Dear Ms. Dortch:

Pursuant to paragraph 97u of the modification order issued on April 27, 2021,¹ Space Exploration Holdings, LLC provides the attached semi-annual constellation status report covering the period from June 1, 2022 to November 30, 2022.

If you have any questions, please do not hesitate to direct them to me.

Sincerely,

/s/ David Goldman

David Goldman
Senior Director of Satellite Policy

SPACE EXPLORATION TECHNOLOGIES CORP.
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Attachment

cc: Karl Kensinger

¹ See *Space Exploration Holdings, LLC*, FCC 21-48, ¶ 97u (rel. Apr. 27, 2021).

SPACE X CONSTELLATION STATUS REPORT

June 1, 2022 – November 30, 2022

SpaceX appreciates this opportunity to update the Commission and the public about the reliability and safety of its satellite constellation. As this report details, SpaceX uses extremely conservative assumptions that minimize risk and exceed industry standards and approaches by a massive margin. In an earlier report, SpaceX detailed how its maneuver threshold is a full order of magnitude more sensitive than the industry standard and how, to minimize non-maneuverable debris, SpaceX satellites are screened at low altitude shortly after deployment to ensure functionality. SpaceX also takes an extremely conservative approach when it chooses to de-orbit satellites and ensures all satellites are fully demisable, exceeding industry standards and causing no calculable risk to life on the ground. SpaceX's tightly integrated approach allows it to quickly identify ways in which it can improve the service, the performance, and the reliability of its satellites. Accordingly, SpaceX has a bias towards de-orbiting and replacing satellites whenever doing so will improve service for consumers on the ground or enhance the sustainability of space. Because of the low altitudes at which these satellites operate, they can be deorbited quickly.

This conservative approach requires a significant investment in sustainability and performance. Not only must SpaceX invest in satellites that are more capable and perform more maneuvers that carry considerable cost to SpaceX, but unlike other operators with less emphasis on sustainability, SpaceX is willing to deorbit satellites at the first sign of trouble, rather than waiting for larger issues to develop. SpaceX takes this most costly approach out of an abundance of caution to best preserve and protect low Earth orbit.

SpaceX volunteered to report on the health of its system because it believes transparency is critical to sustainable space operations. But SpaceX reiterates that it cannot maintain long-term space sustainability unilaterally and without non-U.S. firms participating; no operator, and indeed no country, can do so. SpaceX therefore pleads once again for other operators—including those that have chosen to license their satellites outside the U.S. and claim not to be bound by U.S. rules, yet want to offer services here—to provide similar public disclosures about the performance of their satellites. Only with all operators working together can we truly maintain space sustainability for future operations and human space flight.

Since our last report, SpaceX has conducted 18 launches deploying an additional 905 satellites to its constellation.

RESPONSES TO COMMISSION REQUESTS

1. *“Number of conjunction events identified for Starlink satellites during the reporting period, and the number of events that resulted in an action (maneuver or coordination with another operator), as well as any difficulties encountered in connection with the collision avoidance process and any measures taken to address those difficulties.”*

Events/Maneuvers—SpaceX uses a conservative maneuver threshold an order of magnitude more sensitive than the industry standard. Specifically, SpaceX satellites will maneuver when the probability of collision is greater than $1e-5$ (1 in 100,000 chance of collision), as opposed to the industry standard of $1e-4$ (1 in 10,000 chance of collision). Using this very conservative threshold, along with even more conservative triggers, SpaceX satellites performed 13,612 propulsive maneuvers over the reporting period, averaging approximately 12 maneuvers per satellite, per year.

For other events, other operators asked SpaceX not to perform a maneuver because those operators preferred to maneuver their satellites; this circumstance occurred approximately five times over this period.

Other Issues (i.e., “difficulties encountered in the collision avoidance process and the steps taken to resolve those difficulties”).

Russian Anti-Satellite Weapon Activity Precipitated Close to the Same Number Of Events—The November 2021 Russian anti-satellite weapon demonstration released thousands of pieces of debris into space, spread over the orbits of many operational satellites. The SpaceX collision avoidance system was deftly able to adjust to and accommodate this significant influx of debris. SpaceX is still maneuvering more for COSMOS 1408 debris than for any other objects in space, even though there are less than 25% of the objects from the demonstration still on orbit. Over the reporting period, SpaceX satellites maneuvered almost 1,700 times for COSMOS 1408 debris.

Operator Ephemeris and Covariance Screening and Operator Contact Information on Space-Track.org—Only a subset of spacecraft on Space-Track.org share their propagated ephemeris and covariance data such that the 19th Space Defense Squadron can screen them for conjunctions. Furthermore, spacecraft operators inconsistently provide and share contact information on Space-Track.org. Providing accurate propagated ephemerides and realistic covariance significantly improves collision avoidance screening, provides predictions that include maneuvers, and overall improves space situational awareness for everyone. SpaceX encourages all spacecraft owners both to provide contact information on Space-Track.org and to have their ephemerides screened. In circumstances where SpaceX satellites experience high risk conjunctions with satellites without owner/operator contact information on Space-Track.org, SpaceX makes every effort to obtain contact information through other means. However, if SpaceX cannot contact the operator of the secondary object, we assume maneuver responsibility and our satellites maneuver to lower the risk.

2. *“Satellites that, for purposes of disposal, were removed from operation or screened from further deployment at any time following initial deployment, and identifying whether this occurred less than five years after the satellite began regular operations or were available for use as an on-orbit replacement satellite.”*

Satellites that started Deorbit	Can the satellite still maneuver for collision avoidance?	Removed <5 years after beginning operation?
STARLINK-1016	Yes	Yes
STARLINK-1022	Yes	Yes
STARLINK-1059	Yes	Yes
STARLINK-1102	Yes	Yes
STARLINK-1211	Yes	Yes
STARLINK-1264	No	Yes
STARLINK-1317	No	Yes
STARLINK-1330	No	Yes
STARLINK-1343	Yes	Yes
STARLINK-1419	No	Yes
STARLINK-1488	Yes	Yes
STARLINK-1509	Yes	Yes
STARLINK-1546	Yes	Yes
STARLINK-1561	Yes	Yes
STARLINK-1650	Yes	Yes
STARLINK-1706	Yes	Yes
STARLINK-1839	Yes	Yes
STARLINK-1868	Yes	Yes
STARLINK-1872	Yes	Yes
STARLINK-2345	No	Yes
STARLINK-3165	No	Yes
STARLINK-3695	Yes	Yes
STARLINK-3816	Yes	Yes
STARLINK-4113	Yes	Yes
STARLINK-4161	Yes	Yes
STARLINK-4163	Yes	Yes
STARLINK-4529	Yes	Yes
STARLINK-4613	Yes	Yes
STARLINK-4638	Yes	Yes
STARLINK-4653	Yes	Yes

STARLINK-4654	Yes	Yes
STARLINK-4657	Yes	Yes
STARLINK-4665	Yes	Yes
STARLINK-4696	Yes	Yes
STARLINK-4702	Yes	Yes
STARLINK-4704	Yes	Yes
STARLINK-4713	Yes	Yes
STARLINK-4736	Yes	Yes
STARLINK-4744	Yes	Yes
STARLINK-5005	Yes	Yes

3. *“Satellites that re-entered the atmosphere.”*

Satellite Number	Date of Re-entry	Re-entered <5 years after beginning operation?
STARLINK-1809	6/5/2022	Yes
STARLINK-1214	6/7/2022	Yes
STARLINK-3307	6/16/2022	Yes
STARLINK-2023	6/27/2022	Yes
STARLINK-1874	6/28/2022	Yes
STARLINK-2239	7/11/2022	Yes
STARLINK-2239	7/11/2022	Yes
STARLINK-1514	7/17/2022	Yes
STARLINK-2080	7/22/2022	Yes
STARLINK-1501	7/25/2022	Yes
STARLINK-61	7/29/2022	Yes
STARLINK-4163	7/31/2022	Yes
STARLINK-1858	8/9/2022	Yes
STARLINK-4113	8/10/2022	Yes
STARLINK-1885	8/14/2022	Yes
STARLINK-1367	8/15/2022	Yes
STARLINK-4529	8/17/2022	Yes
STARLINK-2306	8/21/2022	Yes
STARLINK-1322	8/22/2022	Yes
STARLINK-1322	8/22/2022	Yes
STARLINK-1469	8/22/2022	Yes
STARLINK-1823	8/31/2022	Yes
STARLINK-1339	9/11/2022	Yes
STARLINK-4653	9/14/2022	Yes
STARLINK-4654	9/15/2022	Yes
STARLINK-1952	9/17/2022	Yes
STARLINK-4704	9/24/2022	Yes
STARLINK-4657	10/7/2022	Yes
STARLINK-4713	10/7/2022	Yes
STARLINK-1218	10/15/2022	Yes
STARLINK-4613	10/17/2022	Yes
STARLINK-1229	10/23/2022	Yes
STARLINK-1229	10/23/2022	Yes
STARLINK-71	10/23/2022	Yes
STARLINK-24	10/24/2022	Yes
STARLINK-4696	10/24/2022	Yes
STARLINK-4702	10/24/2022	Yes

STARLINK-5005	10/25/2022	Yes
STARLINK-4736	11/14/2022	Yes
STARLINK-4161	11/15/2022	Yes
STARLINK-4744	11/15/2022	Yes
STARLINK-4638	11/16/2022	Yes
STARLINK-4665	11/26/2022	Yes
STARLINK-1898	11/27/2022	Yes
STARLINK-1495	11/28/2022	Yes

4. *“Satellites for which there was a disposal failure, including a discussion of any assessed cause of the failure and remedial actions.”*

Under the conditions of its license, SpaceX must provide an additional report if, during any continuous one-year period that begins after April 2, 2021, there are three or more satellite disposal failures. This section has been expanded to include such a special report; however, no additional disposal failures occurred since the last report SpaceX provided on November 17, 2022.