EXHIBIT B

ORBITAL DEBRIS ASSESSMENT REPORT FOR APEX ARIES 1 SATELLITE

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

Document data is not restricted.

This document contains no proprietary, ITAR, or export-controlled information.

Debris Assessment Software (DAS) version used in analysis: v3.2.5

Revision Record				
Revision:	Date:	Affected Pages:	Changes:	Author(s):
0.0	August 22, 2023	All–Initial	Initial	Thomas Salzman James Bultitude Matt Gill
0.1	October 15, 2023	All	Remove propulsion and Orbit Fab systems and re-run analyses	Thomas Salzman James Bultitude Matt Gill
0.2	January 19, 2024	All	Re-ran analysis with updated DAS version 3.2.5; and clarified battery passivation procedure	Thomas Salzman Matt Gill

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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	Status
4.3-1.a	Compliant
4.3-1.b	Compliant
4.3-2	N/A
4.4-1	Compliant
4.4-2	Compliant
4.4-3	N/A
4.4-4	N/A
4.5-1	Compliant
4.5-2	N/A
4.6-1(a)-c	Compliant
4.6-2	N/A
4.6-3	N/A
4.6-4	Compliant
4.7-1	N/A
4.8-1	Compliant

47 C.F.R. § 5.64 Self-Assessment Evaluation

Section	Compliant	Rationale	Evidence	Description
5.64 a	Compliant	Apex constructs the Apex Aries 1 at its own risk.	Section 1	Satellite construction
5.64 b1	Compliant	There is no planned release of debris.	Section 3, Req. 4.3-1	Planned release of debris during normal operations
5.64 b2	N/A	Satellite houses no post-mission disposal equipment.	Section 5, Req. 4.5-2	Probability of collision with small debris
5.64 b3	Compliant	Apex has assessed and limited the probability of accidental explosions or release of liquids.	Section 4	Probability of accidental explosions or release of liquids
5.64 b4iA	Compliant	Probability is less than 0.001.	Section 5, Req. 4.5-1	Probability of collision with large debris
5.64 b4iB	Compliant	Apex will coordinate with other spacecraft to avoid collisions.	Section 5	Coordination with other spacecraft or systems
5.64 b4iC	Compliant	The Apex Aries 1 will coordinate with when below the orbit of the ISS and other inhabitable spacecraft.	Section 5	Transit through the orbit of inhabitable spacecraft

Section	Compliant	Rationale	Evidence	Description
5.64 b4iD	N/A	Apex will not maintain orbital parameters.	Section 2	Orbital parameter maintenance
5.64 b4iE	Compliant	Apex will take all possible steps to mitigate collision risk upon receipt of a conjunction warning.	Section 5	Conjunction warnings
5.64 b4ii	N/A			GSO only
5.64 b5i	Compliant	Apex will passively track the Apex Aries 1.	Section 2	Space station dentification and tracking
5.64 b5ii	Compliant	Apex will register the satellite.	Section 2	Registration with the 18th Space Control Squadron or successor entity
5.64 b5iii	Compliant	Apex will share information.	Section 2	Sharing information with the 18th Space Control Squadron
5.64 b6	N/A	Apex will not conduct proximity operations.	Section 6, Req. 4.8	Proximity operations
5.64 b7i	N/A			GSO only
5.64 b7ii	Compliant	Apex Aries 1 will demise via atmospheric re-entry.	Section 6	Deorbit rationale
5.64 b7iii	N/A			N/A

Section	Compliant	Rationale	Evidence	Description
5.64 b7ivA	Compliant	The probability of successful demise is greater than 0.9.	Section 7	Probability of successful deorbit
5.64 b7ivB1	Compliant	Apex Aries 1 will deorbit through uncontrolled atmospheric reentry.	Section 7	Controlled or uncontrolled reentry
5.64 b7ivB2	Compliant	The human casualty risk is <1:10,000.	Section 7	Casualty risk

Assessment Report Format

This ODAR follows the format recommended in NASA-STD-8719.14C, Appendix A.1, sections 1 through 8 for the Apex Aries 1 satellite. Sections 9 through 14 apply to the launch vehicle ODAR and are not covered here.

1. Program Management and Mission Overview

Apex is a U.S. company based in Los Angeles, California.

Foreign Government or Space Agency Participation

- None

Mission Overview

Apex Aries 1 is expected to launch in March 2024 into a circular sun-synchronous, low-Earth orbit (LEO). It will be launched in an inclined (97.6 deg) orbit between 505 km and 545 km and will operate for <5 years. Apex Aries 1 will be equipped with reaction wheels, a Global Positioning System (GPS) receiver; star trackers; sun sensors; magnetorquers; inertial measurement unit (IMU); and cameras.

Launch

Apex Aries 1 is planned to launch on a SpaceX Falcon 9 rocket on the Transporter-10 mission. Apex has begun constructing Apex Aries 1 and understands that such construction is at its own risk.[1]

Mission Duration

The anticipated operational lifetime of Apex Aries 1 is less than 5 years in LEO.

Deployment Profile

Apex Aries 1 is expected to deploy from the launch vehicle with the following orbital parameters:

Table 1. Orbital Parameters

	Apogee	**Perigee**	**Inclination**
Max Insertion Orbit	545 km	545 km	97.6° ± 0.1°
Min Insertion Orbit	505 km	505 km	97.6° ± 0.1°

2. Spacecraft Description

Physical description of the spacecraft

The Apex Aries 1 satellite is based on Apex's Aries spacecraft bus platform. Basic physical dimensions are 24.85 x 80.74 x 119.8 cm (solar arrays deployed). The satellite is composed of the Aries spacecraft bus, deployable solar panels, and a payload. The solar panels generate 250 W Orbit Average Power (OAP) of electrical DC power, which is stored in a 60 Ahr commercial off-the-shelf (COTS) Li-Ion unpressurized battery assembly. The solar array is deployed using a hold-down mechanism. The bus is 3-axis stabilized, employing star trackers and sun sensors for attitude knowledge and reaction wheels and magnetorquers for attitude control. Detailed illustrations of the Apex Aries 1 spacecraft are provided in the figures below.

[1] 47 C.F.R. § 5.64(a).

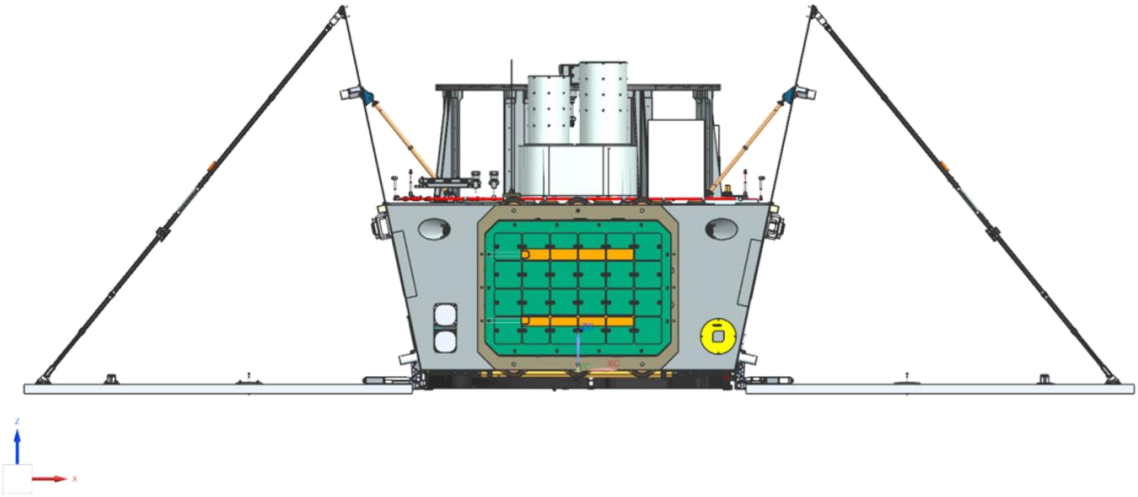

Figure 1. Apex Aries 1 Space Vehicle External View | XY Plane (deployed)

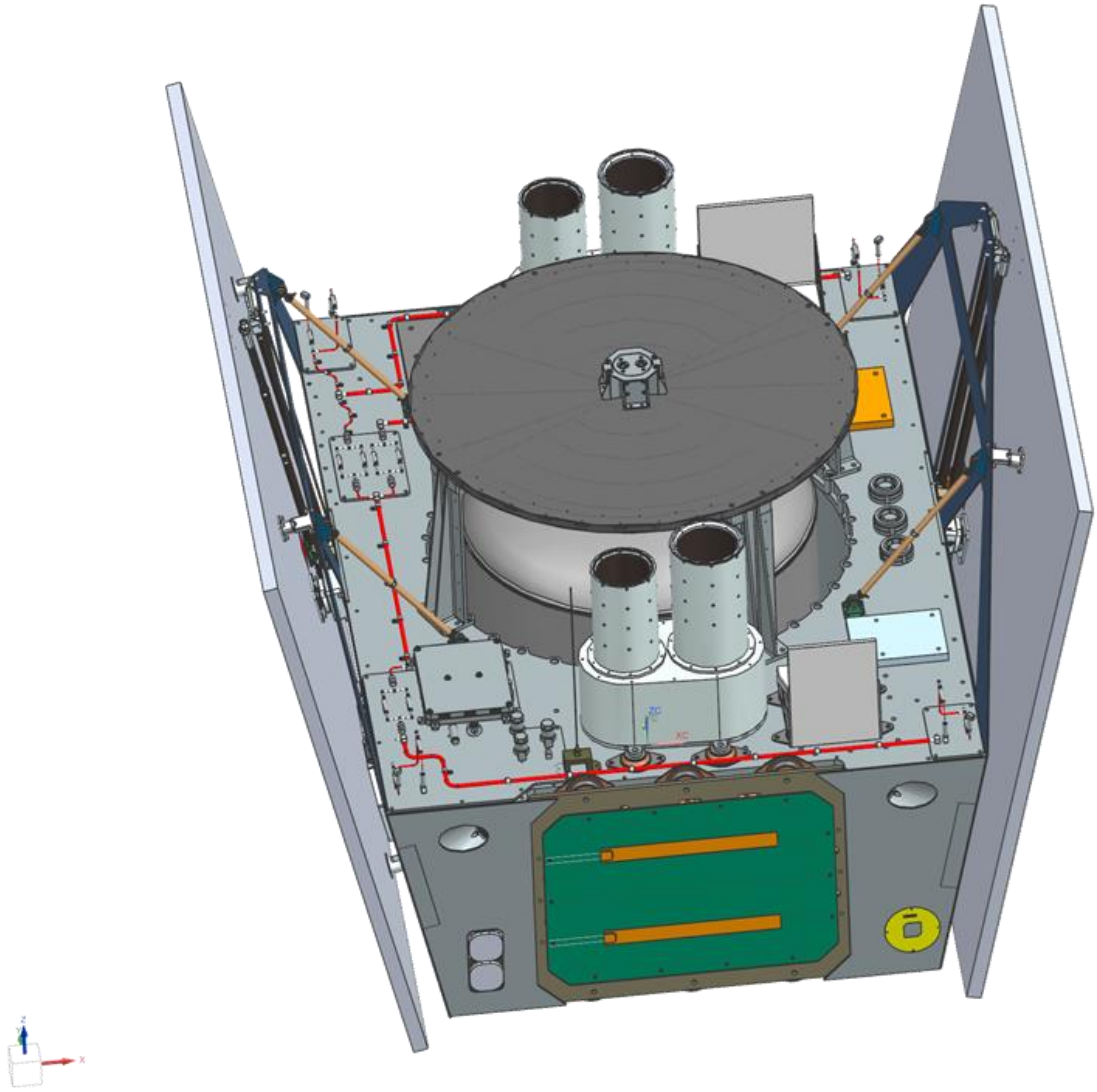

Figure 2. Apex Aries 1 Space Vehicle External View | Isometric View (stowed)

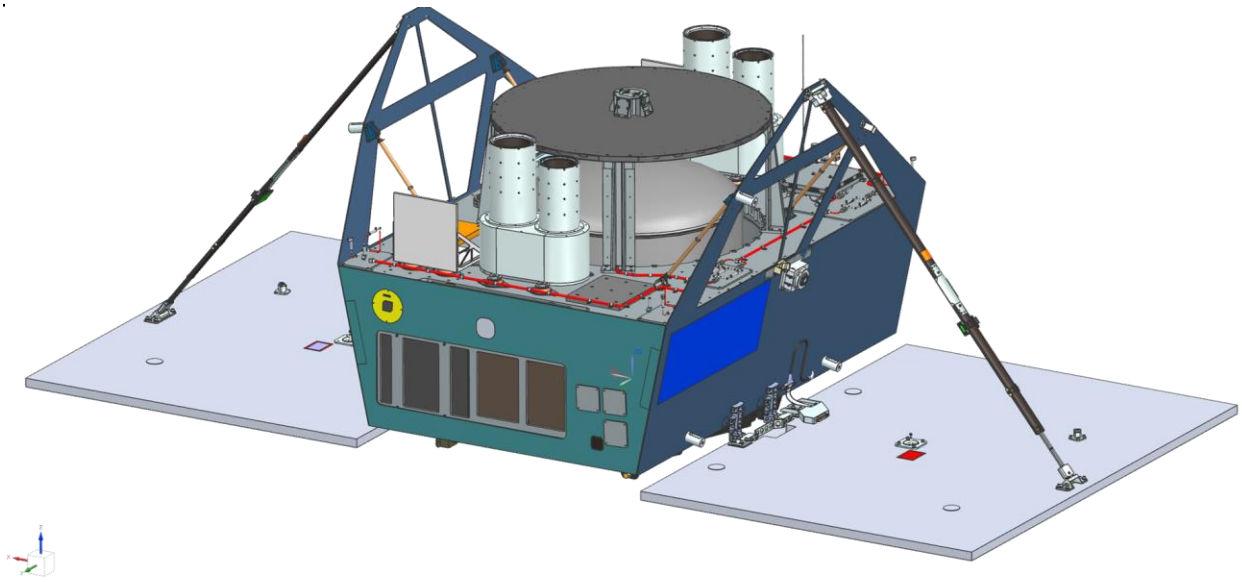

Figure 3. Apex Aries 1 Isometric view (deployed)

Spacecraft Mass

- Mass: 210 kg

Description of propulsion system

None.

Fluids Planned to be On-board

None.

Attitude Control System

The guidance, navigation, and control (GNC) subsystem has a sensor suite consisting of star trackers, IMU (containing gyros and accelerometers), GPS receiver, three-axis magnetometer, and sun sensors. The actuator suite consists of chemical thrusters, reaction wheels, and magnetorquers. The GNC subsystem has several operational modes that enable the spacecraft to perform its mission:

- A *detumbling mode* is used to reduce angular rates below a threshold after launch vehicle separation or after a hardware failure in the GNC subsystem. The magnetometer is used to

sense the orientation of the Earth's magnetic field and the magnetorquers are used to generate torques opposing the rotation of the spacecraft.

- A *pointing mode* is used to orient the spacecraft in either the velocity, anti-velocity, nadir, ground tracking, or inertially fixed directions. This mode is used for ground communication and payload activities.
- A *safe mode* is used to maximize solar power generation while also allowing communications with the ground network. Safe mode is entered either by ground command or autonomously by the flight software when it detects a low battery state of charge. During this mode, the spacecraft will maintain its solar panels pointing toward the sun and will also track selected ground stations when they come within line of sight.

During normal operations, the reaction wheels provide redundant 3-axis attitude control while the magnetorquers are used to maintain wheel speeds below their maximum limits. The nominal spacecraft orientation has the solar panels in the zenith direction (+R for radial) and the launch vehicle separation ring in the velocity direction (+T for tangential).

Description of any range safety or other pyrotechnic devices

None.

Space vehicle separation will be accomplished using a debris-free low-shock release system as designed by approved integrators for our launch. Integrators will install the Planetary Systems Light Band separation system onto the Apex Aries 1 spacecraft. The Light Band is a 24” debris-free deployment mechanism.

Solar array deployment will also be achieved using Space Lock Lora6 hold-down mechanisms, which do not release any debris. Solar arrays will be deployed via a spring-based system folded out.

Description of the electrical generation and storage system

Standard COTS Li-Ion battery cells are charged before payload integration and provide 1760Wh of electrical energy during the eclipse portion of the satellite’s orbit. A series of triple junction

solar cells generate an average on-orbit power of approximately 250 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 can 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 LEO and has a smallest dimension measuring at least 24.85 cm without solar panels deployed. This dimension is greater than 10 cm and, therefore, 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 passive.[2] 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 satellite establishes contact with the nearest available Apex-contracted ground station, satellite tracking will be employed to enhance and maintain satellite ephemeris data. The collected data will be used to identify the spacecraft from two-line element sets once they become available by the 18th Space Control Squadron.

[2] At this time, Apex will not enlist any commercial space situational awareness data but is actively seeking to do so for future missions.

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 18th Space Control Squadron 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

Apex intends to provide the 18th Space Control Squadron information regarding initial deployment, owner/operator (O/O) ephemeris, and planned maneuvers. This sharing is intended to provide better SSA 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. Apex 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 Apex Aries 1. All deployments use a Space Lock Lora6 hold-down mechanism that does not generate any debris. 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

None.

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

Battery Power System: The battery safety systems are discussed in the assessment of spacecraft compliance with ODAR requirement 4.4-1, which describes the combined faults required for the mutually exclusive failures that lead to battery venting. The batteries are COTS batteries equipped with safety vent features that release excessive pressure build-up, precluding explosions.

Plan for any designed spacecraft breakup

There are no planned breakups.

List of components which shall be passivated at EOM including method of passivation and amount which cannot be passivated

- **Reaction Wheels** – will be spun down and the spacecraft will be controlled via torque rods.
- **Batteries** – deenergized to a minimum charge state and then commanded to disconnect charging input and discharge output to the bus to ensure full passivation and no ability to boot satellite.

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).*

Battery explosion:

- **Effect:** All failure modes below might 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 these small batteries, coupled with the multiple enclosures surrounding the batteries, will ensure debris from the battery rupture should be contained within the spacecraft due to the lack of penetration energy.
- **Probability:** Extremely Low. It is believed to be less than 0.01% given that multiple independent (not common mode) faults must occur for each failure mode to cause the ultimate effect (explosion). The Apex Aries 1 spacecraft uses Samsung INR18650-MJ1 battery cells which have extensive flight heritage. Each battery cell has over-voltage and over-current protection. Battery testing includes Lot Sampling Testing, Acceptance Testing, and Final Checkout after Assembling the satellite.
- **Failure Mode 1:** Internal cell short circuit
    - **Mitigation:** Qualification and acceptance shock, vibration, thermal cycling, and vacuum tests followed by maximum system rate-limited charge and discharge will 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
    - **Mitigation:** Battery cells were UL/UN tested in lab for high load discharge rates by short circuiting the terminal to determine the feasibility of an out-of-control thermal rise in the cell.
    - **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:** This failure mode is negated by:
        - Qualification tested short circuit protection on each external circuit;

        - Design of battery packs and insulators such that no contact with nearby board traces is possible without being caused by some other mechanical failure; and
        - 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 must all occur to enable this failure mode.
- **Failure Mode 4:** Inoperable vents
    - **Mitigation:** Battery venting is not inhibited by the battery holder design or the spacecraft design. The battery can vent gases to the external environment.
    - **Combined faults required for realized failure:** The cell manufacturer and the satellite integrator must fail to install proper venting.
- **Failure Mode 5:** Crushing
    - **Mitigation:** Failure mode prevented by design. No moving parts appear near the battery assembly. Battery cells are UL/UN tested for crush and impact.
    - **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 satellite 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:** These modes are negated by a) battery holder/case design made of non-conductive plastic and b) operation in a 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 for this failure mode.

- **Failure Mode 7:** Excess battery cell temperature due to orbital environment and high discharge combined
    - **Mitigation:** The spacecraft thermal design will negate this possibility. Thermal rise has been analyzed in combination with space environment temperatures showing that the batteries do not exceed normal allowable operating temperatures under a variety of modeled cases, including worst case orbital scenarios. Analysis shows these temperatures to be well below temperatures of concern for explosions. Battery cells are UL/UN thermal tested without fire or explosion.
    - **Combined faults required for realized failure:** Incorrect thermal analysis **AND** thermal design **AND** mission simulations in thermal-vacuum chamber testing **AND** over-current 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:** The reaction wheels will be spun down to passivate the Apex Aries 1 satellite. In this EOM mode, all subsystems will be cut off from power.

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: 3.5085E-05.

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

There is no significant risk of collision based on Apex Aries 1's ability to employ differential drag. Studies by Planet Labs and other companies have shown that differential drag can be an effective collision avoidance technique. The effective surface area of the satellite can change from 0.28 to 3.08 m^2 by adjusting the orientation of the Apex Aries 1 spacecraft.

Apex will register Apex Aries 1 with the US Space Force's 18th Space Defense Squadron, which provides active monitoring. Apex will attempt to contact and work with any entity that owns a spacecraft, which has the potential to collide with the Apex Aries 1 satellite, to avoid collision.

If at any time during the spacecraft's mission or de-orbit phase the spacecraft will operate in or transit through the orbits used by any planned or inhabitable spacecraft, including the International Space Station, describe the design and operational strategies, such as coordination, that will be used to minimize the risk of collision and avoid posing any operational constraints to the spacecraft

During the de-orbit phase, the Apex Aries 1 spacecraft will transfer from an altitude greater than that of the ISS and other inhabitable spacecraft to an altitude below that of the ISS and other inhabitable spacecraft; thus, this phase may transit through an orbit used by the ISS or another spacecraft. The Apex Aries 1 spacecraft can employ differential drag as described. Apex will work with the 18th Space Defense Squadron (by uploading predicted ephemeris) to plan and execute

differential drag deorbit maneuvers while Apex Aries 1 passes through the orbits of the ISS and other inhabitable spacecraft to minimize the risk of collision.

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 an actionable Conjunction Data Message (CDM) from the 18th, Apex 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, and modify the spacecraft's attitude, orbit, and/or operations to avoid a collision. If the operator of the other spacecraft does not have maneuvering capabilities, the operator for Apex Aries 1 will upload a special ephemeris including potential collision avoidance maneuvers (CAMs) via the Application Programming Interface (API) to the 18th Space Defense Squadron to avoid a collision after consultation.

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 objects impact and debris generation probability: N/A Apex Aries 1 will not carry propulsion or other post-mission disposal system. Instead it will employ a passive de-orbit approach. Once the solar arrays deploy, the spacecraft will naturally de-orbit within 5 years of deployment to meet the de-orbit requirement.

6. Spacecraft Post-mission Disposal Plans and Procedures

Description of spacecraft disposal option selected

Consistent with NASA-STD 8719.4C, Apex Aries 1 will be disposed of via atmospheric reentry (natural decay). The operational altitude in LEO lends to natural forces that will quickly lead to

atmospheric reentry once the operations are ceased. The orbit of Apex Aries 1 will decay because of atmospheric drag, and the satellite will eventually de-orbit by atmospheric reentry.

Apex Aries 1 nominal deployed configuration area-to-mass ratio calculation:

- Spacecraft mass: 210.0 kg (mass)
- Cross-sectional area: 2.9 m^2 (average)
- Area-to-mass ratio: 0.0138 m^2/kg (final)

Apex Aries 1 undeployed, DOA configuration area-to-mass ratio calculation:

- Spacecraft mass: 210.0 kg (mass)
- Cross-sectional area: 1.75 m^2 (average)
- Area-to-mass ratio: 0.0083 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 Apex Aries 1 satellite reentry is COMPLIANT.

In the event of a hardware failure at the worst-case 545 km circular altitude, Apex Aries 1 would naturally deorbit by 2029 after a 2024 launch (with arrays deployed), which is compliant with the 5 years post mission disposal requirement.[3]

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

[3] Apex Aries 1 would naturally deorbit within approximately 10 years after launch (with arrays not deployed) as shown in the Activity Log.

- **Compliance statement:** An EOM maneuver is not required to ensure deorbit within 5 years of mission completion.

Requirement 4.8 Additional Assessment Requirements for Special Classes of Space Missions

None.

7. Spacecraft Reentry Hazards

Summary of objects expected to survive uncontrolled reentry

For Apex Aries 1, no spacecraft components are expected to survive uncontrolled reentry with an impact energy of greater than 15J. See activity log below.

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.

8. DAS Activity Logs

The following section provides the raw results of the debris analysis using NASA DAS.

01 12 2024; 19:40:21PM Processing Requirement 4.5-1: Return Status : Passed

==========

Run Data

==========

INPUT

Space Structure Name = Apex Aries 1
Space Structure Type = Payload
Perigee Altitude = 545.000 (km)
Apogee Altitude = 545.000 (km)
Inclination = 97.600 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass Ratio = 0.0138 (m^2/kg)
Start Year = 2024.010 (yr)
Initial Mass = 210.000 (kg)
Final Mass = 210.000 (kg)
Duration = 5.000 (yr)
Station-Kept = False
Abandoned = True
Long-Term Reentry = False

OUTPUT

Collision Probability = 3.5085E-05
Returned Message: Normal Processing
Date Range Message: Normal Date Range
Status = Pass

==========

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

Solar arrays deployed – nominal configuration

01 12 2024; 20:24:26PM Processing Requirement 4.6 Return Status : Passed

==========

Project Data

==========

INPUT

Space Structure Name = Apex Aries 1

Space Structure Type = Payload

Perigee Altitude = 545.000000 (km)

Apogee Altitude = 545.000000 (km)

Inclination = 97.600000 (deg)

RAAN = 0.000000 (deg)

Argument of Perigee = 0.000000 (deg)

Mean Anomaly = 0.000000 (deg)

Area-To-Mass Ratio = 0.013800 (m^2/kg)

Start Year = 2024.010000 (yr)

Initial Mass = 210.000000 (kg)

Final Mass = 210.000000 (kg)

Duration = 5.000000 (yr)

Station Kept = False

Abandoned = True

PMD Perigee Altitude = 167.855413 (km)

PMD Apogee Altitude = 178.295829 (km)

PMD Inclination = 97.524589 (deg)

PMD RAAN = 68.153081 (deg)

PMD Argument of Perigee = 254.189000 (deg)

PMD Mean Anomaly = 0.000000 (deg)

Long-Term Reentry = False

OUTPUT

Suggested Perigee Altitude = 167.855413 (km)

Suggested Apogee Altitude = 178.295829 (km)

Returned Error Message = Passes LEO reentry orbit criteria.

Released Year = 2029 (yr)

Requirement = 61

Compliance Status = Pass

==========

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

Solar arrays undeployed, DOA configuration

01 15 2024; 21:28:18PM Processing Requirement 4.6 Return Status : Passed

==========

Project Data

==========

INPUT

Space Structure Name = Apex Aries 1

Space Structure Type = Payload

Perigee Altitude = 545.000000 (km)

Apogee Altitude = 545.000000 (km)

Inclination = 97.600000 (deg)

RAAN = 0.000000 (deg)

Argument of Perigee = 0.000000 (deg)

Mean Anomaly = 0.000000 (deg)

Area-To-Mass Ratio = 0.008300 (m^2/kg)

Start Year = 2024.010000 (yr)

Initial Mass = 210.000000 (kg)

Final Mass = 210.000000 (kg)

Duration = 5.000000 (yr)

Station Kept = False

Abandoned = True

PMD Perigee Altitude = 491.630063 (km)

PMD Apogee Altitude = 492.444505 (km)

PMD Inclination = 97.613693 (deg)

PMD RAAN = 30.525265 (deg)

PMD Argument of Perigee = 181.746848 (deg)

PMD Mean Anomaly = 0.000000 (deg)

Long-Term Reentry = False

OUTPUT

Suggested Perigee Altitude = 491.630063 (km)

Suggested Apogee Altitude = 492.444505 (km)

Returned Error Message = Passes LEO reentry orbit criteria.

Released Year = 2034 (yr)

Requirement = 61

Compliance Status = Pass

==========

.

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

01 12 2024; 20:37:23PM **********Processing Requirement 4.7-1

Return Status : Passed

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

Item Number = 1

name = Apex Aries 1

quantity = 1

parent = 0

materialID = 8

type = Box

Aero Mass = 210.000000

Thermal Mass = 210.000000

Diameter/Width = 0.750000

Length = 1.000000

Height = 0.750000

name = Battery

quantity = 1

parent = 1

materialID = 8

type = Box

Aero Mass = 13.800000

Thermal Mass = 13.800000

Diameter/Width = 0.303000

Length = 0.417000

Height = 0.132000

name = Solar Array panel
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 7.200000
Thermal Mass = 3.600000
Diameter/Width = 1.000000
Length = 1.000000
Height = 0.020000

name = Solar Array AL structure
quantity = 2
parent = 3
materialID = 8
type = Box
Aero Mass = 3.350000
Thermal Mass = 3.350000
Diameter/Width = 1.000000
Length = 1.000000
Height = 0.020000

name = Solar Array Cell and CIC
quantity = 2
parent = 3
materialID = 27
type = Box
Aero Mass = 0.250000
Thermal Mass = 0.250000
Diameter/Width = 1.000000
Length = 1.000000

Height = 0.000300

name = PX Panel
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 3.390000
Thermal Mass = 3.390000
Diameter/Width = 0.854000
Length = 1.120000

name = NX Panel
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 3.390000
Thermal Mass = 3.390000
Diameter/Width = 0.854000
Length = 1.120000

name = PY Panel
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.620000
Thermal Mass = 1.620000
Diameter/Width = 0.352000
Length = 1.120000

name = NY Panel
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 2.400000
Thermal Mass = 2.400000
Diameter/Width = 0.352000
Length = 1.120000

name = PZ Panel
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 12.250000
Thermal Mass = 12.250000
Diameter/Width = 0.352000
Length = 0.854000

name = NZ Panel
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 10.630000
Thermal Mass = 10.630000
Diameter/Width = 0.352000
Length = 0.854000

name = Center Cylinder
quantity = 1
parent = 1
materialID = 8
type = Cylinder
Aero Mass = 8.500000
Thermal Mass = 8.500000
Diameter/Width = 0.600000
Length = 0.325000

name = RWA Bracket
quantity = 4
parent = 1
materialID = 8
type = Box
Aero Mass = 0.250000
Thermal Mass = 0.250000
Diameter/Width = 0.136000
Length = 0.182000
Height = 0.095000

name = Sun Sensor Mount
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 0.060000
Thermal Mass = 0.060000
Diameter/Width = 0.040000
Length = 0.052000
Height = 0.022000

name = Avionics Tray
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 6.000000
Thermal Mass = 6.000000
Diameter/Width = 0.350000
Length = 0.527000

name = Star Tracker Closeout Baffle and Bracket
quantity = 2
parent = 1
materialID = 50
type = Cylinder
Aero Mass = 1.700000
Thermal Mass = 1.700000
Diameter/Width = 0.100000
Length = 0.200000

name = Multi-Layer Insulation Blankets
quantity = 4
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.250000
Thermal Mass = 0.250000
Diameter/Width = 1.000000
Length = 1.000000

name = Reaction Wheels
quantity = 4
parent = 1
materialID = 8
type = Cylinder
Aero Mass = 1.400000
Thermal Mass = 1.400000
Diameter/Width = 0.146000
Length = 0.045000

name = Torque Rods
quantity = 3
parent = 1
materialID = 8
type = Cylinder
Aero Mass = 0.539000
Thermal Mass = 0.539000
Diameter/Width = 0.050000
Length = 0.430000

name = Star Tracker
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 0.270000
Thermal Mass = 0.270000
Diameter/Width = 0.050000
Length = 0.095000
Height = 0.044000

name = GNSS Receiver

quantity = 1

parent = 1

materialID = 8

type = Box

Aero Mass = 0.275000

Thermal Mass = 0.275000

Diameter/Width = 0.056000

Length = 0.094000

Height = 0.026000

name = GNSS L-Band Antenna

quantity = 1

parent = 1

materialID = 8

type = Cylinder

Aero Mass = 0.350000

Thermal Mass = 0.350000

Diameter/Width = 0.090000

Length = 0.027000

name = Endurosat X-Band Transmitter

quantity = 1

parent = 1

materialID = 8

type = Box

Aero Mass = 0.275000

Thermal Mass = 0.275000

Diameter/Width = 0.090000

Length = 0.095000

Height = 0.013000

name = X-Band Antenna
quantity = 3
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.005300
Thermal Mass = 0.005300
Diameter/Width = 0.024000
Length = 0.024000

name = Endurosat S-Band Transceiver
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.191000
Thermal Mass = 0.191000
Diameter/Width = 0.089000
Length = 0.094000
Height = 0.018500

name = S-Band Antenna
quantity = 2
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.130000
Thermal Mass = 0.130000
Diameter/Width = 0.098000
Length = 0.098000

name = Endurosat UHF Transceiver
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.095000
Thermal Mass = 0.095000
Diameter/Width = 0.089000
Length = 0.095000
Height = 0.011000

name = Ethernet Switch
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 2.500000
Thermal Mass = 2.500000
Diameter/Width = 0.180000
Length = 0.230000
Height = 0.040000

name = Ubotica XE-2 Board
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.330000
Thermal Mass = 0.330000
Diameter/Width = 0.090000

Length = 0.094000

name = SPARK RPO Computer Mass Model
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 2.100000
Thermal Mass = 2.100000
Diameter/Width = 0.114000
Length = 0.114000
Height = 0.100000

name = SPARK IR Camera Mass Model
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 2.900000
Thermal Mass = 2.900000
Diameter/Width = 0.100000
Length = 0.145000
Height = 0.100000

name = SPARK Visible Camera Mass Model
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.800000
Thermal Mass = 0.800000

Diameter/Width = 0.079000
Length = 0.083000
Height = 0.065000

name = SPARK - IMU Mass Model
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.055000
Thermal Mass = 0.055000
Diameter/Width = 0.039000
Length = 0.045000
Height = 0.022000

name = Ubotica CogniSAT Camera
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 2.000000
Thermal Mass = 2.000000
Diameter/Width = 0.136000
Length = 0.182000
Height = 0.095000

name = Propulsion Controller Mass Model
quantity = 1
parent = 1
materialID = 8
type = Box

Aero Mass = 0.500000
Thermal Mass = 0.500000
Diameter/Width = 0.114000
Length = 0.114000
Height = 0.018000

name = Tank MLI
quantity = 3
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.500000
Thermal Mass = 0.500000
Diameter/Width = 1.000000
Length = 1.000000

name = PDU
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 1.500000
Thermal Mass = 1.500000
Diameter/Width = 0.114000
Length = 0.114000
Height = 0.050000

name = Separation System - Fly Away
quantity = 1
parent = 1
materialID = 8

type = Cylinder
Aero Mass = 3.550000
Thermal Mass = 3.550000
Diameter/Width = 0.150000
Length = 0.150000

name = Flight Computer
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 1.600000
Thermal Mass = 1.600000
Diameter/Width = 0.114000
Length = 0.114000
Height = 0.050000

name = Apex Payload Camera
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 1.500000
Thermal Mass = 1.500000
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.100000

name = Daughter boards
quantity = 2
parent = 1

materialID = 8

type = Box

Aero Mass = 0.500000

Thermal Mass = 0.500000

Diameter/Width = 0.090000

Length = 0.100000

Height = 0.050000

name = SPARK Interface Plate

quantity = 1

parent = 1

materialID = 8

type = Box

Aero Mass = 3.000000

Thermal Mass = 3.000000

Diameter/Width = 0.100000

Length = 0.150000

Height = 0.100000

name = S-band Radio and SPARK Enclosure Mass Model

quantity = 2

parent = 1

materialID = 8

type = Box

Aero Mass = 4.000000

Thermal Mass = 2.000000

Diameter/Width = 0.114000

Length = 0.114000

Height = 0.100000

name = S-Band Radio PCB

quantity = 2

parent = 43

materialID = 8

type = Box

Aero Mass = 1.500000

Thermal Mass = 1.500000

Diameter/Width = 0.114000

Length = 0.114000

Height = 0.050000

name = SPARK Camera Encolsure Mass Model

quantity = 2

parent = 43

materialID = 8

type = Box

Aero Mass = 0.500000

Thermal Mass = 0.500000

Diameter/Width = 0.114000

Length = 0.114000

Height = 0.050000

name = Harness/Connectors

quantity = 1

parent = 1

materialID = 54

type = Cylinder

Aero Mass = 0.500000

Thermal Mass = 0.500000

Diameter/Width = 0.050000

Length = 0.100000

name = Payload closeout covers
quantity = 4
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.510000
Thermal Mass = 0.510000
Diameter/Width = 0.100000
Length = 0.100000

name = Thermal blanketing
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.500000
Thermal Mass = 0.500000
Diameter/Width = 1.000000
Length = 1.000000

name = Heaters
quantity = 8
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.100000
Thermal Mass = 0.100000
Diameter/Width = 0.100000
Length = 0.100000

name = 1/4-28 Fasteners

quantity = 100
parent = 1
materialID = 54
type = Cylinder
Aero Mass = 0.010000
Thermal Mass = 0.010000
Diameter/Width = 0.010000
Length = 0.100000

name = 440 fasteners
quantity = 100
parent = 1
materialID = 54
type = Cylinder
Aero Mass = 0.010000
Thermal Mass = 0.010000
Diameter/Width = 0.010000
Length = 0.100000

name = Heaters 2
quantity = 12
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.100000
Thermal Mass = 0.100000
Diameter/Width = 0.100000
Length = 0.100000

name = Temperature sensors
quantity = 12

parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.100000
Thermal Mass = 0.100000
Diameter/Width = 0.100000
Length = 0.100000

name = Orbits edge computer Mass Model
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 2.000000
Thermal Mass = 2.000000
Diameter/Width = 0.114000
Length = 0.200000
Height = 0.114000

name = UHF Antenna
quantity = 2
parent = 1
materialID = 54
type = Cylinder
Aero Mass = 0.100000
Thermal Mass = 0.100000
Diameter/Width = 0.050000
Length = 0.100000

name = UHF Hybrid Coupler
quantity = 1

parent = 1
materialID = 8
type = Box
Aero Mass = 0.060000
Thermal Mass = 0.060000
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.100000

name = COMM Carrier Board
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.150000
Thermal Mass = 0.150000
Diameter/Width = 0.100000
Length = 0.100000

name = Magnetometer
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.083000
Thermal Mass = 0.083000
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.050000

name = IMU

quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.137000
Thermal Mass = 0.137000
Diameter/Width = 0.050000
Length = 0.050000
Height = 0.050000

name = Thermal Tape
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.150000
Thermal Mass = 0.150000
Diameter/Width = 0.100000
Length = 0.100000

name = Heaters 2
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.150000
Thermal Mass = 0.150000
Diameter/Width = 0.100000
Length = 0.100000

name = Temp Sensor 2

quantity = 1

parent = 1

materialID = 8

type = Box

Aero Mass = 0.150000

Thermal Mass = 0.150000

Diameter/Width = 0.050000

Length = 0.050000

Height = 0.050000

name = Solar Array HDRM Bracket

quantity = 1

parent = 1

materialID = 8

type = Box

Aero Mass = 0.250000

Thermal Mass = 0.250000

Diameter/Width = 0.100000

Length = 0.100000

Height = 0.100000

name = Solare Array mount brackets

quantity = 2

parent = 1

materialID = 8

type = Box

Aero Mass = 0.340000

Thermal Mass = 0.340000

Diameter/Width = 0.100000

Length = 0.100000

Height = 0.100000

name = Tank Simulator - Adapter Plate
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 2.000000
Thermal Mass = 2.000000
Diameter/Width = 0.100000
Length = 0.665000
Height = 0.063500

name = Tank Simulator - Stiffener
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 4.700000
Thermal Mass = 4.700000
Diameter/Width = 0.100000
Length = 0.580000
Height = 0.100000

name = Tank Simulator - Riser
quantity = 2
parent = 1
materialID = 8
type = Cylinder
Aero Mass = 7.450000
Thermal Mass = 7.450000
Diameter/Width = 0.442000

Length = 0.146000

name = Tank Simulator - Plates
quantity = 4
parent = 1
materialID = 8
type = Box
Aero Mass = 10.050000
Thermal Mass = 10.050000
Diameter/Width = 0.200000
Length = 0.300000
Height = 0.100000

name = S-band antenna bracket
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.156000
Thermal Mass = 0.156000
Diameter/Width = 0.100000
Length = 0.100000

name = L-band antenna bracket
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.281000
Thermal Mass = 0.281000
Diameter/Width = 0.100000

Length = 0.100000

name = Enclosures
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 1.000000
Thermal Mass = 1.000000
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.100000

name = Strut body
quantity = 4
parent = 1
materialID = 8
type = Cylinder
Aero Mass = 0.170000
Thermal Mass = 0.170000
Diameter/Width = 0.100000
Length = 0.050000

name = Side panel closeout survival array
quantity = 2
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.000000
Thermal Mass = 1.000000
Diameter/Width = 0.200000

Length = 0.400000

name = Payload plate
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 0.910900
Thermal Mass = 0.910900
Diameter/Width = 0.200000
Length = 0.200000

name = Fastener Shipset
quantity = 100
parent = 1
materialID = 54
type = Cylinder
Aero Mass = 0.040000
Thermal Mass = 0.040000
Diameter/Width = 0.050000
Length = 0.050000

name = NGC Amplifier
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.300000
Thermal Mass = 0.150000
Diameter/Width = 0.050000
Length = 0.050000

Height = 0.050000

name = Astroscale Docking Plate Mass Model
quantity = 1
parent = 76
materialID = 8
type = Cylinder
Aero Mass = 0.150000
Thermal Mass = 0.150000
Diameter/Width = 0.100000
Length = 0.050000

name = Tank Mount
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 4.800000
Thermal Mass = 4.800000
Diameter/Width = 0.600000
Length = 0.600000

**********OUTPUT****
Item Number = 1

name = Apex Aries 1
Demise Altitude = 77.998096
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****

name = Battery

Demise Altitude = 73.741984

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Solar Array panel

Demise Altitude = 77.571869

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Solar Array AL structure

Demise Altitude = 77.086029

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Solar Array Cell and CIC

Demise Altitude = 77.533614

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = PX Panel

Demise Altitude = 77.583258

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = NX Panel

Demise Altitude = 77.583258

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = PY Panel

Demise Altitude = 77.661132

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = NY Panel

Demise Altitude = 77.497613

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = PZ Panel

Demise Altitude = 74.930793

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = NZ Panel

Demise Altitude = 75.330774

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Center Cylinder

Demise Altitude = 76.617286

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = RWA Bracket

Demise Altitude = 77.771447

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Sun Sensor Mount

Demise Altitude = 77.535309

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Avionics Tray

Demise Altitude = 75.765134

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Star Tracker Closeout Baffle and Bracket

Demise Altitude = 74.531845

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Multi-Layer Insulation Blankets

Demise Altitude = 77.974272

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Reaction Wheels

Demise Altitude = 74.124710

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Torque Rods

Demise Altitude = 77.303291

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Star Tracker

Demise Altitude = 77.172412

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = GNSS Receiver

Demise Altitude = 76.986133

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = GNSS L-Band Antenna

Demise Altitude = 75.807277

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Endurosat X-Band Transmitter

Demise Altitude = 77.027264

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = X-Band Antenna

Demise Altitude = 77.782147

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Endurosat S-Band Transceiver

Demise Altitude = 77.353356

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = S-Band Antenna

Demise Altitude = 77.492463

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Endurosat UHF Transceiver

Demise Altitude = 77.651604

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Ethernet Switch

Demise Altitude = 75.740593

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Ubotica XE-2 Board

Demise Altitude = 76.608263

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SPARK RPO Computer Mass Model

Demise Altitude = 75.174509

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SPARK IR Camera Mass Model

Demise Altitude = 74.824567

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SPARK Visible Camera Mass Model

Demise Altitude = 76.047596

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SPARK - IMU Mass Model

Demise Altitude = 77.507778

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Ubotica CogniSAT Camera

Demise Altitude = 76.196838

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Propulsion Controller Mass Model

Demise Altitude = 76.747372

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Tank MLI

Demise Altitude = 77.946423

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = PDU

Demise Altitude = 75.224005

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Separation System - Fly Away

Demise Altitude = 73.515353

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Flight Computer

Demise Altitude = 75.048989

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Apex Payload Camera

Demise Altitude = 75.667656

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Daughter boards

Demise Altitude = 76.849852

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SPARK Interface Plate

Demise Altitude = 74.812026

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = S-band Radio and SPARK Enclosure Mass Model

Demise Altitude = 75.356994

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = S-Band Radio PCB

Demise Altitude = 72.761079

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = SPARK Camera Encolsure Mass Model

Demise Altitude = 74.471663

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Harness/Connectors

Demise Altitude = 70.799402

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Payload closeout covers

Demise Altitude = 76.113885

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Thermal blanketing

Demise Altitude = 77.946423

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Heaters

Demise Altitude = 77.619045

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = 1/4-28 Fasteners

Demise Altitude = 77.505369

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = 440 fasteners

Demise Altitude = 77.505369

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Heaters 2

Demise Altitude = 77.619045

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Temperature sensors

Demise Altitude = 77.619045

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Orbits edge computer Mass Model

Demise Altitude = 76.420304

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = UHF Antenna

Demise Altitude = 76.284882

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = UHF Hybrid Coupler

Demise Altitude = 77.901320

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = COMM Carrier Board

Demise Altitude = 77.431646

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Magnetometer

Demise Altitude = 77.809489

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = IMU

Demise Altitude = 77.307785

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Thermal Tape

Demise Altitude = 77.431646

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Heaters 2

Demise Altitude = 77.431646

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Temp Sensor 2

Demise Altitude = 77.246170

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Solar Array HDRM Bracket

Demise Altitude = 77.596499

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Solare Array mount brackets

Demise Altitude = 77.453053

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Tank Simulator - Adapter Plate

Demise Altitude = 77.078075

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Tank Simulator - Stiffener

Demise Altitude = 73.432416

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Tank Simulator - Riser

Demise Altitude = 75.295545

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Tank Simulator - Plates

Demise Altitude = 73.050380

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = S-band antenna bracket

Demise Altitude = 77.409456

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = L-band antenna bracket

Demise Altitude = 76.942408

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Enclosures

Demise Altitude = 76.420802

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Strut body

Demise Altitude = 77.353860

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Side panel closeout survival array

Demise Altitude = 77.322543

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Payload plate

Demise Altitude = 76.818609

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Fastener Shipset

Demise Altitude = 76.899550

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = NGC Amplifier

Demise Altitude = 77.255178

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Astroscale Docking Plate Mass Model

Demise Altitude = 76.691415

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

name = Tank Mount

Demise Altitude = 76.733355

Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****

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

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