

Responses to Space Bureau Interrogatories

Applicant name: Anduril Industries, Inc.

Satellite name: ANDURIL-216

- 1. In the ODMF, section 7, bullet c), page 14, it provides the calculated risk of human casualty of 1:10700 which demonstrates surviving debris. Also, the DAS log lists the following components that survive reentry:**

Name	Casualty Area (m2)	Kinetic Energy (J)
V10 Optic	0.56	25689
V10 Optic Housing	0.51	101
V10 Heat Strap	0.35	330
V10 Focus Motor	0.37	763
V10 Baffle	0.73	1886
V3 Optic	0.39	915
Backplate	0.38	84
Optic Housing	0.41	20

Please note that Anduril Industries, Inc. (“Anduril”) has updated the ODAR, which includes an updated DAS activity log and a calculated risk of human casualty of 1:20,100.

- 2. We note the plan for disposal is uncontrolled atmospheric reentry. However, the preferred method given by the U.S. Government Orbital Debris Mitigation Standard Practices for a spacecraft reentering the atmosphere is through a directed reentry trajectory.**

- a. Please explain if this option was considered and why it was not chosen.**

ANDURIL-216 does not have onboard propulsion, and it is therefore not possible to perform a controlled reentry.

- b. If it was not considered, what changes would be required to affect this disposal method?**

Please see the response above.

- 3. We also note that in Section 7, bullet b), it states the following: “No spacecraft components are expected to survive an uncontrolled reentry and impact the surface of the earth with a kinetic energy in excess of 15 joules, as demonstrated in the DAS activity log attached at Appendix A.”**

- a. Please review this statement and update the ODMF, Section 7, bullet b) noting that there is surviving debris per the DAS log provided.**

Anduril has updated the ODAR accordingly.

- 4. In addition, the Technical Annex Section E, Post-Mission Disposal, states “No spacecraft components are expected to survive the re-entry and impact the surface of the earth with a kinetic energy in excess of 15 joules.”**

- a. Please review this section and update it as appropriate.**

Anduril has updated the ODMP accordingly.

- 5. With respect to re-entry casualty risk and liability, do the terms of Anduril Industries, Inc. contract with USG customers, or any relevant regulations, provide for indemnification of Anduril Industries, Inc. in the event of a casualty event?**

Re-entry casualty risk and liability is not subject to contractual or statutory indemnification by the U.S. Government. Consistent with standard practice, Anduril will manage third-party liability risk through commercially obtained insurance.

- 6. Please provide the differential drag maneuver thresholds capabilities and the lead time needed to perform these maneuvers.**

ANDURIL-216 can be reoriented to alter drag in response to COLA notifications, with a ΔV capability of up to 1.5 cm/s per day due to differential drag (difference between minimum and maximum drag) at mean solar activity.

- 7. In the 400.25 MHz downlink, are there plans to transmit beacon signals?**

- a. If yes, will the beacon transmit continuously or intermittent?**

Yes, this downlink channel is used for beacons. Beacons will transmit intermittently and only upon the spacecraft's receipt of a ground command from an authorized earth station. Each beacon transmission event will not exceed 8 minutes in duration, and beacon transmissions will occur no more than 2 times per orbital period and no more than 12 times per 24-hour period. Anduril has updated the NTIA Space Record Data Form and Technical Annex to include information related to the use of a beacon in the 400.25 MHz downlink.

- 8. 2250.0 MHz Power Flux Density (PFD) limits calculation**

- a. Power Flux Density (PFD) limits are specified in ITU Radio Regulations, Article 21, Table 21-4. FCC calculated the maximum PFD levels using the technical parameters provided in the ANDURIL-216 filing (Power -1.7 dBW, Bandwidth 156 kHz, antenna gain 6.1 dBi which produced an EIRP density of -47.5 dBW/Hz and calculated the PFD value at an altitude of 550 km, that exceed the ITU limits for all arriving angles.**
- b. Please explain how the pfd limited is being met with the 156KG1D emission designator.**

Anduril addresses compliance with PFD limits for the 156KG1D emission designator in section V.A.1, pages 4–5 of the Technical Annex: “When operating at worst-case bandwidths or at lower altitudes expected during post-mission disposal, ANDURIL-216 will decrease the transmit power as necessary to stay within the prescribed limit.” Anduril has updated the Technical Annex to demonstrate compliance with PFD limits at worst-case altitude for the 156KG1D emission designator.

9. FCC Form 442 and ITU SpaceCap API filing

a. For operations in the in the 2248 to 2252 MHz frequency range

- i. Form 442 for all three emission designators (3M75G1D, 1M41G1D, 156KG1D) have a transmit power of 2 W (3 dBW); however, in the ITU API filing the transmit power for all three emission is listed as -1.7 dBW. Please check both documents and confirm which transmit power level the correct one and make any appropriate changes to the respective document.**

The conducted powers listed in Form 442 and in the ITU API filing are correct. The values differ because the ITU API file asks for conducted power at the antenna terminals, whereas the conducted power required in the Form 442 is “at the transmitter terminals.” Therefore, the conducted power shown in the ITU API file includes 4.7 dB of losses between the transmitter terminals and the antenna terminals. By contrast, the conducted power shown in Form 442 does not include any losses, consistent with Form 442’s instructions.

- ii. Moreover, the emission designator bandwidths are listed as 3M75G1D, 1M41G1D and in the ITU API filing the emission designator are listed as 4M00G1D—and 1M75G1D—respectively. Please check the bandwidth values in both documents for the 2248 to 2252 MHz frequency range and adjust the bandwidth on the appropriate document to make them consistent.**

Anduril will adjust the bandwidths in the ITU API filing to reflect the necessary bandwidths for the two emission designators mentioned above.

b. For operations in the downlink X-Band

Form 442 for all three emission designators have a transmit power of 2 W (3 dBW) and the ITU API filing the emission designators have a transmit power of -1.0 dBW. Please check both documents and provide the appropriate transmit power level in each document.

The transmit powers listed in Form 442 and the ITU API filing are correct.

The values differ because the ITU API file asks for conducted power at the antenna terminals, whereas the conducted power required in the Form 442 is “at the transmitter terminals.” Therefore, the conducted power shown in the ITU API file includes 4 dB of losses between the transmitter terminals and the antenna terminals. By contrast, the conducted power shown in Form 442 does not include any losses, consistent with Form 442’s instructions.

c. ITU CR/C filing

- i. The US Table of Frequency allocation (Part 2) of the 400.15-401 MHz has footnote 5.264 that requires coordination under 9.11A in the mobile-satellite service.**
- ii. However, the application shows operations in this band will be done under the space operation service (SOS) which does not have this requirement 9.11A coordination. Therefore, the applicant can apply for this frequency band in the ITU API file, and there is no need for the ITU CR/C file unless the plan is to also operate under the MSS allocation. Please let us know if the intention is to operate in both the MSS and SOS or MSS allocation.**

ANDURIL-216 will not operate in the MSS allocation. All operations will be under the SOS allocation. Anduril will update the ITU API file and related filings accordingly.