Sherpa-FX2 Orbital Debris Assessment Report (ODAR)

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

Report Version 1
February 4, 2021

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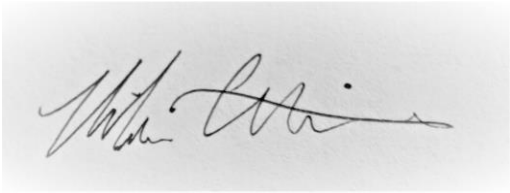
This document contains no proprietary, ITAR, or export-controlled information.

DAS Software Version Used In Analysis: v3.1.0
Report prepared by Mike Coletti, Mission Manager
Analysis prepared by Eric Lund, Lead Systems Engineer

VERSION APPROVAL and/or FINAL APPROVAL*:

Mike Coletti
Mission Manager
Spaceflight, Inc.



*Approval signatures indicate acceptance of the ODAR-defined risk.

Table Contents

Self-assessment of the ODAR using the format in Appendix A.2 of NASA-STD- 8719.14:

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

Orbital Debris Self-Assessment Report Evaluation: Sherpa-FX2 on June 2021 SpaceX Falcon 9 Rideshare Mission

Requirement #	Launch Vehicle				Spacecraft			Comments
	Compliant	Not Compliant	Incomplete	Standard Non-Compliant	Compliant or N/A	Not Compliant	Incomplete	
4.3-1.a	☐	☐	☐	☐	☒	☐	☐	No Debris Released in LEO.
4.3-1.b	☐	☐	☐	☐	☒	☐	☐	No Debris Released in LEO.
4.3-2	☐	☐	☐	☐	☒	☐	☐	No Debris Released in GEO.
4.4-1	☐	☐	☐	☐	☒	☐	☐	
4.4-2	☐	☐	☐	☐	☒	☐	☐	
4.4-3	☐	☐	☐	☐	☒	☐	☐	No planned breakups.
4.4-4	☐	☐	☐	☐	☒	☐	☐	No planned breakups.
4.5-1	☐	☐	☐	☐	☒	☐	☐	
4.5-2	☐	☐	☐	☐	☒	☐	☐	
4.6-1(a)	☐	☐	☐	☐	☒	☐	☐	
4.6-1(b)	☐	☐	☐	☐	☒	☐	☐	
4.6-1(c)	☐	☐	☐	☐	☒	☐	☐	
4.6-2	☐	☐	☐	☐	☒	☐	☐	Spacecraft does not go to GEO.
4.6-3	☐	☐	☐	☐	☒	☐	☐	Spacecraft does not go beyond LEO.
4.6-4	☐	☐	☐	☐	☒	☐	☐	
4.7-1	☐	☐	☐	☐	☒	☐	☐	
4.8-1					☒	☐	☐	No tethers used.

Assessment Report Format:

ODAR Technical Sections Format Requirements:

As Spaceflight, Inc. is based in the US, and governed by the rules and regulation of the US; this ODAR follows the format recommended in NASA- STD-8719.14b, Appendix A.1 and includes the content indicated at a minimum in each section 2 through 8 below for the June 2021 SpaceX Rideshare Mission. Sections 9 through 14 apply to the launch vehicle ODAR and are not covered here.

ODAR Section 1: Program Management and Mission Overview

Project Manager: Mike Coletti

Foreign government or space agency participation: No foreign government or space agency participation.

Schedule of upcoming mission milestones:
Launch: June 2021 – July 2021

Mission Overview:
The June 2021 SpaceX Rideshare Mission ("Transporter-2") is a commercial rideshare mission, for which the primary objective of Spaceflight Inc., is deploying around 25 customer spacecraft into a planned sun-synchronous circular orbit of 525 km ± 25 km. The launch vehicle will deploy a free flyer spacecraft, called "Sherpa-Flex2" or "Sherpa-FX2", which deploys additional customer spacecraft within several hours of liftoff and will carry up to three hosted payloads through de-orbit. (*Each of these satellite customers are responsible for obtaining an FCC or other agency or administration authorization as appropriate and do not constitute debris*). Sherpa-FX2 will rely on atmospheric drag to fully de-orbit. Sherpa-FX2 has no solar panels, attitude control, propulsion, or pressure vessels.

ODAR Configuration:
The ODAR analyses contained in this report was run at the target 525 km altitude and the upper range of the of the mission altitude range of 550 km. ODAR was run for two potential scenarios, at each altitude to provide a comprehensive analysis of various mission success results. Through both of the scenarios described below, at both altitudes, we demonstrate compliance with FCC requirements without the use of a deorbit device.

The terms *Nominal Mission* and *Failed Mission* are defined as follows:

- *Nominal Mission*: All customer deployments successful
- *Failed Mission*[1]*:* All spacecraft deployments unsuccessful

ODAR Summary:

- No debris released in normal operations;

[1] Previously for Sherpa-FX1, Spaceflight presented a Partial Mission Failure case, wherein the deployment sequence was interrupted by an anomaly, resulting in only some of the customers being deployed. Through many successful mission sequence tests and a successful Sherpa-FX1 mission, Spaceflight feels a mid-sequence anomaly would be an exceptionally rare case. Spaceflight feels the most probable off-nominal case would be that the device succumbs to the launch environment before deployments are initiated, hence we only present that case here.

- No credible scenario for breakups;
- The collision probability with other objects is compliant with NASA standards;
- The estimated decay lifetime due to atmospheric drag is under 25 years, through the possible range altitudes and mission cases presented herein, as predicted by DAS 3.1.0.

	525 km	**550 km**
Sherpa-FX2 Nominal Mission	8 years	13.5 years
Sherpa-FX2 Failed Mission	16 years	23.9 years

Launch vehicle and launch site: Falcon 9**,** Vandenberg Air Force Base, California

Proposed launch date: June 2021 – July 2021

Mission duration:

Maximum Sherpa-FX2 Nominal Operations:

- < 24 hours after launch.

Post-Mission Orbit lifetime:

- For a Nominal Mission at 525 km, Sherpa-FX2 has a predicted post-mission orbit lifetime 8 years, and 13.5 years at 550 km.

Launch and deployment profile, including all parking, transfer, and operational orbits with apogee, perigee, and inclination:

Sherpa-FX2

	Apogee Altitude	**Perigee Altitude**	**Inclination**	**Mission Duration**
Mission	525 ± 25 km	525 ± 25 km	97.384 ± 0.1 deg	<1 day (all cases)
End-of-Life Orbit	525 ± 25 km	525 ± 25 km	97.384 ± 0.1 deg	8 years (nominal, 525 km mission) - 23.9 years (failed, 550 km mission)

ODAR Section 2: Spacecraft Description

Physical description of the spacecraft:

Sherpa-FX2 is a non-propulsive, free flying spacecraft that is designed to deploy auxiliary spacecraft. Sherpa-FX2 will also carry up to 3 hosted payloads that will remain on the spacecraft through deorbit. It is structurally alike, to the previously licensed Sherpa-FX1[2]. The separation system and customer payload layout on Sherpa-FX2 can be variable, depending on the number of microsatellites and CubeSats manifested to the mission. CubeSat and Microsatellite separation systems are interchangeable and can be affixed radially on the body of either Sherpa vehicle. A microsatellite, CubeSat dispenser, or other adapter for separation system mounting can be affixed on the outboard end of Sherpa-FX2. Thus, Sherpa-FX2 will deploy customers in the same fashion as the previously licensed Sherpa-FX1. For this Mission, the planned configuration has a microsatellite on the outboard end of Sherpa-FX2, with three microsatellites, two 6U equivalent CubeSat dispensers, two 3U dispensers, and one 12U equivalent CubeSat dispenser, attached radially on the body of Sherpa-FX2.[3] The Sherpa-FX2 Mission configuration also includes an S-band receive antenna and an L-band transmitter as part of its avionics.

Sherpa-FX2 will be attached to a single port on a SpaceX-provided payload ring. The Falcon 9 will have multiple rings with SpaceX's other customers stacked above and/or below the ring to which Spaceflight's Sherpa FX2 is attached. Once a separation signal is received by Sherpa-FX2's separation system from Falcon 9 avionics, Sherpa-FX2 will separate.

In a case where any combination of spacecraft are unable to make the mission, a non-separating mass dummy will be either inserted into a locked dispenser door or affixed directly to the Sherpa-FX2 structure, depending on the missing spacecraft's form factor. These mass dummies are not included in Spaceflight's casualty risk analysis for this submission, because they would be materially and physically the same as those evaluated in Spaceflight's Sherpa-FX1 submission[1]. In that STA, examples for a microsat mass model, entire 12U and 6U dispenser mass models, or a single CubeSat mass model within a flight dispenser were all shown to fully demise and not contribute to any human casualty risk. Some customers are responsible for providing their own mass model. If a case arises that a customer mass model will need to be integrated for flight, Spaceflight will re-run DAS analysis incorporating that specific mass model and its corresponding material properties to ensure demise and no worse risk of casualty than what is presented here, before integration onto the Sherpa-FX2 structure.

Total satellite mass at launch, including all propellants and fluids, potential mass growth and uncertainties:

Sherpa-FX2 without separating customer spacecraft	128 kg
Sherpa-FX2 with separating customer spacecraft	295 kg

Dry mass of satellites at launch, excluding solid rocket motor propellants, but including potential mass growth and uncertainties:

Sherpa-FX2 without separating customer spacecraft	128 kg
Sherpa-FX2 with separating customer spacecraft	295 kg

[2] SAT-STA-20200728-00089 Spaceflight, Inc. Sherpa-FX1 STA

[3] None of the spacecraft to be deployed will themselves deploy additional spacecraft.

Dry mass of satellites at end of mission, excluding solid rocket motor propellants:

Sherpa-FX2 without separating customer spacecraft	128 kg

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

Sherpa-FX2 has no propulsion.

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: N/A

Fluids in Pressurized Batteries: None. Sherpa-FX2 uses two of the same NiMH battery packs previously used on the Sherpa-FX1 mission.

Description of attitude control system and indication of the normal attitude of the spacecraft with respect to the velocity vector: Sherpa-FX2 does not have attitude control.

Description of any range safety or other pyrotechnic devices: None.

Description of the electrical generation and storage system: Standard COTS lithium iron disulfide and nickel-metal hydride battery cells are charged prior to payload integration and provide electrical energy during the mission.

Identification of any other sources of stored energy not noted above: None.

Identification of any radioactive materials on board: None**.**

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

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 intentional releases other than customer spacecraft deployments (see Mission Overview).

Rationale/necessity for release of each object: N/A.

Time of release of each object, relative to launch time: N/A.

Release velocity of each object with respect to spacecraft: N/A.

Expected orbital parameters (apogee, perigee, and inclination) of each object after release: N/A.

Calculated orbital lifetime of each object, including time spent in Low Earth Orbit (LEO): N/A.

Assessment of spacecraft compliance with Requirements 4.3-1 and 4.3-2 (per DAS v3.1.0) 4.3-1,

Mission Related Debris Passing Through LEO: COMPLIANT

4.3-2, Mission Related Debris Passing Near GEO: COMPLIANT

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

Potential causes of spacecraft breakup during deployment and mission operations:

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

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

An in-mission failure of a battery protection circuit could lead to a short circuit resulting in overheating and a very remote possibility of battery cell explosion. The battery safety systems discussed in the FMEA (see requirement 4.4-1 below) describe the combined faults that must occur for any of seven (7) independent, mutually exclusive failure modes to lead to explosion.

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

There are no planned breakups.

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

No components require passivation at EOM.

Rationale for all items which are required to be passivated, but cannot be due to their design:

N/A

Assessment of spacecraft compliance with Requirements 4.4-1 through 4.4-4:

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

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

Compliance statement:

Required Probability: 0.001.

Expected probability: 0.000.

Supporting Rationale and FMEA details:

Battery explosion:

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

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

Failure mode 1: Internal short circuit.
Mitigation 1: Qualification and acceptance shock, vibration, thermal cycling, and vacuum tests followed by maximum system rate-limited charge and discharge to prove that no internal short circuit sensitivity exists.
Combined faults required for realized failure: Environmental testing and functional charge/discharge tests must both be ineffective in discovery of the failure mode.

Failure Mode 2: Internal thermal rise due to high load discharge rate.
Mitigation 2: Cells were tested in lab for high load discharge rates in a variety of flight-like configurations to determine like likelihood and impact of an out of control thermal rise in the cell. Cells were also tested in a hot environment to test the upper limit of the cells capability. No failures were seen.
*Combined faults required for realized failure: S*pacecraft thermal design must be incorrect and external over-current detection and disconnect function must fail to enable this failure mode.

Failure Mode 3: Excessive discharge rate or short circuit due to external device failure or terminal contact with conductors not at battery voltage levels (due to abrasion or inadequate proximity separation).
Mitigation 3: This failure mode is negated by a) qualification-tested short circuit protection on each external circuit, b) design of battery packs and insulators such that no contact with nearby board traces is possible without being caused by some other mechanical failure, c) obviation of such other mechanical failures by proto- qualification and acceptance environmental tests (shock, vibration, thermal cycling, and thermal-vacuum tests).
Combined faults required for realized failure: An external load must fail/short- circuit and external over-current detection and disconnect function failure must all occur to enable this failure mode.

Failure Mode 4: Inoperable vents.
Mitigation 4: Battery vents are not inhibited by the battery holder design or the spacecraft.
Combined effects required for realized failure: The final assembler fails to install proper venting.

Failure Mode 5: Crushing.
Mitigation 5: This mode is negated by spacecraft design. There are no moving parts in the proximity of the batteries.
Combined faults required for realized failure: A catastrophic failure must occur in an external system and the failure must cause a collision sufficient to crush the batteries leading to an internal short circuit and the satellite must be in a naturally sustained orbit at the time the crushing occurs.

Failure Mode 6: Low level current leakage or short-circuit through battery pack case or due to moisture-based degradation of insulators.
Mitigation 6: These modes are negated by a) battery holder/case design made of non-conductive plastic, and b) operation in vacuum such that no moisture can affect insulators.
Combined faults required for realized failure: Abrasion or piercing failure of circuit board coating or wire insulators and dislocation of battery packs and failure of battery terminal insulators and failure to detect such failure modes in environmental tests must occur to result in this failure mode.

Failure Mode 7: Excess temperatures due to orbital environment and high discharge combined.
Mitigation 7: The spacecraft thermal design will negate this possibility. Thermal rise has been analyzed in combination with space environment temperatures showing that batteries do not exceed normal allowable operating temperatures, which are well below temperatures of concern for explosions.

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

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

Design of all spacecraft and launch vehicle orbital stages shall include the ability to deplete all onboard sources of stored energy and disconnect all energy generation sources when they are no longer required for mission operations or post-mission disposal or control to a level which cannot cause an explosion or deflagration large enough to release orbital debris or break up the spacecraft (Requirement 56450).

Compliance statement:
Sherpa-FX2 is designed such that when mission operations begin, all energy from the secondary batteries will dissipate within 24 hours. The primary batteries will dissipate all energy within 24 hours. Additionally, Sherpa-FX2 battery charge circuits include overcharge protection and active thermal monitoring to limit the risk of battery failure. However, in the unlikely event that a battery cell does explosively rupture, the small size, mass, and potential energy, of these small batteries is such that while the spacecraft could be expected to vent gases, most debris from the battery rupture should be contained within the vessel due to the lack of penetration energy.

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

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

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

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

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

Assessment of spacecraft compliance with Requirements 4.5-1 and 4.5-2 (per DAS v3.1.0, and calculation methods provided in NASA-STD-8719.14, section 4.5.4):

Requirement 4.5-1:

Assess probability of collision with intact space systems or large debris (>10cm)

Large Object Impact and Debris Generation Probability:

Spacecraft	Nominal Mission	Failed Mission	Status
Sherpa-FX2	0.00001690	0.00003760	COMPLIANT

Requirement 4.5-2:

Assess and limit the probability of damage to critical components as a result of impact with small debris.

Probability of Damage from Small Debris:

Not applicable – there are no subsystems vital to completing post mission disposal and the spacecraft is fully compliant with orbit lifetime requirements in all cases.

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

Sherpa-FX2 batteries will deplete in less than 24 hours after separation. Sherpa-FX2 will deorbit naturally and rely on atmospheric drag. Sherpa-FX2 does not have propellants or pressure vessels.

Recontact Analysis. Although beyond the scope of a standard orbital debris analysis, Spaceflight has conducted extensive testing and modeling to limit the risk that individual spacecraft that will be deployed on this mission will re-contact with each other after release. That analysis is presented as attachment titled *Sherpa-FX2 Long-Term Recontact Probability* to Spaceflight's STA application.

ODAR Section 6: Assessment of Spacecraft Post-mission Disposal Plans and Procedures

6.1 Description of spacecraft disposal option selected: Sherpa-FX2 will deorbit naturally by atmospheric re-entry.

6.2 Plan for any spacecraft maneuvers required to accomplish post-mission disposal:

Sherpa-FX2 does not have propulsion or attitude control. There is no plan for post-mission disposal maneuvers.

6.3 Calculation of area-to-mass ratio after post-mission disposal if the controlled reentry option is not selected:

Spacecraft Mass:

	Nominal Mission	Failed Mission
Sherpa-FX2	128 kg	295 kg

Cross-sectional Area: (arithmetic mean for random tumbling attitude)

	Nominal Mission	Failed Mission
Sherpa-FX2	0.9942 m²	1.0668 m²

Area to mass ratio: (arithmetic mean for random tumbling attitude)

	Nominal Mission	Failed Mission
Sherpa-FX2	0.0078 m²/kg	0.00361 m²/kg

6.4 Assessment of spacecraft compliance with Requirements 4.6-1 through 4.6-5 (per DAS v 3.1.0 and NASA-STD-8719.14 section):

Requirement 4.6-1: Disposal for space structures passing through LEO:
A spacecraft or orbital stage with a perigee altitude below 2000 km shall be disposed of by one of three methods:
(Requirement 56557)
a. Atmospheric reentry option:

- *Leave the space structure in an orbit in which natural forces will lead to atmospheric reentry within 25 years after the completion of mission but no more than 30 years after launch; or*
- *Maneuver the space structure into a controlled de-orbit trajectory as soon as practical after completion of mission.*

b. Storage orbit option: Maneuver the space structure into an orbit with perigee altitude greater than 2000 km and apogee less than GEO - 500 km.
c. Direct retrieval: Retrieve the space structure and remove it from orbit within 10 years after completion of mission.

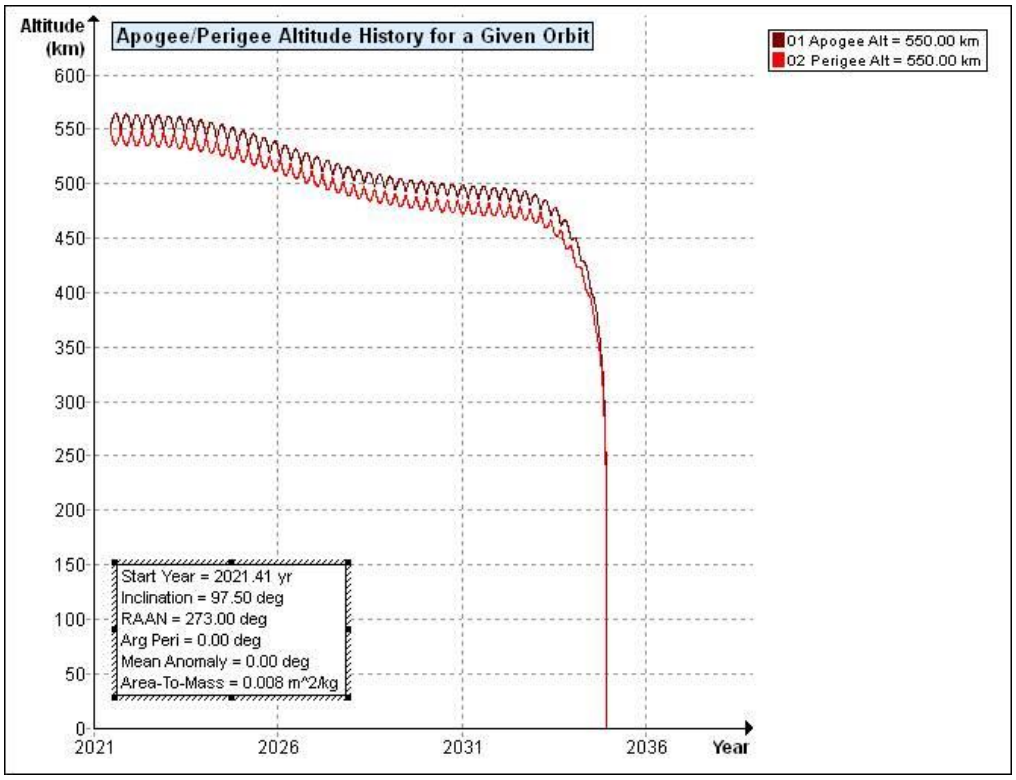


Figure 1 - Sherpa-FX2 (Nominal Mission at 550 km) orbit history

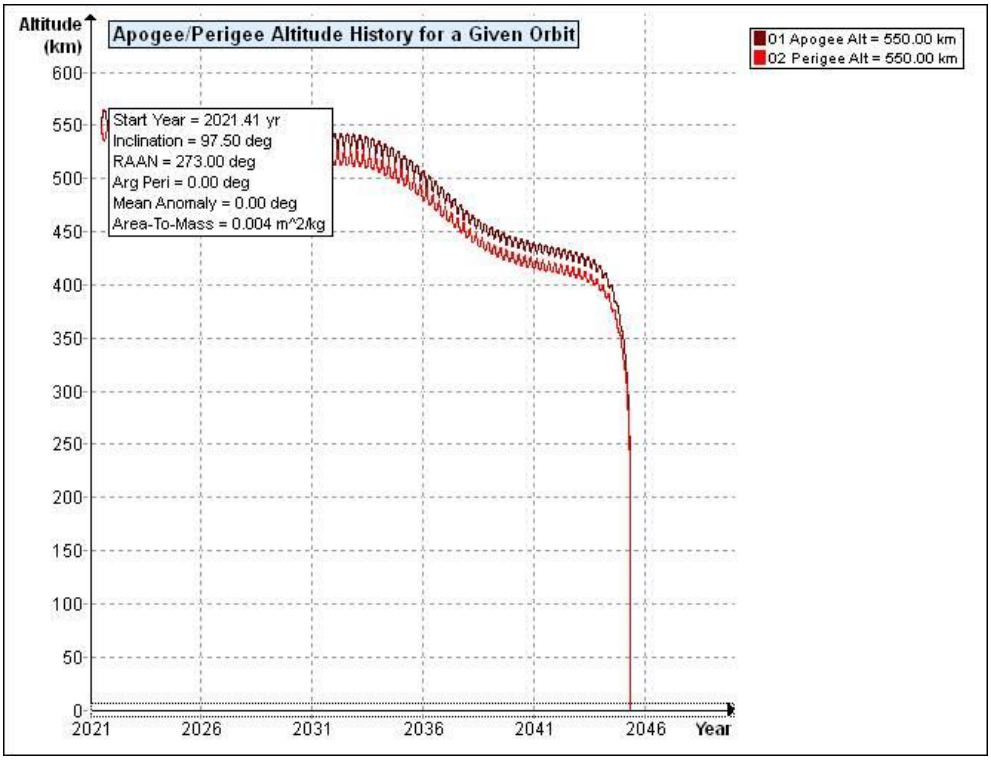


Figure 2 - Sherpa-FX2 (Failed Mission at 550 km) orbit history.

Analysis: Sherpa-FX2 reentry is COMPLIANT using method "a".

Satellite Name	Sherpa-FX2	Sherpa-FX2
BOL Orbit (Drop off)	525 x 525 km	550 x 550 km
Operational Orbit	525 x 525 km	550 x 550 km
EOM Orbit	525 x 525 km	550 x 550 km
Total Lifetime for Nominal Mission	8 years	13.5 years
Total Lifetime if Mission Failure	16 years	23.9 years

Requirement 4.6-2. Disposal for space structures near GEO.

Analysis: Not applicable.

***Requirement 4.6-3. Disposal for space structures between LEO and GEO*.** **Analysis:** Not applicable.

Requirement 4.6-4. Reliability of Post-mission Disposal Operations

Reliability: Sherpa-FX2 will rely on atmospheric drag to fully de-orbit. Spaceflight shows DAS analysis cases here for: (i) its planned or Nominal Mission (successful deployment of all spacecraft planned to be deployed); and (ii) were there to be an off-nominal case, the most likely failure scenario, a Total Mission Failure where no spacecraft are deployed. In both cases DAS returns a total mission lifetime less than 25 years.

As with SSO-A and Sherpa-FX1, Spaceflight has a team of highly qualified engineers, and a well-established process for rideshare missions such as this. Spaceflight finds that an avionics failure in the middle of the separation sequence is highly unlikely and has previously demonstrated flight heritage on the Sherpa-FX1 mission. If the primary avionics systems were to fail, it will most likely succumb to the launch environment, which occurs prior to any deployments from Sherpa-FX2, resulting in an orbit lifetime less than 25 years. Finally, Spaceflight believes a successful mission, the "Nominal Mission" case, is most probable. In either case, the analysis contained above shows compliance with FCC regulation and guidelines.

ODAR Section 7: Assessment of Spacecraft Reentry Hazards

Assessment of spacecraft compliance with Requirement 4.7-1:

> ***Requirement 4.7-1:*** Limit the risk of human casualty:
> *The potential for human casualty is assumed for any object with an impacting kinetic energy in excess of 15 joules:*
> *a) For uncontrolled reentry, the risk of human casualty from surviving debris shall not exceed 0.0001 (1:10,000) (Requirement 56626).*

Summary Analysis Results:
DAS calculates Sherpa-FX2 and its separation systems and subcomponents listed in further detail in the full DAS results appended to this report, has a 1:100,000,000 risk of human casualty and thus that spacecraft meets the requirement. No components of the spacecraft are expected to survive reentry.

Requirements 4.7-1b, and 4.7-1c below are non-applicable requirements because the Sherpa-FX2 Mission does not use controlled reentry.

> 4.7-1, b) **NOT APPLICABLE.** For controlled reentry, the selected trajectory shall ensure that no surviving debris impact with a kinetic energy greater than 15 joules is closer than 370 km from foreign landmasses, or is within 50 km from the continental U.S., territories of the U.S., and the permanent ice pack of Antarctica (Requirement 56627).
> 4.7-1 c) **NOT APPLICABLE.** For controlled reentries, the product of the probability of failure of the reentry burn (from Requirement 4.6-4.b) and the risk of human casualty assuming uncontrolled reentry shall not exceed 0.0001 (1:10,000) (Requirement 56628).

ODAR Section 8: Assessment for Tether Missions

Not applicable. There are no tethers in the mission.

Raw DAS Output – Nominal Mission at 525 km (all customers separated)

01 20 2021; 12:59:11PM Activity Log Started
01 20 2021; 12:59:11PM Opened Project C:\Users\elund\Box\Eric Lund\Missions and Programs\SXRS-5\DAS RevA post-deploy\
01 20 2021; 12:59:23PM Processing Requirement 4.3-1: Return Status : Not Run

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

========== End of Requirement 4.3-1 ==========
01 20 2021; 12:59:25PM Processing Requirement 4.3-2: Return Status : Passed

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

========== End of Requirement 4.3-2 ==========
01 20 2021; 13:21:21PM Processing Requirement 4.5-1: Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX2
Space Structure Type = Payload
Perigee Altitude = 525.000 (km)
Apogee Altitude = 525.000 (km)
Inclination = 97.384 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass Ratio = 0.0078 (m^2/kg)
Start Year = 2021.000 (yr)
Initial Mass = 295.000 (kg)
Final Mass = 128.000 (kg)
Duration = 0.010 (yr)
Station-Kept = False
Abandoned = True

OUTPUT

Collision Probability = 1.6905E-05
Returned Message: Normal Processing
Date Range Message: Normal Date Range
Status = Pass

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

01 20 2021; 13:21:23PM Processing Requirement 4.6 Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX2

Space Structure Type = Payload

Perigee Altitude = 525.000000 (km)
Apogee Altitude = 525.000000 (km)
Inclination = 97.384300 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.007771 (m^2/kg)
Start Year = 2021.000000 (yr)
Initial Mass = 295.000000 (kg)
Final Mass = 128.000000 (kg)
Duration = 0.010000 (yr)
Station Kept = False
Abandoned = True
PMD Perigee Altitude = 523.358271 (km)
PMD Apogee Altitude = 526.633916 (km)
PMD Inclination = 97.385395 (deg)
PMD RAAN = 3.532465 (deg)
PMD Argument of Perigee = 173.801136 (deg)
PMD Mean Anomaly = 0.000000 (deg)

OUTPUT

Suggested Perigee Altitude = 523.358271 (km)
Suggested Apogee Altitude = 526.633916 (km)
Returned Error Message = Passes LEO reentry orbit criteria.

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

==========

========== End of Requirement 4.6 ==========
01 20 2021; 13:21:34PM **********Processing Requirement 4.7-1
Return Status : Passed

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

name = Sherpa-FX2
quantity = 1
parent = 0
materialID = 5
type = Cylinder
Aero Mass = 128.000000
Thermal Mass = 128.000000
Diameter/Width = 0.813000

name = FX upper 24-in separation sytem
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 1.800000
Thermal Mass = 1.800000
Diameter/Width = 0.610000
Length = 0.610000
Height = 0.031000

name = FX Hex Plate
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 12.000000
Thermal Mass = 12.000000
Diameter/Width = 0.822000
Length = 0.822000
Height = 0.070000

name = FX Interior Wall
quantity = 6
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.162000
Thermal Mass = 1.162000
Diameter/Width = 0.118000
Length = 0.318000

name = FX Corner Brace
quantity = 6
parent = 1
materialID = 8
type = Box
Aero Mass = 2.040000
Thermal Mass = 2.040000
Diameter/Width = 0.151000
Length = 0.178000
Height = 0.151000

name = FX DuoPack adapter plate
quantity = 2
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.920000
Thermal Mass = 1.920000
Diameter/Width = 0.311000
Length = 0.350000

name = FX QuadPack adapter plate
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.727000
Thermal Mass = 1.727000
Diameter/Width = 0.297000
Length = 0.311000

name = MLB adapter plate
quantity = 3
parent = 1
materialID = 8
type = Box
Aero Mass = 2.170000
Thermal Mass = 2.170000
Diameter/Width = 0.283660
Length = 0.311150

Height = 0.031750

name = ISIPod L-bracket
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 2.000000
Thermal Mass = 2.000000
Diameter/Width = 0.300000
Length = 0.400000
Height = 0.150000

name = FX avionics deck plate
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 4.100000
Thermal Mass = 4.100000
Diameter/Width = 0.544000
Length = 0.544000
Height = 0.022000

name = FX R2A-Core
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 3.200000
Thermal Mass = 3.200000
Diameter/Width = 0.285000
Length = 0.285000
Height = 0.090000

name = FX battery module
quantity = 2
parent = 1
materialID = 5
type = Box
Aero Mass = 2.650000
Thermal Mass = 2.650000
Diameter/Width = 0.100000
Length = 0.139000
Height = 0.100000

name = FX EyeStar Black Box
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 0.290000
Thermal Mass = 0.290000
Diameter/Width = 0.054000
Length = 0.089000
Height = 0.047000

name = empty ISIPod
quantity = 2
parent = 1
materialID = 5

type = Box
Aero Mass = 2.000000
Thermal Mass = 2.000000
Diameter/Width = 0.180000
Length = 0.414000
Height = 0.130000

name = FX empty DuoPack
quantity = 2
parent = 1
materialID = 5
type = Box
Aero Mass = 4.600000
Thermal Mass = 4.600000
Diameter/Width = 0.250000
Length = 0.402000
Height = 0.152400

name = empty QuadPack
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 7.500000
Thermal Mass = 7.500000
Diameter/Width = 0.250000
Length = 0.440000
Height = 0.250000

name = PRA
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 11.998000
Thermal Mass = 11.998000
Diameter/Width = 0.626000
Length = 0.626000
Height = 0.070000

name = 15-3 Spacer Ring
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 6.350000
Thermal Mass = 6.350000
Diameter/Width = 0.198000
Length = 0.198000
Height = 0.076200

name = FX lower 8-in separation system
quantity = 3
parent = 1
materialID = 5
type = Box
Aero Mass = 1.191000
Thermal Mass = 1.191000
Diameter/Width = 0.117508
Length = 0.117508
Height = 0.045466

name = lower 15-in separation system
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 2.057000
Thermal Mass = 2.057000
Diameter/Width = 0.206154
Length = 0.206154
Height = 0.045466

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

name = Sherpa-FX2
Demise Altitude = 77.999092
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX upper 24-in separation sytem
Demise Altitude = 75.541252
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Hex Plate
Demise Altitude = 60.130455
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Interior Wall
Demise Altitude = 72.844116
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Corner Brace
Demise Altitude = 72.654305
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX DuoPack adapter plate
Demise Altitude = 73.088615
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX QuadPack adapter plate
Demise Altitude = 72.968544
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = MLB adapter plate
Demise Altitude = 72.472847
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = ISIPod L-bracket
Demise Altitude = 75.473404
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX avionics deck plate
Demise Altitude = 71.815086
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX R2A-Core
Demise Altitude = 70.333923
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX battery module
Demise Altitude = 67.150024
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX EyeStar Black Box
Demise Altitude = 74.773804
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = empty ISIPod
Demise Altitude = 74.938217
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX empty DuoPack
Demise Altitude = 71.671951
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = empty QuadPack
Demise Altitude = 70.730232
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = PRA
Demise Altitude = 62.091202
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = 15-3 Spacer Ring
Demise Altitude = 59.087605
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX lower 8-in separation system
Demise Altitude = 69.305084
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = lower 15-in separation system
Demise Altitude = 69.622650
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****

========== End of Requirement 4.7-1 ==========
01 20 2021; 13:21:34PM Project Data Saved To File
01 20 2021; 13:21:38PM Project Data Saved To File

Raw DAS Output –Mission Failure at 525 km (no customers separated)

01 21 2021; 10:41:55AM Activity Log Started
01 21 2021; 10:41:56AM Opened Project C:\Users\elund\Box\Eric Lund\Missions and Programs\SXRS-5\DAS RevA DoA\
01 21 2021; 10:42:07AM Processing Requirement 4.3-1: Return Status : Not Run

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

========== End of Requirement 4.3-1 ==========
01 21 2021; 10:42:10AM Processing Requirement 4.3-2: Return Status : Passed

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

========== End of Requirement 4.3-2 ==========
01 21 2021; 11:28:49AM Processing Requirement 4.5-1: Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX2
Space Structure Type = Payload
Perigee Altitude = 525.000 (km)
Apogee Altitude = 525.000 (km)
Inclination = 97.384 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass Ratio = 0.0036 (m^2/kg)
Start Year = 2021.000 (yr)
Initial Mass = 295.000 (kg)
Final Mass = 295.000 (kg)
Duration = 0.010 (yr)
Station-Kept = False
Abandoned = True

OUTPUT

Collision Probability = 3.7596E-05
Returned Message: Normal Processing
Date Range Message: Normal Date Range
Status = Pass

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

01 21 2021; 11:28:51AM Processing Requirement 4.6 Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX2

Space Structure Type = Payload

Perigee Altitude = 525.000000 (km)
Apogee Altitude = 525.000000 (km)
Inclination = 97.384300 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.003610 (m^2/kg)
Start Year = 2021.000000 (yr)
Initial Mass = 295.000000 (kg)
Final Mass = 295.000000 (kg)
Duration = 0.010000 (yr)
Station Kept = False
Abandoned = True
PMD Perigee Altitude = 523.358192 (km)
PMD Apogee Altitude = 526.633443 (km)
PMD Inclination = 97.385395 (deg)
PMD RAAN = 3.532465 (deg)
PMD Argument of Perigee = 174.025861 (deg)
PMD Mean Anomaly = 0.000000 (deg)

OUTPUT

Suggested Perigee Altitude = 523.358192 (km)
Suggested Apogee Altitude = 526.633443 (km)
Returned Error Message = Passes LEO reentry orbit criteria.

Released Year = 2036 (yr)
Requirement = 61
Compliance Status = Pass

==========

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

Raw DAS Output – Nominal Mission at 550 km (all customers separated)

01 29 2021; 11:23:21AM Activity Log Started
01 29 2021; 11:23:21AM Opened Project C:\Users\elund\Box\Eric Lund\Missions and Programs\SXRS-5\DAS RevA post-deploy\
01 29 2021; 11:23:51AM Mission Editor Changes Applied
01 29 2021; 11:23:51AM Project Data Saved To File
01 29 2021; 11:23:54AM Processing Requirement 4.3-1: Return Status : Not Run

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

========== End of Requirement 4.3-1 ==========
01 29 2021; 11:23:56AM Processing Requirement 4.3-2: Return Status : Passed

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

========== End of Requirement 4.3-2 ==========
01 29 2021; 11:50:05AM Processing Requirement 4.5-1: Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX2
Space Structure Type = Payload
Perigee Altitude = 550.000 (km)
Apogee Altitude = 550.000 (km)
Inclination = 97.500 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass Ratio = 0.0078 (m^2/kg)
Start Year = 2021.000 (yr)
Initial Mass = 295.000 (kg)
Final Mass = 128.000 (kg)
Duration = 0.010 (yr)
Station-Kept = False
Abandoned = True

OUTPUT

Collision Probability = 3.4436E-05
Returned Message: Normal Processing
Date Range Message: Normal Date Range
Status = Pass

==========

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

01 29 2021; 11:50:08AM Processing Requirement 4.6 Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX2
Space Structure Type = Payload

Perigee Altitude = 550.000000 (km)
Apogee Altitude = 550.000000 (km)
Inclination = 97.500000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.007771 (m^2/kg)
Start Year = 2021.000000 (yr)
Initial Mass = 295.000000 (kg)
Final Mass = 128.000000 (kg)
Duration = 0.010000 (yr)
Station Kept = False
Abandoned = True
PMD Perigee Altitude = 548.385245 (km)
PMD Apogee Altitude = 551.609703 (km)
PMD Inclination = 97.501102 (deg)
PMD RAAN = 3.542512 (deg)
PMD Argument of Perigee = 173.951631 (deg)
PMD Mean Anomaly = 0.000000 (deg)

OUTPUT

Suggested Perigee Altitude = 548.385245 (km)
Suggested Apogee Altitude = 551.609703 (km)
Returned Error Message = Passes LEO reentry orbit criteria.

Released Year = 2034 (yr)
Requirement = 61
Compliance Status = Pass

==========

========== End of Requirement 4.6 ==========
01 29 2021; 11:50:12AM **********Processing Requirement 4.7-1
Return Status : Passed

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

name = Sherpa-FX2
quantity = 1
parent = 0
materialID = 5
type = Cylinder
Aero Mass = 128.000000
Thermal Mass = 128.000000
Diameter/Width = 0.813000

name = FX upper 24-in separation sytem
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 1.800000
Thermal Mass = 1.800000
Diameter/Width = 0.610000

Length = 0.610000
Height = 0.031000

name = FX Hex Plate
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 12.000000
Thermal Mass = 12.000000
Diameter/Width = 0.822000
Length = 0.822000
Height = 0.070000

name = FX Interior Wall
quantity = 6
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.162000
Thermal Mass = 1.162000
Diameter/Width = 0.118000
Length = 0.318000

name = FX Corner Brace
quantity = 6
parent = 1
materialID = 8
type = Box
Aero Mass = 2.040000
Thermal Mass = 2.040000
Diameter/Width = 0.151000
Length = 0.178000
Height = 0.151000

name = FX DuoPack adapter plate
quantity = 2
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.920000
Thermal Mass = 1.920000
Diameter/Width = 0.311000
Length = 0.350000

name = FX QuadPack adapter plate
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.727000
Thermal Mass = 1.727000
Diameter/Width = 0.297000
Length = 0.311000

name = MLB adapter plate
quantity = 3
parent = 1
materialID = 8
type = Box
Aero Mass = 2.170000

Thermal Mass = 2.170000
Diameter/Width = 0.283660
Length = 0.311150
Height = 0.031750

name = ISIPod L-bracket
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 2.000000
Thermal Mass = 2.000000
Diameter/Width = 0.300000
Length = 0.400000
Height = 0.150000

name = FX avionics deck plate
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 4.100000
Thermal Mass = 4.100000
Diameter/Width = 0.544000
Length = 0.544000
Height = 0.022000

name = FX R2A-Core
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 3.200000
Thermal Mass = 3.200000
Diameter/Width = 0.285000
Length = 0.285000
Height = 0.090000

name = FX battery module
quantity = 2
parent = 1
materialID = 5
type = Box
Aero Mass = 2.650000
Thermal Mass = 2.650000
Diameter/Width = 0.100000
Length = 0.139000
Height = 0.100000

name = FX EyeStar Black Box
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 0.290000
Thermal Mass = 0.290000
Diameter/Width = 0.054000
Length = 0.089000
Height = 0.047000

name = empty ISIPod

quantity = 2
parent = 1
materialID = 5
type = Box
Aero Mass = 2.000000
Thermal Mass = 2.000000
Diameter/Width = 0.180000
Length = 0.414000
Height = 0.130000

name = FX empty DuoPack
quantity = 2
parent = 1
materialID = 5
type = Box
Aero Mass = 4.600000
Thermal Mass = 4.600000
Diameter/Width = 0.250000
Length = 0.402000
Height = 0.152400

name = empty QuadPack
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 7.500000
Thermal Mass = 7.500000
Diameter/Width = 0.250000
Length = 0.440000
Height = 0.250000

name = PRA
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 11.998000
Thermal Mass = 11.998000
Diameter/Width = 0.626000
Length = 0.626000
Height = 0.070000

name = 15-3 Spacer Ring
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 6.350000
Thermal Mass = 6.350000
Diameter/Width = 0.198000
Length = 0.198000
Height = 0.076200

name = FX lower 8-in separation system
quantity = 3
parent = 1
materialID = 5
type = Box
Aero Mass = 1.191000
Thermal Mass = 1.191000

Diameter/Width = 0.117508
Length = 0.117508
Height = 0.045466

name = lower 15-in separation system
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 2.057000
Thermal Mass = 2.057000
Diameter/Width = 0.206154
Length = 0.206154
Height = 0.045466

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

name = Sherpa-FX2
Demise Altitude = 77.999817
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX upper 24-in separation sytem
Demise Altitude = 75.533455
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Hex Plate
Demise Altitude = 60.231030
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Interior Wall
Demise Altitude = 72.850060
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Corner Brace
Demise Altitude = 72.668243
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX DuoPack adapter plate
Demise Altitude = 73.091049
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX QuadPack adapter plate
Demise Altitude = 72.969254
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = MLB adapter plate

Demise Altitude = 72.467041
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = ISIPod L-bracket
Demise Altitude = 75.476692
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX avionics deck plate
Demise Altitude = 71.831902
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX R2A-Core
Demise Altitude = 70.341408
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX battery module
Demise Altitude = 67.148643
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX EyeStar Black Box
Demise Altitude = 74.773628
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = empty ISIPod
Demise Altitude = 74.942795
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX empty DuoPack
Demise Altitude = 71.661888
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = empty QuadPack
Demise Altitude = 70.731926
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = PRA
Demise Altitude = 62.102901
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = 15-3 Spacer Ring
Demise Altitude = 59.115799

Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX lower 8-in separation system
Demise Altitude = 69.313759
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = lower 15-in separation system
Demise Altitude = 69.642227
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****

========== End of Requirement 4.7-1 ==========
01 29 2021; 11:50:12AM Project Data Saved To File

Raw DAS Output –Mission Failure at 550 km (no customers separated)

01 29 2021; 09:59:22AM Activity Log Started
01 29 2021; 09:59:22AM Opened Project C:\Users\elund\Box\Eric Lund\Missions and Programs\SXRS-5\DAS RevA DoA\
01 29 2021; 09:59:35AM Processing Requirement 4.3-1: Return Status : Not Run

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

========== End of Requirement 4.3-1 ==========
01 29 2021; 09:59:36AM Processing Requirement 4.3-2: Return Status : Passed

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

========== End of Requirement 4.3-2 ==========
01 29 2021; 11:15:26AM Processing Requirement 4.5-1: Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX2
Space Structure Type = Payload
Perigee Altitude = 550.000 (km)
Apogee Altitude = 550.000 (km)
Inclination = 97.500 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass Ratio = 0.0036 (m^2/kg)
Start Year = 2021.000 (yr)
Initial Mass = 295.000 (kg)
Final Mass = 295.000 (kg)
Duration = 0.010 (yr)
Station-Kept = False
Abandoned = True

OUTPUT

Collision Probability = 5.8447E-05
Returned Message: Normal Processing
Date Range Message: Normal Date Range
Status = Pass

==========

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

01 29 2021; 11:15:30AM Processing Requirement 4.6 Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX2
Space Structure Type = Payload

Perigee Altitude = 550.000000 (km)
Apogee Altitude = 550.000000 (km)
Inclination = 97.500000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.003610 (m^2/kg)
Start Year = 2021.000000 (yr)
Initial Mass = 295.000000 (kg)
Final Mass = 295.000000 (kg)
Duration = 0.010000 (yr)
Station Kept = False
Abandoned = True
PMD Perigee Altitude = 548.385268 (km)
PMD Apogee Altitude = 551.609323 (km)
PMD Inclination = 97.501102 (deg)
PMD RAAN = 3.542512 (deg)
PMD Argument of Perigee = 174.176703 (deg)
PMD Mean Anomaly = 0.000000 (deg)

OUTPUT

Suggested Perigee Altitude = 548.385268 (km)
Suggested Apogee Altitude = 551.609323 (km)
Returned Error Message = Passes LEO reentry orbit criteria.

Released Year = 2045 (yr)
Requirement = 61
Compliance Status = Pass

==========

========== End of Requirement 4.6 ==========
01 29 2021; 11:15:35AM **********Processing Requirement 4.7-1
Return Status : Passed

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

name = Sherpa-FX2
quantity = 1
parent = 0
materialID = 5
type = Cylinder
Aero Mass = 295.000000
Thermal Mass = 295.000000
Diameter/Width = 0.813000

name = FX upper 24-in separation sytem
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 1.800000
Thermal Mass = 1.800000
Diameter/Width = 0.610000
Length = 0.610000

Height = 0.031000

name = FX Hex Plate
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 12.000000
Thermal Mass = 12.000000
Diameter/Width = 0.822000
Length = 0.822000
Height = 0.070000

name = FX Interior Wall
quantity = 6
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.162000
Thermal Mass = 1.162000
Diameter/Width = 0.118000
Length = 0.318000

name = FX Corner Brace
quantity = 6
parent = 1
materialID = 8
type = Box
Aero Mass = 2.040000
Thermal Mass = 2.040000
Diameter/Width = 0.151000
Length = 0.178000
Height = 0.151000

name = FX DuoPack adapter plate
quantity = 2
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.920000
Thermal Mass = 1.920000
Diameter/Width = 0.311000
Length = 0.350000

name = FX QuadPack adapter plate
quantity = 1
parent = 1
materialID = 8
type = Flat Plate
Aero Mass = 1.727000
Thermal Mass = 1.727000
Diameter/Width = 0.297000
Length = 0.311000

name = MLB adapter plate
quantity = 3
parent = 1
materialID = 8
type = Box
Aero Mass = 2.170000
Thermal Mass = 2.170000

Diameter/Width = 0.283660
Length = 0.311150
Height = 0.031750

name = ISIPod L-bracket
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 2.000000
Thermal Mass = 2.000000
Diameter/Width = 0.300000
Length = 0.400000
Height = 0.150000

name = FX avionics deck plate
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 4.100000
Thermal Mass = 4.100000
Diameter/Width = 0.544000
Length = 0.544000
Height = 0.022000

name = FX R2A-Core
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 3.200000
Thermal Mass = 3.200000
Diameter/Width = 0.285000
Length = 0.285000
Height = 0.090000

name = FX battery module
quantity = 2
parent = 1
materialID = 5
type = Box
Aero Mass = 2.650000
Thermal Mass = 2.650000
Diameter/Width = 0.100000
Length = 0.139000
Height = 0.100000

name = FX EyeStar Black Box
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 0.290000
Thermal Mass = 0.290000
Diameter/Width = 0.054000
Length = 0.089000
Height = 0.047000

name = empty ISIPod
quantity = 2

parent = 1
materialID = 5
type = Box
Aero Mass = 2.000000
Thermal Mass = 2.000000
Diameter/Width = 0.180000
Length = 0.414000
Height = 0.130000

name = FX empty DuoPack
quantity = 2
parent = 1
materialID = 5
type = Box
Aero Mass = 4.600000
Thermal Mass = 4.600000
Diameter/Width = 0.250000
Length = 0.402000
Height = 0.152400

name = empty QuadPack
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 7.500000
Thermal Mass = 7.500000
Diameter/Width = 0.250000
Length = 0.440000
Height = 0.250000

name = PRA
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 11.998000
Thermal Mass = 11.998000
Diameter/Width = 0.626000
Length = 0.626000
Height = 0.070000

name = 15-3 Spacer Ring
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 6.350000
Thermal Mass = 6.350000
Diameter/Width = 0.198000
Length = 0.198000
Height = 0.076200

name = FX lower 8-in separation system
quantity = 3
parent = 1
materialID = 5
type = Box
Aero Mass = 1.191000
Thermal Mass = 1.191000
Diameter/Width = 0.117508

Length = 0.117508
Height = 0.045466

name = lower 15-in separation system
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 2.057000
Thermal Mass = 2.057000
Diameter/Width = 0.206154
Length = 0.206154
Height = 0.045466

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

name = Sherpa-FX2
Demise Altitude = 77.998375
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX upper 24-in separation sytem
Demise Altitude = 76.346458
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Hex Plate
Demise Altitude = 67.388969
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Interior Wall
Demise Altitude = 74.356865
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Corner Brace
Demise Altitude = 74.215584
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX DuoPack adapter plate
Demise Altitude = 74.542831
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX QuadPack adapter plate
Demise Altitude = 74.451355
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = MLB adapter plate
Demise Altitude = 74.040718

Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = ISIPod L-bracket
Demise Altitude = 76.278023
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX avionics deck plate
Demise Altitude = 73.605568
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX R2A-Core
Demise Altitude = 72.383125
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX battery module
Demise Altitude = 69.828629
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX EyeStar Black Box
Demise Altitude = 75.775063
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = empty ISIPod
Demise Altitude = 75.907417
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX empty DuoPack
Demise Altitude = 73.427376
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = empty QuadPack
Demise Altitude = 72.719269
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = PRA
Demise Altitude = 66.339401
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = 15-3 Spacer Ring
Demise Altitude = 63.084335
Debris Casualty Area = 0.000000

Impact Kinetic Energy = 0.000000

****
name = FX lower 8-in separation system
Demise Altitude = 71.547256
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = lower 15-in separation system
Demise Altitude = 71.794197
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****

========== End of Requirement 4.7-1 ==========
01 29 2021; 11:15:35AM Project Data Saved To File
01 29 2021; 11:16:50AM Project Data Saved To File

END of Sherpa-FX2 Orbital Debris Assessment Report (ODAR)