REQUEST FOR SPECIAL TEMPORARY AUTHORITY

Spaceflight Inc. (“Spaceflight”), pursuant to Section 25.120 of the Commission’s Rules,[1] hereby requests Special Temporary Authority (“STA”) to permit it to deploy and operate the Sherpa-FX3, launching on a SpaceX Falcon 9 for a period not to exceed 36 hours, with such period to commence from their launch and deployment that is scheduled to occur between December 1, 2021, and January 31, 2021. Sherpa-FX3 will operate for up to 36 hours from launch and deployment.

Overview

The Sherpa-FX3 will be placed in sun synchronous orbit (SSO)at an altitude of 525 km ± 25km at an inclination of 97.59 degrees. At that point and after subsequent delays in accordance with SpaceX requirements, the Rapidly Reconfigurable Avionics (R2A)-Core (discussed below) will initiate a timed sequence of procedures to begin the deployment of spacecraft on Sherpa-FX3.

Sherpa-FX3

Sherpa-FX3 will be functionally the same as Sherpa-FX1, approved by the Commission under license number SAT-STA-20200728-00089. Sherpa-FX3 is a non-propulsive, free-flying spacecraft that will deploy auxiliary spacecraft after Sherpa-FX3 itself separates from the Falcon 9 launch vehicle. Sherpa-FX3 will deploy up to eight (8) spacecraft.[2] Of these spacecraft, three have propulsion. None of the Sherpa-FX3 deployed spacecraft will deploy further payloads or spacecraft. The total launch mass of the Sherpa-FX3 will be approximately 280 kg, of which approximately150 kg will be made up of customer spacecraft to be deployed. Sherpa-FX3 will also carry one approximately 5 kg, hosted payload , subject to the provider of that payload, NearSpace Launch, securing its own separate authority for this mission from the Commission.

[1] Spaceflight also respectfully requests a waiver of Section 25.113(g) of the Commission’s rules, requiring orbital deployment approval and operating authority to be applied for and granted prior to orbital deployment and operation of a space station. In this case, given: (1) the short operational life of Sherpa-FX3; (2) the similarity of its function to that of an upper stage launch vehicle; (3) the descriptions contained herein and in the associated attachments of the spacecraft operations and debris mitigation plans that might otherwise be presented forapproval as part of an application for approval for the orbital deployment and operation of a space station; and (4) the overall public interest of the mission that is presented, Spaceflight urges that the underlying purpose of the rule sought to be waived is met and that the grant of the requested waiver will serve the public interest.

[2] Currently, eight (8) spacecraft are expected to be onboard the Sherpa-FX3. However, the Sherpa-FX3 manifest may change before launch. In any event, Sherpa-FX3 will carry no more than eight (8) spacecraft on this launch and all risk assessments and analyses of the Sherpa-FX3 spacecraft factor in the maximum number of spacecraft and highest possible launch mass.

Further detail on Sherpa-FX3 and the hosted payloads is included in Exhibit A.

Like Sherpa FX1 and Sherpa FX2, Sherpa-FX3 will utilize Spaceflight's R2A-Core sequencer that communicates over L-band with the Globalstar network. R2A-Core will utilize the EyeStar S3 Black Box Radio (provided by NearSpace Launch) and L-Band transmitterto send deployment confirmation telemetry to the Globalstar constellation for relay bycommercial Globalstar and NearSpace Launch data services to Spaceflight.

The Sherpa-FX3 mission is anticipated to last less than six (6) hours and all communications from R2A-Core will stop at or less than 36 hours after launch.[3] Sherpa-FX3 is equipped with an S-band receiver, also contained within the EyeStar S3 Black Box Radio, to allow a kill-command to be sent from a ground station operated by NearSpace Launch to deactivate the transmitter in the event of radio frequency interference. The R2A-Core will also have an on-board timer to cut off its transmissions several hours after the end of the planned deployment cycle. If all else fails, battery life is expected to be exhausted by 36 hours into the mission. Sherpa-FX3 will naturally deorbit over time.

Radio Frequencies to Be Employed

Spaceflight seeks authority to employ the same frequencies for the FX3 spacecraft as Spaceflight was authorized for its FX2 spacecraft. Thus, Spaceflight seeks authority to permit it to establish one-way telemetry link from both Sherpa-FX3 to the Globalstar constellation for an up to 36-hour period during spacecraft deployment. Globalstar will use its own licensed network to downlink the telemetry and is responsible for securing FCC authority to receive signals from R2A-Core.[4] The L-band link will permit the Spaceflight technical crew to monitor the deployment of the small spacecraft onboard both Sherpa vehicles. This data will be disseminated both to Spaceflight's customers and to the Combined Space Operations Center (CSpOC).

Spaceflight also seeks authority for the operation of an S-band receive antenna to be connected to both Sherpa-FX3 to enable it to receive signals from a NearSpace Launch owned and operated S-band transmit station.[5] The purpose of this S-band link is to enable the L-band antenna to be shut down from the ground if required to avoid any unanticipated harmful interference and/or as a final failsafe if theL-band antenna is not shut off within 36 hours by operation of its on board timer or lossof battery life. The Sherpa-FX3 is equipped with a GPS receive unit to enable it to be more easily tracked.

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[3] Due to improvements in technology, the battery life on the Sherpa-FX3 is now 36 hours instead of the 24 hour battery life of Sherpa-FX2.

[4] R2A-Core does not transmit signals to the ground, except through the Globalstar constellation network.

[5] This is the same facility for which NearSpace Launch was authorized to use to support Spaceflight's FX1 and FX2 missions.

Authority for that unit is also hereby requested.[6]

After the 36-hour period, R2A-Core and communication to or from the EyeStarS3 Black Box Radio will shut down completely and Sherpa-FX3 will no longer receive or send communication.

A summary of frequencies to be used is detailed in the table below:

Sherpa-FX3 OTV Comms	
Parameter	**S-Band Uplink to Sherpa**
Data Rate	38.4 Kbps
Modulation	2-GFSK
Center Frequency	2075 MHz
Bandwidth	300 KHz
Transmit Power	
Transmit Antenna/Gain	
EIRP	
Polarization	
Receive Antennas	Active Patch/5.5 dBi
Receive Noise Temp.	
Receive System Figure of Merit (G/T)	
Encryption	AES-256
Duty Cycle (max)	50%

[6] There may also be a passively modulated radar reflector to help identify Sherpa sooner among the cluster of objects separated by the launch vehicle. This radar reflector does not transmit or receive any radio frequencies and is simply a component to assist identification and tracking.

With regard to these frequencies, Spaceflight understands that it will need waivers to use the 402.9 MHz band as a non-conforming use. Such waivers are respectfully requested. With regard to use of 400.5 MHz, Spaceflight understands that its use would be permitted only on a secondary, non-interference basis.

With regard to all frequencies to be employed that were and/or are also being employed for Spaceflight's Sherpa-FX3, Spaceflight will observe all operating restrictions and coordination conditions for its new SherpaFX3 missions as were specified in the grant to Spaceflight of Special Temporary Authority for its Sherpa-FX1 mission.[7]

Customer Manifest:

Current customer manifest for Sherpa-FX3 is attached as Exhibit D. Because the availability of customer spacecraft can change closer to the time of launch, Spaceflight requests that the authority it be granted include authority: (i) to substitute non-separating mass module(s) for customer spacecraft that are not available.

Responsibilities of Owners/Operators of Spacecraft to be Deployed and Hosted Payloads; Customer Manifests

The spacecraft to be deployed and the hosted payload on Sherpa-FX3 are owned and to be operated by Spaceflight's customers or, in some cases, their customer operator. Each customer is expressly required under its agreement with Spaceflight to obtain and/or require its customer operator to obtain all licenses, authorization, clearances, and permits from their applicable administrations that may be necessary to operate its individual spacecraft or hosted payload. Further detail on the hosted payload to be flown on Sherpa-FX3 is included in Exhibit A, the Technical Annex, attached hereto. The above referenced customer manifests include the identity of customers or, if different, operators, and their authorizing administrations.

Exhibits

A more detailed technical showing is attached as Exhibit A.

An Orbital Debris Assessment Report ("ODAR") for the Sherpa-FX3 is attached hereto as Exhibit B

A Recontact Probability Analysis relative to the customer spacecraft to be deployed by Sherpa-FX3 is attached hereto as Exhibit C .

Lists of customers/operators for the spacecraft to be deployed and the hosted

[7] SAT-STA-20200728-00089.

payload are attached hereto as Exhibit D.

Exhibit E, together with Attachment 1 and 2 detailing Spaceflight's ownership information is attached hereto.

An ITU Cost Recovery Letter is provided as Exhibit F hereto. Spaceflight notes that the attached letter does not have the Commission file number for this Request which will only be available after the Request is filed. Once available, Spaceflight will resubmit the ITU Cost Recovery Letter with that file number.

Spaceflight also has under preparation and will submit as soon as possible a SpaceCap filing covering the frequencies requested for use herein.

Conclusion

Spaceflight urges that grant of the instant request for Special Temporary Authority will be in the public interest. Such grant will permit Spaceflight to continue to provide its new and innovative deployment technology for small spacecraft, thereby providing a cost-efficient means for placing them into their designed orbits.

Technical Annex to STA

Spaceflight's Sherpa-FX3 Mission

Spaceflight, Inc, ("Spaceflight") is planning to launch and deploy the Sherpa-FX3 free flyer on a Space Exploration Technologies Corporation ("SpaceX") Falcon 9 (the "Mission").

Sherpa-FX3 is scheduled to be launched by Space Exploration Technologies Corporation (SpaceX) on a Falcon 9 launch vehicle between 1 December 2021 and 31 January 2022. On a SpaceX port, the Sherpa-FX3 will separate from the Falcon 9 upon receipt of a separation commands from the launch vehicle once the launch vehicle reaches the destination orbit, targeted at 525 km, with a tolerance of ± 25km. In addition to Sherpa-FX3, the Falcon 9 will have multiple rings with SpaceX's own customers stacked above and/or below the ring to which Spaceflight's Sherpa-FX3 is attached.

Sherpa-FX3

Sherpa-FX3 will be functionally the same as Sherpa-FX1 and Sherpa-FX2, previously approved by the Commission under license number SES-STA-20200728-00089 and SAT-STA-20210205-00017. Sherpa-FX3 is a non-propulsive, free flying spacecraft that is designed to deploy auxiliary spacecraft. Like previous missions (SSO-A,[1] Sherpa-FX1,[2] and Sherpa-FX2,[3]), Sherpa-FX3 consists of several structural elements to mount both microsatellites and CubeSat dispensers. Spaceflight provides the launch capacity, structure, separation systems, and integration services for the customer spacecraft located on Sherpa-FX3. Like Sherpa-FX1 and Sherpa-FX2, Sherpa-FX3 contains a Rapidly Reconfigurable Avionics Core ("R2A-Core") system to command the deployment of up to eight (8) customer spacecraft into Sun Synchronous Orbit ("SSO").[4] Sherpa-FX3 will be attached to a single port on a SpaceX-provided payload ring. Once a separation signal is received by Sherpa-FX3's separation system from SpaceX's Falcon 9 avionics, Sherpa-FX3 will separate. After Sherpa-FX3's separation from the Falcon 9 launch vehicle and a subsequent

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[1] SAT-STA-20180523-00042.
[2] SAT-STA-20200728-00089.
[3] SAT-STA-20210205-00017.
[4] Spaceflight notes that while the Sherpa-FX3 manifest may change before launch, Sherpa-FX3 will carry no more than eight8) spacecraft on this launch and all risk assessments and analyses of the Sherpa-FX3 spacecraft factor in the maximum number of spacecraft and highest possible launch mass. The Mission analyses will be rerun with the final spacecraft configuration and we expect it to show improved results compared to those presented in the application.

delay in accordance with SpaceX requirements, the R2A-Core will initiate its own separation sequence to deploy customer spacecraft from Sherpa-FX3 and send telemetry back to Spaceflight. The R2A-Core also activates the EyeStar S3 Black Box Radio (provided by NearSpace Launch and more fully described below); specifically, the L-band transmitter that sends deployment confirmation telemetry to the Globalstar constellation for relay by commercial Globalstar and NearSpace Launch data services to Spaceflight.

The Sherpa-FX3 Mission is anticipated to last less than six hours, and all communications will stop at or less than 36 hours after launch. The R2A-Core is equipped with an S-band receiver, also contained within the EyeStar Radio, to allow a kill-command to be sent from a ground station operated by NearSpace Launch to deactivate the transmitter in the event of radio frequency interference. The R2A-Core will also have an on-board timer to cut off its transmissions several hours after the end of the planned deployment cycle. If all else fails, battery life is expected to be exhausted by 36 hours into the Sherpa-FX3 Mission.

The internal volume of Sherpa-FX3 will contain R2A-Core sequencer and batteries.

Sherpa-FX3 will also carry one non-separating customer hosted payload on its structure, as further detailed below.

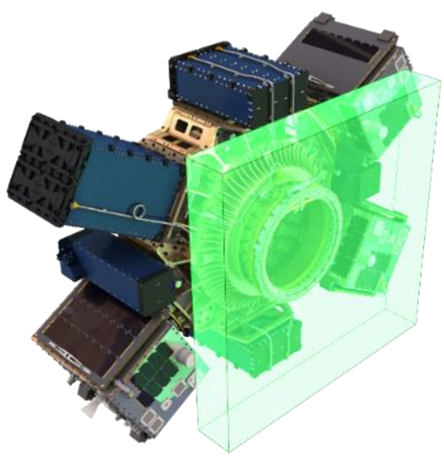

Figure 1: Physical architecture of Spaceflight's Sherpa-FX3 with customers on a SpaceX Falcon 9 Rideshare Mission.

Hosted Payloads

Spaceflight will host one (1) payload on Sherpa-FX3. The hosted payload that is permanently affixed to the Sherpa-FX3 spacecraft (TROOP-3) has a radio transmitter. The TROOP-3 payload is owned and operated by NearSpace Launch. TROOP-3 has two independent mechanical switches that are connected to the Sherpa-FX3 separation systems. Other than the mechanical interface of the payload to Sherpa-FX3, these switches are the only interface to Sherpa-FX3, and all power and radios are electrically independent from those belonging the Sherpa-FX3. There are payload inhibit switches that prevent inadvertent activation of the payload with single fault tolerance. When the Sherpa-FX3 separates, the two switches will close, activating an onboard timer on the TROOP-3 payload. Thereafter, these switches have no further function. TROOP-3 will automatically begin beaconing after 30 minutes from the activation of the timer. Any RF transmissions from the payload or from the ground will be licensed by NearSpace Launch and NearSpace Launch must obtain the proper authorization as a prerequisite to integration on Sherpa-FX3.

RF System Design – R2A-Core

The R2A-Core has an L-band transmitter, an S-band receiver, and a GPS L-band receiver. The L-band transmitter broadcasts through one simplex patch antenna to the Globalstar constellation using a NearSpace Launch the EyeStar S3 Black Box Radio, the same system that flew on the Sherpa-FX1 and Sherpa-FX2 missions. The EyeStar S3 Black Box Radio has an absolute temperature operating range between -40°C and 60°C. If found to be outside of that range for too long, the transmitter will stop working. The EyeStar S3 Black Box Radio unit transmits 99.00% of its radiated power within 1.8817 MHz of the specified 2.5 MHz bandwidth. The EyeStar S3 Black Box Radio also includes an integrated Novatel GPS receiver module that works in conjunction with a GPS patch antenna.

Other radio property details are shown in the following table:

Sherpa R2A-Core Communication System	
Parameter	**L-band Uplink to Globalstar**
Data Rate	100 bps
Modulation	BPSK
Center Frequency	1616.25 MHz
Bandwidth	2.5 MHz
Transmit Power	0.10 W (max)
Transmit Antenna	Patch
Receive Antennas	Patch (S-band, GPS)
EIRP	-8 dBW
Encryption	AES-128 and AES-256
Duty Cycle (max)	50%

RF Concept of Operations

The L-band avionics systems on the R2A Core are set to beacon data to the Globalstar constellation from activation until cut off by a timer set to shut off transmissions once the deployments of all Sherpa FX-3 customer spacecraft are complete. The duty cycle for the L-band system is a transmission up to 10 seconds every 20 seconds (30 seconds of broadcast time per minute; a 50% duty cycle). The EyeStar S3 Radio has an S-band uplink that can receive a kill command from the NearSpace Launch ground station.

The L-band transmitter will continue to broadcast until the earliest of the following:

- Programmed stop (via R2A-Core's onboard mission sequence);
- Kill command from S-band ground transmitter; or
- Battery depleted (No more than 36 hours after starting).

The S-band receive antenna's purpose is solely to receive a kill command from the ground.

Sherpa-FX3 Mission Communication System

Communication details for the Sherpa-FX3 Mission are provided in the following table:

Sherpa-FX3 OTV Comms	
Parameter	**S-Band Uplink to Sherpa**
Data Rate	38.4 Kbps
Modulation	2-GFSK
Center Frequency	2075 MHz
Bandwidth	300 KHz
Transmit Power	
Transmit Antenna/Gain	
EIRP	
Polarization	
Receive Antennas	Active Patch/5.5 dBi
Receive Noise Temp.	
Receive System Figure of Merit (G/T)	
Encryption	AES-256
Duty Cycle (max)	50%

Sherpa-FX3 Orbital Debris Assessment Report (ODAR)

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

Report Version 1
August 10, 2021

Document Data is Not Restricted.

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-8719.14B.

Orbital Debris Self-Assessment Report Evaluation: Sherpa-FX3 on December 2021-January 2022 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 United States (US), and governed by the laws, 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 December 2021-January 2022 SpaceX Rideshare Mission. Sections 9 through 14 which 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: December 2021-January 2022

Mission Overview:
The December 2021-January 2022 SpaceX Rideshare Mission ("Transporter-3") is a commercial rideshare mission, for which the primary objective of Spaceflight Inc., is deploying 8 customer spacecraft into a planned sun-synchronous circular orbit of 525 km with a tolerance of ± 25 km. The launch vehicle will deploy a free flyer spacecraft, called "Sherpa-FX3", which will deploy additional customer spacecraft within several hours of launch and separation and will carry one hosted payload 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*). This represents a worst-case scenario and ensures that any changes to the Sherpa-FX3 manifest will be bounded by this ODAR analysis.

Sherpa-FX3 is physically and functionally identical to the Sherpa-FX1 and Sherpa-FX2 vehicles Spaceflight has flown previously.

ODAR Configuration:
ODAR analysis was run for two potential scenarios (Nominal Mission and Failed Mission). The results presented here for the Failed Mission envelope the worst-case scenario and our final mission analyses shall be no worse than these initial baselined numbers. Since the physical architecture layout of the Sherpa vehicle is often not finalized until around Launch – 3months, due to customer remanifest, vehicle optimization, etc., Spaceflight seeks to initially present these worst-case, generalized results for the Sherpa FX-3 vehicle now. Once the physical architecture has been finalized, Spaceflight shall rerun our ODAR analysis and provide an updated ODAR report to the Commission demonstrating that the finalized ODAR shows equal or improved results compared to those baselined in this submission.

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

- *Nominal Mission*: All customer deployments successful.
- *Failed Mission:* All spacecraft deployments unsuccessful, which represents a worst-case scenario.[1]

[1] In addition to assuming the highest possible mass, Spaceflight has also assumed the highest target orbit and highest ballistic coefficient throughout the orbit lifetime of the vehicles.

In order to most accurately perform analysis within the constraints of the DAS tool, ODAR analyses contained in this report were run for the scenarios in the following table, showing comparison to the intended mission.

Scenario	DAS Analysis	Mission	Delta between DAS and Mission
Sherpa-FX3 Nominal Mission	525 km operational orbit, no PMD	525 km operational orbit, No PMD	None
Sherpa-FX3 Failed Mission	550 km (highest possible), no PMD	550 km (highest possible), no PMD	None

ODAR Summary:

- No debris released in normal operations;
- No credible scenario for breakups;
- The collision probability with other objects is compliant with NASA standards; and
- The estimated worst-case 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.

	Nominal Mission	Failed Mission
Sherpa-FX3	12.9 years	16.0 years

Launch vehicle and launch site: SpaceX Falcon 9**,** Cape Canaveral Air Force Station, Florida

Proposed launch date: December 2021-January 2022

Mission duration:

Maximum Sherpa-FX3 Nominal Transmitting Operations:

- < 36 hours

Post-Mission Orbit lifetime:

- For a Nominal Mission at 525 km, Sherpa-FX3 has a predicted post-mission orbit lifetime 12.9 years.

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

Sherpa-FX3

	Apogee Altitude	Perigee Altitude	Inclination	Duration
Mission Orbit	525 ± 25 km	525 ± 25 km	97.384 ± 0.1 deg	<1 day
End-of-Life Orbit	525 ± 25 km	525 ± 25 km	97.384 ± 0.1 deg	12.9 years (nominal) 16.0 years (failed, 550 km mission)

ODAR Section 2: Spacecraft Description

Physical description of the spacecraft:
Sherpa-FX3 is a non-propulsive, free flying spacecraft that is designed to deploy auxiliary spacecraft. Sherpa-FX3 will also carry one (1) hosted payload that will remain on the spacecraft through deorbit.[2] It is structurally alike, to the previously licensed Sherpa-FX1[3] and Sherpa-FX2[4]. The separation system and customer payload layout on Sherpa-FX3 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 the Sherpa-FX3 vehicle. A microsatellite, CubeSat dispenser, or other adapter for separation system mounting can be affixed on the outboard end of Sherpa-FX3. Thus, Sherpa-FX3 will deploy customers in the same fashion as the previously licensed Sherpa-FX1 and Sherpa-FX2. For this Mission, the planned configuration has a microsatellite on the outboard end of Sherpa-FX3, with three microsatellites, a 3U dispenser containing 4 sub-3U cubesats, and a hosted payload attached radially on the body of Sherpa-FX3.[5] The Sherpa-FX3 Mission configuration also includes an S-band receive antenna and an L-band transmitter as part of its avionics.

Sherpa-FX3 will be attached to a single port on a SpaceX-provided payload ring. The SpaceX Falcon 9 will have multiple rings with SpaceX's other customers stacked above and/or below the ring to which Spaceflight's Sherpa-FX3 is attached. Once a separation signal is received by Sherpa-FX3's separation system from SpaceX's Falcon 9 avionics, the Sherpa-FX3 will separate.

Sherpa-FX3 utilizes the R2A-Core system for its primary mission to command the deployment of approximately 8 customer spacecraft into SSO. After Sherpa-FX3's separation from SpaceX's Falcon 9 launch vehicle and a subsequent delay in accordance with SpaceX requirements, once activated, the R2A-Core executes an onboard mission sequence to deploy customer spacecraft. The internal volume of Sherpa-FX3 will contain R2A-Core sequencer and batteries.

The R2A-Core also activates the EyeStar S3 Black Box Radio (provided by NearSpace Launch) and, specifically, the L-band transmitter which sends deployment confirmation telemetry to the Globalstar constellation for relay by commercial Globalstar and NearSpace Launch data services to Spaceflight.

In a case where any combination of spacecraft are unable to make the mission, a non-separating mass model will be either inserted into a locked dispenser door or affixed directly to the Sherpa structure, depending on the missing spacecraft's form factor. These mass models are materially and physically the same as those evaluated in Spaceflight's Sherpa-FX1 submission and therefore have not been included in this new risk analysis. In the Sherpa-FX12STA, 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-FX3 structure.

[2] There may also be a passively modulated radar reflector to help identify Sherpa sooner among the cluster of objects separated by the launch vehicle. This radar reflector does not transmit or receive any radio frequencies and is simply a component to assist identification and tracking.
[3] SAT-STA-20200728-00089 Spaceflight, Inc. Sherpa-FX1 STA.
[4] SAT-STA-20210205-00017 Spaceflight, Inc. Sherpa-FX2 and Sherpa-LTE1 STA.
[5] None of the spacecraft to be deployed will themselves deploy additional spacecraft.

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

Sherpa-FX3	280 kg

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

Sherpa-FX3	280 kg

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

Sherpa-FX3	130.4 kg

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

Sherpa-FX3 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.

> **Power System #1:** Sherpa-FX3 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-FX3 does not have attitude control.

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

Description of the electrical generation and storage system:

> **Power System #1:** Standard Commercial Off The Shelf (COTS) lithium iron disulfide and nickel-metal hydride battery cells are charged prior to payload integration and provide electrical energy during the primary phase of the mission to separate customer spacecraft. Total energy capacity is ~228 W·hr and the maximum voltage is 36 VDC. These batteries have no ability to recharge once Sherpa-FX3 is in orbit. The electrical load on this circuit has a low-voltage cut-off at ~23 VDC, below which the batteries have <1% energy capacity remaining. These batteries are at the very center of the structure. In the event of an unlikely battery explosion, the structure would contain any fragments or debris.

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: For Sherpa-FX3 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-FX3 is designed such that when mission operations begin, all energy from the secondary batteries will dissipate within 36 hours. The primary batteries will dissipate all energy within 36 hours. Additionally, Sherpa-FX3 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 for Sherpa-FX3.

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-8719.14b, 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-FX3	0.00001728	0.00005305	PASS

Requirement 4.5-2:

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

Spacecraft	Status
Sherpa-FX3	COMPLIANT

Probability of Damage from Small Debris

Sherpa-FX3 does not have the ability to perform a post mission disposal maneuver and is compliant with all orbit lifetime requirements.

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

Sherpa-FX3 batteries will deplete within 36 hours after separation. Sherpa-FX3 will deorbit naturally and rely on atmospheric drag. Sherpa-FX3 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-FX3 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-FX3 will deorbit naturally by atmospheric re-entry.

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

Sherpa-FX3 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-FX3	130.4 kg	280 kg

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

	Nominal Mission	**Failed Mission**
Sherpa-FX3	0.6920 m^2	1.3252 m^2

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

	Nominal Mission	**Failed Mission**
Sherpa-FX3	0.005307 m^2/kg	0.004733 m^2/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.

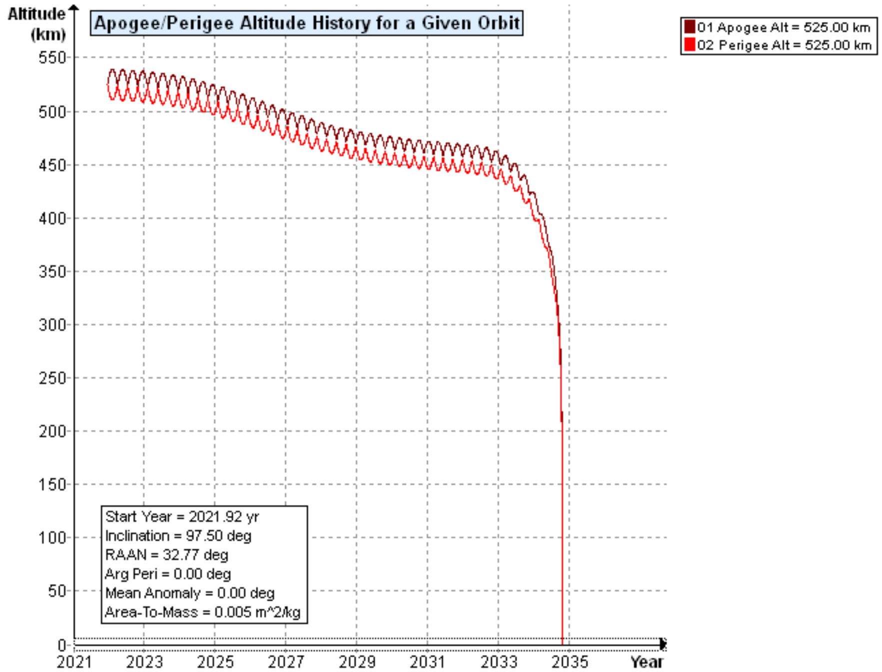

Figure 1 - Sherpa-FX3 (Nominal Mission at 525 km) orbit history

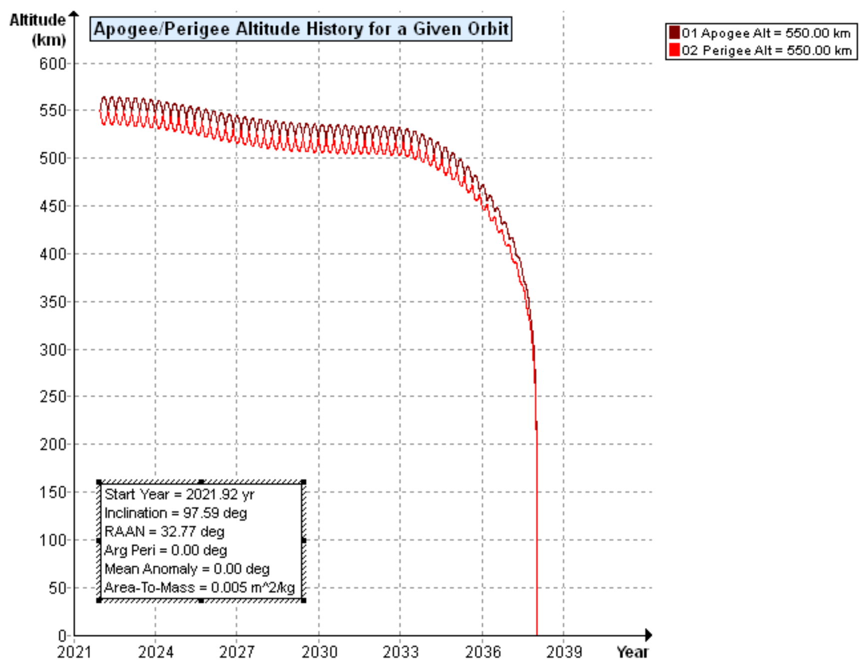

Figure 2 - Sherpa-FX3 (Failed Mission at 550 km) orbit history.

Analysis: Sherpa-FX3 reentry is COMPLIANT using method "a".

Satellite Name	**Sherpa-FX3**

BOL Orbit (Drop off)	550 x 550 km
Operational Orbit	550 x 550 km
EOM Orbit	550 x 550 km
Total Lifetime for Nominal Mission	12.9 years
Total Lifetime if Mission Failure	16 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-FX3 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) an off-nominal Mission Failure case, where no spacecraft are deployed. In both cases, DAS returns a total mission lifetime less than 25 years.

Spaceflight shows DAS analysis cases here for: (i) its planned or Nominal Mission (successful deployment of all spacecraft planned to be deployed and successful orbit reduction); (ii) an off-nominal Mission Failure case where no spacecraft are deployed and the electric propulsion system is not commissioned and altitude decays naturally via atmospheric drag. In each case DAS returns a total on-orbit lifetime of 25 years or less.

As with SSO-A, Sherpa-FX1, Sherpa-FX2 and Sherpa-LTE1, 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, Sherpa-FX2, and Sherpa-LTE1 missions. If the primary avionics systems were to fail, it will most likely succumb to the launch environment, which occurs prior to any deployments from the Sherpa vehicles resulting in the Mission Failure cases.

Finally, Spaceflight believes a successful mission, “Nominal Mission” case, is most probable. The analysis contained above shows compliance with the applicable FCC regulations 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-FX3 and its separation systems and subcomponents (listed in further detail in the full DAS results appended to this report) have a 1:100,000,000 risk of human casualty and thus that the Sherpa FX-3 meets the requirement. No components of the Sherpa FX-3 are expected to survive reentry.

For the "Mission Failed" case, as the Sherpa vehicle begins to demise, customer payloads will break free and should demise as described in the ODAR assessments they would have provided during their own licensing efforts. Consistent with Spaceflight's prior missions, Spaceflight relies upon its customers' own authorizations for reentry hazards each for their own spacecraft.

Requirements 4.7-1b, and 4.7-1c below are non-applicable requirements because the Sherpa-FX3 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

08 08 2021; 16:35:53PM Activity Log Started
08 08 2021; 16:35:54PM Opened Project C:\Users\elund\Box\Eric Lund\Missions and Programs\SXRS-6\DAS ODAR Rev B Nominal\
08 08 2021; 16:36:09PM Processing Requirement 4.3-1: Return Status : Not Run

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No Project Data Available
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============== End of Requirement 4.3-1 ==============
08 08 2021; 16:36:11PM Processing Requirement 4.3-2: Return Status : Passed

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No Project Data Available
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============== End of Requirement 4.3-2 ==============
08 08 2021; 17:24:14PM Processing Requirement 4.5-1: Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX3
Space Structure Type = Payload
Perigee Altitude = 525.000 (km)
Apogee Altitude = 525.000 (km)
Inclination = 97.498 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass Ratio = 0.0053 (m^2/kg)
Start Year = 2021.918 (yr)
Initial Mass = 280.000 (kg)
Final Mass = 130.600 (kg)
Duration = 0.010 (yr)
Station-Kept = False
Abandoned = True

OUTPUT

Collision Probability = 1.7282E-05
Returned Message: Normal Processing
Date Range Message: Normal Date Range
Status = Pass

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

08 08 2021; 17:24:17PM Project Data Saved To File
08 08 2021; 17:24:23PM Requirement 4.5-2: Compliant

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

08 08 2021; 17:24:25PM Processing Requirement 4.6 Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX3
Space Structure Type = Payload

Perigee Altitude = 525.000000 (km)
Apogee Altitude = 525.000000 (km)
Inclination = 97.498000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.005307 (m^2/kg)
Start Year = 2021.918000 (yr)
Initial Mass = 280.000000 (kg)
Final Mass = 130.600000 (kg)
Duration = 0.010000 (yr)
Station Kept = False
Abandoned = True
PMD Perigee Altitude = 523.377211 (km)
PMD Apogee Altitude = 526.612841 (km)
PMD Inclination = 97.496581 (deg)
PMD RAAN = 3.586296 (deg)
PMD Argument of Perigee = 166.918252 (deg)
PMD Mean Anomaly = 0.000000 (deg)

OUTPUT

Suggested Perigee Altitude = 523.377211 (km)
Suggested Apogee Altitude = 526.612841 (km)
Returned Error Message = Passes LEO reentry orbit criteria.

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

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

=============== End of Requirement 4.6 ===============
08 08 2021; 17:24:29PM *********Processing Requirement 4.7-1
Return Status : Passed

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

name = Sherpa-FX3
quantity = 1
parent = 0
materialID = 5
type = Cylinder
Aero Mass = 130.600006
Thermal Mass = 130.600006

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 = 10.000000
Thermal Mass = 10.000000
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 = 0.830000
Thermal Mass = 0.830000
Diameter/Width = 0.118000
Length = 0.318000

name = FX Corner Brace
quantity = 6
parent = 1
materialID = 8
type = Box
Aero Mass = 1.100000
Thermal Mass = 1.100000
Diameter/Width = 0.151000
Length = 0.178000
Height = 0.151000

name = FX QuadPack adapter plate
quantity = 4
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 w spacer
quantity = 3

parent = 1
materialID = 8
type = Box
Aero Mass = 2.840000
Thermal Mass = 2.840000
Diameter/Width = 0.283660
Length = 0.311150
Height = 0.059030

name = FX antenna bracket w antennas
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 1.428000
Thermal Mass = 1.428000
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 = 3.800000
Thermal Mass = 3.800000
Diameter/Width = 0.544000
Length = 0.544000
Height = 0.022000

name = FX R2A-Core
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 3.100000
Thermal Mass = 3.100000
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 NSL Black Box Std
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 3U CSD
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 3.254000
Thermal Mass = 3.254000
Diameter/Width = 0.157000
Length = 0.402000
Height = 0.134000

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 = FX QuadPack Mass Model
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 26.299999
Thermal Mass = 26.299999
Diameter/Width = 0.250000
Length = 0.528000
Height = 0.250000

name = FX PRA
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 8.573400
Thermal Mass = 8.573400
Diameter/Width = 0.626000
Length = 0.626000
Height = 0.070000

name = FX 15-3 Spacer Ring
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 6.663090

Thermal Mass = 6.663090
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 = 2.137868
Thermal Mass = 2.137868
Diameter/Width = 0.206154
Length = 0.206154
Height = 0.045466

name = TagSat-3
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 1.920000
Thermal Mass = 1.920000
Diameter/Width = 0.168000
Length = 0.226000
Height = 0.098800

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

name = Sherpa-FX3
Demise Altitude = 77.998985
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX upper 24-in separation sytem
Demise Altitude = 75.561157
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Hex Plate
Demise Altitude = 65.440125
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Interior Wall
Demise Altitude = 74.333366
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Corner Brace
Demise Altitude = 75.097557
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX QuadPack adapter plate
Demise Altitude = 73.018227
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = MLB adapter plate w spacer
Demise Altitude = 71.655098
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX antenna bracket w antennas
Demise Altitude = 76.225677
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX avionics deck plate
Demise Altitude = 72.360001
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX R2A-Core
Demise Altitude = 70.643524
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX battery module
Demise Altitude = 67.245712
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX NSL Black Box Std
Demise Altitude = 74.793434
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = empty 3U CSD

Demise Altitude = 72.961761
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = empty QuadPack
Demise Altitude = 70.788521
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX QuadPack Mass Model
Demise Altitude = 58.213013
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX PRA
Demise Altitude = 67.274368
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX 15-3 Spacer Ring
Demise Altitude = 58.463749
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX lower 8-in separation system
Demise Altitude = 69.385178
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = lower 15-in separation system
Demise Altitude = 69.392578
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = TagSat-3
Demise Altitude = 72.550003
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****

============== End of Requirement 4.7-1 ===============
08 08 2021; 17:24:29PM   Project Data Saved To File

Raw DAS Output – Failed Mission

08 08 2021; 17:26:21PM Activity Log Started
08 08 2021; 17:26:22PM Opened Project C:\Users\elund\Box\Eric Lund\Missions and Programs\SXRS-6\DAS ODAR Rev B DoA\
08 08 2021; 17:26:32PM Processing Requirement 4.3-1: Return Status : Not Run

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

============== End of Requirement 4.3-1 ==============
08 08 2021; 17:26:34PM Processing Requirement 4.3-2: Return Status : Passed

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

============== End of Requirement 4.3-2 ==============
08 08 2021; 20:34:43PM Processing Requirement 4.5-1: Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX3_DoA
Space Structure Type = Payload
Perigee Altitude = 550.000 (km)
Apogee Altitude = 550.000 (km)
Inclination = 97.594 (deg)
RAAN = 0.000 (deg)
Argument of Perigee = 0.000 (deg)
Mean Anomaly = 0.000 (deg)
Final Area-To-Mass Ratio = 0.0047 (m^2/kg)
Start Year = 2021.918 (yr)
Initial Mass = 280.200 (kg)
Final Mass = 280.200 (kg)
Duration = 0.010 (yr)
Station-Kept = False
Abandoned = True

OUTPUT

Collision Probability = 5.3054E-05
Returned Message: Normal Processing
Date Range Message: Normal Date Range
Status = Pass

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

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

08 08 2021; 20:34:46PM Project Data Saved To File
08 08 2021; 20:34:57PM Requirement 4.5-2: Compliant

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

08 08 2021; 20:35:00PM Processing Requirement 4.6 Return Status : Passed

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

INPUT

Space Structure Name = Sherpa-FX3_DoA
Space Structure Type = Payload

Perigee Altitude = 550.000000 (km)
Apogee Altitude = 550.000000 (km)
Inclination = 97.594000 (deg)
RAAN = 0.000000 (deg)
Argument of Perigee = 0.000000 (deg)
Mean Anomaly = 0.000000 (deg)
Area-To-Mass Ratio = 0.004733 (m^2/kg)
Start Year = 2021.918000 (yr)
Initial Mass = 280.200000 (kg)
Final Mass = 280.200000 (kg)
Duration = 0.010000 (yr)
Station Kept = False
Abandoned = True
PMD Perigee Altitude = 548.418795 (km)
PMD Apogee Altitude = 551.568986 (km)
PMD Inclination = 97.592575 (deg)
PMD RAAN = 3.586401 (deg)
PMD Argument of Perigee = 163.426735 (deg)
PMD Mean Anomaly = 0.000000 (deg)

OUTPUT

Suggested Perigee Altitude = 548.418795 (km)
Suggested Apogee Altitude = 551.568986 (km)
Returned Error Message = Passes LEO reentry orbit criteria.

Released Year = 2037 (yr)
Requirement = 61
Compliance Status = Pass

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

=============== End of Requirement 4.6 ===============
08 08 2021; 20:35:06PM *********Processing Requirement 4.7-1
Return Status : Passed

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

name = Sherpa-FX3_DoA
quantity = 1
parent = 0
materialID = 5
type = Cylinder
Aero Mass = 280.200012
Thermal Mass = 280.200012

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 = 10.000000
Thermal Mass = 10.000000
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 = 0.830000
Thermal Mass = 0.830000
Diameter/Width = 0.118000
Length = 0.318000

name = FX Corner Brace
quantity = 6
parent = 1
materialID = 8
type = Box
Aero Mass = 1.100000
Thermal Mass = 1.100000
Diameter/Width = 0.151000
Length = 0.178000
Height = 0.151000

name = FX QuadPack adapter plate
quantity = 4
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 w spacer
quantity = 3

parent = 1
materialID = 8
type = Box
Aero Mass = 2.840000
Thermal Mass = 2.840000
Diameter/Width = 0.283660
Length = 0.311150
Height = 0.059030

name = FX antenna bracket w antennas
quantity = 2
parent = 1
materialID = 8
type = Box
Aero Mass = 1.428000
Thermal Mass = 1.428000
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 = 3.800000
Thermal Mass = 3.800000
Diameter/Width = 0.544000
Length = 0.544000
Height = 0.022000

name = FX R2A-Core
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 3.100000
Thermal Mass = 3.100000
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 NSL Black Box Std
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 3U CSD
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 3.254000
Thermal Mass = 3.254000
Diameter/Width = 0.157000
Length = 0.402000
Height = 0.134000

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 = FX QuadPack Mass Model
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 26.299999
Thermal Mass = 26.299999
Diameter/Width = 0.250000
Length = 0.528000
Height = 0.250000

name = FX PRA
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 8.573400
Thermal Mass = 8.573400
Diameter/Width = 0.626000
Length = 0.626000
Height = 0.070000

name = FX 15-3 Spacer Ring
quantity = 1
parent = 1
materialID = 8
type = Box
Aero Mass = 6.663090

Thermal Mass = 6.663090
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 = 2.137868
Thermal Mass = 2.137868
Diameter/Width = 0.206154
Length = 0.206154
Height = 0.045466

name = TagSat-3
quantity = 1
parent = 1
materialID = 5
type = Box
Aero Mass = 1.920000
Thermal Mass = 1.920000
Diameter/Width = 0.168000
Length = 0.226000
Height = 0.098800

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name = Sherpa-FX3_DoA
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Impact Kinetic Energy = 0.000000

****
name = FX upper 24-in separation sytem
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Impact Kinetic Energy = 0.000000

****
name = FX Hex Plate
Demise Altitude = 69.036789
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Interior Wall
Demise Altitude = 75.214851
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX Corner Brace
Demise Altitude = 75.815979
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX QuadPack adapter plate
Demise Altitude = 74.178185
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = MLB adapter plate w spacer
Demise Altitude = 73.050003
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX antenna bracket w antennas
Demise Altitude = 76.674156
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX avionics deck plate
Demise Altitude = 73.698349
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Impact Kinetic Energy = 0.000000

****
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Demise Altitude = 72.215454
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****
name = FX battery module
Demise Altitude = 69.358665
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****
name = empty 3U CSD

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Demise Altitude = 69.627716
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX 15-3 Spacer Ring
Demise Altitude = 61.798462
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = FX lower 8-in separation system
Demise Altitude = 71.143936
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = lower 15-in separation system
Demise Altitude = 71.156197
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****
name = TagSat-3
Demise Altitude = 73.773125
Debris Casualty Area = 0.000000
Impact Kinetic Energy = 0.000000

****

============== End of Requirement 4.7-1 ==============
08 08 2021; 20:35:06PM Project Data Saved To File

END of Sherpa-FX3 Orbital Debris Assessment Report (ODAR)

Sherpa-FX3 Long-Term Recontact Probability

REVISION / DATE

A / 09 August 2021

SPACEFLIGHT

SPACEFLIGHT, INC.
1505 WESTLAKE AVENUE NORTH SUITE 600
SEATTLE, WASHINGTON 98109

REV	DATE	PREPARED BY	ANALYSIS BY	CHANGES
A	2021-08-09	M. Coletti	E. Lund	Initial Release

1. Introduction

The Sherpa-FX3 Mission (hereinafter "Mission") on a SpaceX Rideshare launch, currently planned for December 2021-January 2022, is a commercial rideshare mission with the primary Spaceflight, Inc. ("Spaceflight") objective of hosting one customer payload which will remain attached to Sherpa-FX3, and deploying up to 8 customer spacecraft into a planned sun-synchronous circular orbit of 525 ± 25 km altitude. SpaceX's Falcon 9 launch vehicle will deploy the free flyer vehicle, called Sherpa-FX3, which subsequently deploys the additional customer spacecraft within several hours of liftoff.[1]

The separation system and customer payload layout on the Sherpa vehicles can be variable, depending on the quantity of microsatellites and CubeSats manifested to the mission. CubeSat and Microsatellite separation systems are interchangeable and can be affixed radially on the body of Sherpa. A microsatellite, CubeSat dispenser, or other adapter for separation system mounting can be affixed on the outboard end of Sherpa. The Sherpa structure upon which the separation systems are affixed is identical to the previously licensed Sherpa-FX1, Sherpa-FX2, and Sherpa-LTE1. Thus, Sherpa-FX3 will deploy customers in the same fashion as the previously licensed Sherpas.

Currently, the planned configuration for Sherpa-FX3 has a microsatellite on the outboard end, with three (3) microsatellites, and a single 3U equivalent Cubesat dispenser containing four (4) sub-3U cubesats attached radially on the body of Sherpa.[2] Sherpa-FX3 will also carry one approximately 5 kg hosted payload, subject to the provider of that payload, NearSpace Launch, securing its own separate authority for this mission from the Commission. The Sherpa-FX3 Mission configuration also includes an S-band receive antenna and an L-band transmitter as part of its avionics.

This report presents a worst-case probability of recontact for this mission based on the actual manifest and incorporates the worst possible change in manifest subsequent to filing.

[1] Spaceflight notes that, as with any rideshare mission, there is a possibility that one or more customers will either not be ready, not be able to meet one or more of Spaceflight and/or SpaceX's readiness criteria for flight or, choose to remove their spacecraft from the mission. Removed customers will be replaced by a non-separating mass model to keep the various launch and mission analyses valid. Since the Sherpa-FX3 does not have any attitude control, system dispersion is dependent on the momentum change after each deployment. This momentum change is based on the specific mass of each spacecraft and the spring energy in their separation system. Therefore, replacing a separating customer spacecraft with a non-separating mass model will change the momentum of the Sherpa FX3 and thus the deployment vector for subsequent spacecraft. In such event, a new recontact analysis will be run to verify that the mission cumulative recontact probability is 2×10^{-4} or less. If the probability of recontact would be greater than this threshold, a new sequence will be developed and tested to ensure that this threshold is met.

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

2. Methodology

Spaceflight has performed a high-fidelity analysis set forth below, using the same analytic techniques that Spaceflight described for its previously successful SSO-A and Sherpa-FX1, Sherpa-FX2, and Sherpa-LTE1 missions. Because of the nature of the Mission, the recontact risk can be no greater than that of Sherpa-FX2, which the Commission has already authorized.

As a general matter, spacecraft with propulsion or differential drag capabilities should be able to avoid conjunction with other spacecraft. There are 3 spacecraft with propulsion on the mission. The propulsion systems on customer spacecraft identified in the STA filing are sufficient to enable them to perform collision avoidance. There are a number of variables, such as when customer spacecraft can activate propulsion, time to closest approach (TCA), or ground pass availability to command the spacecraft to perform a debris avoidance maneuver, that affect the ability of a given spacecraft to perform an avoidance maneuver. Therefore, we present a summary of our analyses here without propulsion factored in. There is also some risk of conjunction in the period immediately following launch which is mitigated through the use of collision avoidance analysis between the launch vehicle and the Combined Space Operations Center (CSpOC). Additionally, the nature of that risk, and more generally of conjunctions involving spacecraft deployed as part of the Sherpa-FX3 Mission, is one better described as recontact rather than collision because of the low-speed nature of any possible conjunction. Contact at this low speed may cause minor damage to a spacecraft, but little or no debris.

The high-fidelity approach is based on a Monte Carlo analysis of a deployment sequence based on the current manifest and is presented as a worst-case scenario. This analysis approach considers the mass and separation system properties for all Spaceflight customer spacecraft. Appropriate distributions are applied to these parameters based on customer and vendor inputs, and Monte Carlo simulations of the full Sherpa-FX3 Mission are run using a six degree-of-freedom orbit and attitude dynamics model with relative distances tracked between all spacecraft. Final mission analyses with our final configuration will show equal or better recontact analysis results and Spaceflight will provide those results to the Commission.

Sub-3U spacecraft will be grouped together in the same slot of their separation system, and are therefore considered a single aggregate 3U spacecraft in these analyses. Sub-3U spacecraft are modeled as a single 3U spacecraft only when they are consolidated in a single dispenser slot (in the case of this mission, the 3U dispenser has 4 sub-3U spacecraft within). In this configuration, all of the spacecraft in the slot are deployed simultaneously and in the same direction and same initial velocity. These sub-3U spacecraft have very small springs between them to help push them apart gradually over time. The change in velocity caused by these small springs is substantially less than the spring energy variation margin that is included in in Spaceflight's Monte Carlo deployment simulation that applies for each dispenser slot. This means that the dispersal of the three sub-3U spacecraft will fall within the volume of space that is accounted for in that simulation therefore creating no greater recontact risk as so modeled than would be the case for single 3U spacecraft. These spacecraft would be deployed in the same velocity vector and thus relative velocities between them would be negligible compared to relative velocities between other spacecraft on the mission, or between Resident Space Objects. Ordering of the spacecraft within the dispenser will also help mitigate the chance of recontact, since they are intentionally designed with slightly different masses. By placing the least massive spacecraft with the highest separation velocity such that it is separated first, we thereby minimize the chance a spacecraft "catches up" to another spacecraft it was deployed with.

The probability of recontact is then found by counting the number of recontact events, which are said to occur if an object pair's relative distance falls below that particular object pair's combined hard-body radius and dividing by the total number of simulations run.

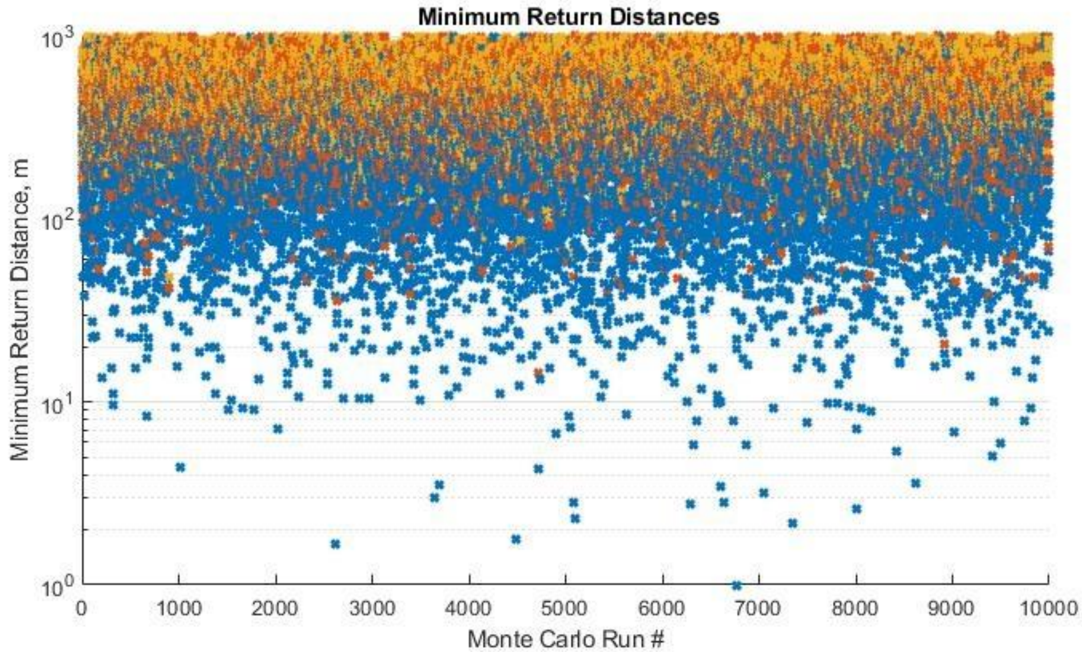

Figure 1: 10,000 simulation Monte Carlo analysis over five orbits.

A 10,000-run Monte Carlo analysis was performed using this approach over a period that lasted five orbits after the last spacecraft is deployed from Sherpa-FX3 (a duration of approximately 8 hours) (Figure 1). The analysis was based on a deployment sequence that was chosen to reduce the probability of recontact. Further, this time period encompasses the period of highest spacecraft density where recontact events are most probable. Any final modifications to deployment sequence order or timing from that which was used as inputs to the analysis here, shall have an equal or reduced probability of recontact than those presented herein. The five-orbit time period was chosen for detailed analysis because of the divergence of spacecraft that naturally occurs over this period, as further analyzed below. During this time (five orbits), two recontact event were observed (Pr(recontact) = $2x10^{-4}$) with a $\Delta v < 1.0$ m/s. There was a 99.0% probability that all relative miss distances remained above 16.3 m, a 95% probability of all miss distances being greater than 43.4 m, and a 90.0% probability of all miss distances being greater than 66.8 m.

Customer spacecraft are prohibited from performing propulsive maneuvers within the first 45 minutes after separation from Sherpa, however once that time period has passed the probability of recontact would further be reduced.

3. Conclusions

Therefore, Spaceflight estimates that the worst-case probability of recontact for all objects on Sherpa-FX3 is $2x10^{-4}$.

FX3 Manifest

Spacecraft Name	Spacecraft Type	Operator	Country Of Operator	Quantity	Propulsion	Deploys Other Spacecraft	Comment
Hawk 4A-4C	microsatellite	Hawkeye 360	USA	3	Y	N	
Lynk-05	microsatellite	Lynk Global	USA	1	N	N	
WVSats	cubesat	Intermodal Holdings	USA	4	N	N	
TagSat-3	*hosted payload*	*NearSpace Launch*	*USA*	*1*	*N*	*N*	*Does not separate*

Spaceflight Ownership Information

In connection with Spaceflight's previous request for an STA for FX1, the Bureau asked Spaceflight to provide information responsive to the questions contained in Form 312 Main Form, Application for Satellite Space Station Authorizations, Questions 29-34 and 36-40, which would typically be completed by an applicant for deployment and operating authority.

We provide that same information in Attachments 1 and 2. Note regarding responses to questions 30-34: It is Spaceflight's understanding that these questions would be inapplicable even were Spaceflight to seek ordinary license authority, including for deployment and operations, because the space station would not be used for broadcast or common carrier operations and would not be an aeronautical en route or aeronautical fixed station. *See,* Section 310(b) of the Communications Act. Spaceflight nevertheless notes as to foreign ownership, as indicated in its response to question 40, that its capital stock is 100% owned and voted by a Japanese company, M&Y Space Co., Ltd.

Attachment 1

Question	Response
29. Is the applicant a foreign government or the representative of any foreign government?	No.
30. Is the applicant an alien or the representative of an alien?	N/A. See note to Exhibit E
31. Is the applicant a corporation organized under the laws of any foreign government?	N/A. See note to Exhibit E
32. Is the applicant a corporation of which more than one-fifth of the capital stock is owned of record or voted by aliens or their representatives or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?	N/A. See note to Exhibit E
33. Is the applicant a corporation directly or indirectly controlled by any other corporation of which more than one-fourth of the capital stock is owned of record or voted by aliens, their representatives, or by a foreign government or representative thereof or by any corporation organized under the laws of a foreign country?	N/A. See note to Exhibit E
34. If any answer to questions 29, 30, 31, 32 and/or 33 is Yes, attach as an exhibit, the identification of the aliens or foreign entities, their nationality, their relationship to the applicant, and the percentage of stock they own or vote.	N/A. See note to Exhibit E.
36. Has the applicant or any party to this application had any FCC station authorization or license revoked or had any application for an initial, modification or renewal of FCC station authorization, license, or construction permit denied by the Commission? If Yes, attach as an exhibit, an explanation of the circumstances.	No.
37. Has the applicant, or any party to this application, or any party directly or indirectly controlling the applicant ever been convicted of a felony by any state or federal court? If Yes, attach as an exhibit, an explanation of the circumstances.	No.
38. Has any court finally adjudged the applicant, or any person directly or indirectly controlling the applicant, guilty of unlawfully monopolizing or attempting unlawfully to monopolize radio communication, directly or indirectly, through control of manufacture or sale of radio apparatus, exclusive traffic arrangement or any other means or unfair methods of competition? If Yes, attach as an exhibit, an explanation of the circumstances.	No.
39. Is the applicant, or any person directly or indirectly controlling the applicant, currently a party in any pending matter referred to in the preceding two items? If Yes, attach as an exhibit, an explanation of the circumstances.	No.
40. If the applicant is a corporation and is applying for a space station license, attach as an exhibit the names, addresses, and citizenship of those stockholders owning of record and/or voting 10 percent or more of the Filer's voting stock and the percentages so held. In the case of fiduciary control, indicate the beneficiary(ies) or class of beneficiaries. Also list the names and addresses of the officers and directors of the Filer.	See Attachment 2.

Attachment 2

Spaceflight, Inc.'s ownership structure and Officers and Directors are listed below:

Ownership
M&Y Space Co., Ltd., a Japanese Private Company
2-1, Otemachi 1-chome
Chiyoda-ku, Tokyo 100-8631,
Japan
Owns 100% of Spaceflight, Inc., stock
Has 100% voting rights

Officers and Directors
c/o Spaceflight, Inc.
1505 Westlake Avenue North, Suite 600
Seattle, WA 98109

Tomohiro Musha
Chairman of the Board of Directors

Ryan Bates
Director

Curtis Dean Blake
Chief Executive Officer and Director

David Ekizian
Director

Norikazu Sano
Director

Yonosuke Miwa
Chief Financial Officer

Sasha Field
General Counsel and Secretary

August 10, 2021

Secretary
Office of the Secretary
Federal Communications Commission
45 L Street, N.E.
Washington, D.C. 20554

Subject: ITU Cost Recovery Fees for Sherpa-FX3

Reference: FCC File No.

Dear FCC Secretary,

Spaceflight, Inc. ("Spaceflight"), proposed operator of the subject network, is aware that as a result of actions taken at the International Telecommunication Union's 1998 Plenipotentiary Conference, and modified by the ITU Council in 2001, 2002 and 2004, processing fees will now be charged by the ITU for satellite network filings. As a consequence, Commission applicants are responsible for any and all fees charged by the ITU. The applicant hereby states that it is aware of this requirement and accepts responsibility to pay any cost recovery fees associated with these applications. Invoices for such fees should be sent to the point of contact specified below:

(1) Point of Contact Name: Alexandra Field

(2) Applicant: Spaceflight, Inc.

(3) Applicant Address: 1505 Westlake Avenue North, Suite 600
Seattle, WA 98109, U.S.A.

(4) Email address: legal@spaceflight.com

(5) Telephone number: 206-348-3582

Sincerely,

/s/ Alexandra Field
Alexandra Field
General Counsel