Exhibit C

YAM-8 Orbital Debris Assessment Report (ODAR)

YAM-8-ODAR-1.0

This report is presented in compliance with NASA-STD-8719.14C, APPENDIX A.

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Debris Assessment Software (DAS) version used in analysis: v3.2.6

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Revision:	Date:	Affected Pages:	Changes:	Author(s):
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ODAR Self-Assessment Evaluation:

A self-assessment is provided below in accordance with the assessment format provided in Appendix A.2 of NASA-STD-8719.14C.

ODAR Requirement	Compliant or N/A	Not Compliant	Incomplete
4.3-1.a	x		
4.3-1.b	x		
4.3-2	x		
4.4-1	x		
4.4-2	x		
4.4-3	x		
4.4-4	x		
4.5-1	x		
4.5-2	x		
4.6-1(a)-c	x		
4.6-2	x		
4.6-3	x		
4.6-4	x		
4.7-1	x		
4.8-1	x		

Assessment Report Format:

This ODAR follows the format recommended in NASA-STD-8719.14C, Appendix A.1, sections 1 through 8 for the Loft Orbital spacecraft ("YAM-8"). Sections 9 through 14 apply to the launch vehicle ODAR and are not covered here.

1. Program Management and Mission Overview

Loft Orbital is a U.S. company headquartered in San Francisco, California.

Program Manager

- MG Kalnay

Senior Management

- Alexander B. Greenberg (Co-founder & Chief Operating Officer)

Foreign Government or Space Agency Participation

- None

Mission Overview

Following deployment, the YAM-8 spacecraft will employ its propulsion capability to move to the operational orbit of 540 km x 540 km orbital altitude with an inclination of 97.7 degrees at an LTDN of 10:30. The YAM-8 spacecraft is expected to be launched on a SpaceX Transporter mission. The deployment orbit altitude will be 590 km ± 20 km, and following deployment, the YAM-8 spacecraft will be relocated to its operational orbit. The transition to the operational orbit depends upon the parameters of the insertion orbit. Analysis indicates that the maximum time to achieve the planned operational orbit could be as much as 10 days (from the maximum insertion orbit). During the mission, the spacecraft will employ station keeping, as clarified below. At the end of mission (EOM), the spacecraft will use all remaining propellant to deorbit down to a circular orbit of no lower than 350km[1] and then passivated. If YAM-8 reaches 350km with remaining propellant any excess propellant will be vented before passivation.

Launch

The YAM-8 will be launched aboard a Falcon-9 launch vehicle, as part of a rideshare program. The launch site is Cape Canaveral, FL.

[1] YAM-8 will pause to passively deorbit through past the ISS and any other manned spacecraft.

The spacecraft are expected to operate at the following target orbital parameters:[2]

- Apogee: 540 km nominal ± 5 km
- Perigee: 540 km nominal ± 5 km
- Target Inclination: 97.7° ± 1.0°
- LTAN[3]: 10:30 ± 5 minutes

YAM-8 has on-board propulsion and therefore does actively change its orbit. Loft Orbital expects the YAM-8 spacecraft to be launched into an approximate SSO orbit but does not intend to strictly maintain SSO throughout the spacecraft lifetime. Accordingly, Loft Orbital expects the LTDN to drift over time.

Mission Duration

The anticipated operational lifetime of YAM-8 is 7.0 years (with a goal of 10 years) after which a post-mission disposal (PMD) maneuver will be conducted to lower the orbit altitude as much as possible but no lower than 350 km (circular).

2. Spacecraft Description

Physical description of the spacecraft

Physical description of the constellation: The YAM-8 spacecraft is based on the AOS Arrow bus originally developed by Airbus for the OneWeb broadband telecommunications company. Basic physical dimensions are 1200 mm x 1052 mm x 1036 mm with a mass of approximately 200 kg. The spacecraft is composed of the Airbus OneWeb bus and the Loft Orbital Payload Hub. The solar panels generate 500-550W of orbit average electric power which is stored in a 51Ah COTS Li-Ion unpressurized battery assembly. The bus is 3-axis stabilized, employing star

[2] As a worst-case scenario, Loft Orbital has assumed a 610-km deployment orbital altitude for purposes of this orbital debris analysis.
[3] Loft will be launched into an approximate SSO orbit with the reported LTDN but will not maintain an SSO orbit and therefore, the LTDN will drift.

trackers, magnetometers, GPS and sun sensors for attitude knowledge and reaction wheels and torque rods for attitude control. The YAM-8 spacecraft is depicted in Figure 1.

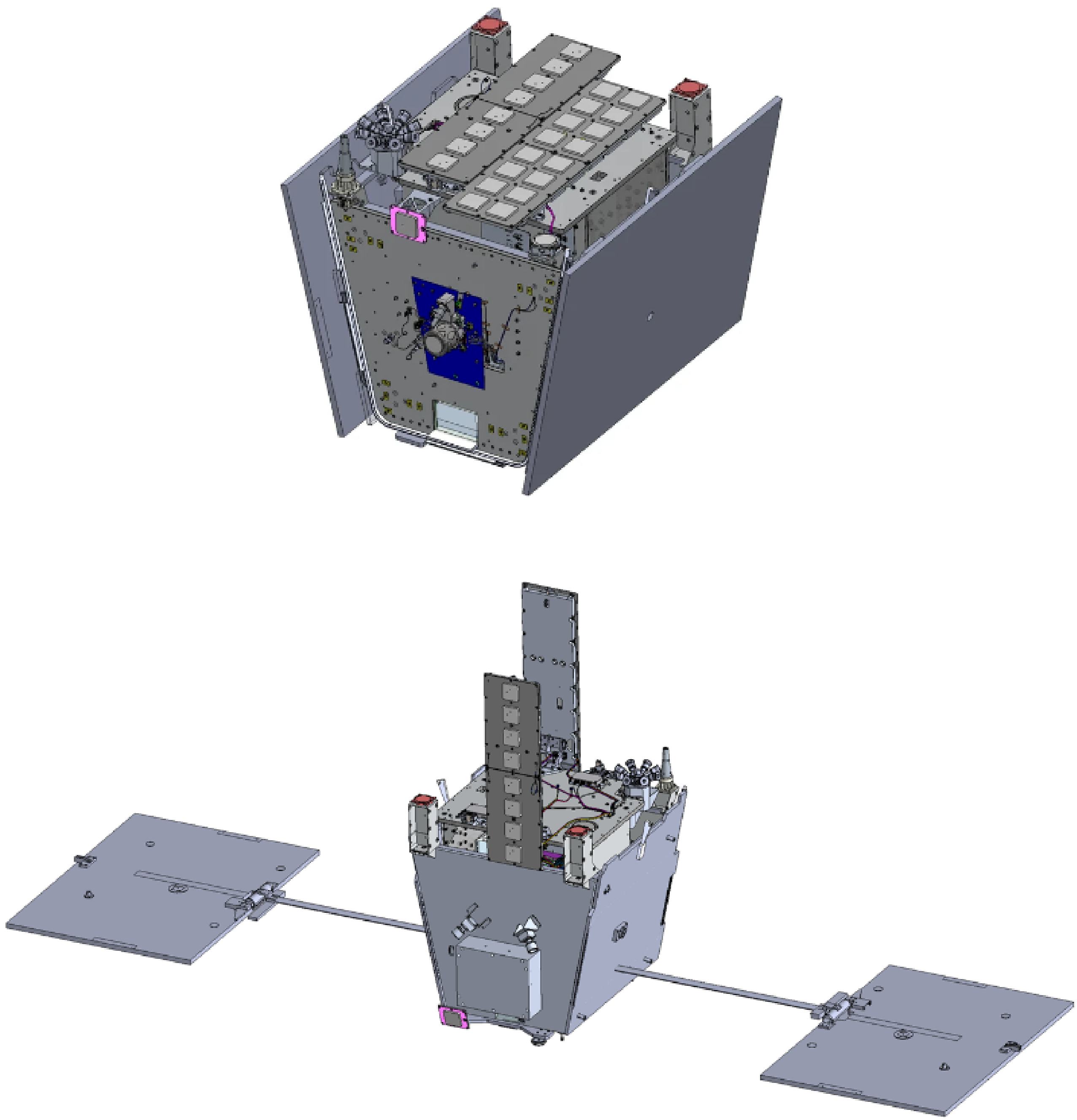


Figure 1. YAM-8 Spacecraft Configuration

Spacecraft Mass

- Wet Mass: 200 kg
- Dry Mass: 194 kg (tank is capable of handling up to 6 kg of propellant and this analysis assumes a worst-case scenario of carrying a full propellant load)

Description of propulsion system

The YAM-8 spacecraft will include a BUSEK, BHT-350 Xenon-Ion Hall Effect Thruster (Xenon HET). The Xenon tank capacity is 14 kg max tank capacity (incl. residuals) and this spacecraft is expected to carry 6 kg of propellant. The HET total impulse is57 kNs and provides a thrust of 13.6 mN @ 954.8s of ISP.

Fluids Planned to be On-board

0.351kg of ammonia in sealed heat pipes

Up to 14 kg Xenon propellant, max of 14 kg assumed for the YAM-8 spacecraft.

Fluids in Pressurized Batteries: None

The YAM-8 spacecraft uses unpressurized standard COTS Lithium-Ion batteries. Total unit dimensions 338mm x 275mm x 120mm and mass of 9.648kg.

Attitude Control System:

The long axis of the YAM-8 spacecraft can be oriented parallel to the nadir vector during imaging or other payload operations, but the spacecraft will typically be oriented in a nadir-pointing attitude.

The YAM-8 spacecraft attitude will be controlled initially by torque rods, which will allow the spacecraft to be aligned relative to the Earth's magnetic field. These will allow the spacecraft to detumble and align with the magnetic field.

- A *safe mode* is optimized for solar power generation from the spacecraft. The spacecraft's deployable panel will be oriented towards the sun. This mode will make use of magnetometers, sun sensors, reaction wheels, and magnetic torquers to orient the spacecraft correctly.

- A *targeted tracking mode* will allow the spacecraft Nadir panel to be directed at any location on the Earth's surface. This mode will make use of reaction wheels and a star tracker to orient the spacecraft.
- An *LVLH mode* keeps the Nadir panel pointed towards the Earth's surface. This mode will make use of reaction wheels and a star tracker to orient the spacecraft. This is the primary ACS mode of the YAM-8 spacecraft during nominal operations

Description of any range safety or other pyrotechnic devices

None. The YAM-8 spacecraft will be separated from the Falcon-9 launch vehicle using a deployer with debris free actuation.

Description of the electrical generation and storage system

Standard COTS Li-Ion battery cells are charged before payload integration and provide 51 Ah of electrical energy during the eclipse portion of the spacecraft's orbit. Six strings of 18/19 GaAs solar cells generate average on-orbit power of approximately 500-550 W. The charge/discharge cycle is managed by the electronic power system which is monitored by the flight computer.

Identification of any other sources of stored energy not noted above

Reaction wheels store kinetic energy but will be disconnected from power at the end of the operational lifetime.

Identification of any radioactive material on board

None

Address the trackability of the spacecraft. Spacecraft operating in low-Earth orbit will be presumed trackable if each individual spacecraft is 10 cm or larger in its smallest dimension, excluding deployable components:

The spacecraft is in low-Earth orbit and has a smallest dimension measuring at least 10 cm. Thus, it is trackable.

The statement shall also disclose the following:

How the operator plans to identify the spacecraft following deployment and whether spacecraft tracking will be active or passive:
Spacecraft tracking will be active. Prior to deployment an initial ephemeris is produced by the launch service that will be used to schedule a contact time window with the ground station. The accuracy of the ephemeris will depend on the launch vehicle's performance, delays, and deployment times. A more accurate ephemeris will be made available shortly after deployment. After deployment when the spacecraft establishes contact with the nearest available Loft Orbital contracted ground station, active spacecraft tracking will be employed to enhance and maintain spacecraft ephemeris data. The collected data will be used to identify the spacecraft from two-line element sets once they become available by the $18^{th}/19^{th}$ Space Defense Squadron (SDS).

Whether, prior to deployment, the spacecraft will be registered with the 18th Space Control Squadron or successor entity:
Prior to deployment, the spacecraft will be registered with the $18^{th}/19^{th}$ SDS via their Satellite Registration Form and Space Situational Awareness (SSA) Sharing Agreement.

The extent to which the spacecraft operator plans to share information regarding initial deployment, ephemeris, and/or planned maneuvers with the 18th Space Control Squadron or successor entity, other entities that engage in space situational awareness or space traffic management functions, and/or other operators:
Loft intends to provide the $18^{th}/19^{th}$ SDS information regarding initial deployment, owner/operator (O/O) ephemeris, and planned maneuvers. This is intended to provide better space situational awareness and improve the accuracy of conjunction analysis (CA). The higher accuracy O/O ephemeris will improve the quality of the CA and reduce the frequency of Conjunction Data Messages (CDMs). Loft Orbital intends to share ephemeris with other operators on an as-needed basis.

Planned Proximity Operations

None

3. Spacecraft Debris Released During Normal Operations

Assessment of Spacecraft Compliance with Requirements 4.3-1 and 4.3-2

Requirement 4.3-1: Mission Related Debris Passing Through LEO

- **Compliance statement:** No release of debris will occur during the lifetime of YAM-8. Additionally, there is no probable scenario for unintentional debris generation.

Requirement 4.3-2: Mission Related Debris Passing Near GEO

- **Compliance statement:** This requirement is not applicable to this mission profile.

4. Spacecraft Intentional Breakups and Potential for Explosions

Potential causes of spacecraft breakup during deployment and mission operations

There is no credible scenario that would result in spacecraft breakup during normal deployment operations.

Summary of failure modes and effects analyses of all credible failure modes which may lead to an accidental explosion

In-mission failure of a battery cell protection circuit could lead to a short circuit resulting in overheating and a very remote possibility of battery cell explosion. The battery safety systems discussed in the FMEA (see requirement 4.4-1 below) describe the combined faults that must occur for any of seven (7) independent, mutually exclusive failure modes to lead to explosion. In addition to the battery protection mentioned above, the YAM-8 battery unit features two temperature sensors which monitor battery cells for high temperatures.

Plan for any designed spacecraft breakup

There are no planned breakups.

List of components which shall be passivated at End of Mission (EOM) including method of passivation and amount which cannot be passivated

- **Reaction Wheels** – reaction wheels will be spun down and the spacecraft will be controlled via toque rods
- **Sealed Heat Pipes** – no passivation is planned or required
- **Batteries** – batteries will be drawn down and then isolated from the EPS to passivate at EOM, once spacecraft has been deorbited and any remaining propellant has been vented.

Rationale for Non-Passivation

N/A

Assessment of Spacecraft Compliance with Requirements 4.4-1 through 4.4-4

Requirement 4.4-1: Limiting the risk to other space systems from accidental explosions during deployment and mission operations while in orbit about Earth or the Moon

- *For each spacecraft and launch vehicle orbital stage employed for a mission, the program or project shall demonstrate, via failure mode and effects analyses or equivalent analyses, that the integrated probability of explosion for all credible failure modes of each spacecraft and launch vehicle is less than 0.001 (excluding small particle impacts) (Requirement 56449).*

Compliance statement:

Required Probability: 0.001

Expected probability: 0.000; COMPLIANT.

Supporting Rationale and FMEA details:

Battery explosion:

Effect: All failure modes below might theoretically result in battery explosion with the possibility of orbital debris generation. However, in the unlikely event that a battery cell does explosively rupture, the small size, mass, and potential energy, of the selected COTS batteries is such that while the spacecraft could be expected to vent gases, most debris from the battery rupture should be contained within the vessel due to the lack of penetration energy.

Probability: Extremely Low. It is believed to be a much less than 0.1% probability that multiple independent (not common mode) faults must occur for each failure mode to cause the ultimate effect (explosion).

Failure mode 1: Internal short circuit.

Mitigation 1: Qualification and acceptance shock, vibration, thermal cycling, and vacuum tests followed by maximum system rate-limited charge and discharge to prove that no internal short circuit sensitivity exists.

Combined faults required for realized failure: Environmental testing AND functional charge/discharge tests must both be ineffective in discovery of the failure mode.

Failure Mode 2: Internal thermal rise due to high load discharge rate.

Combined faults required for realized failure: Spacecraft thermal design must be incorrect AND external over-current detection and disconnect function must fail to enable this failure mode.

Failure Mode 3: Excessive discharge rate or short circuit due to external device failure or terminal contact with conductors not at battery voltage levels (due to abrasion or inadequate proximity separation).

Mitigation 3: This failure mode is negated by a) qualification-tested short circuit protection on each external circuit, b) design of battery packs and insulators such that no contact with nearby board traces is possible without being caused by some other mechanical failure, c) obviation of such other mechanical failures by proto qualification and acceptance environmental tests (shock, vibration, thermal cycling, and thermal-vacuum tests).

Combined faults required for realized failure: An external load must fail/short-circuit AND external over-current detection and disconnect function failure must all occur to enable this failure mode.

Failure Mode 4: Inoperable vents.

Mitigation 4: Battery vents are not inhibited by the battery holder design or the spacecraft.

Combined effects required for realized failure: The final assembler fails to install proper venting.

Failure Mode 5: Crushing

Mitigation 5: This mode is negated by spacecraft design. There are no moving parts in the proximity of the batteries.

Combined faults required for realized failure: A catastrophic failure must occur in an external system AND the failure must cause a collision sufficient to crush the batteries leading to an internal short circuit AND the spacecraft must be in a naturally sustained orbit at the time the crushing occurs.

Failure Mode 6: Low level current leakage or short-circuit through battery pack case or due to moisture-based degradation of insulators.

Mitigation 6: These modes are negated by a) battery holder/case design made of non-conductive plastic, and b) operation in vacuum such that no moisture can affect insulators.

Combined faults required for realized failure: Abrasion or piercing failure of circuit board coating or wire insulators AND dislocation of battery packs AND failure of battery terminal insulators AND failure to detect such failure modes in environmental tests must occur to result in this failure mode.

Failure Mode 7: Excess temperatures due to orbital environment and high discharge combined.

Mitigation 7: The spacecraft thermal design will negate this possibility. Thermal rise has been analyzed in combination with space environment temperatures showing that batteries do not exceed normal allowable operating temperatures which are well below temperatures of concern for explosions.

Combined faults required for realized failure: Thermal analysis AND thermal design AND mission simulations in thermal-vacuum chamber testing AND overcurrent monitoring and control must all fail for this failure mode to occur.

Requirement 4.4-2: Design for passivation after completion of mission operations while in orbit about Earth or the Moon

- *Design of all spacecraft and launch vehicle orbital stages shall include the ability to deplete all onboard sources of stored energy and disconnect all energy generation sources when they are no longer required for mission operations or post-mission disposal or control to a level which cannot cause an explosion or deflagration large enough to release orbital debris or break up the spacecraft (Requirement 56450).*
- **Compliance statement:** YAM-8's battery charge circuits include overcharge protection and a parallel design to limit the risk of battery failure. However, in the unlikely event that battery cell does explosively rupture, the small size, mass, and potential energy, of these small batteries is such that while the spacecraft could be expected to vent gases, most debris from the battery rupture should be contained within the vessel due to the lack of penetration energy.

Requirement 4.4-3: Limiting the long-term risk to other space systems from planned breakups

- **Compliance statement:** This requirement is not applicable. There are no planned breakups.

Requirement 4.4-4: Limiting the short-term risk to other space systems from planned breakups

- **Compliance statement:** This requirement is not applicable. There are no planned breakups.

5. Spacecraft Potential for On-Orbit Collisions

Requirement 4.5-1: Limiting debris generated by collisions with large objects when operating in Earth orbit

- *For each spacecraft and launch vehicle orbital stage in or passing through LEO, the program or project shall demonstrate that, during the orbital lifetime of each spacecraft and orbital stage, the probability of accidental collision with space objects larger than 10 cm in diameter is less than 0.001 (Requirement 56506).*
- **Compliance statement:** Large object impact and debris generation probability: 1.5921E-04. This was based upon a worst-case scenario of the YAM-8 spacecraft being deployed to a maximum orbital altitude of 610km and failing before solar array deployment. Analysis of normal operations was also conducted and the probability of collision with large objects was 7.2168E-05.

Requirement 4.5-2: Limiting the probability of damage from small objects when operating in Earth or lunar orbit

- *For each spacecraft, the program or project shall demonstrate that, during the mission of the spacecraft, the probability of accidental collision with orbital debris and meteoroids sufficient to prevent compliance with the applicable post-mission disposal requirements is less than 0.01 (Requirement 56507).*
- **Compliance Statement:**
  Small Object Impact and Debris Generation Probability: Even though the YAM-8 spacecraft does not rely upon propulsion to meet the 5-year deorbit at end of mission, a collision with small objects analysis was conducted to demonstrate that the probability of

collision with small objects has less than a 0.01 probability of preventing a deorbit maneuver at the end of life. This analysis made conservative assumptions regarding which components include critical surfaces and the effective cross-sectional areas of these critical surfaces. The bus supplier provided a deorbit reliability analysis. From this analysis, all single point failure components were included in the collision with small object analysis. The spacecraft will be operated during the majority of the mission in a 3-axis stabilized orientation with the +X panel in the direction of motion (referred to as V in the NASA DAS User Guide). Also, the +Z panel (referred to as U in the NASA DAS User Guide) reflects the Zenith surface of the spacecraft, thus the -Z panel reflects the Nadir surface. The highest critical surface risk of collision with small objects is the battery which is mounted outside of the +X panel. One could easily argue that the battery assembly should not be included in this analysis, given that it is composed of a large number of redundant battery cells. Out of an abundance of caution, the battery assembly was included in the analysis and further the cross-sectional area of the battery assembly critical surface reflects 50% of the cross-sectional area of battery assembly box. While it would stand to reason that there may be some circuits in the battery assembly which could disable the spacecraft if penetrated by a small object, the fraction of the overall surface area which would reflect an actual critical surface would likely reflect no more than 1-5% of the surface area of the entire battery assembly. This same general approach was also used for the following electronic components: flight computer (which is also redundant), other electronics (most of which are not critical surfaces), propulsion system, GPS, TT&C, SADA and PCDU. For each of these electronic assemblies the assumed area of the critical surface was the cross-section area of the assembly. The list of components/assemblies containing or reflecting a critical surface, the mounting location and the effective surface area used in the DAS model are listed below in Figure 1. The collision probability with small objects was estimated by the DAS software to be no more than 0.0032170 assuming a 10-year mission life followed by a post-mission disposal (PMD) maneuver down to as low as 350km circular orbit altitude.

Component	Mounting Location	Interior vs. Exterior	Surface Area (m^2)
Propellant Tank	-X Panel	Interior	0.08
Thruster	-X Panel	Exterior	0.015
XFS	-X Panel	Interior	0.015
PPU	-X Panel	Interior	0.08
GPS Antennas	+Z Panel	Exterior	0.0032
GPS LNA	+Z Panel	Interior	0.0032
TT&C Antenna	+Z/-Z Panel	Exterior	0.01
Flight Computer	+Z Panel	Interior	0.004
Other Electronics	+Z Panel	Interior	0.02
PCDU	+Z Panel	Interior	0.047
Battery	+X Panel	Exterior	0.069
TT&C Hybrid Coupler	+X Panel	Exterior	0.0012
SADA	+Z Panel	Interior	0.0072

Figure 1 Collision With Small Objects - Critical Surfaces

Even though the YAM-8 spacecraft do not require propulsion in order to meet the 5-year deorbit requirement, a further analysis was conducted4 to demonstrate that the reliability of being able to conduct a PMD is at least 90% with a goal of 99%. The bus supplier conducted a detailed deorbit reliability analysis and determined that the bus reliability is 97% at end of mission. Details of the deorbit reliability analysis are provided in Figure 2 below.

Detailed description and assessment of efficacy of any planned debris avoidance capability intended to help in meeting requirement 4.5-1

Loft Orbital will engage with USSPACECOM to coordinate collision avoidance activities.

TABLE 5: BASIC REPORTING CRITERIA		
	Space-Track Criteria	Emergency Criteria
Notification Method	Conjunction Data Message (CDM)	Conjunction Data Message (CDM) & Close Approach Notification (CAN) email

[4] The reliability analysis for the Longbow bus was previously conducted for the YAC-1 mission but is also relevant for YAM-8.

Near Earth: HAC	TCA ≤ 3 days and Overall miss ≤ 1km and Probability of Collision ≥ e^-7	TCA ≤ 3 days, Overall miss ≤ 1km and Probability of Collision ≥ e^-4
Near Earth O/O Ephemeris	TCA ≤ 3 days and Overall miss ≤ 1km and Probability of Collision ≥ e^-7	TCA ≤ 3 days and Overall miss ≤ 1km and Probability of Collision ≥ e^-4

Loft Orbital has analyzed the updated processes and protocols at USSPACECOM with the 18th and 19th Space Defense Squadrons roles and responsibilities. In the context of receiving CDM and CAN emails, and in close coordination with USSSPACECOM and other operators, Loft Orbital intends to alter the orbit altitude at TCA of the YAM-8 spacecraft to facilitate conjunction/collision avoidance.

Prior to launch, Loft Orbital will coordinate with the 18th/19th SDS to share critical information about the propulsion capabilities of the YAM-8 spacecraft. Following launch and deployment, Loft Orbital will conduct a complete checkout of the YAM-8 spacecraft, including evaluation of the HET propulsion system. Depending upon the outcome of each initial checkout, Loft Orbital will update 18th/19th SDS about the maneuvering capabilities of the YAM-8 spacecraft.

Upon receipt of a conjunction data message (CDM), Loft Orbital will submit updated ephemeris information to Space-track.org for review by 18th/19th SDS. This will take place within four hours of receipt of the CDM message. If the CDM indicates that the risk of conjunction is with another operational spacecraft, Loft Orbital will also contact the other spacecraft operations team within 8 hours of receipt of the CDM, realizing that the other team may not respond promptly. The purpose of this outreach, for each CDM, is to maximize the time for responsive action and to allow for a wider range of responses. CDM are typically issued 72 hours prior to the time of closest approach (TCA).

Response when risk threshold is reached, next steps:

Upon submission of updated YAM-8 ephemeris data to 18th/19th SDS, the assessment on probability of collision (Pc) will be refined at 18th/19th SDS. If the Pc drops based on higher fidelity orbit information, then no further actions will be needed in response to that CDM. Loft

Orbital assumes that an updated Pc will be received within 8 hours of providing update ephemeris, given the 8-hour cycle for Concern List screenings. Assuming a CDM 72-hours before TCA, the Loft Orbital process should allow a refined determination if action is required 60 hours before TCA. In light of the fact that the proposed orbit change maneuvers must be started at least 2.5 hours before TCA, this provides 57.5 hours to coordinate optimum maneuver planning between all affected parties and to monitor the evolution of the Pc calculations to determine if any collision avoidance maneuver is even warranted.

If the Pc stays the same or increases, after 18th/19th SDS incorporates the latest ephemeris into its evaluation, then Loft Orbital will take further actions, which will be predicated on collaboration with any other affected spacecraft operators and based on analysis of the projected new space track of the appropriate YAM-8 spacecraft that would come from proposed collision avoidance maneuvers. Loft Orbital will adjust its projected orbit to avoid collisions. If the other spacecraft operator identified by the CDM concurs with Loft Orbital that its spacecraft's orbit should be adjusted, and that is the only object that is the subject of the CDM, then Loft Orbital will take no action and monitor the situation to accommodate the other spacecraft operator's collision avoidance maneuver.

When Loft Orbital determines that the proper course of action is to adjust the orbit/trajectory of the applicable YAM-8 satellite, it will take the following steps:

The first step is to review the current threat risk with updated information from 18th/19th SDS. The threshold for initiating the following maneuvers is: Pc > 1e-4. In the event that the Pc exceeds that threshold, then Loft Orbital will work through the options below, at each point checking with 18th/19th SDS to ensure that the proposed response will not cause any further risks of collision prior to engaging in the actions:

- Loft Orbital will conduct two 8-minute propulsion maneuvers, phased ½ half orbit apart to either raise or lower the orbit altitude by up to 200m (whichever will be most effective at reducing Pc) at the Time of Closest Approach (TCA). These propulsion maneuvers can be executed as late as 1.5 orbits (less than 2.5 hours) before TCA. Moving the orbit altitude by 200m should be sufficient to reduce Pc < 1e-4 in most or all circumstances.

Of course, Loft Orbital will conduct a maneuver based upon guidance from the 18th/19th SDS which in most cases may require far less delta-V to reduce the Pc to an optimum (or sufficiently safe) value.

- In the event that the Loft Orbital YAM-8 propulsion capability is not operational, Loft Orbital will coordinate with the 18th/19th SDS to provide information regarding the YAM-8 spacecraft's ability to employ differential drag to alter its trajectory. Such an approach will be slower and significantly less effective than employing electric propulsion, but the YAM-8 spacecraft has deployable solar arrays which enable a significant difference between the minimum and maximum drag configurations.

Throughout this process, Loft Orbital will remain in active communication with 18th/19th SDS to ensure that its responses are reviewed and assessed. Loft After the end of its operational life the YAM-8 spacecraft will be actively deorbited to just above the ISS orbit and the orbit of Tiangong, the Chinese space station, and allowed to passively deorbit through those respective orbits.[5] This passive deorbit stage will pass through the orbital altitude of the ISS and Tiangong. As can be seen in Figure 3 below, the orbit stays nearly circular, thus limiting the period of time when conjunctions may occur. Loft Orbital intends to monitor the location of the YAM-8 spacecraft and work closely with organizations, such as the 18th Space Defense Squadron and SpaceNav, to avoid potential collisions. With respect to the ISS, Loft Orbital will also engage with NASA during the deorbit process through the ISS orbit.

Certify that upon receipt of a space situational awareness conjunction warning, the operator will review and take all possible steps to assess the collision risk, and will mitigate the collision risk if necessary

Upon receipt of a space situational awareness conjunction warning, Loft Orbital certifies that it will attempt to contact the operator of any active spacecraft involved in such a warning, share ephemeris data and other appropriate operational information with any such operator in order to

[5] Loft Orbital understands that NASA would prefer not to have spacecraft actively deorbit through the ISS orbit as this reduces NASA's ability to accurate predict conjunctions with the ISS. This same approach will be employed when passing through the orbits of all manned spacecraft.

avoid a collision. The YAM-8 spacecraft has maneuvering capabilities and will employ those capabilities to adjust its orbit to address potential conjunctions, as described above.

6. Spacecraft Post-mission Disposal Plans and Procedures

Description of spacecraft disposal option selected

Consistent with NASA-STD 8719.4C, YAM-8 will be disposed of via atmospheric reentry. While a a post-mission disposal (PMD) maneuver is not necessary to comply with FCC regulations, YAM-8 will attempt to conduct a PMD under nominal conditions. The PMD should take approximately 3-6 months to complete. The operational altitude in low-Earth orbit lends to natural forces that will lead to atmospheric reentry in approximately 3-4 months.

Systems or Components Required to Accomplish Post-mission Disposal Maneuvers

The subsystems required for deorbit are listed in the reliability analysis shown below in Figure 2.

Subsystem/Equipment	Red	m	n	p	Deorbitation	Conf change wrt SK
TOTAL BUS					0,970 434	
AOCS					0,998 845	
Reaction Wheel (RW)	HOT	3	4	1	0,998 948	
Magnetometer (MM)	COLD	1	2	1	1,000 000	
Magnetotorquer (MT)	COLD	1	2	1	1,000 000	
Star Tracker (OH)	HOT	1	2	1	0,999 897	
Coarse Sun Sensor (CSS)	COLD	1	2	2	1,000 000	
GPS	COLD	1	2	1	0,999 999	
GPS LNA	SPF	1	1	1	0,999 987	
GPS Antenna	SPF	1	1	1	0,998 828	
Processing					0,999 803	
OBC	HOT	1	2	1	0,999 828	x
OBC	HOT	1	2	1	0,999 976	
Power Supply					0,990 174	
PCDU: SA sections	HOT	5	6	1	0,999 997	
PCDU: whole distrib	SPF	1	1	1	0,993 593	
PCDU: TM/TC channels	HOT	1	2	1	0,999 997	
Battery					0,999 819	
Solar Array	HOT	5	6	1	0,999 917	
SADA-A	COLD	1	2	1	0,999 999	
SADA-B	SPF	1	1	2	0,996 829	
Mechanism					0,998 819	
SADS	SPF	1	1	1	0,998 728	
TT&C (Ground / Space)					0,999 203	
TTC (Rx + Tx channels)	HOT	1	2	1	0,999 281	
Coupler	SPF	1	1	1	0,999 986	
TM/TC antenna	SPF	1	1	2	0,999 936	
Thermal Control					0,999 999	
Heaters (bus unit)	HOT	1	2	9	1,000 000	
Heaters (PAM)	HOT	1	2	3	1,000 000	
Thermistors	HOT	1	2	22	0,999 999	
PROPULSION					0,983 335	
PPU	SPF	1	1	1	0,997 474	
HET (thruster)	SPF	1	1	1	0,991 890	
XFS	SPF	1	1	1	0,993 887	
Tank	SPF	1	1	1	0,999 972	

Figure 2 Deorbit Reliability Analysis

Post-mission Disposal Maneuver Plan

At end of mission, the YAM-8 spacecraft will be deorbited as much as possible but no lower than 350 km circular orbit.

Calculation of area-to-mass ratio after post-mission disposal

The final area-to-mass ratio is calculated using the dry mass of the vehicle and the average cross-sectional area. Average cross-sectional area is calculated using the equation for estimated average cross-sectional area for non-convex shapes from NASA-STD-8179.14C: $A_{avg} = (A_{max} + A_1 + A_2)/2$, where A_{max} is the maximum cross-sectional area, and A_1 and A_2 are the cross-sectional areas for the two viewing directions orthogonal to the maximum cross sectional area viewing direction.

YAM-8 area-to-mass ratio calculation (stowed):

- Spacecraft mass: 200 kg (wet mass)
- Cross-sectional area: 2.03 m^2 (average)
- Area-to-mass ratio: 0.01015 m^2/kg (final)

YAM-8 area-to-mass ratio calculation (deployed):

- Spacecraft mass: 200 kg (wet mass)
- Cross-sectional area: 2.59 m^2 (average)
- Area-to-mass ratio: 0.01295 m^2/kg (final)

Assessment of spacecraft compliance with ODAR requirements 4.6-1 to 4.6-4

Requirement 4.6-1(a): Disposal for space structures in or passing through LEO

- **Compliance statement:** The YAM-8 reentry is COMPLIANT. From the PMD orbit of 350 x 350 km, the YAM-8 spacecraft will passively deorbit in ~3-4 months with orbit history as shown in Figure 3. However, if a PMD maneuver cannot be executed, the YAM-8 spacecraft can still passively deorbit from the operational orbit in less than 5-years as shown below.

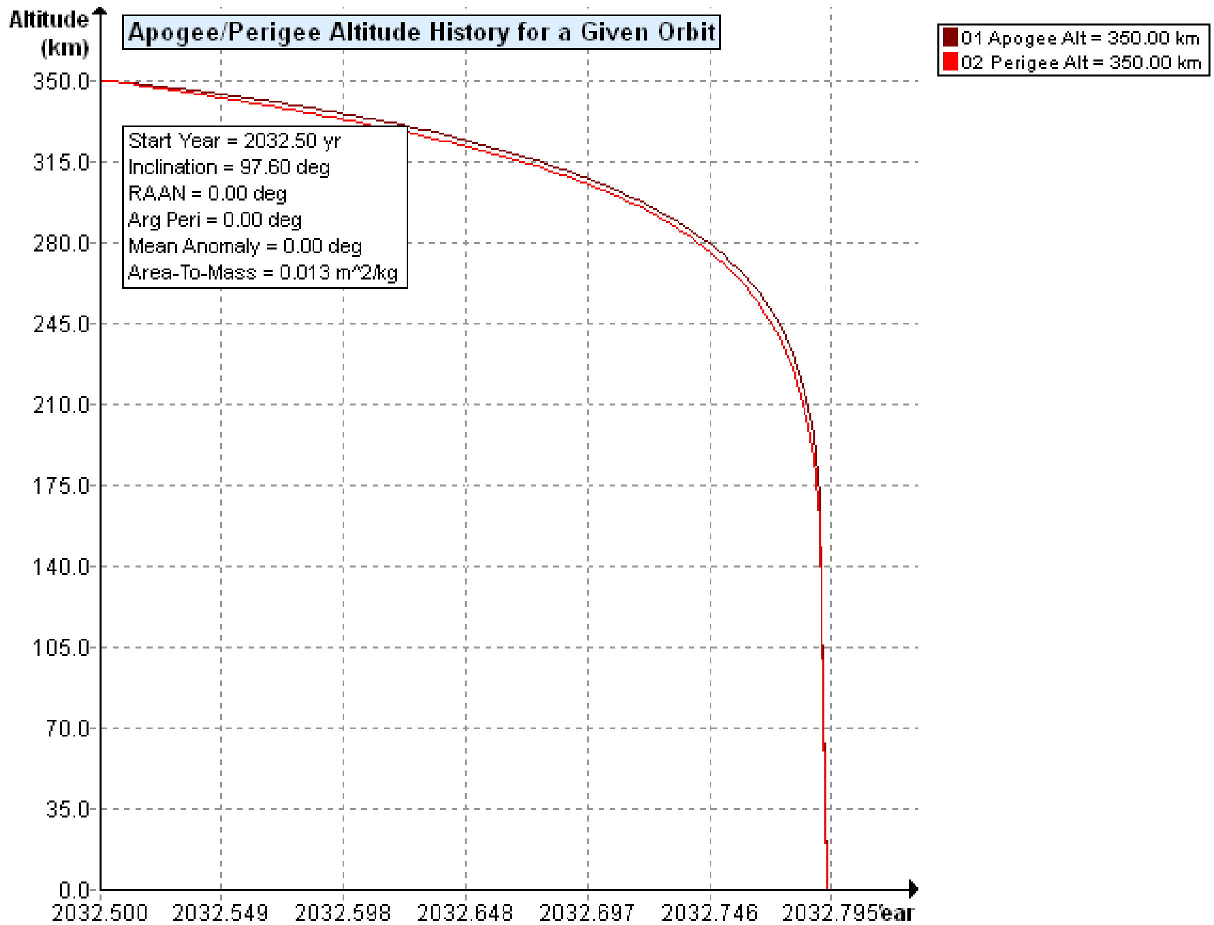
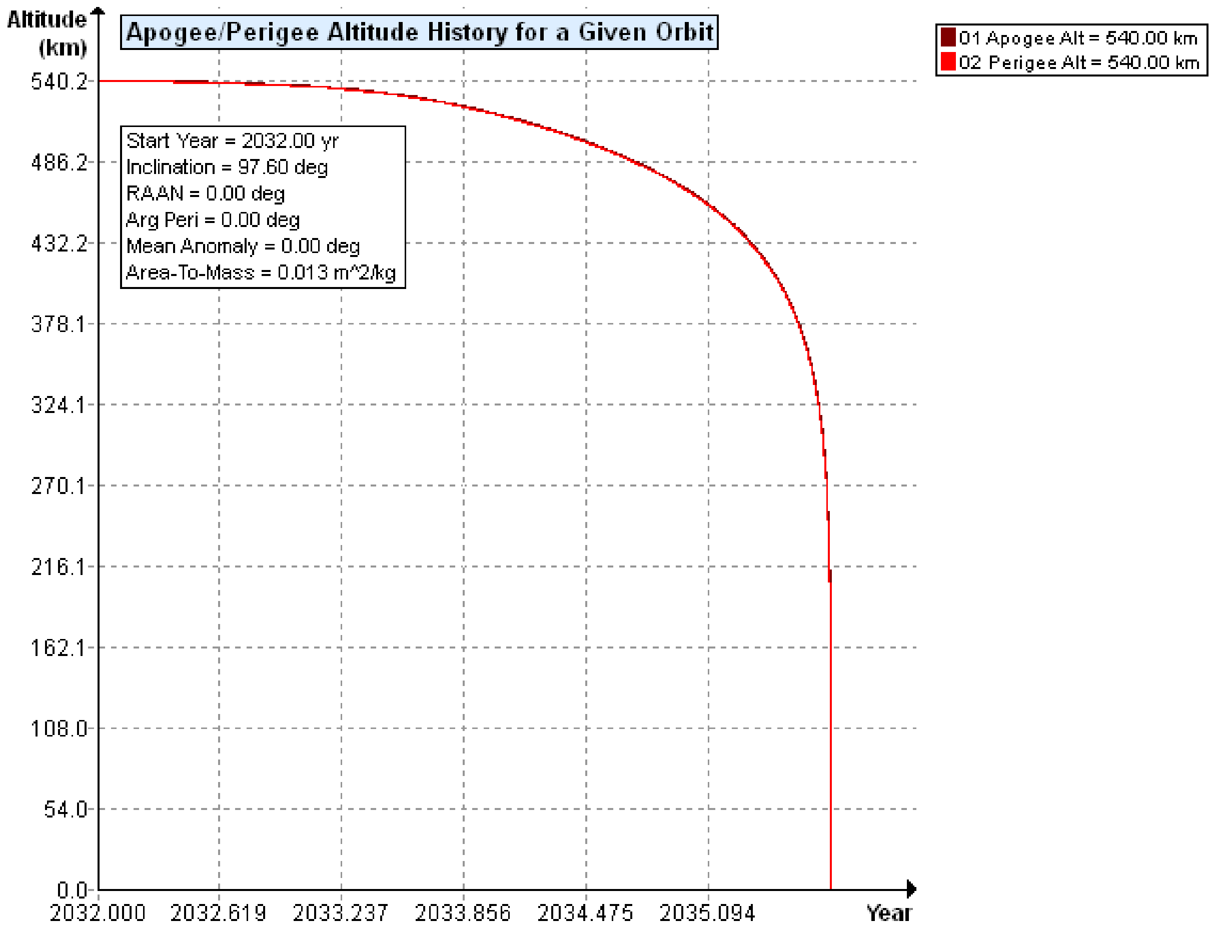


Figure 3. Orbital Decay Profile from PMD Orbit

From the operational orbit of 540 km x 540 km, the passive deorbit time is 3.7 years[6]. The start date of 2032 was selected to capture orbit lowering from the insertion orbit down to 540 km and then 7 years of operations at 540 km. If the mission can be extended to 10 years, the passive deorbit time in 2035 reduces to a minimum of ~2.2 years in 2033.5, as the solar cycle progresses.

[6] This analysis is intended to reflect the outcome should a YAM-8 spacecraft lose the ability to conduct a PMD maneuver while in the operational orbit.


Altitude (km)
Apogee/Perigee Altitude History for a Given Orbit
01 Apogee Alt = 540.00 km
02 Perigee Alt = 540.00 km
540.2
486.2
432.2
378.1
324.1
270.1
216.1
162.1
108.0
54.0
0.0
Start Year = 2032.00 yr
Inclination = 97.60 deg
RAAN = 0.00 deg
Arg Peri = 0.00 deg
Mean Anomaly = 0.00 deg
Area-To-Mass = 0.013 m^2/kg
2032.000
2032.619
2033.237
2033.856
2034.475
2035.094
Year

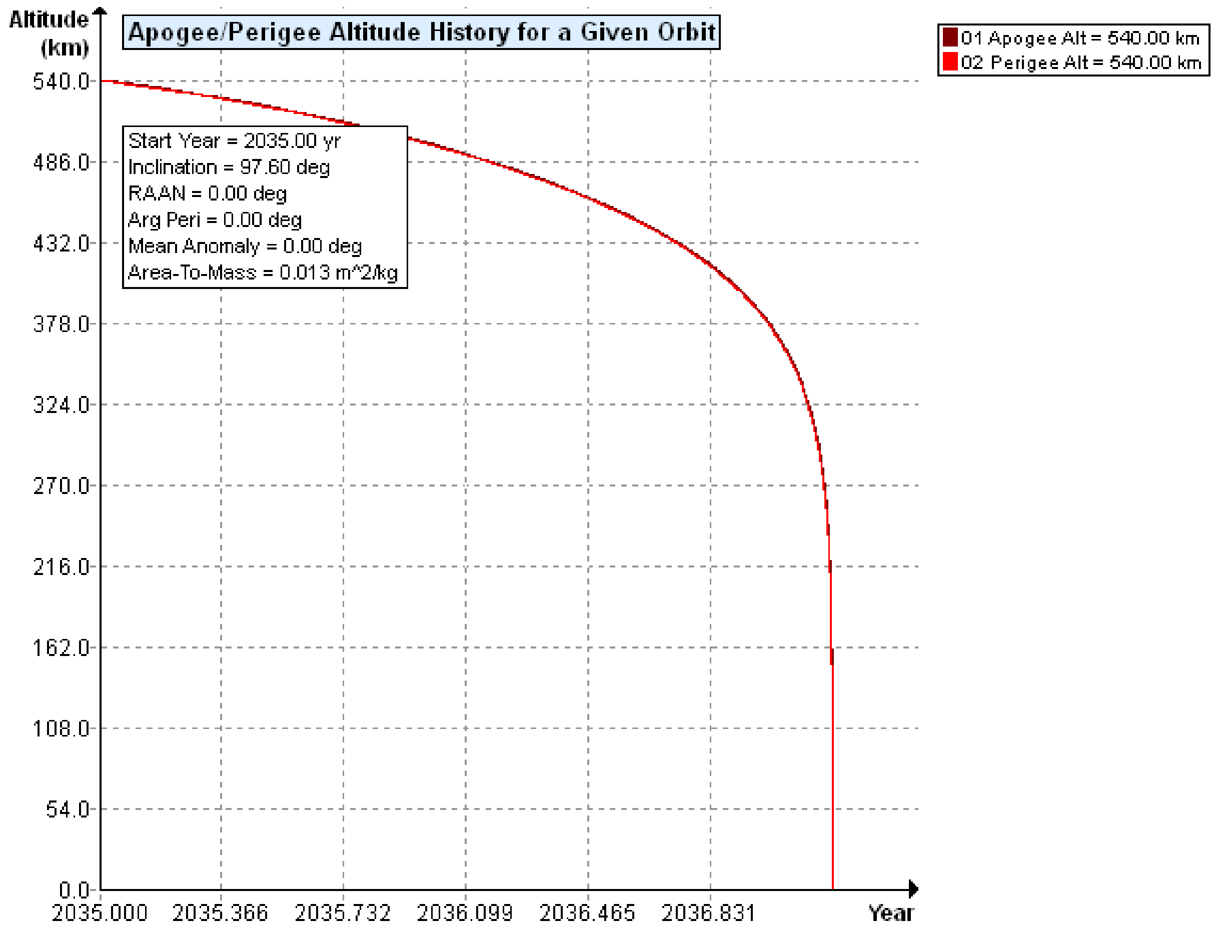


Figure 4. Orbital Decay Profile from Operational Orbit Starting in 2032 and 2035 Respectively

Requirement 4.6-2: Disposal for space structure near GEO

- **Compliance statement:** Not applicable

Requirement 4.6-3: Disposal for space structures between LEO and GEO

- **Compliance statement:** Not applicable

Requirement 4.6-4: Reliability of post-mission disposal operations

- **Compliance statement:** As shown in Figure 2 above, the reliability of the PMD maneuver at the end of mission is 97%.

7. Spacecraft Reentry Hazards

Summary of objects expected to survive uncontrolled reentry

DAS v3.2.6 reports that YAM-8 is compliant with the requirement with acceptable risk of human casualty. As shown below, no components survive reentry with energy greater than 15 joules.

Compliance Assessment for Requirement 4.7-1

Limit the risk of human casualty.

Requirement 4.7-1(a):

- *The potential for human casualty is assumed for any object with an impacting kinetic energy in excess of 15 joules. For uncontrolled reentry, the risk of human casualty from surviving debris shall not exceed 0.0001 (1:10,000) (Requirement 56626).*
- **Compliance statement:** The calculated risk of human casualty is 0.

Requirement 4.7-1(b):

- **Compliance statement:** Not applicable since controlled reentry is not an element of the end of mission disposal plan

Requirement 4.7-1(c):

- **Compliance statement:** Not applicable since controlled reentry is not an element of the end of mission disposal plan

Analysis using DAS v3.2.6

05 16 2024; 09:46:51AM Project Data Saved To File
05 16 2024; 09:47:27AM Processing Requirement 4.3-1: Return Status : Not Run

======================
No Project Data Available
======================

=============== End of Requirement 4.3-1 ===============
05 16 2024; 09:47:30AM Processing Requirement 4.3-2: Return Status : Passed

======================
No Project Data Available
======================

=============== End of Requirement 4.3-2 ===============
05 16 2024; 10:10:34AM Processing Requirement 4.5-1: Return Status : Passed

==============
Run Data
==============

INPUT

Space Structure Name = YAM-8 - Small Objects
Space Structure Type = Payload
Perigee Altitude = 540.000 (km)
Apogee Altitude = 540.000 (km)
Inclination = 97.700 (deg)
RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass Ratio = 0.0129 (m^2/kg)

Start Year = 2024.850 (yr)

Initial Mass = 200.000 (kg)

Final Mass = 194.000 (kg)

Duration = 10.000 (yr)

Station-Kept = True

PMD Perigee Altitude = 350.000 (km)

PMD Apogee Altitude = 350.000 (km)

PMD Inclination = 97.700 (deg)

PMD RAAN = 0.000 (deg)

PMD Argument of Perigee = 0.000 (deg)

PMD Mean Anomaly = 0.000 (deg)

Long-Term Reentry = False

OUTPUT

Collision Probability = 7.2168E-05

Returned Message: Normal Processing

Date Range Message: Normal Date Range

Status = Pass

==============

INPUT

Space Structure Name = YAM-8

Space Structure Type = Payload

Perigee Altitude = 610.000 (km)

Apogee Altitude = 610.000 (km)

Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass Ratio = 0.0101 (m^2/kg)

Start Year = 2024.850 (yr)

Initial Mass = 200.000 (kg)

Final Mass = 194.000 (kg)

Duration = 5.000 (yr)

Station-Kept = False

Abandoned = True

Long-Term Reentry = False

OUTPUT

Collision Probability = 1.5921E-04

Returned Message: Normal Processing

Date Range Message: Normal Date Range

Status = Pass

==============

=============== End of Requirement 4.5-1 ===============

05 16 2024; 10:11:46AM Project Data Saved To File

05 16 2024; 10:43:35AM Requirement 4.5-2: Compliant

==

Spacecraft = YAM-8

Critical Surface = Tank

==

INPUT

Apogee Altitude = 610.000 (km)
Perigee Altitude = 610.000 (km)
Orbital Inclination = 97.700 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass = 0.0101 (m^2/kg)
Initial Mass = 194.000 (kg)
Final Mass = 194.000 (kg)
Station Kept = No
Start Year = 2024.850 (yr)
Duration = 5.000 (yr)
Orientation = Fixed Oriented
CS Areal Density = 0.540 (g/cm^2)
CS Surface Area = 0.0800 (m^2)
Vector = (0.000000 (u), -1.000000 (v), 0.000000 (w))
CS Pressurized = Yes
Outer Wall 1 Density: 0.360 (g/cm^2) Separation: 0.100 (cm)
Outer Wall 2 Density: 1.080 (g/cm^2) Separation: 1.000 (cm)

OUTPUT

Probability of Penetration = 3.2372E-07 (3.2372E-07)
Returned Error Message: Normal Processing
Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = Thruster

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 1.350 (g/cm^2)

CS Surface Area = 0.0150 (m^2)

Vector = (0.000000 (u), -1.000000 (v), 0.000000 (w))

CS Pressurized = No

OUTPUT

Probability of Penetration = 4.6311E-07 (4.6312E-07)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = Computer

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.540 (g/cm^2)

CS Surface Area = 0.0040 (m^2)

Vector = (1.000000 (u), 0.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1 Density: 1.620 (g/cm^2) Separation: 1.000 (cm)

Outer Wall 2 Density: 0.270 (g/cm^2) Separation: 2.000 (cm)

OUTPUT

Probability of Penetration = 6.1176E-08 (6.1176E-08)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

==

Spacecraft = YAM-8

Critical Surface = OtherElectronics

==

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.540 (g/cm^2)

CS Surface Area = 0.0200 (m^2)

Vector = (1.000000 (u), 0.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1 Density: 1.620 (g/cm^2) Separation: 1.000 (cm)

Outer Wall 2 Density: 0.270 (g/cm^2) Separation: 2.000 (cm)

OUTPUT

Probability of Penetration = 3.0588E-07 (3.0588E-07)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = Battery

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.540 (g/cm^2)

CS Surface Area = 0.0034 (m^2)

Vector = (0.000000 (u), 1.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1   Density: 1.947 (g/cm^2) Separation: 1.000 (cm)

OUTPUT

Probability of Penetration = 2.7728E-03 (2.7767E-03)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = PCDU

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.540 (g/cm^2)

CS Surface Area = 0.0469 (m^2)

Vector = (1.000000 (u), 0.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1   Density: 1.620 (g/cm^2) Separation: 1.000 (cm)

Outer Wall 2   Density: 0.270 (g/cm^2) Separation: 2.000 (cm)

OUTPUT

Probability of Penetration = 7.1691E-07 (7.1691E-07)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = GpsAntenna1

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.360 (g/cm^2)

CS Surface Area = 0.0016 (m^2)

Vector = (1.000000 (u), 0.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1   Density: 0.540 (g/cm^2) Separation: 0.500 (cm)

OUTPUT

Probability of Penetration = 6.4440E-06 (6.4440E-06)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = GpsAntenna2

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.360 (g/cm^2)

CS Surface Area = 0.0016 (m^2)

Vector = (1.000000 (u), 0.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1   Density: 0.540 (g/cm^2) Separation: 0.500 (cm)

OUTPUT

Probability of Penetration = 6.4440E-06 (6.4440E-06)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

==

Spacecraft = YAM-8

Critical Surface = TTCAntenna

==

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.360 (g/cm^2)

CS Surface Area = 0.0100 (m^2)

Vector = (1.000000 (u), 0.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1 Density: 0.540 (g/cm^2) Separation: 0.500 (cm)

OUTPUT

Probability of Penetration = 4.0274E-05 (4.0275E-05)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = XFS

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.360 (g/cm^2)

CS Surface Area = 0.0150 (m^2)

Vector = (0.000000 (u), -1.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1   Density: 1.776 (g/cm^2) Separation: 1.000 (cm)

Outer Wall 2   Density: 0.270 (g/cm^2) Separation: 2.000 (cm)

OUTPUT

Probability of Penetration = 1.0837E-08 (1.0837E-08)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = PPU

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.540 (g/cm^2)

CS Surface Area = 0.0800 (m^2)

Vector = (0.000000 (u), -1.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1   Density: 1.620 (g/cm^2) Separation: 1.000 (cm)

Outer Wall 2   Density: 0.270 (g/cm^2) Separation: 2.000 (cm)

OUTPUT

Probability of Penetration = 5.4782E-08 (5.4782E-08)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

==

Spacecraft = YAM-8

Critical Surface = SADA

==

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.540 (g/cm^2)

CS Surface Area = 0.0072 (m^2)

Vector = (1.000000 (u), 0.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1   Density: 2.730 (g/cm^2) Separation: 1.000 (cm)

Outer Wall 2   Density: 0.270 (g/cm^2) Separation: 2.000 (cm)

OUTPUT

Probability of Penetration = 1.3821E-08 (1.3821E-08)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = Coupler

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.270 (g/cm^2)

CS Surface Area = 0.0012 (m^2)

Vector = (0.000000 (u), 1.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1 Density: 1.620 (g/cm^2) Separation: 1.000 (cm)

Outer Wall 2 Density: 0.270 (g/cm^2) Separation: 2.000 (cm)

OUTPUT

Probability of Penetration = 2.5491E-04 (2.5494E-04)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = TTCAntenna2

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.360 (g/cm^2)

CS Surface Area = 0.0100 (m^2)

Vector = (-1.000000 (u), 0.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1   Density: 0.540 (g/cm^2) Separation: 0.500 (cm)

OUTPUT

Probability of Penetration = 4.0274E-05 (4.0275E-05)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

===

Spacecraft = YAM-8

Critical Surface = GPSLNA

===

INPUT

Apogee Altitude = 610.000 (km)

Perigee Altitude = 610.000 (km)

Orbital Inclination = 97.700 (deg)

RAAN = 0.000 (deg)

Argument of Perigee = 0.000 (deg)

Mean Anomaly = 0.000 (deg)

Final Area-To-Mass = 0.0101 (m^2/kg)

Initial Mass = 194.000 (kg)

Final Mass = 194.000 (kg)

Station Kept = No

Start Year = 2024.850 (yr)

Duration = 5.000 (yr)

Orientation = Fixed Oriented

CS Areal Density = 0.360 (g/cm^2)

CS Surface Area = 0.0032 (m^2)

Vector = (1.000000 (u), 0.000000 (v), 0.000000 (w))

CS Pressurized = No

Outer Wall 1   Density: 0.270 (g/cm^2) Separation: 1.000 (cm)

Outer Wall 2   Density: 0.270 (g/cm^2) Separation: 0.500 (cm)

OUTPUT

Probability of Penetration = 2.9347E-06 (2.9347E-06)

Returned Error Message: Normal Processing

Date Range Error Message: Normal Date Range

=============== End of Requirement 4.5-2 ===============

05 16 2024; 10:43:37AM   Processing Requirement 4.6   Return Status : Passed

==============

Project Data

==============

INPUT

Space Structure Name = YAM-8 - Small Objects

Space Structure Type = Payload

Perigee Altitude = 540.000000 (km)

Apogee Altitude = 540.000000 (km)

Inclination = 97.700000 (deg)

RAAN = 0.000000 (deg)

Argument of Perigee = 0.000000 (deg)

Mean Anomaly = 0.000000 (deg)

Area-To-Mass Ratio = 0.012950 (m^2/kg)

Start Year = 2024.850000 (yr)

Initial Mass = 200.000000 (kg)

Final Mass = 194.000000 (kg)

Duration = 10.000000 (yr)

Station Kept = True

Abandoned = False

Long-Term Reentry = False

OUTPUT

Suggested Perigee Altitude = 350.000000 (km)

Suggested Apogee Altitude = 350.000000 (km)

Returned Error Message = Passes LEO reentry orbit criteria.

Released Year = 2034 (yr)

Requirement = 61

Compliance Status = Pass

==============

INPUT

Space Structure Name = YAM-8

Space Structure Type = Payload

Perigee Altitude = 610.000000 (km)

Apogee Altitude = 610.000000 (km)

Inclination = 97.700000 (deg)

RAAN = 0.000000 (deg)

Argument of Perigee = 0.000000 (deg)

Mean Anomaly = 0.000000 (deg)

Area-To-Mass Ratio = 0.010150 (m^2/kg)

Start Year = 2024.850000 (yr)

Initial Mass = 200.000000 (kg)

Final Mass = 194.000000 (kg)

Duration = 5.000000 (yr)

Station Kept = False

Abandoned = True

PMD Perigee Altitude = 594.313093 (km)

PMD Apogee Altitude = 594.885081 (km)

PMD Inclination = 97.564059 (deg)

PMD RAAN = 312.629051 (deg)

PMD Argument of Perigee = 127.355545 (deg)

PMD Mean Anomaly = 0.000000 (deg)

Long-Term Reentry = False

OUTPUT

Suggested Perigee Altitude = 594.313093 (km)

Suggested Apogee Altitude = 594.885081 (km)

Returned Error Message = Passes LEO reentry orbit criteria.

Released Year = 2045 (yr)

Requirement = 61

Compliance Status = Pass

==============

=============== End of Requirement 4.6 ===============

05 16 2024; 10:43:45AM *********Processing Requirement 4.7-1

Return Status : Passed

***********INPUT****

Item Number = 1

name = YAM-8

quantity = 1

parent = 0

materialID = 5

type = Box

Aero Mass = 194.000000

Thermal Mass = 194.000000

Diameter/Width = 1.000000

Length = 1.000000

Height = 1.000000

name = Spacecraft_OW

quantity = 1

parent = 1

materialID = 5

type = Box

Aero Mass = 87.729000

Thermal Mass = 15.000000

Diameter/Width = 0.750000

Length = 0.750000

Height = 0.750000

name = Walls

quantity = 6

parent = 2

materialID = 5

type = Flat Plate

Aero Mass = 12.121500

Thermal Mass = 1.685000

Diameter/Width = 0.780000

Length = 0.780000

name = Payload Antenna

quantity = 2

parent = 3

materialID = 5

type = Box

Aero Mass = 12.350000

Thermal Mass = 12.350000

Diameter/Width = 0.400000

Length = 0.700000

Height = 0.100000

name = Electronic Boxes

quantity = 6

parent = 3

materialID = 5

type = Box

Aero Mass = 2.385000

Thermal Mass = 2.385000

Diameter/Width = 0.125000

Length = 0.375000

Height = 0.063000

name = SPT Thruster Baseplate

quantity = 1

parent = 3

materialID = 66

type = Flat Plate

Aero Mass = 0.037000

Thermal Mass = 0.037000

Diameter/Width = 0.120000

Length = 0.140000

name = SPT XFS Steel

quantity = 1

parent = 3

materialID = 58

type = Box

Aero Mass = 1.000000

Thermal Mass = 1.000000

Diameter/Width = 0.100000

Length = 0.150000

Height = 0.050000

name = SPT Ceramic

quantity = 1

parent = 3

materialID = 40

type = Cylinder

Aero Mass = 0.040000

Thermal Mass = 0.040000

Diameter/Width = 0.030000

Length = 0.022000

name = Tank Carbon

quantity = 1

parent = 3

materialID = -1

type = Cylinder

Aero Mass = 2.332000

Thermal Mass = 0.745000

Diameter/Width = 0.160000

Length = 0.500000

name = Tank Shell

quantity = 1

parent = 9

materialID = 5

type = Cylinder

Aero Mass = 1.587000

Thermal Mass = 1.587000

Diameter/Width = 0.156000

Length = 0.500000

name = Reaction Wheel

quantity = 4

parent = 3

materialID = 58

type = Cylinder

Aero Mass = 2.500000

Thermal Mass = 2.500000

Diameter/Width = 0.065000

Length = 0.095000

name = Battery

quantity = 1

parent = 3

materialID = 5

type = Box

Aero Mass = 9.500000

Thermal Mass = 9.500000

Diameter/Width = 0.230000

Length = 0.300000

Height = 0.100000

name = SADA

quantity = 1

parent = 3

materialID = 58

type = Cylinder

Aero Mass = 0.700000

Thermal Mass = 0.700000

Diameter/Width = 0.022000

Length = 0.230000

name = M0 PAM walls

quantity = 6

parent = 1

materialID = 5

type = Flat Plate

Aero Mass = 10.943333

Thermal Mass = 5.075000

Diameter/Width = 0.490000

Length = 0.590000

name = PDPU1

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 0.500000

Thermal Mass = 0.500000

Diameter/Width = 0.100000

Length = 0.150000

Height = 0.040000

name = GPU

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 0.500000

Thermal Mass = 0.500000

Diameter/Width = 0.090000

Length = 0.090000

Height = 0.030000

name = SDR

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 2.000000

Thermal Mass = 2.000000

Diameter/Width = 0.110000

Length = 0.180000

Height = 0.080000

name = Diplexer

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 0.200000

Thermal Mass = 0.200000

Diameter/Width = 0.070000

Length = 0.070000

Height = 0.040000

name = GNSS splitter

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 0.050000

Thermal Mass = 0.050000

Diameter/Width = 0.070000

Length = 0.070000

Height = 0.040000

name = R3 payload

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 2.500000

Thermal Mass = 2.500000

Diameter/Width = 0.180000

Length = 0.180000

Height = 0.080000

name = Pyxis CE

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 5.700000

Thermal Mass = 5.700000

Diameter/Width = 0.160000

Length = 0.160000

Height = 0.160000

name = Pyxis filter

quantity = 6

parent = 14

materialID = 5

type = Box

Aero Mass = 0.360000

Thermal Mass = 0.360000

Diameter/Width = 0.060000

Length = 0.080000

Height = 0.050000

name = Argos payload - Cam

quantity = 1

parent = 14

materialID = 8

type = Box

Aero Mass = 0.500000

Thermal Mass = 0.500000

Diameter/Width = 0.080000

Length = 0.080000

Height = 0.060000

name = Argos payload - Optical head

quantity = 8

parent = 14

materialID = 66

type = Cylinder

Aero Mass = 0.100000

Thermal Mass = 0.100000

Diameter/Width = 0.190000

Length = 0.100000

name = Argos payload - Optical hub

quantity = 1

parent = 14

materialID = 66

type = Box

Aero Mass = 0.100000

Thermal Mass = 0.100000

Diameter/Width = 0.080000

Length = 0.080000

Height = 0.050000

name = Argos bracket

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 1.000000

Thermal Mass = 1.000000

Diameter/Width = 0.170000

Length = 0.200000

Height = 0.150000

name = HS100 payload - CE

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 0.800000

Thermal Mass = 0.800000

Diameter/Width = 0.100000

Length = 0.100000

Height = 0.050000

name = HS100 payload - OFE primary

quantity = 1

parent = 14

materialID = 5

type = Cylinder

Aero Mass = 0.300000

Thermal Mass = 0.300000

Diameter/Width = 0.100000

Length = 0.120000

name = HS100 payload - OFE secondary

quantity = 1

parent = 14

materialID = 66

type = Cylinder

Aero Mass = 0.300000

Thermal Mass = 0.300000

Diameter/Width = 0.100000

Length = 0.120000

name = HS100 Mirror/Lens

quantity = 1

parent = 14

materialID = 71

type = Flat Plate

Aero Mass = 0.200000

Thermal Mass = 0.200000

Diameter/Width = 0.080000

Length = 0.080000

name = HS100 bracket

quantity = 1

parent = 14

materialID = 5

type = Box

Aero Mass = 1.000000

Thermal Mass = 1.000000

Diameter/Width = 0.100000

Length = 0.100000

Height = 0.040000

name = RO array

quantity = 2

parent = 14

materialID = 5

type = Flat Plate

Aero Mass = 6.800000

Thermal Mass = 6.800000

Diameter/Width = 0.270000

Length = 0.860000

name = HDRM

quantity = 2

parent = 14

materialID = 5

type = Box

Aero Mass = 1.500000

Thermal Mass = 1.500000

Diameter/Width = 0.120000

Length = 0.150000

Height = 0.030000

name = Adapter plates

quantity = 6

parent = 1

materialID = 5

type = Flat Plate

Aero Mass = 0.200000

Thermal Mass = 0.200000

Diameter/Width = 0.150000

Length = 0.200000

*************OUTPUT****

Item Number = 2

name = YAM-8

Demise Altitude = 77.993872

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Spacecraft_OW

Demise Altitude = 74.836918

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Walls

Demise Altitude = 74.009598

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Payload Antenna

Demise Altitude = 63.623603

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Electronic Boxes

Demise Altitude = 68.858239

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SPT Thruster Baseplate

Demise Altitude = 0.000000

Debris Casualty Area = 0.474446

Impact Kinetic Energy = 0.730151

****

name = SPT XFS Steel

Demise Altitude = 61.275313

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SPT Ceramic

Demise Altitude = 71.082309

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Tank Carbon

Demise Altitude = 73.679252

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Tank Shell

Demise Altitude = 71.055509

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Reaction Wheel

Demise Altitude = 50.793695

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Battery

Demise Altitude = 57.282383

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SADA

Demise Altitude = 62.828194

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = M0 PAM walls

Demise Altitude = 73.677935

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = PDPU1

Demise Altitude = 70.677884

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = GPU

Demise Altitude = 68.261315

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SDR

Demise Altitude = 66.295762

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Diplexer

Demise Altitude = 71.082578

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = GNSS splitter

Demise Altitude = 73.033869

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = R3 payload

Demise Altitude = 64.714126

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Pyxis CE

Demise Altitude = 58.508227

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Pyxis filter

Demise Altitude = 69.904233

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Argos payload - Cam

Demise Altitude = 71.919119

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Argos payload - Optical head

Demise Altitude = 0.000000

Debris Casualty Area = 3.904615

Impact Kinetic Energy = 4.130592

****

name = Argos payload - Optical hub

Demise Altitude = 71.099440

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Argos bracket

Demise Altitude = 71.301701

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = HS100 payload - CE

Demise Altitude = 67.348341

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = HS100 payload - OFE primary

Demise Altitude = 71.279651

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = HS100 payload - OFE secondary

Demise Altitude = 67.853038

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = HS100 Mirror/Lens

Demise Altitude = 65.842088

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = HS100 bracket

Demise Altitude = 65.146002

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = RO array

Demise Altitude = 63.855470

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = HDRM

Demise Altitude = 64.410652

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Adapter plates

Demise Altitude = 77.020556

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

=============== End of Requirement 4.7-1 ===============

05 16 2024; 10:43:45AM Project Data Saved To File

8. Special Classes of Space Missions

Not applicable.

END OF ODAR