



June 8, 2020

**BY ELECTRONIC FILING**

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International Bureau  
Federal Communications Commission  
445 Twelfth Street, S.W.  
Washington, DC 20554

Ex Parte Presentation: *Space Exploration Holdings, LLC,*  
*IBFS File No. SAT-MOD-20200417-00037*

Dear Mr. Albuquerque:

Viasat is writing with reference to the exchange of letters between the International Bureau and SpaceX regarding the above-referenced modification application on the issue of orbital debris, dated May 6, May 15, June 3, and June 4, 2020.

Viasat has been following with interest this exchange, and, after using both the latest NASA DAS tool, version 3.0.1, and the ESA tool, DRAMA/MIDAS, has been unable to replicate the results that SpaceX has provided to the Commission.

As an initial matter, Viasat has concerns about the analytical tools that SpaceX is employing in its analysis. SpaceX correspondence indicates that it is relying on a combination of an outdated version of NASA's Debris Assessment Software ("DAS"), version 2.0.2, and other undisclosed proprietary software.

NASA DAS 2.0.2 was released on 1 December 2011, and includes an older, 2.0 version of the Orbital Debris Engineering Model ("ORDEM") released in 2001. The more recent 3.0.1 version of DAS, released on 31 January 2020, incorporates ORDEM 3.0. ORDEM 3.0 incorporates significant improvements over its predecessor, ORDEM 2.0, which was released in 2001.<sup>1</sup> In fact, there have been four subsequent releases of DAS since the version that SpaceX states that it is using, as follows:<sup>2</sup>

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<sup>1</sup> <https://www.orbitaldebris.jsc.nasa.gov/modeling/engrmodeling.html>.

<sup>2</sup> [https://orbitaldebris.jsc.nasa.gov/library/das3\\_0/das3.0\\_release\\_notes.txt](https://orbitaldebris.jsc.nasa.gov/library/das3_0/das3.0_release_notes.txt).

- Ver. 2.1 (31 March 2016): updated the orbital debris environment model from ORDEM 2000 (*a.k.a.* ORDEM 2) to ORDEM 3.0;
- Ver. 2.1.1 (18 January 2017): fixed logic error in Fortran subroutine that produced invalid probability of collision calculation for Requirement 4.5-1;
- Ver. 3.0 (30 July 2019): updated ORDEM debris populations data, projected to year 2100;
- Ver. 3.0.1 (31 January 2020): fixes some non-computational issues.

Viasat believes that some of the issues that the Bureau and others may be having, when attempting to replicate SpaceX's results, may be a result of using this outdated version of the DAS software and underlying version of the ORDEM. For example, SpaceX claims that its proprietary tool uses the debris flux tables obtained from DAS 2.0.2 using the "Debris Impacts vs. Orbit Altitude" tool in the "Science and Engineering" utilities at all operational inclinations. This potentially has critical impacts on the results that SpaceX provides. Moreover, as explained in the release notes, the logic error in versions before version 2.1.1 produces an invalid calculation of the probability of collision risk with large objects.

As to the use of proprietary software, it is not possible to assess whether this software is in fact a higher fidelity model (as claimed) without having access to the software to evaluate it. In addition, it appears that SpaceX's proprietary tool is using the ORDEM 2.0 debris environment model instead of the current ORDEM 3.0 model. If SpaceX chooses to use a proprietary tool to meet the Commission's requirements, then it should be required to provide its source code to the Commission, and to provide to all interested parties both a useable copy of the tool and a validation report demonstrating that the tool is "higher fidelity" than DAS 3.0.1.

In this respect, Viasat disagrees with SpaceX's apparent justification for using its own proprietary software, instead of DAS, by which SpaceX claims that DAS "does not actually propagate a decay trajectory through the different debris flux levels at different altitude."<sup>3</sup> This appears to be at odds with the DAS 3.0 User's Manual,<sup>4</sup> which states in Table C-3 with respect to Large Object Collisions and ORDEM calls, "Once for every calendar year in orbit (not just mission lifetime)."

Moreover, NASA has confirmed to Viasat that DAS accounts for the post-mission disposal (PMD) orbit. Before calling the ORDEM routines, DAS generates an "orbit history" based on information in the Mission Editor. If PMD is selected, then the orbit history jumps to the PMD orbit at the end of the mission duration and is propagated freely through orbit decay until reentry. Points along this orbit history are used to obtain the ORDEM fluxes.

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<sup>3</sup> SpaceX *Ex Parte* dated May 15, 2020 from William M. Wiltshire to Mr. Jose P. Albuquerque at note 7.

<sup>4</sup> <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20190027721.pdf>.

It is unclear whether the SpaceX analysis includes any increase in debris flux due to future intra- and inter-system collisions, which are not accounted for by DAS, resulting from the introduction of many thousands of new satellites in similar or overlapping orbits.

Viasat requests that the Commission instruct SpaceX to use the most recent version of DAS (3.01) and ORDEM (3.0) to recompute the results for submission and produce those results before placing the application on public notice.

Respectfully submitted,

/s/

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cc: Karl Kensinger  
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