GITAI SC1 Orbital Debris Assessment Report (ODAR)

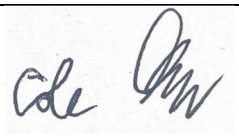
per NASA-STD 8719.14C

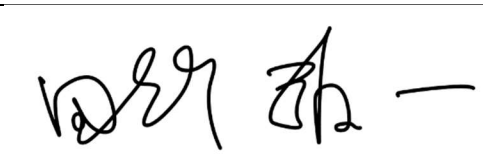
Revision 0

Date: June 19 2024

GITAI USA INC. HEADQUARTERS
2255 Dominguez Way
Torrance, CA 90501

Required Signatures

Title: Project Manager Cole Garda	
Date	6/19/2024

Title: Software Engineer / Systems Engineer Yuichi Tadakoro	
Date	6/19/2024

Version History

Version	Date	Change Author	Affected Pages	Change Summary
Rev 0	6/19/2024	CG	All	Initial Release

Self assessment of the ODAR

A self-assessment against NASA-STD-8719.14C spacecraft mission requirements is shown below for SC1.

Requirement	Resolution	Remarks
4.3-1.a MRD 25-year limit	N/A	No separating objects
4.3-1.b MRD<100 object x year limit	N/A	No separating objects
4.3-2 GEO MRD	N/A	No separating objects
4.4-1 <0.001 Explosion Risk	COMPLIANT	
4.4-2 Passivate Energy Sources	COMPLIANT	
4.4-3 Limit Intentional BU, Long Term	N/A	No planned breakups
4.4-4 Limit Intentional BU, Short Term	N/A	No planned breakups
4.5-1 <0.001 10cm Impact Risk	COMPLIANT	
4.5-2 <0.01 Small MMOD Impacts	N/A	Passive demise in less than 5 years.
4.6-1a-c LEO Disposal	COMPLIANT	
4.6-2 Storage or Earth-escape	N/A	
4.6-3 Long-term Reentry	N/A	
4.6-4 Disposal Reliability	COMPLIANT	
4.7-1 Reentry Risk	COMPLIANT	
4.8-1 Special Classes	N/A	No special classes

Table 1: Self-Assessment of SC1

a. Statement of any restrictions on the data in the ODAR such as proprietary, ITAR, or export controls. If the document does not contain any restrictions, then a statement to that effect must be included. If the document does contain restricted information, the restricted information must be summarized and marked clearly on the page(s) where it occurs and on the cover.

This document does not contain any restricted information.

Debris Assessment Software (DAS) version 3.2.6 was used for evaluation of the SC1 against requirements.

1. ODAR Section 1: Program Management and Mission Overview

Mission Directorate / Company: GITAI USA Inc.

Program Executive: Seiya Shimizu (VP of Program Management)

Address: 2255 Dominguez Way, Torrance, CA 90501

a. Identification of the responsible program/project manager and senior scientific and management personnel.

Program / Project Manager: Cole Garda

Senior Software Engineer: Yuichi Tadakoro

b. Identification of any foreign government or space agency participation in the mission and a summary of NASA's responsibility under the governing agreement(s)

None

c. Brief description of the mission

GITAI will launch the SC1 satellite aboard the SpaceX Rideshare Bandwagon-2. The satellite will perform ADCS maneuvers and deploy a cube to test perception capabilities. The mission will last at least 6 months.

d. Identification of the anticipated launch vehicle and launch site .

Launch Vehicle: SpaceX Falcon 9

Launch Site: Cape Canaveral, FL

e. Identification of the proposed launch date and mission duration

Proposed launch date: October 15, 2024

Mission duration: 6 months

f. Description of the launch and deployment profile, including all parking, transfer, and operational orbits with apogee, perigee, and inclination

SC1 satellite will be launched into a mid-inclination orbit (45.0°) at an altitude of 510 km. Eccentricity will be <0.004. There will be no orbital transfers.

g. Description of the spacecraft's maneuver capability, including both attitude and orbit control.

The propulsion system utilizes one thruster with Green Bipropellant (N2O+Propylene) and a self-pressurizing tank. The propulsion system is on board to gain flight heritage and for on-orbit testing and calibration. No orbit change is planned. The propulsion system will be tested within the first 3 months in orbit.

For attitude control, the satellite is equipped with four reaction wheels and three magnetorquers.

h. Reason for selection of operational orbit(s) (such as ground track, SSO, GEO sync, instrument resolution, co-locate with other spacecraft, …)

Ground tracking (high coverage), cost, and timing of mission were considerations in selecting the orbit.

i. Identification of any interaction or potential physical interference with other operational spacecraft (Note: This does not include potential for RF interaction unless it affects the risk of generating orbital debris.)

There is no expected interaction or interference with other operational spacecraft.

2. ODAR Section 2: Spacecraft Description

The spacecraft is a single unit with the dimensions of 16 stacked 10 cm X 10 cm X 10 cm CubeSat modules (giving an overall dimension of 20 cm X 20 cm X 40 cm.) The total wet mass is 20.20 kg.

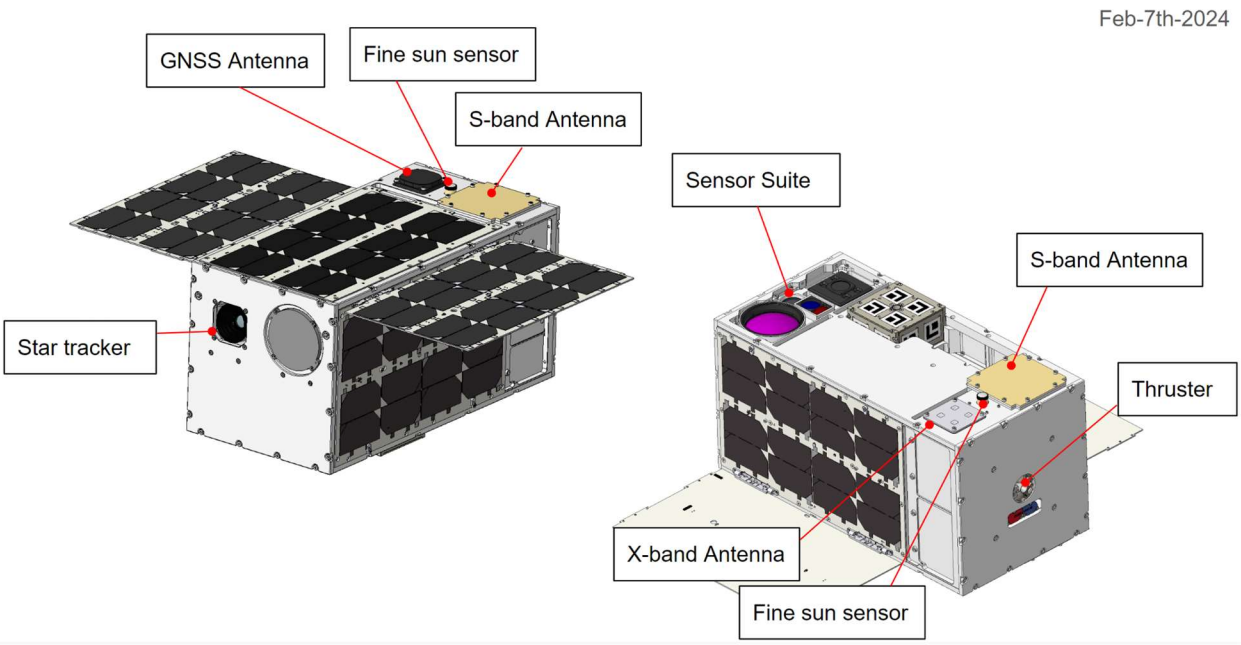


Figure 2-1: SC1 Overview

The spacecraft contains the following systems:

Attitude Determination and Control System (ADCS): The attitude determination and control system is capable of controlling the 3-dimensional attitude of the spacecraft. The system consists of four reaction wheels for momentum, and 3 magnetorquers mounted on the structure for canceling environmental torques and unloading the momentum of the reaction wheels. The critical components are the magnetorquers, dual triaxis magnetometers, a 6-axis Inertial Measurement Unit (IMU) and reaction wheels. Additional hardware being flown but not required for flight control includes a GPS receiver and a star tracker.

Command and Data Handling (CDH) Subsystem: The printed circuit board in the CDH subsystem is the satellite bus on-board computer (OBC). The bus OBC receives data from the spacecraft subsystems and communicates all data to the transceiver and vice versa. It will also perform health checks on subsystems to confirm they are responsive.

Communication Subsystem: The communication subsystem includes: an X-Band Transmitter, an S-Band Telemetry/Telecommand (TM/TC) Transceiver, 2 S-Band Antennae Type IV and an X-Band 2x2 Element Patch Antenna Array. A 3rd party will provide ground stations for communication from the satellite to the ground. In conformance with § 5.107 Transmitter control requirements, all transmission from the satellite can be terminated by command from mission operations via the S band uplink.

Power Subsystem: The power subsystem is a direct energy transfer system using a solar array producing approximately 16W of orbit average power to charge the 252 W-hr battery system. The solar arrays utilize standard photovoltaic cells; the batteries are COTS Lithium-Ion cells. The OBC sends signals to the Power Distribution Module to control load switching.

Thermal Subsystem: The thermal subsystem controls hardware temperature with passive cooling (surface finish and/or color) to maintain low temperature during sun exposure and utilizing heaters to stabilize temperatures during eclipse. Sensors are wired to the controller board, which hosts thermal control algorithms to control the heaters.

Structure Subsystem: The 16U satellite structure is fabricated with aluminum (A7075). There are two 6U deployable solar arrays and a deployable payload cube attached to the satellite with a polyester restraint.

Propulsion Subsystem: The propulsion system utilizes one thruster with Green Bipropellant (N2O+Propylene) and a self-pressurizing tank. The propulsion system is on board to gain flight heritage and for on-orbit testing and calibration. No orbit change is planned.

3D Recognition Payload Subsystem: The payload complement includes a restrained deployable cube with fiducial and reflective markers on the surface for testing GITAI's proprietary visual and 3D recognition software. The payload sensor suite includes two wide field-of-view visual cameras, a 3D LiDAR sensor, a laser rangefinder and an infrared camera.

WiFi Payload Subsystem: This payload will test the connection stability of the Wi-Fi to communicate between modules within the spacecraft. The Wi-Fi module on the payload computer will communicate with the Raspberry Pi Pico W Wi-Fi module, in the 2.4GHz band.

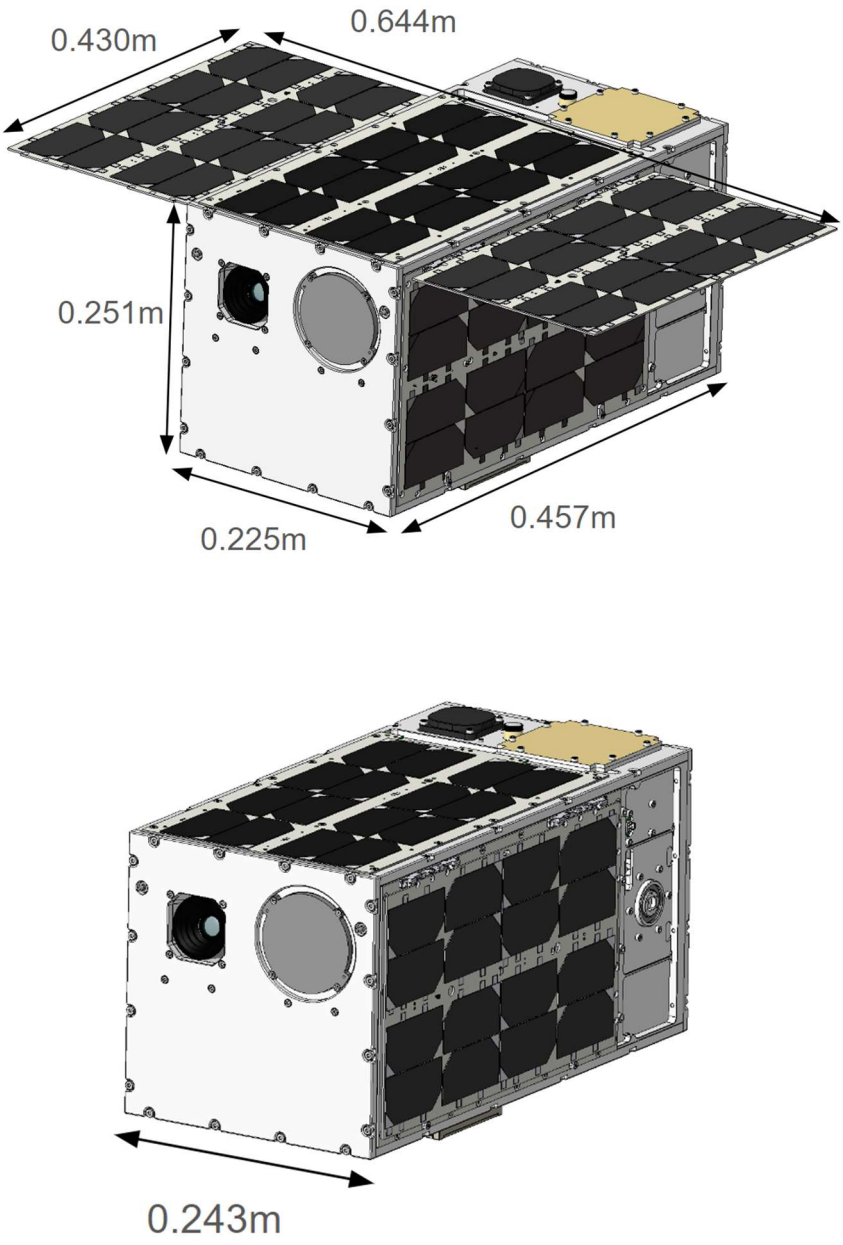


Figure 2-2: SC1 Maximum Volume Envelope

a. Total spacecraft mass at launch, including all propellants and fluids

20.20 kg

b. Dry mass of spacecraft at launch, excluding solid rocket motor propellants

20.03 kg

c. Description of all propulsion systems (cold gas, mono-propellant, bi-propellant, electric, nuclear)

The propulsion system utilizes one thruster with Green Bipropellant (N2O+Propylene) and a self-pressurizing tank. The propulsion system is on board to gain flight heritage and for on-orbit testing and calibration.

d. Identification, including mass and pressure, of all fluids (liquids and gases) planned to be on board and a description of the fluid loading plan or strategies, excluding fluids in sealed heat pipes. Description of all fluid systems, including size, type, and qualifications of fluid containers such as propellant and pressurization tanks, including pressurized batteries

Propulsion System

The propulsion system contains two pressure vessels: a single oxidizer tank (volume = 252 mL, tank mass = 680g, oxidizer mass = 169g, max pressure = 1340.1 psi) and single fuel tank (volume = 66.7 mL, tank mass = 680g, fuel mass = 29.7g, max pressure = 239.3 psi) that are integrated as a monolithic tank design for the storage of the propene (C3H6) and nitrous oxide (N2O) bipropellant. The vessels are comprised of inconel 718. The maximum operating temperature for these tanks is +30°C (+86°F).

At launch, the oxygen tank contains approximately 524 J of stored energy, and the fuel tank contains approximately 96 J of stored energy when at room temperature. At its maximum operating temperature (+30°C or +86°F), the oxygen tank contains approximately 995J of stored energy while the fuel tank contains approximately 127.5 J of stored energy. However, thermal analysis indicates that the tanks will likely not reach its maximum operating temperature during launch or at any time while on orbit. A comparatively small amount of energy is stored within the propellant lines leading out of the tank up to the first valve. The energy stored within the tank will drop throughout the mission as the propellant is expended.

Downstream of the oxidizer tank is a commercial off-the-shelf (COTS) solenoid valve rated to 1340.1 psi operating pressure. All of the propellant lines are 11.08mm OD, 0.57mm thick stainless steel with a design burst pressure safety factor of 2.5.

Qualification

The qualification model tanks were subjected to a standard qualification test campaign in accordance with ECSS-E-ST-32-02C. The campaign was made up of the following tests:

- Non-destructive inspection (NDI)
    - Visual Inspection
- Proof pressure test
- Helium leak test
- Hydrostatic cycling tests
- Design burst pressure test
- Burst test

Qualification done according to ECSS-E-ST-32-02C and AIAA-S-080A-2018 [VER-1030]. Vibration test performed at system level.

The flight model tanks were subjected to the following acceptance tests:
- Non-destructive inspection (NDI)
    - Visual Inspection
- Proof pressure test
    - Oxidizer tank only
    - Fuel tank only
    - Both tanks together
- Helium leak test

The batteries are not pressurized.

e. Description of all active and/or passive attitude control systems with an indication of the normal attitude of the spacecraft with respect to the velocity vector

The attitude determination and control system is capable of controlling the 3-dimensional attitude of the spacecraft. The system consists of four reaction wheels for momentum, and 3 magnetorquers mounted on the structure for canceling environmental torques and unloading the momentum of the reaction wheels. The critical components are the magnetorquers, dual triaxis magnetometers, a 6-axis Inertial Measurement Unit (IMU) and reaction wheels. Additional hardware being flown but not required for flight control include a GPS receiver, a star tracker, and a sun sensor.

The two nominal operational modes will be charging (solar panels facing sun) and nadir pointing.

For charging mode, the attitude with respect to the velocity vector will change throughout the mission depending on the location of the sun and the orbital location of the satellite. The ADCS system will orient the top face of the deployed solar panels perpendicular to the sun vector.

For nadir pointing mode, see the normal attitude with respect to the velocity vector below:

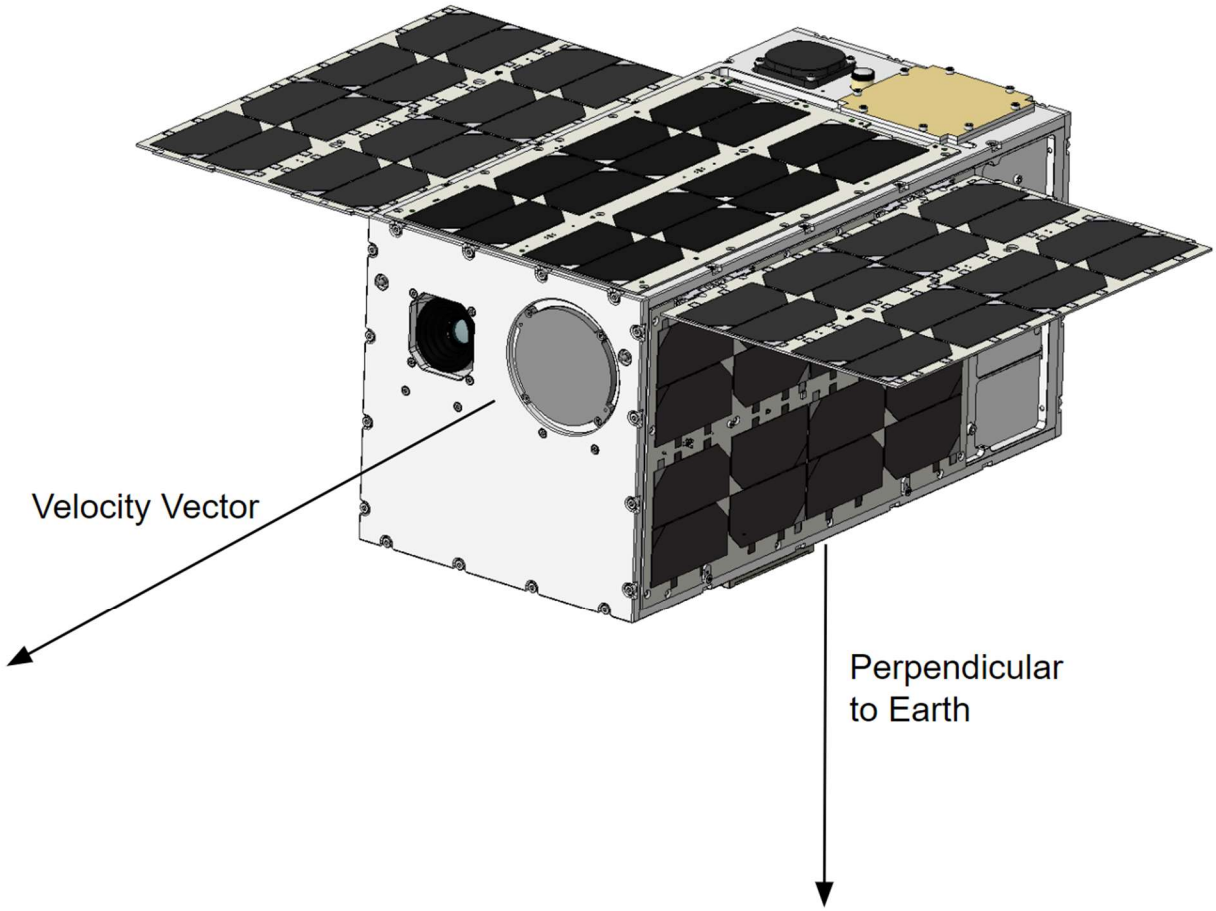


Figure 2-3: SC1 Nadir Pointing Attitude

f. Description of any range safety or other pyrotechnic devices

There are no range safety or pyrotechnic devices on the spacecraft.

g. Description of the electrical generation and storage system

The power subsystem is a direct energy transfer system using a solar array producing approximately 16W of orbit average power to charge the battery system. The solar arrays utilize standard photovoltaic cells.

The system utilizes vented 18650 lithium-ion cells arranged into 3 battery packs (8 cells each). The cells are COTS cells, with 252 W-hr total capacity.

h. Identification of any other sources of stored energy not noted above

There are no other sources of energy storage on the spacecraft

i. Identification of any radioactive materials on board or make a positive statement that there are no radioactive materials onboard

There are no radioactive materials on spacecraft.

3. ODAR Section 3: Assessment of Spacecraft Debris Released during Normal Operations

a. Identification of any object (>1 mm) expected to be released from the spacecraft any time after launch, including object dimensions, mass, and material

There are no separating objects from the spacecraft during any phase of SC1.

b. Assessment of spacecraft compliance with Requirements 4.3-1 and 4.3-2

4.3-1a/b, Mission Related Debris Passing Through LEO: N/A

There are no planned separating objects from the spacecraft.

4.3-2, Mission Related Debris Passing Near GEO: N/A

There are no planned separating objects from the spacecraft.

The spacecraft is compliant with Requirements 4.3-1 and 4.3-2.

4. ODAR Section 4: Assessment of Spacecraft Intentional Breakups and Potential for Explosions.

a. Identification of all potential causes of spacecraft breakup during deployment and mission operations

During nominal deployment and mission operations, there are no credible scenarios that result in spacecraft breakup.

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

The spacecraft contains the propellant and pressurant system, and the EPS system which contains lithium-ion batteries. As described here, protections are provided in each system to prevent on-orbit explosions.

Propulsion System:

The propulsion system is a pressurized system. If the pressure in the tanks or the feed lines exceeded the burst pressure, the tanks would rupture and potentially penetrate the satellite external structure, creating debris. This system underwent a qualification campaign and an acceptance test campaign to prevent this failure. Due to the extensive analysis and the comprehensive testing campaign underwent by the tanks and feed system, there is a near zero probability of failure.

Failure mode 1: Tank temperature rises enough for pressure in the tanks to exceed burst pressure. Measured burst for oxidizer tank: 294.4 bar(a); measured burst pressure for fuel tank: 173.4 bar(a).

Mitigation 1: At launch, the oxygen tank contains approximately 524 J of stored energy and the fuel tank contains approximately 96 J of stored energy when at room temperature. At its maximum operating temperature (+30°C or +86°F), the oxygen tank contains approximately 995J of stored energy while the fuel tank contains approximately 127.5 J of stored energy. However, thermal analysis indicates that the tanks will likely not reach its maximum operating temperature during launch or at any time while on orbit. A comparatively small amount of energy is stored within the propellant lines leading out of the tank up to the first valve. The measured safety factor for the burst pressure over MEOP is 3.18 for the oxidizer and 10.5 for the fuel, comfortably out of range of any reasonable temperature/pressure conditions. Further, the tanks are thermally insulated from the rest of the spacecraft and include a thermocouple for temperature feedback. Further, the oxidizer tank includes a pressure relief valve set to proof pressure.

Combined faults required for realized failure: extreme heating environment AND thermal design failure.

Failure Mode 2: Manufacturing error causes tanks to rupture below burst pressure.

Mitigation 2: The fuel tank QM has a measured burst pressure resulting in a safety factor of 10.5 above flight MEOP (16.5 bar(a)). The fuel tank FM was tested at proof pressure in accordance to ECSS-E-ST-32-02C/AIAA-S-080A-2018 [VER-1030] at 1.5x ground MEOP (13.7 bar(a)).

The oxidizer tank QM has a measured burst pressure resulting in a safety factor of 3.18 above flight MEOP (92.4 bar(a)). The oxidizer tank FM was tested at proof pressure in accordance to ECSS-E-ST-32-02C/AIAA-S-080A-2018 [VER-1030] at 1.5x ground MEOP (67.1 bar(a)).

Downstream of the oxidizer tank is a commercial off-the-shelf (COTS) solenoid valve rated to 1340.1 psi operating pressure. All of the propellant lines are 11.08mm OD, 0.57mm thick stainless steel with a design burst pressure safety factor of 2.5.

Combined faults required for realized failure: Manufacturing error AND testing error

Failure Mode 3: Crushing

Mitigation 3: The tanks are enclosed and properly supported within the spacecraft structure. There are no moving parts that pose a risk to the tanks' structures, nor are there operations that threaten the integrity of the spacecraft structure.

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 tank AND the satellite must be in a naturally sustained orbit at the time the crushing occurs.

Lithium-Ion Battery:

SC1 utilizes vented 18650 lithium-ion cells arranged into 3 battery packs (8 cells each). Battery packs feature mitigations against elevated temperatures and current interrupt devices. These mitigations prevent any catastrophic failure mode and potential for on-orbit explosion to occur.

All cells undergo a full campaign of acceptance tests, with the level and duration of the tests following the ESA standard ECSS -E-ST-10-03C and GEVS standard GSFC-STD-7000A.

Environmental and mechanical test performed:

- Random Vibration
- Sinusoidal Vibration
- Pyroshock Test
- Thermal Cycling
- Thermal Vacuum
- Total Ionizing Dose

Cell Safety Devices

The failure modes listed below, if realized, could result in an explosion of the batteries. Each failure mode has been addressed with appropriate safety features, which make the probability of an explosion near zero.

Failure mode 1: Internal short circuit.

Mitigation 1: A full qualification test campaign has been performed on a qualification model unit of the EPS and its battery packs. All components and standard platform configurations undergo qualification based on tailored ESA ECSS-E-ST-10-03 methodology (the acceptance tests are 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.

Mitigation 2: Each battery pack includes a negative temperature coefficient (NTC) thermistor that senses any thermal rise with fast response time and high reliability. Furthermore, the balancer of the battery pack features embedded overtemperature and overcurrent protections during discharge mode.

Combined faults required for realized failure: The NTC thermistor must fail to provide feedback of the thermal rise AND spacecraft thermal design must be incorrect AND discharge overcurrent protection of the balancer must fail for this failure mode to occur.

Failure Mode 3: Overcharging and excessive charge rate.

Mitigation 3: The satellite bus battery charging circuit design reduces the possibility of the batteries being overcharged if circuits function nominally. This circuit has been proto-qualification tested for survival in shock, vibration, and thermal-vacuum environments. The charger circuit limits the charge current to zero when batteries are charged at 32.3V. Besides this, the balancer includes Charge Over Voltage, Charge Over Current and Charge Over Temperature protections. If all those circuits fail to operate, continuing charge can cause gas generation. The battery packs are not hermetically enclosed and there are gaps that allow gas to escape, mitigating any explosion hazard.

Combined faults required for realized battery rupture mitigation failure effect:

1) For overcharging: The charge control circuit must fail to function AND the NTC thermistor must fail (or temperatures generated must be insufficient to cause the NTC thermistor to register the thermal rise) AND Charge Over Voltage protection circuit AND the battery pack has to be enclosed in an additional external hermetical enclosure to fail to vent generated gasses at acceptable rates to avoid explosion.

2) For excessive charge rate: The maximum power which can be available from all solar panels is 120W. The maximum charge rate that the battery can accept is 5A or at fully discharged batteries 5A * 24V = 120W Max. The battery cell used is US18650VTC6. Each 84Wh battery pack features 8 cells connected in series (8S1P). Each battery pack has its own battery charging circuit and thus when more battery packs are used, the incoming photovoltaic energy from the solar panels and deployable solar arrays is distributed to the battery packs and there are no physical means of exceeding charging rate limits. For this failure mode to become active, the charger's circuit must fail AND the charge overcurrent protection must fail. The gaps in the battery pack design keep the battery cells from rupturing and is thus limited to worst-case effects of overcharging.

Failure Mode 4: 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 4: This failure mode is negated by a) circuit protection on each external circuit, b) design of battery packs, dedicated aluminum enclosure and battery cells cage for each battery pack 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 qualification and acceptance environmental tests (shock, vibration, thermal cycling, and thermal-vacuum tests).

Combined faults required for realized failure: The NTC thermistor must fail (or temperatures generated must be insufficient to cause the NTC thermistor to register the thermal rise) AND an external load must fail/short-circuit AND external over-current detection and disconnect function must fail to enable this failure mode.

Failure Mode 5: Inoperable vents.

Mitigation 5: The battery packs are not hermetically enclosed and there are gaps that allow gas to escape, mitigating any explosion hazard. The surrounding satellite structure is not hermetically sealed, so the gas will always have an escape route.

Combined faults required for realized failure: The cell manufacturer or the satellite manufacturer fails to establish proper venting.

Failure Mode 6: Crushing.

Mitigation 6: This mode is negated by battery pack and spacecraft design. Each battery pack features dedicated aluminum enclosure and battery cells cage. Furthermore, 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 battery pack aluminum enclosure, the battery cells cage and 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 7: Low level current leakage or short-circuit through battery pack case or due to moisture-based degradation of insulators.

Mitigation 7: These modes are negated by a) battery holder/case design and assembly of the battery cells with the help of non-conductive epoxy adhesive to the battery pack cage, and b) operation in vacuum such that no moisture can affect insulators.

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 battery pack aluminum enclosure, AND dislocation of battery packs AND failure to detect such failures in environmental tests must occur to result in this failure mode.

Failure Mode 8: Excess temperatures due to orbital environment and high discharge combined.

Mitigation 8: 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 The NTC thermistor must fail (or temperatures generated must be insufficient to cause the NTC thermistor to register the thermal rise) AND Discharge Over-Current monitoring and control must all fail for this failure mode to occur.

Failure Mode 9: Polarity reversal due to over-discharge caused by continuous load during periods of negative power generation vs. consumption.

Mitigation 9: In nominal operations, the spacecraft EPS design negates this mode because the processor will stop when voltage drops too low, below 26V (discharge cutoff threshold) assuming the charge circuit does not fail, also the balancer's Under Voltage Circuit will disconnect the discharge line from the batteries when the threshold of 24V is reached. This disables ALL connected loads, creating a guaranteed power-positive charging scenario. The spacecraft will not restart or connect any loads

until battery voltage is above the acceptable threshold that is with a positive increment compared to the discharge cutoff threshold. At this point, only the safe mode processor is enabled (EPS II's own microcontroller) and charging the battery commences. Once the battery reaches 90% of the peak voltage (31V), it will switch to nominal mode and will be able to receive ground commands for continuing mission functions.

Combined faults required for realized failure: The microcontroller of the EPS must stop executing code AND significant loads must be commanded/stuck "on"; AND power margin analysis must be wrong AND the balancer Under Voltage Protection must fail AND the charge control circuit must fail for this failure mode to occur.

Failure Mode 10: Excess battery temperatures due to post mission orbital environment and constant solar panel overcharge while satellite is powered off.

Mitigation 10: These battery packs have battery protection circuits, which prevent over-charge and over-heating. They are lot- tested and supplied by NKON B.V. Netherlands. The battery charging circuit cannot exceed 4.1V and thus will never overcharge the battery packs.

c. Detailed plan for any designed spacecraft breakup, including explosions and intentional collisions

The spacecraft is not designed for breakup and the mission does not include any planned explosions or collisions.

d. List of components which are passivated at EOM. List includes method of passivation and amount which cannot be passivated.

Propulsion pressure vessels

- Fully relieve fuel and oxidizer tanks

e. Rationale for all items which are required to be passivated but cannot be due to their design.

The probability of battery explosion is very low, and, due to the small mass of the satellites and their short orbital lifetimes the effect of an explosion on the far-term LEO environment is negligible, per HQ OSMA Policy Memo/Email to 8719.14: CubeSat Battery Non-Passivation, Suzanne Aleman to Justin Treptow, 10, March 2014[1]

[1] HQ OSMA Policy Memo/Email to 8719.14: CubeSat Battery Non-Passivation, Suzanne Aleman to Justin Treptow, 10, March 2014

The batteries meet Reg. 56450 (4.4-2), per this reference, by virtue of the HQ OSMA policy regarding battery disconnect stating "CubeSats as a satellite class need not disconnect their batteries if flown in LEO with orbital lifetimes less than 25 years."[2]

f. Assessment of spacecraft compliance with Requirements 4.4-1 through 4.4-4

Requirement 4.4-1: Limiting probability of accidental explosions: COMPLIANT

"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)."

Given the limited amount of stored energy and the safeguards described in the sections above there is no credible scenario for an explosion on the spacecraft.

The expected probability of accidental explosions is under 0.001 and is compliant to this requirement.

Requirement 4.4-2: Passivate to limit probability of accidental explosions: COMPLIANT

All sources of stored energy are passivated at the conclusion of the mission.

Requirement 4.4-3: Limit the long-term risk to other space systems from planned breakups: N/A

There are no planned breakups.

[2] HQ OSMA Emai1:6U CubcSat Battery Non-Passivation Suzanne Aleman to Justin Treptow, 8 August 2017

5. ODAR Section 5: Assessment of Spacecraft Potential for On-Orbit Collisions

a. Calculation of spacecraft probability of collision with space objects larger than 10 cm in diameter during the orbital lifetime of the spacecraft. Calculation of spacecraft probability of collision with space objects, including orbital debris and meteoroids, of sufficient size to prevent post mission disposal.

The total probability of accidental collision with space objects larger than 10 cm in diameter was calculated to be 1.47E-06 which is less than the required 0.001 probability.

b. Assessment of spacecraft compliance with Requirements 4.5-1 and 4.5-2

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

Requirement 4.5-2: Limit debris generated by collisions with small objects when operating in Earth orbit: COMPLIANT

6. ODAR Section 6: Assessment of Spacecraft Post Mission Disposal Plans and Procedures

The satellite will demise naturally within 5 years after the mission completion date.

a. Identification of all systems or components required to accomplish any post mission disposal operation, including passivation and maneuvering

No maneuvering capability is required, and no operational systems are required for passive demise within 5 years after the end of the mission.

Passivation of the propulsion system would require sending commands to the spacecraft at the end of mission to vent the remaining fuel and oxidizer. This would require active core subsystems to be operational. This includes the communication, data handling/ OBC, power, and propulsion subsystems.

b. Plan for any spacecraft maneuvers required to accomplish post mission disposal

No maneuvering of the vehicle is needed to accomplish a post mission disposal.

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

Parameter/ Mission Phase	Start Date	Mass *kg*	Effective Cross-Sectional Area m^2	Area to Mass Ratio m^2/kg	Initial Altitude *km*	Final Altitude *km*	Probability of Collision with Large Objects
LEOPS/ Mission Execution	L	20.20	0.1783	0.0088	510	502	7.8973E-07
Post Mission Disposal	L + 6M	20.03	0.1783	0.0089	502	0	6.8027E-07
Demise	L + 4.7Y	20.03	0.1783	0.0089	0	N/A	N/A

Table 6-1 Orbit Lifetime Calculation

d. If appropriate, preliminary plan for spacecraft controlled reentry

N/A

e. Assessment of spacecraft compliance with Requirements 4.6-1 through 4.6-4

From DAS

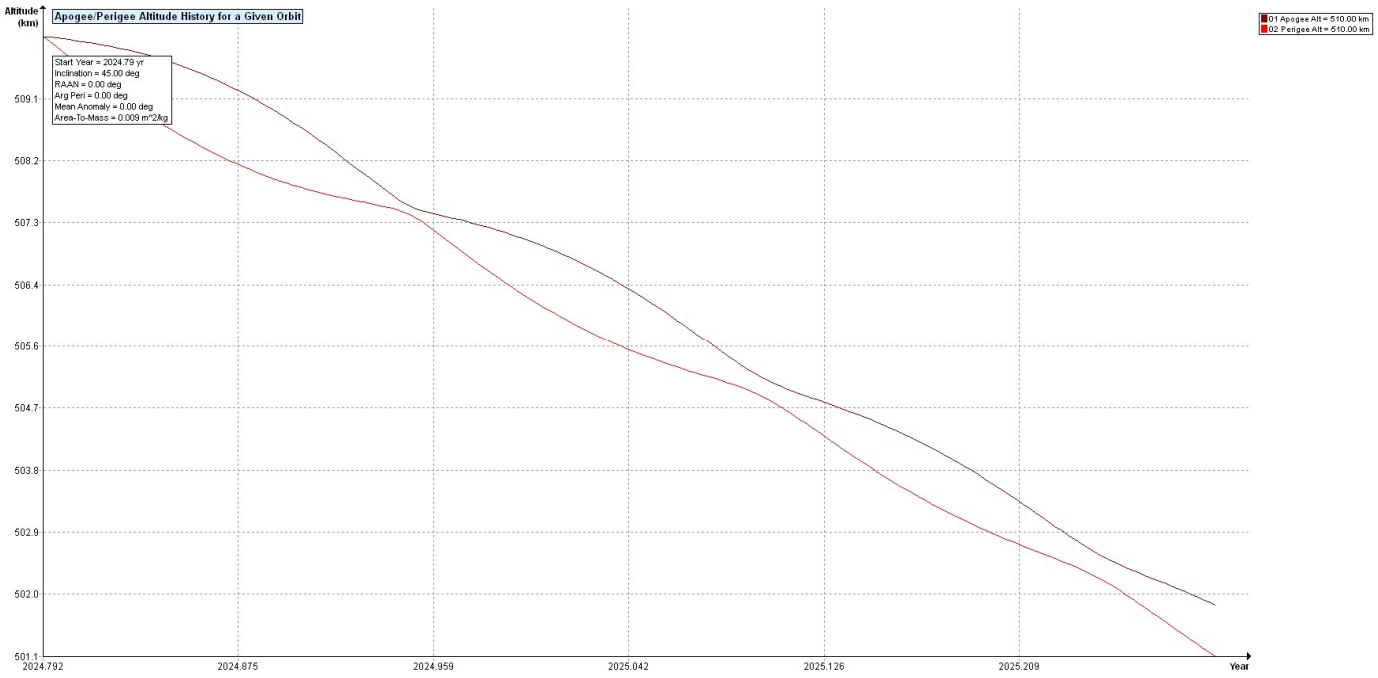


Figure 6-1: Altitude vs Time for LEOPS/Mission Execution Phase

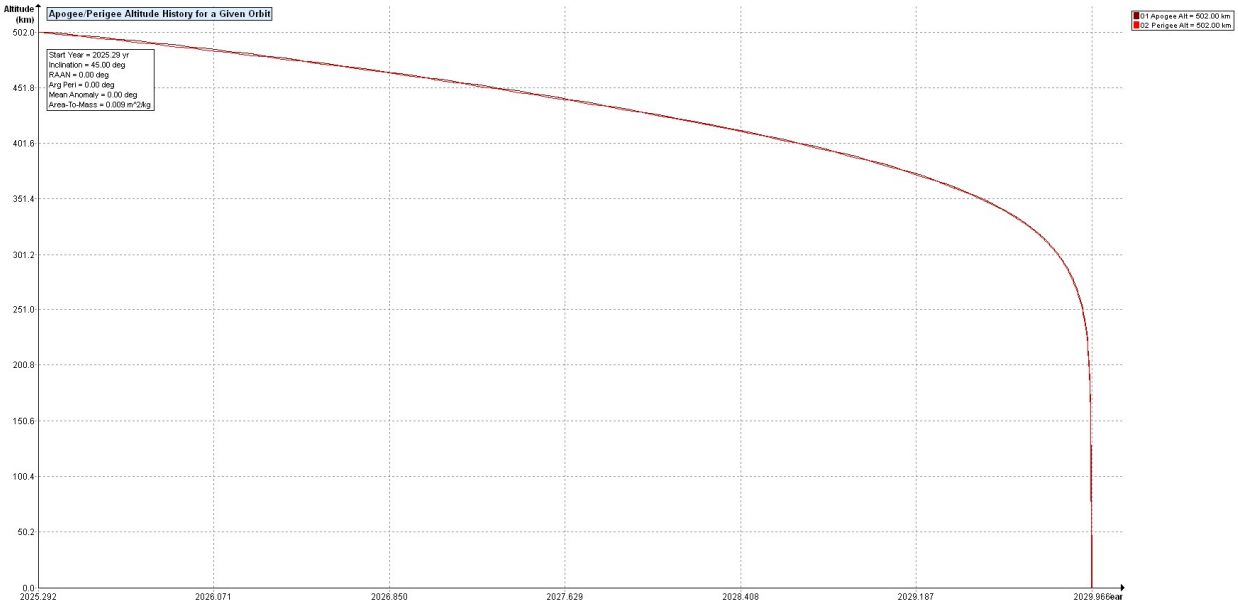


Figure 6-2: Altitude vs Time for Post Mission Disposal Phase

Requirement 4.6-1, Disposal for space structures passing through LEO: COMPLIANT

Per DAS, the deorbit is <4.7 years after the end of the mission, which is less than the FCC limit of 5 years after the end of the mission.

Requirement 4.6-2, Disposal for space structures near GEO: N/A

Requirement 4.6-3, Disposal for space structures between LEO and GEO: N/A

Requirement 4.6-4, Reliability of post-mission disposal operations: N/A

7. ODAR Section 7: Assessment of Spacecraft Reentry Hazards

a. Detailed description of spacecraft components by size, mass, material, shape, and original location on the space vehicle, if the atmospheric reentry option is selected

Table 7-1 lists spacecraft components used in the DAS reentry analysis.

Component Name	Qty	Material	Body Type	Mass (kg)	Diameter/ Width (m)	Length (m)	Height (m)
SC1	1	Aluminum 7075-T6	Box	20.03	0.2	0.4	0.2
TOPFRAME	1	Aluminum 7075-T6	Box	1.449735884	0.226	0.44	0.012
SC1BOTTOMFRAME	1	Aluminum 7075-T6	Box	0.820266618	0.226	0.44	0.012
SC1FRONTFRAME	1	Aluminum 7075-T6	Box	0.539054662	0.226	0.226	0.007
SC1REARFRAME	1	Aluminum 7075-T6	Box	0.380478916	0.226	0.226	0.007
SC1RIGHTFRAME	1	Aluminum 7075-T6	Box	0.45075758	0.21	0.44	0.008
SC1LEFTFRAME	1	Aluminum 7075-T6	Box	0.470145425	0.21	0.44	0.008
SC1MAINCAMHOLDER	1	Aluminum 7075-T6	Cylinder	0.142190317	0.086	0.0895	
SC1BUSPCBFRAME	1	Aluminum 7075-T6	Box	0.623283509	0.21	0.245	0.015
SC1BUSBPHOLDER	1	Aluminum 7075-T6	Box	0.030818754	0.09	0.096	0.008
SC1BUSCOTSHOLDER	1	Aluminum 7075-T6	Box	0.033892662	0.09	0.096	0.008
SC1REARDIAPHRAGM	1	Aluminum 7075-T6	Box	0.438124782	0.2	0.21	0.012
SC1FRONTDIAPHRAGM	1	Aluminum 7075-T6	Box	0.517123015	0.2	0.21	0.012
SC1BUSGCB3FRAME	1	Aluminum 7075-T6	Box	1.059874718	0.21	0.245	0.015
SC1IMUHOLDER	1	Aluminum 6061-T6	Box	0.069390606	0.037	0.096	0.014
SC1MAINCAMBOTTOM	1	Aluminum 7075-T6	Box	0.188269533	0.092	0.21	0.01
SC1MAINCAMMIDDLE	1	Aluminum 7075-T6	Box	0.068325785	0.092	0.12	0.008
SC1MAINCAMTOP	1	Aluminum 7075-T6	Box	0.117240725	0.092	0.21	0.01
SC1MAINCAMRIGHT	1	Aluminum 7075-T6	Box	0.053286081	0.087	0.092	0.008
SC1MAINCAMCENTER	1	Aluminum 7075-T6	Box	0.080505122	0.087	0.092	0.008
SC1MAINCAMLEFT	1	Aluminum 7075-T6	Box	0.067205196	0.087	0.092	0.008
SC1BUSBPPRESSER	2	Aluminum 7075-T6	Box	0.026246103	0.092	0.108	0.006
SC1TRACKERMOUNT	1	Aluminum 7075-T6	Box	0.110790168	0.06	0.06	0.055
SC1CUBEDEPFRAME	1	Aluminum 7075-T6	Box	0.462930938	0.105	0.243	0.037
SC1TSGDS4	1	Aluminum 7075-T6	Box	0.117177109	0.112	0.112	0.08
SC1TSGM8	1	Aluminum 7075-T6	Box	0.118979104	0.112	0.112	0.08
SC1GDS4R1HEATSINK	1	Aluminum 6061-T6	Box	0.058393493	0.075	0.096	0.01
SC1GNSSMOUINT	1	Aluminum 6061-T6	Box	0.015483431	0.048	0.096	0.006
SC1INTERFACEMOUNT	1	Aluminum 6061-T6	Box	0.015988594	0.042	0.05	0.01
GM8MTRHOUSING	1	Aluminum 7075-T6	Box	0.055	0.06	0.06	0.035
GM8MTRBRGHOLDER	1	Aluminum 7075-T6	Box	0.021	0.06	0.06	0.0135
6804ZZ	2	Steel AISI 304	Box	0.017	0.032	0.032	0.008
GM8MTRSHAFT	1	Aluminum 7075-T6	Cylinder	0.033	0.032	0.036	
GM8MTRROTOR	1	Iron	Box	0.017	0.036	0.036	0.01
GM7CONNECTORR0	1	Fiberglass	Box	0.02	0.036	0.046	0.009
SC16UDEPLOYSPST	2	Aluminum 5052	Box	0.355	0.209	0.342	0.003

Component Name	Qty	Material	Body Type	Mass (kg)	Diameter/ Width (m)	Length (m)	Height (m)
SC16UDEPLOYSPDP	2	Aluminum 5052	Box	0.3	0.195	0.33	0.003
SC1LIDARHELIOS2	1	Aluminum 6061-T6	Box	0.398	0.06	0.083	0.06
SC1BOSON640IRCAM	1	Aluminum 6061-T6	Cylinder	0.391	0.082	0.1	
SC1DCRELEASEPANEL	1	Aluminum 7075-T6	Box	0.027	0.035	0.074	0.004
SC16USOLARPANEL	1	Fiberglass	Box	0.39	0.209	0.342	0.003
SC108U Tank	1	Inconel 718	Box	0.695	0.096	0.096	0.08
SC108U Feed system	1	Steel AISI 316	Cylinder	0.1	0.018	0.05	
SC108U Structure	1	Aluminum 6061-T6	Box	0.0016	0.018	0.06	0.0065
SC1OBCI	1	Aluminum 6061-T6	Box	0.061	0.094	0.094	0.01728
OBC PCB	1	Fiberglass	Box	0.0225	0.094	0.094	0.0016
SC1SBAND	1	Aluminum 6061-T6	Box	0.1399	0.094	0.094	0.0185
SBand TMTC Transceiver PCB	1	Fiberglass	Box	0.02	0.094	0.094	0.0013
SC1XBAND	1	Aluminum 6061-T6	Box	0.175	0.0959	0.0959	0.0266
XBand Tx Baseband PCB	1	Fiberglass	Box	0.073	0.0959	0.0959	0.0045
XBand Tx BUC PCB	1	Fiberglass	Box	0.016	0.0959	0.0959	0.001
SC1 X BAND ANTENNA 2X2	1	Fiberglass	Box	0.0235	0.06	0.06	0.004
SC1ESPIIPDM	1	Aluminum 6061-T6	Box	0.129	0.0957	0.0957	0.0197
EPS Type II PDM PCB	1	Fiberglass	Box	0.13	0.0937	0.0937	0.0083
SC1ESPIIBP8	3	Aluminum 6061-T6	Box	0.2838	0.0957	0.0957	0.0677
EPS Type II BP8S 1P Input PCB	3	Fiberglass	Box	0.12	0.0937	0.0937	0.008
EPS Type II BP8S 1P Balancer PCB	3	Fiberglass	Box	0.0535	0.0882	0.0882	0.004
Cage Half	6	Aluminum 6061-T6	Box	0.0638	0.0845	0.0845	0.045
Battery Cell	24	Aluminum 6061-T6	Cylinder	0.05	0.019	0.07	
SC1SBANDANTENNA	2	Fiberglass	Box	0.114	0.098	0.098	0.007
SC1SRFSPLITTER HYBRID COUPLER	1	Aluminum 6061-T6	Box	0.0724	0.0956	0.0956	0.0072
SC1SRFSPLITTER HYBRID COUPLER PC BOARD	1	Fiberglass	Box	0.02	0.0956	0.0956	0.0012
SC1CUBETORQUER	3	Iron	Cylinder	0.0145	0.006	0.12	
SC1CUBEWHEELPMIDHousing	1	Aluminum 6061-T6	Box	0.0501	0.1	0.1	0.05
SC1CUBEWHEELPMIDLid	1	Aluminum 6061-T6	Box	0.0344	0.1	0.1	0.05
SC1CUBEWHEELPMIDFlywheel	1	Steel AISI 410	Box	0.278	0.1	0.1	0.05
SC1CUBEWHEELPMIDBase	1	Aluminum 6061-T6	Box	0.0412	0.08	0.08	0.04
SC1GNSSMODULE	1	Fiberglass	Box	0.031	0.045	0.075	0.005
SC1DEORBIT	1	Aluminum 7075-T6	Box	0.14	0.08	0.08	0.035
GDS4R1	1	Fiberglass	Box	0.03	0.075	0.075	0.006
GCB3R2	1	Fiberglass	Box	0.105	0.095	0.24	0.005
BPCONNECT	2	Fiberglass	Box	0.03	0.082	0.095	0.005
PAYLOADPDUR1	1	Fiberglass	Box	0.03	0.09	0.15	0.005
SC1GNSSADAPTER	1	Fiberglass	Box	0.015	0.045	0.075	0.005
SC1BUSPINADAPTER	1	Fiberglass	Box	0.03	0.082	0.095	0.005
SC1ADCSR1	1	Fiberglass	Box	0.095	0.095	0.24	0.005

Table 7-1: SC1 Components List

b. Summary of objects expected to survive an uncontrolled reentry, using NASA Debris Assessment Software (DAS).

Table 7-2 lists the components expected to survive reentry

Name	Qty	Material	Body Type	Mass (kg)	Diameter/ Width (m)	Length (m)	Height (m)	Demise Alt	Total DCA	KE
SC1CUBEWHEELPMIDFlywheel	1	Steel AISI 410	Box	0.278	0.1	0.1	0.05	0	0.41	87.34

Table 7-2: SC1 Components Survival List

c. Calculation of probability of human casualty for the expected year of uncontrolled reentry and the spacecraft orbital inclination

The risk of human casualty is 1:126400 from DAS.

d. Assessment of spacecraft compliance with Requirement 4.7-1

Requirement 4.7-1, Limit the risk of human casualty: COMPLIANT

8. ODAR Section 8: Assessment for Special Classes of Space Missions

Specify the special mission class(es) and detail how the ODAR addresses additional measures applied to the mission.

N/A - SC1 is not a member of any special class of mission.

Requirement 4.8-1, Assessment of compliance for special classes of space missions: N/A

9. ODAR Sections 9-14: Launch Vehicle

Sections 9 through 14 pertain to the Launch Vehicle for SC1 and are not covered in this document.

Appendix A – DAS Activity Log

Activity log for LEOPS/Mission Execution Phase

06 17 2024; 15:53:52PM Activity Log Started

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

========== End of Requirement 4.3-1 ==========
06 17 2024; 15:57:26PM Processing Requirement 4.3-2: Return Status : Passed

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

========== End of Requirement 4.3-2 ==========
06 17 2024; 16:00:31PM Processing Requirement 4.5-1: Return Status : Passed

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

INPUT

Space Structure Name = SC1
Space Structure Type = Payload
Perigee Altitude = 510.000 (km)
Apogee Altitude = 510.000 (km)
Inclination = 45.000 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass Ratio = 0.0089 (m^2/kg)
Start Year = 2024.792 (yr)
Initial Mass = 20.200 (kg)
Final Mass = 20.030 (kg)
Duration = 0.500 (yr)
Station-Kept = False
Abandoned = True
Long-Term Reentry = False

OUTPUT

Collision Probability = 7.8973E-07
Returned Message: Normal Processing
Date Range Message: Normal Date Range
Status = Pass

==========

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

06 17 2024; 16:00:48PM Processing Requirement 4.6 Return Status : Passed

==========
Project Data
==========

INPUT

Space Structure Name = SC1
Space Structure Type = Payload

Perigee Altitude = 510.000000 (km)
Apogee Altitude = 510.000000 (km)
Inclination = 45.000000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.008900 (m^2/kg)
Start Year = 2024.792000 (yr)
Initial Mass = 20.200000 (kg)
Final Mass = 20.030000 (kg)
Duration = 0.500000 (yr)
Station Kept = False
Abandoned = True
PMD Perigee Altitude = 501.115504 (km)
PMD Apogee Altitude = 501.843527 (km)
PMD Inclination = 44.996634 (deg)
PMD RAAN = 92.879353 (deg)
PMD Argument of Perigee = 341.815043 (deg)
PMD Mean Anomaly = 0.000000 (deg)
Long-Term Reentry = False

OUTPUT

Suggested Perigee Altitude = 501.115504 (km)
Suggested Apogee Altitude = 501.843527 (km)
Returned Error Message = Passes LEO reentry orbit criteria.

Released Year = 2029 (yr)
Requirement = 61
Compliance Status = Pass

==========

========== End of Requirement 4.6 ==========
06 17 2024; 16:01:15PM *********Processing Requirement 4.7-1

Return Status : Passed

**********INPUT****
 Item Number = 1

name = SC1
quantity = 1
parent = 0
materialID = 9
type = Box
Aero Mass = 20.030001
Thermal Mass = 20.030001
Diameter/Width = 0.200000
Length = 0.400000
Height = 0.200000

name = TOPFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 1.449736
Thermal Mass = 1.449736
Diameter/Width = 0.226000
Length = 0.440000
Height = 0.012000

name = SC1BOTTOMFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.820267
Thermal Mass = 0.820267
Diameter/Width = 0.226000
Length = 0.440000
Height = 0.012000

name = SC1FRONTFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.539055
Thermal Mass = 0.539055
Diameter/Width = 0.226000
Length = 0.226000
Height = 0.007000

name = SC1REARFRAME
quantity = 1

parent = 1
materialID = 9
type = Box
Aero Mass = 0.380479
Thermal Mass = 0.380479
Diameter/Width = 0.226000
Length = 0.226000
Height = 0.007000

name = SC1RIGHTFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.450758
Thermal Mass = 0.450758
Diameter/Width = 0.210000
Length = 0.440000
Height = 0.008000

name = SC1LEFTFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.470145
Thermal Mass = 0.470145
Diameter/Width = 0.210000
Length = 0.440000
Height = 0.008000

name = SC1MAINCAMHOLDER
quantity = 1
parent = 1
materialID = 9
type = Cylinder
Aero Mass = 0.142190
Thermal Mass = 0.142190
Diameter/Width = 0.086000
Length = 0.089500

name = SC1BUSPCBFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.623284
Thermal Mass = 0.623284
Diameter/Width = 0.210000
Length = 0.245000
Height = 0.015000

name = SC1BUSBPHOLDER
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.030819
Thermal Mass = 0.030819
Diameter/Width = 0.090000
Length = 0.096000
Height = 0.008000

name = SC1BUSCOTSHOLDER
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.033893
Thermal Mass = 0.033893
Diameter/Width = 0.090000
Length = 0.096000
Height = 0.008000

name = SC1REARDIAPHRAGM
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.438125
Thermal Mass = 0.438125
Diameter/Width = 0.200000
Length = 0.210000
Height = 0.012000

name = SC1FRONTDIAPHRAGM
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.517123
Thermal Mass = 0.517123
Diameter/Width = 0.200000
Length = 0.210000
Height = 0.012000

name = SC1BUSGCB3FRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 1.059875

Thermal Mass = 1.059875
Diameter/Width = 0.210000
Length = 0.245000
Height = 0.015000

name = SC1IMUHOLDER
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.069391
Thermal Mass = 0.069391
Diameter/Width = 0.037000
Length = 0.096000
Height = 0.014000

name = SC1MAINCAMBOTTOM
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.188270
Thermal Mass = 0.188270
Diameter/Width = 0.092000
Length = 0.210000
Height = 0.010000

name = SC1MAINCAMMIDDLE
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.068326
Thermal Mass = 0.068326
Diameter/Width = 0.092000
Length = 0.120000
Height = 0.008000

name = SC1MAINCAMTOP
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.117241
Thermal Mass = 0.117241
Diameter/Width = 0.092000
Length = 0.210000
Height = 0.010000

name = SC1MAINCAMRIGHT
quantity = 1

parent = 1
materialID = 9
type = Box
Aero Mass = 0.053286
Thermal Mass = 0.053286
Diameter/Width = 0.087000
Length = 0.092000
Height = 0.008000

name = SC1MAINCAMCENTER
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.080505
Thermal Mass = 0.080505
Diameter/Width = 0.087000
Length = 0.092000
Height = 0.008000

name = SC1MAINCAMLEFT
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.067205
Thermal Mass = 0.067205
Diameter/Width = 0.087000
Length = 0.092000
Height = 0.008000

name = SC1BUSBPPRESSER
quantity = 2
parent = 1
materialID = 9
type = Box
Aero Mass = 0.026246
Thermal Mass = 0.026246
Diameter/Width = 0.092000
Length = 0.108000
Height = 0.006000

name = SC1TRACKERMOUNT
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.110790
Thermal Mass = 0.110790
Diameter/Width = 0.060000
Length = 0.060000

Height = 0.055000

name = SC1CUBEDEPFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.462931
Thermal Mass = 0.462931
Diameter/Width = 0.105000
Length = 0.243000
Height = 0.037000

name = SC1TSGDS4
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.117177
Thermal Mass = 0.117177
Diameter/Width = 0.112000
Length = 0.112000
Height = 0.080000

name = SC1TSGM8
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.118979
Thermal Mass = 0.118979
Diameter/Width = 0.112000
Length = 0.112000
Height = 0.080000

name = SC1GDS4R1HEATSINK
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.058393
Thermal Mass = 0.058393
Diameter/Width = 0.075000
Length = 0.096000
Height = 0.010000

name = SC1GNSSMOUINT
quantity = 1
parent = 1
materialID = 8
type = Box

Aero Mass = 0.015483
Thermal Mass = 0.015483
Diameter/Width = 0.048000
Length = 0.096000
Height = 0.006000

name = SC1INTERFACEMOUNT
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.015989
Thermal Mass = 0.015989
Diameter/Width = 0.042000
Length = 0.050000
Height = 0.010000

name = GM8MTRHOUSING
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.055000
Thermal Mass = 0.055000
Diameter/Width = 0.060000
Length = 0.060000
Height = 0.035000

name = GM8MTRBRGHOLDER
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.021000
Thermal Mass = 0.021000
Diameter/Width = 0.060000
Length = 0.060000
Height = 0.013500

name = 6804ZZ
quantity = 2
parent = 1
materialID = 58
type = Box
Aero Mass = 0.017000
Thermal Mass = 0.017000
Diameter/Width = 0.032000
Length = 0.032000
Height = 0.008000

name = GM8MTRSHAFT

quantity = 1
parent = 1
materialID = 9
type = Cylinder
Aero Mass = 0.033000
Thermal Mass = 0.033000
Diameter/Width = 0.032000
Length = 0.036000

name = GM8MTRROTOR
quantity = 1
parent = 1
materialID = 38
type = Box
Aero Mass = 0.017000
Thermal Mass = 0.017000
Diameter/Width = 0.036000
Length = 0.036000
Height = 0.010000

name = GM7CONNECTORR0
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.020000
Thermal Mass = 0.020000
Diameter/Width = 0.036000
Length = 0.046000
Height = 0.009000

name = SC16UDEPLOYSPST
quantity = 2
parent = 1
materialID = 7
type = Box
Aero Mass = 0.355000
Thermal Mass = 0.355000
Diameter/Width = 0.209000
Length = 0.342000
Height = 0.003000

name = SC16UDEPLOYSPDP
quantity = 2
parent = 1
materialID = 7
type = Box
Aero Mass = 0.300000
Thermal Mass = 0.300000
Diameter/Width = 0.195000
Length = 0.330000

Height = 0.003000

name = SC1LIDARHELIOS2
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.398000
Thermal Mass = 0.398000
Diameter/Width = 0.060000
Length = 0.083000
Height = 0.060000

name = SC1BOSON640IRCAM
quantity = 1
parent = 1
materialID = 8
type = Cylinder
Aero Mass = 0.391000
Thermal Mass = 0.391000
Diameter/Width = 0.082000
Length = 0.100000

name = SC1DCRELEASEPANEL
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.027000
Thermal Mass = 0.027000
Diameter/Width = 0.035000
Length = 0.074000
Height = 0.004000

name = SC16USOLARPANEL
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.390000
Thermal Mass = 0.390000
Diameter/Width = 0.209000
Length = 0.342000
Height = 0.003000

name = SC108U Tank
quantity = 1
parent = 1
materialID = 37
type = Box
Aero Mass = 0.695000

Thermal Mass = 0.695000
Diameter/Width = 0.096000
Length = 0.096000
Height = 0.080000

name = SC108U Feed system
quantity = 1
parent = 1
materialID = 59
type = Cylinder
Aero Mass = 0.100000
Thermal Mass = 0.100000
Diameter/Width = 0.018000
Length = 0.050000

name = SC108U Structure
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.001600
Thermal Mass = 0.001600
Diameter/Width = 0.018000
Length = 0.060000
Height = 0.006500

name = SC1OBCI
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.083500
Thermal Mass = 0.061000
Diameter/Width = 0.094000
Length = 0.094000
Height = 0.017280

name = OBC PCB
quantity = 1
parent = 45
materialID = 23
type = Box
Aero Mass = 0.022500
Thermal Mass = 0.022500
Diameter/Width = 0.094000
Length = 0.094000
Height = 0.001600

name = SC1SBAND
quantity = 1
parent = 1

materialID = 8
type = Box
Aero Mass = 0.159900
Thermal Mass = 0.139900
Diameter/Width = 0.094000
Length = 0.094000
Height = 0.018500

name = SBand TMTC Transceiver PCB
quantity = 1
parent = 47
materialID = 23
type = Box
Aero Mass = 0.020000
Thermal Mass = 0.020000
Diameter/Width = 0.094000
Length = 0.094000
Height = 0.001300

name = SC1XBAND
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.264000
Thermal Mass = 0.175000
Diameter/Width = 0.095900
Length = 0.095900
Height = 0.026600

name = XBand Tx Baseband PCB
quantity = 1
parent = 49
materialID = 23
type = Box
Aero Mass = 0.073000
Thermal Mass = 0.073000
Diameter/Width = 0.095900
Length = 0.095900
Height = 0.004500

name = XBand Tx BUC PCB
quantity = 1
parent = 49
materialID = 23
type = Box
Aero Mass = 0.016000
Thermal Mass = 0.016000
Diameter/Width = 0.095900
Length = 0.095900
Height = 0.001000

name = SC1 X BAND ANTENNA 2X2
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.023500
Thermal Mass = 0.023500
Diameter/Width = 0.060000
Length = 0.060000
Height = 0.004000

name = SC1ESPIIPDM
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.259000
Thermal Mass = 0.129000
Diameter/Width = 0.095700
Length = 0.095700
Height = 0.019700

name = EPS Type II PDM PCB
quantity = 1
parent = 53
materialID = 23
type = Box
Aero Mass = 0.130000
Thermal Mass = 0.130000
Diameter/Width = 0.093700
Length = 0.093700
Height = 0.008300

name = SC1ESPIIBP8
quantity = 3
parent = 1
materialID = 8
type = Box
Aero Mass = 0.984900
Thermal Mass = 0.283800
Diameter/Width = 0.095700
Length = 0.095700
Height = 0.067700

name = EPS Type II BP8S 1P Input PCB
quantity = 3
parent = 55
materialID = 23
type = Box
Aero Mass = 0.120000

Thermal Mass = 0.120000
Diameter/Width = 0.093700
Length = 0.093700
Height = 0.008000

name = EPS Type II BP8S 1P Balancer PCB
quantity = 3
parent = 55
materialID = 23
type = Box
Aero Mass = 0.053500
Thermal Mass = 0.053500
Diameter/Width = 0.088200
Length = 0.088200
Height = 0.004000

name = Cage Half
quantity = 6
parent = 55
materialID = 8
type = Box
Aero Mass = 0.063800
Thermal Mass = 0.063800
Diameter/Width = 0.084500
Length = 0.084500
Height = 0.045000

name = Battery Cell
quantity = 24
parent = 55
materialID = 8
type = Cylinder
Aero Mass = 0.050000
Thermal Mass = 0.050000
Diameter/Width = 0.019000
Length = 0.070000

name = SC1SBANDANTENNA
quantity = 2
parent = 1
materialID = 23
type = Box
Aero Mass = 0.114000
Thermal Mass = 0.114000
Diameter/Width = 0.098000
Length = 0.098000
Height = 0.007000

name = SC1SRFSPLITTER HYBRID COUPLER
quantity = 1
parent = 1

materialID = 8
type = Box
Aero Mass = 0.092400
Thermal Mass = 0.072400
Diameter/Width = 0.095600
Length = 0.095600
Height = 0.007200

name = SC1SRFSPLITTER HYBRID COUPLER PC BOARD
quantity = 1
parent = 61
materialID = 23
type = Box
Aero Mass = 0.020000
Thermal Mass = 0.020000
Diameter/Width = 0.095600
Length = 0.095600
Height = 0.001200

name = SC1CUBETORQUER
quantity = 3
parent = 1
materialID = 38
type = Cylinder
Aero Mass = 0.014500
Thermal Mass = 0.014500
Diameter/Width = 0.006000
Length = 0.120000

name = SC1CUBEWHEELPMIDHousing
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.403700
Thermal Mass = 0.050100
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.050000

name = SC1CUBEWHEELPMIDLid
quantity = 1
parent = 64
materialID = 8
type = Box
Aero Mass = 0.034400
Thermal Mass = 0.034400
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.050000

name = SC1CUBEWHEELPMIDFlywheel
quantity = 1
parent = 64
materialID = 62
type = Box
Aero Mass = 0.278000
Thermal Mass = 0.278000
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.050000

name = SC1CUBEWHEELPMIDBase
quantity = 1
parent = 64
materialID = 8
type = Box
Aero Mass = 0.041200
Thermal Mass = 0.041200
Diameter/Width = 0.080000
Length = 0.080000
Height = 0.040000

name = SC1GNSSMODULE
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.031000
Thermal Mass = 0.031000
Diameter/Width = 0.045000
Length = 0.075000
Height = 0.005000

name = SC1DEORBIT
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.140000
Thermal Mass = 0.140000
Diameter/Width = 0.080000
Length = 0.080000
Height = 0.035000

name = GDS4R1
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.030000
Thermal Mass = 0.030000

Diameter/Width = 0.075000
Length = 0.075000
Height = 0.006000

name = GCB3R2
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.105000
Thermal Mass = 0.105000
Diameter/Width = 0.095000
Length = 0.240000
Height = 0.005000

name = BPCONNECT
quantity = 2
parent = 1
materialID = 23
type = Box
Aero Mass = 0.030000
Thermal Mass = 0.030000
Diameter/Width = 0.082000
Length = 0.095000
Height = 0.005000

name = PAYLOADPDUR1
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.030000
Thermal Mass = 0.030000
Diameter/Width = 0.090000
Length = 0.150000
Height = 0.005000

name = SC1GNSSADAPTER
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.015000
Thermal Mass = 0.015000
Diameter/Width = 0.045000
Length = 0.075000
Height = 0.005000

name = SC1BUSPINADAPTER
quantity = 1
parent = 1

materialID = 23
type = Box
Aero Mass = 0.030000
Thermal Mass = 0.030000
Diameter/Width = 0.082000
Length = 0.095000
Height = 0.005000

name = SC1ADCSR1
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.095000
Thermal Mass = 0.095000
Diameter/Width = 0.095000
Length = 0.240000
Height = 0.005000

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

name = SC1
Demise Altitude = 77.999185
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = TOPFRAME
Demise Altitude = 75.627397
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BOTTOMFRAME
Demise Altitude = 76.660901
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1FRONTFRAME
Demise Altitude = 76.320615
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1REARFRAME
Demise Altitude = 76.812587
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1RIGHTFRAME
Demise Altitude = 77.218341
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1LEFTFRAME
Demise Altitude = 77.184574
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMHOLDER
Demise Altitude = 76.704535
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSPCBFRAME
Demise Altitude = 76.240530
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSBPHOLDER
Demise Altitude = 77.665344
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSCOTSHOLDER
Demise Altitude = 77.632544
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1REARDIAPHRAGM
Demise Altitude = 76.504589
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1FRONTDIAPHRAGM
Demise Altitude = 76.234128
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSGCB3FRAME
Demise Altitude = 75.020303

Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1IMUHOLDER
Demise Altitude = 77.536820
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMBOTTOM
Demise Altitude = 77.028422
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMMIDDLE
Demise Altitude = 77.406320
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMTOP
Demise Altitude = 77.395459
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMRIGHT
Demise Altitude = 77.383888
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMCENTER
Demise Altitude = 77.073519
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMLEFT
Demise Altitude = 77.221197
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSBPPRESSER
Demise Altitude = 77.741609
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1TRACKERMOUNT
Demise Altitude = 76.770255
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBEDEPFRAME
Demise Altitude = 76.484442
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1TSGDS4
Demise Altitude = 77.455768
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1TSGM8
Demise Altitude = 77.444725
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1GDS4R1HEATSINK
Demise Altitude = 77.720509
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1GNSSMOUINT
Demise Altitude = 77.895844
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1INTERFACEMOUNT
Demise Altitude = 77.808204
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM8MTRHOUSING
Demise Altitude = 77.229904
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM8MTRBRGHOLDER
Demise Altitude = 77.598463

Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = 6804ZZ
Demise Altitude = 75.183912
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM8MTRSHAFT
Demise Altitude = 76.631540
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM8MTRROTOR
Demise Altitude = 75.954633
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM7CONNECTORR0
Demise Altitude = 77.263909
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC16UDEPLOYSPST
Demise Altitude = 77.212254
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC16UDEPLOYSPDP
Demise Altitude = 77.284447
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1LIDARHELIOS2
Demise Altitude = 76.691239
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BOSON640IRCAM
Demise Altitude = 76.582188
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1DCRELEASEPANEL
Demise Altitude = 77.286388
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC16USOLARPANEL
Demise Altitude = 77.044945
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC108U Tank
Demise Altitude = 70.498220
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC108U Feed system
Demise Altitude = 71.658699
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC108U Structure
Demise Altitude = 77.983083
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1OBCI
Demise Altitude = 77.758446
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = OBC PCB
Demise Altitude = 77.458755
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1SBAND
Demise Altitude = 77.447910
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SBand TMTC Transceiver PCB
Demise Altitude = 77.181868

Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1XBAND
Demise Altitude = 77.384892
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = XBand Tx Baseband PCB
Demise Altitude = 76.488227
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = XBand Tx BUC PCB
Demise Altitude = 77.183404
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1 X BAND ANTENNA 2X2
Demise Altitude = 77.422761
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1ESPIIPDM
Demise Altitude = 77.513166
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = EPS Type II PDM PCB
Demise Altitude = 75.961251
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1ESPIIBP8
Demise Altitude = 77.303469
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = EPS Type II BP8S 1P Input PCB
Demise Altitude = 75.910479
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = EPS Type II BP8S 1P Balancer PCB
Demise Altitude = 76.583331
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = Cage Half
Demise Altitude = 77.084126
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = Battery Cell
Demise Altitude = 76.541651
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1SBANDANTENNA
Demise Altitude = 76.729275
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1SRFSPLITTER HYBRID COUPLER
Demise Altitude = 77.681432
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1SRFSPLITTER HYBRID COUPLER PC BOARD
Demise Altitude = 77.419017
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBETORQUER
Demise Altitude = 76.587664
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBEWHEELPMIDHousing
Demise Altitude = 77.867324
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBEWHEELPMIDLid
Demise Altitude = 77.774629

Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBEWHEELPMIDFlywheel
Demise Altitude = 0.000000
Debris Casualty Area = 0.405372
Impact Kinetic Energy = 87.342253

****
name = SC1CUBEWHEELPMIDBase
Demise Altitude = 77.708740
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1GNSSMODULE
Demise Altitude = 77.298528
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1DEORBIT
Demise Altitude = 76.637363
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GDS4R1
Demise Altitude = 77.495413
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GCB3R2
Demise Altitude = 77.453131
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = BPCONNECT
Demise Altitude = 77.611242
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = PAYLOADPDUR1
Demise Altitude = 77.763732
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1GNSSADAPTER
Demise Altitude = 77.659018
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSPINADAPTER
Demise Altitude = 77.611242
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1ADCSR1
Demise Altitude = 77.502890
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****

========== End of Requirement 4.7-1 ==========
06 17 2024; 16:01:15PM Project Data Saved To File
06 17 2024; 16:02:21PM Science and Engineering - Apogee/Perigee History for a Given Orbit

INPUT

Perigee Altitude = 510.000000 (km)
Apogee Altitude = 510.000000 (km)
Inclination = 45.000000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.008800 (m^2/kg)
Start Year = 2024.792000 (yr)
Integration Time = 0.500000 (yr)

OUTPUT

Plot
06 17 2024; 16:13:21PM Project Data Saved To File
06 17 2024; 16:13:41PM Project Data Saved To File
06 17 2024; 16:13:41PM Science and Engineering - Cross Sectional Area Plot

INPUT

Satellite Orientation = Random Tumbling
Component Shapes - Number of Items = 14
Number of [v,w,u] Triangles = 14

Point 1 [0.000,0.000,0.000]
Point 2 [0.000,0.225,0.000]

Point 3 [0.000,0.000,0.225]

Point 1 [0.000,0.225,0.225]
Point 2 [0.000,0.000,0.225]
Point 3 [0.000,0.225,0.000]

Point 1 [0.000,0.000,0.225]
Point 2 [0.000,0.000,0.000]
Point 3 [0.454,0.000,0.000]

Point 1 [0.000,0.000,0.225]
Point 2 [0.454,0.000,0.000]
Point 3 [0.454,0.000,0.225]

Point 1 [0.000,0.000,0.225]
Point 2 [0.000,0.225,0.225]
Point 3 [0.454,0.000,0.225]

Point 1 [0.454,0.000,0.225]
Point 2 [0.454,0.225,0.225]
Point 3 [0.000,0.225,0.225]

Point 1 [0.000,0.000,0.000]
Point 2 [0.454,0.000,0.000]
Point 3 [0.000,0.225,0.000]

Point 1 [0.000,0.225,0.000]
Point 2 [0.454,0.225,0.000]
Point 3 [0.454,0.000,0.000]

Point 1 [0.000,0.225,-0.202]
Point 2 [0.000,0.225,0.427]
Point 3 [0.342,0.225,0.427]

Point 1 [0.000,0.225,-0.202]
Point 2 [0.342,0.225,-0.202]
Point 3 [0.342,0.225,0.427]

Point 1 [0.342,0.225,0.000]
Point 2 [0.454,0.225,0.000]
Point 3 [0.454,0.225,0.225]

Point 1 [0.342,0.225,0.000]
Point 2 [0.342,0.225,0.225]
Point 3 [0.454,0.225,0.225]

Point 1 [0.454,0.000,0.000]
Point 2 [0.454,0.000,0.225]
Point 3 [0.454,0.225,0.225]

Point 1 [0.454,0.000,0.000]

Point 2 [0.454,0.225,0.000]
Point 3 [0.454,0.225,0.225]

Number of [v,w,u] Cylinders = 0

Number of [v,w,u] Spheres = 0

OUTPUT

Plot
06 17 2024; 16:18:17PM Project Data Saved To File

Activity log for Post Mission Disposal Phase

06 17 2024; 16:22:59PM Activity Log Started
==========
No Project Data Available
==========

========== End of Requirement 4.3-1 ==========
06 17 2024; 16:25:44PM Processing Requirement 4.3-2: Return Status : Passed

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

========== End of Requirement 4.3-2 ==========
06 17 2024; 16:28:08PM Processing Requirement 4.5-1: Return Status : Passed

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

INPUT

Space Structure Name = SC1
Space Structure Type = Payload
Perigee Altitude = 502.000 (km)
Apogee Altitude = 502.000 (km)
Inclination = 45.000 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass Ratio = 0.0089 (m^2/kg)
Start Year = 2025.292 (yr)
Initial Mass = 20.030 (kg)
Final Mass = 20.030 (kg)
Duration = 4.700 (yr)
Station-Kept = False
Abandoned = True
Long-Term Reentry = False

OUTPUT

Collision Probability = 6.8027E-07
Returned Message: Normal Processing
Date Range Message: Normal Date Range
Status = Pass

==========

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

06 17 2024; 16:30:06PM Processing Requirement 4.6 Return Status : Passed

==========
Project Data
==========

INPUT

Space Structure Name = SC1
Space Structure Type = Payload

Perigee Altitude = 502.000000 (km)
Apogee Altitude = 502.000000 (km)
Inclination = 45.000000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.008900 (m^2/kg)
Start Year = 2025.292000 (yr)
Initial Mass = 20.030000 (kg)
Final Mass = 20.030000 (kg)
Duration = 4.700000 (yr)
Station Kept = False
Abandoned = True
PMD Perigee Altitude = -1.000000 (km)
PMD Apogee Altitude = -1.000000 (km)
PMD Inclination = 0.000000 (deg)
PMD RAAN = 0.000000 (deg)
PMD Argument of Perigee = 0.000000 (deg)
PMD Mean Anomaly = 0.000000 (deg)
Long-Term Reentry = False

OUTPUT

Suggested Perigee Altitude = 502.000000 (km)
Suggested Apogee Altitude = 502.000000 (km)
Returned Error Message = Reentry during mission (no PMD req.).

Released Year = 2029 (yr)
Requirement = 61
Compliance Status = Pass

==========

========== End of Requirement 4.6 ==========
06 17 2024; 16:30:39PM *********Processing Requirement 4.7-1
Return Status : Passed

**********INPUT****
Item Number = 1

name = SC1
quantity = 1
parent = 0
materialID = 9
type = Box
Aero Mass = 20.030001
Thermal Mass = 20.030001
Diameter/Width = 0.200000
Length = 0.400000
Height = 0.200000

name = TOPFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 1.449736
Thermal Mass = 1.449736
Diameter/Width = 0.226000
Length = 0.440000
Height = 0.012000

name = SC1BOTTOMFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.820267
Thermal Mass = 0.820267
Diameter/Width = 0.226000
Length = 0.440000
Height = 0.012000

name = SC1FRONTFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.539055
Thermal Mass = 0.539055
Diameter/Width = 0.226000
Length = 0.226000
Height = 0.007000

name = SC1REARFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.380479
Thermal Mass = 0.380479

Diameter/Width = 0.226000
Length = 0.226000
Height = 0.007000

name = SC1RIGHTFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.450758
Thermal Mass = 0.450758
Diameter/Width = 0.210000
Length = 0.440000
Height = 0.008000

name = SC1LEFTFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.470145
Thermal Mass = 0.470145
Diameter/Width = 0.210000
Length = 0.440000
Height = 0.008000

name = SC1MAINCAMHOLDER
quantity = 1
parent = 1
materialID = 9
type = Cylinder
Aero Mass = 0.142190
Thermal Mass = 0.142190
Diameter/Width = 0.086000
Length = 0.089500

name = SC1BUSPCBFRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.623284
Thermal Mass = 0.623284
Diameter/Width = 0.210000
Length = 0.245000
Height = 0.015000

name = SC1BUSBPHOLDER
quantity = 1
parent = 1
materialID = 9

type = Box
Aero Mass = 0.030819
Thermal Mass = 0.030819
Diameter/Width = 0.090000
Length = 0.096000
Height = 0.008000

name = SC1BUSCOTSHOLDER
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.033893
Thermal Mass = 0.033893
Diameter/Width = 0.090000
Length = 0.096000
Height = 0.008000

name = SC1REARDIAPHRAGM
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.438125
Thermal Mass = 0.438125
Diameter/Width = 0.200000
Length = 0.210000
Height = 0.012000

name = SC1FRONTDIAPHRAGM
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.517123
Thermal Mass = 0.517123
Diameter/Width = 0.200000
Length = 0.210000
Height = 0.012000

name = SC1BUSGCB3FRAME
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 1.059875
Thermal Mass = 1.059875
Diameter/Width = 0.210000
Length = 0.245000
Height = 0.015000

name = SC1IMUHOLDER
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.069391
Thermal Mass = 0.069391
Diameter/Width = 0.037000
Length = 0.096000
Height = 0.014000

name = SC1MAINCAMBOTTOM
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.188270
Thermal Mass = 0.188270
Diameter/Width = 0.092000
Length = 0.210000
Height = 0.010000

name = SC1MAINCAMMIDDLE
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.068326
Thermal Mass = 0.068326
Diameter/Width = 0.092000
Length = 0.120000
Height = 0.008000

name = SC1MAINCAMTOP
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.117241
Thermal Mass = 0.117241
Diameter/Width = 0.092000
Length = 0.210000
Height = 0.010000

name = SC1MAINCAMRIGHT
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.053286
Thermal Mass = 0.053286

Diameter/Width = 0.087000
Length = 0.092000
Height = 0.008000

name = SC1MAINCAMCENTER
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.080505
Thermal Mass = 0.080505
Diameter/Width = 0.087000
Length = 0.092000
Height = 0.008000

name = SC1MAINCAMLEFT
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.067205
Thermal Mass = 0.067205
Diameter/Width = 0.087000
Length = 0.092000
Height = 0.008000

name = SC1BUSBPPRESSER
quantity = 2
parent = 1
materialID = 9
type = Box
Aero Mass = 0.026246
Thermal Mass = 0.026246
Diameter/Width = 0.092000
Length = 0.108000
Height = 0.006000

name = SC1TRACKERMOUNT
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.110790
Thermal Mass = 0.110790
Diameter/Width = 0.060000
Length = 0.060000
Height = 0.055000

name = SC1CUBEDEPFRAME
quantity = 1
parent = 1

materialID = 9
type = Box
Aero Mass = 0.462931
Thermal Mass = 0.462931
Diameter/Width = 0.105000
Length = 0.243000
Height = 0.037000

name = SC1TSGDS4
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.117177
Thermal Mass = 0.117177
Diameter/Width = 0.112000
Length = 0.112000
Height = 0.080000

name = SC1TSGM8
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.118979
Thermal Mass = 0.118979
Diameter/Width = 0.112000
Length = 0.112000
Height = 0.080000

name = SC1GDS4R1HEATSINK
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.058393
Thermal Mass = 0.058393
Diameter/Width = 0.075000
Length = 0.096000
Height = 0.010000

name = SC1GNSSMOUINT
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.015483
Thermal Mass = 0.015483
Diameter/Width = 0.048000
Length = 0.096000
Height = 0.006000

name = SC1INTERFACEMOUNT
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.015989
Thermal Mass = 0.015989
Diameter/Width = 0.042000
Length = 0.050000
Height = 0.010000

name = GM8MTRHOUSING
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.055000
Thermal Mass = 0.055000
Diameter/Width = 0.060000
Length = 0.060000
Height = 0.035000

name = GM8MTRBRGHOLDER
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.021000
Thermal Mass = 0.021000
Diameter/Width = 0.060000
Length = 0.060000
Height = 0.013500

name = 6804ZZ
quantity = 2
parent = 1
materialID = 58
type = Box
Aero Mass = 0.017000
Thermal Mass = 0.017000
Diameter/Width = 0.032000
Length = 0.032000
Height = 0.008000

name = GM8MTRSHAFT
quantity = 1
parent = 1
materialID = 9
type = Cylinder
Aero Mass = 0.033000

Thermal Mass = 0.033000
Diameter/Width = 0.032000
Length = 0.036000

name = GM8MTRROTOR
quantity = 1
parent = 1
materialID = 38
type = Box
Aero Mass = 0.017000
Thermal Mass = 0.017000
Diameter/Width = 0.036000
Length = 0.036000
Height = 0.010000

name = GM7CONNECTORR0
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.020000
Thermal Mass = 0.020000
Diameter/Width = 0.036000
Length = 0.046000
Height = 0.009000

name = SC16UDEPLOYSPST
quantity = 2
parent = 1
materialID = 7
type = Box
Aero Mass = 0.355000
Thermal Mass = 0.355000
Diameter/Width = 0.209000
Length = 0.342000
Height = 0.003000

name = SC16UDEPLOYSPDP
quantity = 2
parent = 1
materialID = 7
type = Box
Aero Mass = 0.300000
Thermal Mass = 0.300000
Diameter/Width = 0.195000
Length = 0.330000
Height = 0.003000

name = SC1LIDARHELIOS2
quantity = 1
parent = 1

materialID = 8
type = Box
Aero Mass = 0.398000
Thermal Mass = 0.398000
Diameter/Width = 0.060000
Length = 0.083000
Height = 0.060000

name = SC1BOSON640IRCAM
quantity = 1
parent = 1
materialID = 8
type = Cylinder
Aero Mass = 0.391000
Thermal Mass = 0.391000
Diameter/Width = 0.082000
Length = 0.100000

name = SC1DCRELEASEPANEL
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.027000
Thermal Mass = 0.027000
Diameter/Width = 0.035000
Length = 0.074000
Height = 0.004000

name = SC16USOLARPANEL
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.390000
Thermal Mass = 0.390000
Diameter/Width = 0.209000
Length = 0.342000
Height = 0.003000

name = SC108U Tank
quantity = 1
parent = 1
materialID = 37
type = Box
Aero Mass = 0.695000
Thermal Mass = 0.695000
Diameter/Width = 0.096000
Length = 0.096000
Height = 0.080000

name = SC108U Feed system
quantity = 1
parent = 1
materialID = 59
type = Cylinder
Aero Mass = 0.100000
Thermal Mass = 0.100000
Diameter/Width = 0.018000
Length = 0.050000

name = SC108U Structure
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.001600
Thermal Mass = 0.001600
Diameter/Width = 0.018000
Length = 0.060000
Height = 0.006500

name = SC1OBCI
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.083500
Thermal Mass = 0.061000
Diameter/Width = 0.094000
Length = 0.094000
Height = 0.017280

name = OBC PCB
quantity = 1
parent = 45
materialID = 23
type = Box
Aero Mass = 0.022500
Thermal Mass = 0.022500
Diameter/Width = 0.094000
Length = 0.094000
Height = 0.001600

name = SC1SBAND
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.159900
Thermal Mass = 0.139900
Diameter/Width = 0.094000

Length = 0.094000
Height = 0.018500

name = SBand TMTC Transceiver PCB
quantity = 1
parent = 47
materialID = 23
type = Box
Aero Mass = 0.020000
Thermal Mass = 0.020000
Diameter/Width = 0.094000
Length = 0.094000
Height = 0.001300

name = SC1XBAND
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.264000
Thermal Mass = 0.175000
Diameter/Width = 0.095900
Length = 0.095900
Height = 0.026600

name = XBand Tx Baseband PCB
quantity = 1
parent = 49
materialID = 23
type = Box
Aero Mass = 0.073000
Thermal Mass = 0.073000
Diameter/Width = 0.095900
Length = 0.095900
Height = 0.004500

name = XBand Tx BUC PCB
quantity = 1
parent = 49
materialID = 23
type = Box
Aero Mass = 0.016000
Thermal Mass = 0.016000
Diameter/Width = 0.095900
Length = 0.095900
Height = 0.001000

name = SC1 X BAND ANTENNA 2X2
quantity = 1
parent = 1
materialID = 23

type = Box
Aero Mass = 0.023500
Thermal Mass = 0.023500
Diameter/Width = 0.060000
Length = 0.060000
Height = 0.004000

name = SC1ESPIIPDM
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.259000
Thermal Mass = 0.129000
Diameter/Width = 0.095700
Length = 0.095700
Height = 0.019700

name = EPS Type II PDM PCB
quantity = 1
parent = 53
materialID = 23
type = Box
Aero Mass = 0.130000
Thermal Mass = 0.130000
Diameter/Width = 0.093700
Length = 0.093700
Height = 0.008300

name = SC1ESPIIBP8
quantity = 3
parent = 1
materialID = 8
type = Box
Aero Mass = 0.984900
Thermal Mass = 0.283800
Diameter/Width = 0.095700
Length = 0.095700
Height = 0.067700

name = EPS Type II BP8S 1P Input PCB
quantity = 3
parent = 55
materialID = 23
type = Box
Aero Mass = 0.120000
Thermal Mass = 0.120000
Diameter/Width = 0.093700
Length = 0.093700
Height = 0.008000

name = EPS Type II BP8S 1P Balancer PCB
quantity = 3
parent = 55
materialID = 23
type = Box
Aero Mass = 0.053500
Thermal Mass = 0.053500
Diameter/Width = 0.088200
Length = 0.088200
Height = 0.004000

name = Cage Half
quantity = 6
parent = 55
materialID = 8
type = Box
Aero Mass = 0.063800
Thermal Mass = 0.063800
Diameter/Width = 0.084500
Length = 0.084500
Height = 0.045000

name = Battery Cell
quantity = 24
parent = 55
materialID = 8
type = Cylinder
Aero Mass = 0.050000
Thermal Mass = 0.050000
Diameter/Width = 0.019000
Length = 0.070000

name = SC1SBANDANTENNA
quantity = 2
parent = 1
materialID = 23
type = Box
Aero Mass = 0.114000
Thermal Mass = 0.114000
Diameter/Width = 0.098000
Length = 0.098000
Height = 0.007000

name = SC1SRFSPLITTER HYBRID COUPLER
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.092400
Thermal Mass = 0.072400
Diameter/Width = 0.095600

Length = 0.095600
Height = 0.007200

name = SC1SRFSPLITTER HYBRID COUPLER PC BOARD
quantity = 1
parent = 61
materialID = 23
type = Box
Aero Mass = 0.020000
Thermal Mass = 0.020000
Diameter/Width = 0.095600
Length = 0.095600
Height = 0.001200

name = SC1CUBETORQUER
quantity = 3
parent = 1
materialID = 38
type = Cylinder
Aero Mass = 0.014500
Thermal Mass = 0.014500
Diameter/Width = 0.006000
Length = 0.120000

name = SC1CUBEWHEELPMIDHousing
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 0.403700
Thermal Mass = 0.050100
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.050000

name = SC1CUBEWHEELPMIDLid
quantity = 1
parent = 64
materialID = 8
type = Box
Aero Mass = 0.034400
Thermal Mass = 0.034400
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.050000

name = SC1CUBEWHEELPMIDFlywheel
quantity = 1
parent = 64
materialID = 62
type = Box

Aero Mass = 0.278000
Thermal Mass = 0.278000
Diameter/Width = 0.100000
Length = 0.100000
Height = 0.050000

name = SC1CUBEWHEELPMIDBase
quantity = 1
parent = 64
materialID = 8
type = Box
Aero Mass = 0.041200
Thermal Mass = 0.041200
Diameter/Width = 0.080000
Length = 0.080000
Height = 0.040000

name = SC1GNSSMODULE
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.031000
Thermal Mass = 0.031000
Diameter/Width = 0.045000
Length = 0.075000
Height = 0.005000

name = SC1DEORBIT
quantity = 1
parent = 1
materialID = 9
type = Box
Aero Mass = 0.140000
Thermal Mass = 0.140000
Diameter/Width = 0.080000
Length = 0.080000
Height = 0.035000

name = GDS4R1
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.030000
Thermal Mass = 0.030000
Diameter/Width = 0.075000
Length = 0.075000
Height = 0.006000

name = GCB3R2

quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.105000
Thermal Mass = 0.105000
Diameter/Width = 0.095000
Length = 0.240000
Height = 0.005000

name = BPCONNECT
quantity = 2
parent = 1
materialID = 23
type = Box
Aero Mass = 0.030000
Thermal Mass = 0.030000
Diameter/Width = 0.082000
Length = 0.095000
Height = 0.005000

name = PAYLOADPDUR1
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.030000
Thermal Mass = 0.030000
Diameter/Width = 0.090000
Length = 0.150000
Height = 0.005000

name = SC1GNSSADAPTER
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.015000
Thermal Mass = 0.015000
Diameter/Width = 0.045000
Length = 0.075000
Height = 0.005000

name = SC1BUSPINADAPTER
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.030000
Thermal Mass = 0.030000
Diameter/Width = 0.082000

Length = 0.095000
Height = 0.005000

name = SC1ADCSR1
quantity = 1
parent = 1
materialID = 23
type = Box
Aero Mass = 0.095000
Thermal Mass = 0.095000
Diameter/Width = 0.095000
Length = 0.240000
Height = 0.005000

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

name = SC1
Demise Altitude = 77.999185
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = TOPFRAME
Demise Altitude = 75.627397
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BOTTOMFRAME
Demise Altitude = 76.660901
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1FRONTFRAME
Demise Altitude = 76.320615
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1REARFRAME
Demise Altitude = 76.812587
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1RIGHTFRAME
Demise Altitude = 77.218341
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1LEFTFRAME
Demise Altitude = 77.184574
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMHOLDER
Demise Altitude = 76.704535
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSPCBFRAME
Demise Altitude = 76.240530
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSBPHOLDER
Demise Altitude = 77.665344
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSCOTSHOLDER
Demise Altitude = 77.632544
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1REARDIAPHRAGM
Demise Altitude = 76.504589
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1FRONTDIAPHRAGM
Demise Altitude = 76.234128
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSGCB3FRAME
Demise Altitude = 75.020303
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1IMUHOLDER

Demise Altitude = 77.536820
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMBOTTOM
Demise Altitude = 77.028422
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMMIDDLE
Demise Altitude = 77.406320
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMTOP
Demise Altitude = 77.395459
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMRIGHT
Demise Altitude = 77.383888
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMCENTER
Demise Altitude = 77.073519
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1MAINCAMLEFT
Demise Altitude = 77.221197
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSBPPRESSER
Demise Altitude = 77.741609
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1TRACKERMOUNT
Demise Altitude = 76.770255
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBEDEPFRAME
Demise Altitude = 76.484442
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1TSGDS4
Demise Altitude = 77.455768
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1TSGM8
Demise Altitude = 77.444725
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1GDS4R1HEATSINK
Demise Altitude = 77.720509
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1GNSSMOUINT
Demise Altitude = 77.895844
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1INTERFACEMOUNT
Demise Altitude = 77.808204
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM8MTRHOUSING
Demise Altitude = 77.229904
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM8MTRBRGHOLDER
Demise Altitude = 77.598463
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = 6804ZZ

Demise Altitude = 75.183912
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM8MTRSHAFT
Demise Altitude = 76.631540
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM8MTRROTOR
Demise Altitude = 75.954633
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GM7CONNECTORR0
Demise Altitude = 77.263909
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC16UDEPLOYSPST
Demise Altitude = 77.212254
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC16UDEPLOYSPDP
Demise Altitude = 77.284447
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1LIDARHELIOS2
Demise Altitude = 76.691239
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BOSON640IRCAM
Demise Altitude = 76.582188
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1DCRELEASEPANEL
Demise Altitude = 77.286388
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC16USOLARPANEL
Demise Altitude = 77.044945
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC108U Tank
Demise Altitude = 70.498220
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC108U Feed system
Demise Altitude = 71.658699
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC108U Structure
Demise Altitude = 77.983083
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1OBCI
Demise Altitude = 77.758446
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = OBC PCB
Demise Altitude = 77.458755
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1SBAND
Demise Altitude = 77.447910
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SBand TMTC Transceiver PCB
Demise Altitude = 77.181868
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1XBAND

Demise Altitude = 77.384892
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = XBand Tx Baseband PCB
Demise Altitude = 76.488227
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = XBand Tx BUC PCB
Demise Altitude = 77.183404
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1 X BAND ANTENNA 2X2
Demise Altitude = 77.422761
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1ESPIIPDM
Demise Altitude = 77.513166
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = EPS Type II PDM PCB
Demise Altitude = 75.961251
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1ESPIIBP8
Demise Altitude = 77.303469
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = EPS Type II BP8S 1P Input PCB
Demise Altitude = 75.910479
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = EPS Type II BP8S 1P Balancer PCB
Demise Altitude = 76.583331
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = Cage Half
Demise Altitude = 77.084126
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = Battery Cell
Demise Altitude = 76.541651
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1SBANDANTENNA
Demise Altitude = 76.729275
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1SRFSPLITTER HYBRID COUPLER
Demise Altitude = 77.681432
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1SRFSPLITTER HYBRID COUPLER PC BOARD
Demise Altitude = 77.419017
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBETORQUER
Demise Altitude = 76.587664
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBEWHEELPMIDHousing
Demise Altitude = 77.867324
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBEWHEELPMIDLid
Demise Altitude = 77.774629
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1CUBEWHEELPMIDFlywheel

Demise Altitude = 0.000000
Debris Casualty Area = 0.405372
Impact Kinetic Energy = 87.342253

****
name = SC1CUBEWHEELPMIDBase
Demise Altitude = 77.708740
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1GNSSMODULE
Demise Altitude = 77.298528
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1DEORBIT
Demise Altitude = 76.637363
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GDS4R1
Demise Altitude = 77.495413
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = GCB3R2
Demise Altitude = 77.453131
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = BPCONNECT
Demise Altitude = 77.611242
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = PAYLOADPDUR1
Demise Altitude = 77.763732
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1GNSSADAPTER
Demise Altitude = 77.659018
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1BUSPINADAPTER
Demise Altitude = 77.611242
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = SC1ADCSR1
Demise Altitude = 77.502890
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****

========== End of Requirement 4.7-1 ==========
06 17 2024; 16:30:39PM Project Data Saved To File
06 17 2024; 16:31:17PM Science and Engineering - Apogee/Perigee History for a Given Orbit

INPUT

Perigee Altitude = 0.000000 (km)
Apogee Altitude = 0.000000 (km)
Inclination = 0.000000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.000000 (m^2/kg)
Start Year = 0.000000 (yr)
Integration Time = 0.000000 (yr)

OUTPUT

Plot
06 17 2024; 16:31:21PM Science and Engineering - Apogee/Perigee History for a Given Orbit

INPUT

Perigee Altitude = 502.000000 (km)
Apogee Altitude = 502.000000 (km)
Inclination = 45.000000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.008900 (m^2/kg)
Start Year = 2025.292000 (yr)
Integration Time = 5.000000 (yr)

OUTPUT

Plot

06 17 2024; 16:31:52PM Science and Engineering - Orbit Lifetime/Dwell Time

INPUT

Start Year = 2025.292000 (yr)
Perigee Altitude = 502.000000 (km)
Apogee Altitude = 502.000000 (km)
Inclination = 45.000000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Area-To-Mass Ratio = 0.008900 (m^2/kg)

OUTPUT

Orbital Lifetime from Startyr = 4.668131 (yr)
Time Spent in LEO during Lifetime = 4.666986 (yr)
Last year of Propagation = 2029 (yr)
Returned Error Message: Object reentered
06 17 2024; 16:32:01PM Project Data Saved To File
06 17 2024; 16:32:27PM Project Data Saved To File