## Exhibit H - SoFIE Orbital Debris Assessment Report

**6/28/26**

### INTRODUCTION

The Solar Flare and Ionosphere Explorer (SoFIE) mission orbital debris footprint has been evaluated in accordance with NASA-STD-8719.14. The primary analytical tool utilized for this safety validation is the NASA Debris Assessment Software (DAS) Version 3.2.7. This document presents the comprehensive results of the digital simulation. A summary of the results are provided in Table 1.

| Requirement | Description | Status | Result / Rationale |
|---|---|---|---|
| **4.3-1** | Release of debris during operations | **Compliant** | 0 Objects Released |
| **4.3-2** | Passing near GEO | **N/A** | Low Earth Orbit (LEO) mission |
| **4.4-1** | Accidental Explosions Risk | **Compliant** | Low Risk |
| **4.4-2** | Design for Passivation | **Compliant** | Low Rsik |
| **4.4-3 / 4** | Planned Structural Breakups | **Compliant** | No Planned Kinetic or Breakup Events |
| **4.5-1 / 2** | Collision Probability | **Compliant** | DAS v3.2.7 Risk Model Passed |
| **4.6-1** | Deorbit Timeline (Nominal Deployed) | **Compliant** | 4.8 Years Natural Orbit Decay |
| **4.6-1** | Deorbit Timeline (Anomalous Stowed) | **Compliant** | 6.4 Years Natural Orbit Decay |
| **4.7-1** | Human Casualty Risk | **Compliant** | Full Atmospheric Ablation (ORSAT) |
| **4.8-1** | Tether Risks | **Compliant** | No Tethers Utilized |

**Table 1:** *Summary of the NASA-STD-8719.14 compliance assessment for the SoFIE mission. Detailed analytical logs are archived in Appendix A and Appendix B.*

### SECTION 1: PROGRAM MANAGEMENT AND MISSION OVERVIEW

The SoFIE spacecraft is a 3U CubeSat developed by Saint Francis University to investigate the interaction dynamics between solar flares and the Earth's ionosphere. Saint Francis University enforces strict operational policies to eliminate intentional space debris generation.

The vehicle is architected to release zero operational fragments or covers during its deployment and active phases. To mitigate long-term energy risks, the battery charging infrastructure features autonomous hardware overcharge protections, and all radio frequency (RF) transmitters are designed with remote terminal command capabilities to neutralize post-mission transmission interference or electrical energy storage.

The anticipated launch window opens no earlier than August 1, 2028 (Digital Year: 2028.5820) with a baseline operational lifecycle of 1.5 years (18 months). The target orbital profile is a 500 km circular altitude at an inclination of 97.4°, operating within a Sun-Synchronous Orbit (SSO).

## SECTION 2: SPACECRAFT GEOMETRIC AND STRUCTURAL CONFIGURATION

The primary flight vehicle structure consists of a standard 3U aluminum chassis (10.0 cm x 10.0 cm x 30.0 cm). The top cap features a cylindrical auxiliary payload volume extension (tuna can assembly) to house the dedicated High Frequency (HF) antenna suite. The maximum launch mass of the integrated spacecraft is 4.0 kg (with mass growth allowance).

**Deployable Mechanisms:**

- **Solar Arrays:** Two 2U x 3U deployable solar panels (16.6 cm x 30.0 cm per panel) mounted at diagonally opposite long corners of the primary chassis.
- **Antennas:** Two orthogonal Nitinol dipole wire antennas (5.0 m tip-to-tip length, 1.0 mm wire diameter) horizontally integrated onto the upper extension for HF science data reception (3–30 MHz). RF communications also utilize one S-band antenna mounted on a deployable flip-out paddle.

**Subsystem Itemization:**

- **Power (EPS):** Two 2U x 3U deployed solar panels, integrated Lithium-Ion battery pack.
- **ADCS:** Active magnetorquer control system with sun sensors and IMU.
- **Communications:** UHF transceiver (uplink/downlink) and an S-band radio (high-rate science telemetry downlink).
- **Avionics:** On-Board Computer (OBC) and Software Defined Radio (SDR).
- **Payload Suite:** Raspberry Pi4 computer, HF receiver, single-channel topside ionospheric sounder, two commercial off-the-shelf (COTS) optical cameras, and an X-ray flux sensor.

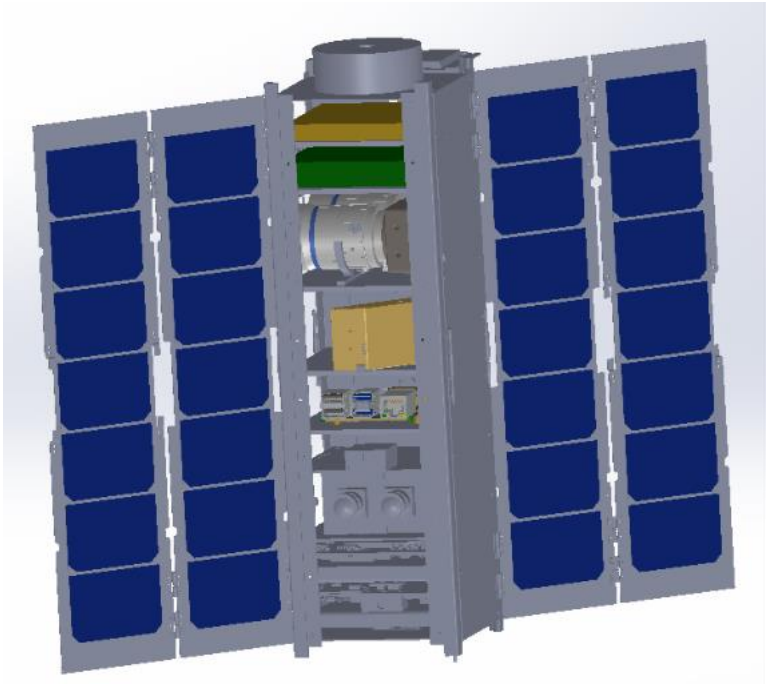

FIGURE 1: SoFIE Deployed/Operational Spacecraft CAD Model

**SECTION 3: ASSESSMENT OF DEBRIS RELEASED DURING NORMAL OPERATIONS**

- **Requirement 4.3-1 (Limit Number and Orbital Lifetime of Debris Passing Through LEO): COMPLIANT**
  The SoFIE flight sequence is physically designed to release zero (0) intentional object fragments, structural covers, or tie-down remnants into orbit. Mechanical solar panel release latches, deployment springs, and antenna hold-down mechanisms are fully captive systems that remain permanently bonded to the primary 3U chassis core structure post-actuation.

- **Requirement 4.3-2 (Limit Number and Orbital Lifetime of Objects Passing Near GEO): NOT APPLICABLE**
  The SoFIE spacecraft operates exclusively within a 500 km Low Earth Orbit (LEO) profile and does not enter or cross geosynchronous transport corridors.

**SECTION 4: ASSESSMENT OF ACCIDENTAL EXPLOSIONS AND INTENTIONAL BREAKUPS**

- **Requirement 4.4-1 (Potential for Accidental Explosion): COMPLIANT**
  The CubeSat does not possess chemical propulsion units, pressurized fluid vessels,

pyrotechnic charges, or explosive actuators. The only system onboard capable of energetic outgassing or chemical fragmentation is the Lithium-Ion battery pack.

The EXA battery packs are TRL 9 and have flown on several missions.

> Reference: NASA HQ Office of Safety and Mission Assurance (OSMA) Policy Memo/Email to 8719.14: CubeSat Battery Non-Passivation, Suzanne Aleman to Justin Treptow, 10, March 2014

As discussed in the above reference, with respect to 3U and smaller CubeSats, the probability of battery explosion is very low and due to the very small mass of the satellites and their short orbital lifetimes the effect of an explosion on the LEO environment is negligible.

- **Requirement 4.4-2 (Design for Passivation at End of Mission): COMPLIANT**

> Reference: NASA HQ Office of Safety and Mission Assurance (OSMA) Policy Memo/Email to 8719.14: CubeSat Battery Non-Passivation, Suzanne Aleman to Justin Treptow, 10, March 2014

As discussed in the above reference, SoFIE batteries meet Requirement 4.4-2 via the HQ OSMA policy regarding CubeSat battery disconnect stating; “CubeSats as a satellite class need not disconnect their batteries if flown in LEO with orbital lifetimes less than 25 years.”

- **Requirements 4.4-3 & 4.4-4 (Planned Structural Breakups): COMPLIANT**
The SoFIE mission features no planned structural breakups, on-orbit destruction profiles, or kinetic impact experiments.

**SECTION 5: ASSESSMENT OF SPACECRAFT RISK FROM ACCIDENTAL COLLISIONS**

To rigorously evaluate accidental collision probability, the vehicle geometry was modeled in its maximum deployed configuration using the NASA-mandated "Three Orthogonal Views Method" for complex, non-convex structures across three perpendicular axes:

- **View 1 (A_max Front View):** 14.142 cm body diagonal + 33.2 cm panels = 47.342 cm width. Cross-sectional Area = (47.342 cm × 30.0 cm) + (500.0 cm × 0.1 cm antenna) = 1,470.26 $cm^2$.
- **View 2 (A_1 Side View):** 14.142 cm diagonal width × 30.0 cm chassis height. Cross-sectional Area = 424.26 $cm^2$ + (500.0 cm × 0.1 cm antenna) = 474.26 $cm^2$.

- **View 3 (A_2 Top View):** 10.0 cm × 10.0 cm top cap footprint + intersecting antenna cross. Cross-sectional Area = 100.00 $cm^2$ + 100.00 $cm^2$ = 200.00 $cm^2$.
- **Resultant Average Cross-Sectional Area:** 1,072.26 $cm^2$ (0.10723 $m^2$)
- **Resultant Operational Area-to-Mass (A/m) Ratio:** 0.02681 $m^2$/kg

**DAS v3.2.7 Simulation Outcome**

To validate on-orbit safety, this derived 0.10723 $m^2$ operational cross-section was integrated into the DAS collision module. The simulation evaluated the mathematical probability of impact with both cataloged space debris and operational payloads while tracking at the target 500 km, 97.4° orbit. Based on the resulting low-probability metrics, the spacecraft successfully meets all safety criteria.

- **Requirement 4.5-1 & 4.5-2 Status: PASSED / COMPLIANT**

**SECTION 6: ASSESSMENT OF POST-MISSION ORBITAL LIFETIME (DISPOSAL)**

To verify compliant orbital extraction, natural atmospheric decay timelines were modeled under both nominal and worst-case mechanical failure conditions.

**Scenario A: Nominal Configuration (Fully Deployed Model)**

- **Area Input to DAS:** 0.10723 $m^2$ (A/m = 0.02681 $m^2$/kg)
- **Planned Operational Mission:** 1.5 Years
- **Natural Decay Lifetime:** 4.8 Years from launch

*Compliance Analysis:* The high-drag cross-section generated by the deployed solar arrays and the 5.0-m dipole antenna strips kinetic energy rapidly from the orbit. Total natural orbital lifetime is 4.8 years, meaning reentry occurs well inside the regulatory post-mission buffer, satisfying the 5-year limit.

**Scenario B: Anomalous Configuration (Fully Stowed Failure Model)**

To ensure a conservative safety margin, an identical evaluation was conducted to simulate a worst-case mechanism deployment failure.

- **Area Input to DAS:** 0.03500 $m^2$ (Based on 1/4 of the total 1,400 $cm^2$ stowed surface area)
- **Resultant Stowed Area-to-Mass (A/m) Ratio:** 0.00875 $m^2$/kg
- **Natural Decay Lifetime:** 6.4 Years from launch

*Compliance Analysis:* If all solar arrays and antennas remain stowed, the reduced aerodynamic profile extends the decay window. However, the stowed 4.0 kg vehicle naturally decays within 6.4 total years from launch. Subtracting the 1.5-year operational lifecycle yields a post-mission decay window of 4.9 years, remaining compliant with regulatory requirements.

- **Requirement 4.6-1 Status: PASSED / COMPLIANT**

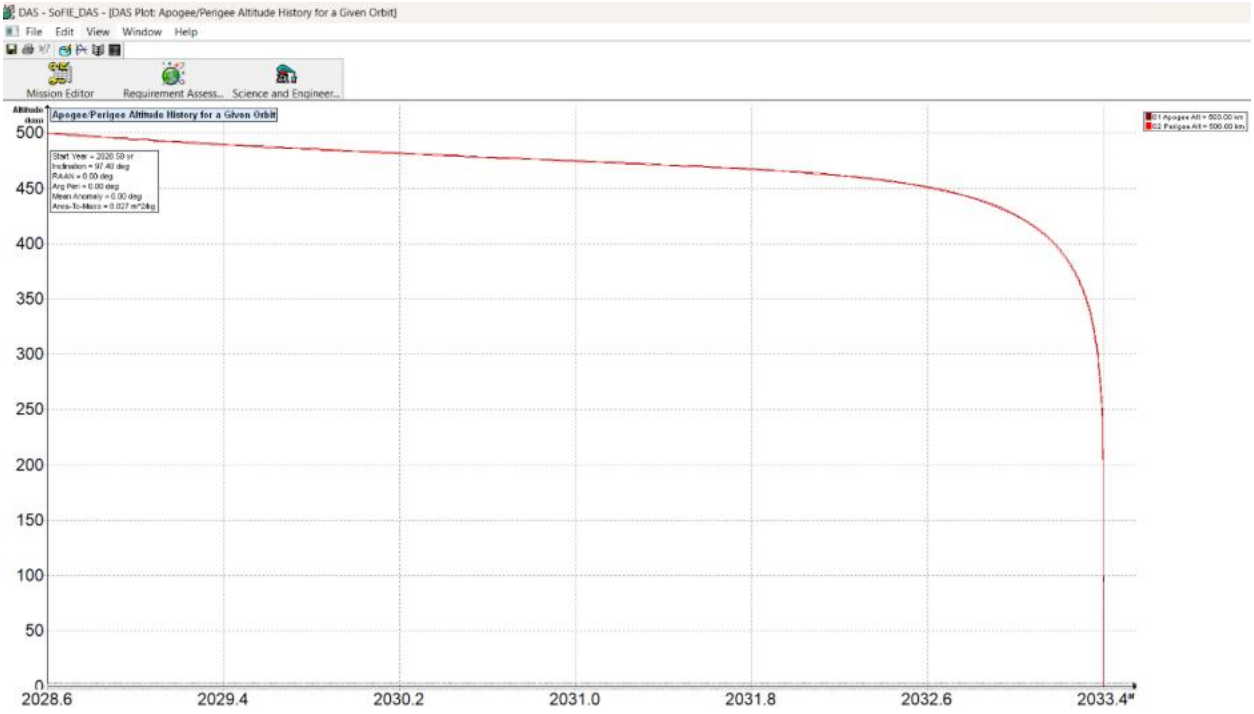


FIGURE 2: DAS Requirement 4.6 Nominal Deployment Decay Plot

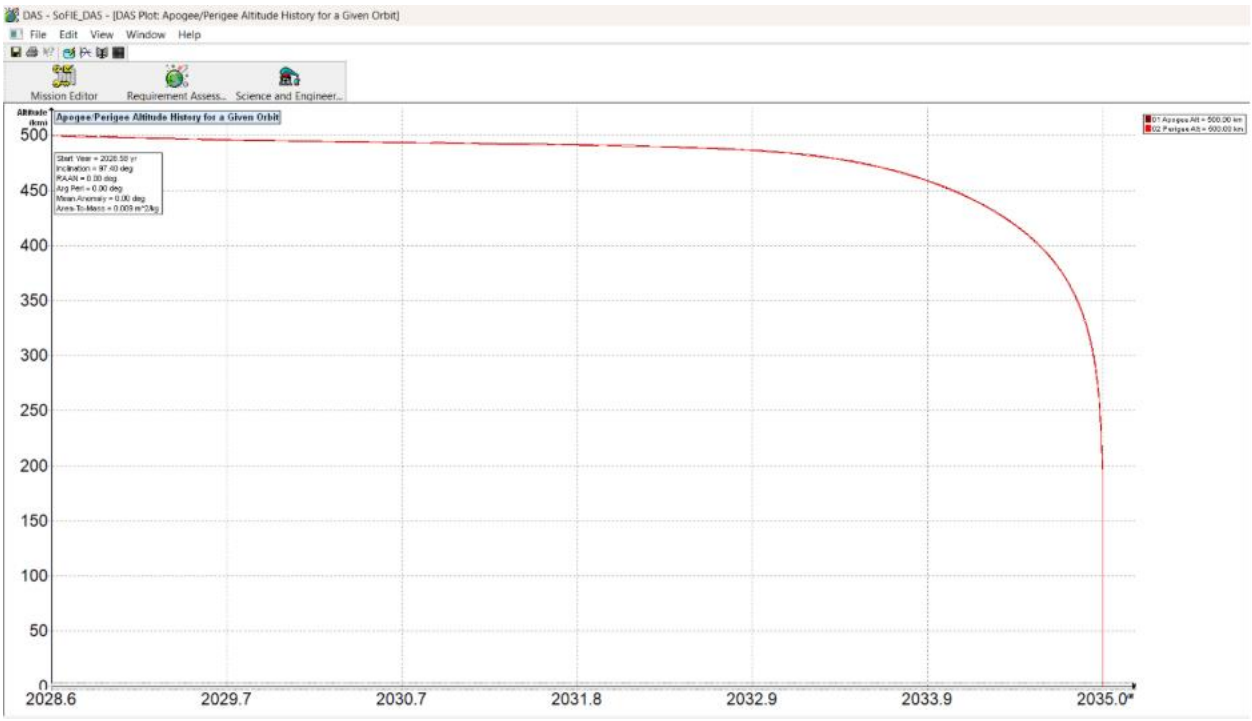


FIGURE 3: DAS Requirement 4.6 Anomalous Deployment Decay Plot

**SECTION 7: ASSESSMENT OF HUMAN CASUALTY RISK**

- **Requirement 4.7-1 (Spacecraft Demise Analysis): COMPLIANT**

**Modeling Methodology**

The human injury risk was evaluated using the Object Reentry Survival Analysis Tool (ORSAT) thermal ablation module inside DAS v3.2.7. The 4.0 kg spacecraft was modeled using an itemized component-nesting hierarchy encompassing the primary structure (Aluminum 6061-T6 chassis and antenna extension cap), the electrical power subsystem (populated epoxy-composite PCBs and Li-Ion cells), avionics/communications (OBC/SDR boards, copper/brass RF blocks, and stainless steel fasteners), deployable mechanisms (5.0 m Nitinol wire elements and 1.0 g Nitinol hinges), and the payload core (silicon/aluminum X-ray sensor and dual optical cameras with N-BK7 glass lenses nested inside an aluminum housing).

The high-fidelity ORSAT aerothermal simulation indicates that all internal and external components undergo complete thermal demise and burn up entirely before reaching the Earth's surface. The calculated kinetic impact energy of surviving fragments is 0 Joules, reducing human casualty risk to zero.

- **Requirement 4.7-1 Status: PASSED / COMPLIANT**

**SECTION 8: ASSESSMENT FOR TETHER MISSIONS**

- **Requirement 4.8-1 (Tether Analysis): COMPLIANT**
  The SoFIE mission does not utilize tethers, guy wires, flexible drag lines, or electrodynamic cables of any type, eliminating wrap or unexpected cross-section entanglement risks.

**SECTION 9: FINAL COMPLIANCE CONCLUSION**

Technical evaluations executed within the NASA Debris Assessment Software (DAS v3.2.7) verify that the 3U Solar Flare and Ionosphere Explorer (SoFIE) satellite developed by Saint Francis University successfully satisfies all orbital safety requirements.

Whether operating under nominal parameters with its 0.10723 $m^2$ deployed solar array active (yielding a 4.8-year total lifetime) or in a worst-case 0.03500 $m^2$ stowed anomalous state (yielding a 6.4-year total lifetime), the spacecraft naturally deorbits and fully demises via high-altitude atmospheric ablation. The mission presents zero residual risk to the space environment, operational assets, or personnel on the ground.

# APPENDIX A: NASA DEBRIS ASSESSMENT SOFTWARE (DAS) SIMULATION LOGS – Deployed Configuration

**Project Name:** SoFIE (Solar Flare and Ionosphere Explorer)
**Simulation Execution Date:** June 28, 2026
**Software Version:** NASA DAS v3.2.7

```
06 28 2026; 12:37:05PM Activity Log Started
06 28 2026; 12:37:28PM Mission Editor Changes Applied
06 28 2026; 12:37:28PM Project Data Saved To File

================================================================================
PROCESSING REQUIREMENT 4.3-1: LIMIT NUMBER OF OPERATIONAL DEBRIS
================================================================================
Return Status: Not Run (0 Objects Released)
--------------------------------------------------------------------------------
No Project Data Available
========================== End of Requirement 4.3-1 ==========================

================================================================================
PROCESSING REQUIREMENT 4.3-2: LIMIT LIFETIME OF OPERATIONAL DEBRIS
================================================================================
Return Status: Passed (Low Earth Orbit Mission / Non-GEO)
--------------------------------------------------------------------------------
No Project Data Available
========================== End of Requirement 4.3-2 ==========================

================================================================================
PROCESSING REQUIREMENT 4.5-1: COLLISION PROBABILITY WITH SPACE OBJECTS
================================================================================
Return Status: Passed

[RUN INPUT DATA]
Space Structure Name       = SoFIE
Space Structure Type       = Payload
Perigee Altitude           = 500.000 (km)
Apogee Altitude            = 500.000 (km)
Inclination                = 97.400 (deg)
RAAN                       = 0.000 (deg)
Argument of Perigee        = 0.000 (deg)
Mean Anomaly               = 0.000 (deg)
Final Area-To-Mass Ratio   = 0.0268 (m^2/kg)
Start Year                 = 2028.582 (yr)
Initial Mass               = 4.000 (kg)
Final Mass                 = 4.000 (kg)
```

```
Duration                    = 1.500 (yr)
Station-Kept                = False
Abandoned                   = True
Long-Term Reentry           = False

[SIMULATION OUTPUT]
Collision Probability       = 9.8511E-06
Returned Message            = Normal Processing
Date Range Message          = Normal Date Range
Status                      = Pass
========================== End of Requirement 4.5-1 ==========================

06 28 2026; 12:41:04PM Project Data Saved To File
06 28 2026; 12:41:06PM Requirement 4.5-2: Compliant
========================== End of Requirement 4.5-2 ==========================

================================================================================
PROCESSING REQUIREMENT 4.6: POST-MISSION ORBITAL LIFETIME (DISPOSAL)
================================================================================
Return Status: Passed

[PROJECT INPUT DATA]
Space Structure Name        = SoFIE
Space Structure Type        = Payload
Perigee Altitude            = 500.000000 (km)
Apogee Altitude             = 500.000000 (km)
Inclination                 = 97.400000 (deg)
RAAN                        = 0.000000 (deg)
Argument of Perigee         = 0.000000 (deg)
Mean Anomaly                = 0.000000 (deg)
Area-To-Mass Ratio          = 0.026810 (m^2/kg)
Start Year                  = 2028.582000 (yr)
Initial Mass                = 4.000000 (kg)
Final Mass                  = 4.000000 (kg)
Duration                    = 1.500000 (yr)
Station Kept                = False
Abandoned                   = True
PMD Perigee Altitude        = 481.971666 (km)
PMD Apogee Altitude         = 483.275263 (km)
PMD Inclination             = 97.452822 (deg)
PMD RAAN                    = 182.438188 (deg)
PMD Argument of Perigee     = 206.094921 (deg)
PMD Mean Anomaly            = 0.000000 (deg)
Long-Term Reentry           = False

[SIMULATION OUTPUT]
```

```
Suggested Perigee Altitude = 481.971666 (km)
Suggested Apogee Altitude  = 483.275263 (km)
Returned Error Message     = Passes LEO reentry orbit criteria.
Released Year              = 2033 (yr)
Requirement ID             = 61
Compliance Status          = Pass
========================== End of Requirement 4.6 ============================

================================================================================
PROCESSING REQUIREMENT 4.7-1: COMPONENT NESTING HIERARCHY AND DEMISE RISK
================================================================================
Return Status: Passed

[ORSAT MODELING HARDWARE HIERARCHY INPUTS]
Item Number = 1
  Name                     = SoFIE
  Quantity                 = 1
  Parent ID                = 0 (Primary Core)
  Material ID              = 8 (Aluminum 6061-T6)
  Type                     = Box
  Aero Mass                = 4.000000 kg
  Thermal Mass             = 4.000000 kg
  Dimensions (W x L x H)   = 0.100000 m x 0.300000 m x 0.100000 m

Item Number = 2
  Name                     = 3U_Frame_and_Tun_Can
  Quantity                 = 1
  Parent ID                = 1
  Material ID              = 8 (Aluminum 6061-T6)
  Type                     = Box
  Aero Mass                = 3.064000 kg
  Thermal Mass             = 1.000000 kg
  Dimensions (W x L x H)   = 0.100000 m x 0.376000 m x 0.100000 m

Item Number = 3
  Name                     = Nitinol_Wire_Antennas
  Quantity                 = 4
  Parent ID                = 2
  Material ID              = -1 (User Defined Nitinol)
  Type                     = Cylinder
  Aero Mass                = 0.012500 kg
  Thermal Mass             = 0.012500 kg
  Dimensions (Dia x L)     = 0.001000 m x 2.500000 m

Item Number = 4
  Name                     = Solar Panel
```

```
  Quantity                = 4
  Parent ID               = 2
  Material ID             = 25 (Silicon/Glass Composite)
  Type                    = Flat Plate
  Aero Mass               = 0.203500 kg
  Thermal Mass            = 0.186000 kg
  Dimensions (W x L)      = 0.100000 m x 0.300000 m

Item Number = 5
  Name                    = Lens
  Quantity                = 2
  Parent ID               = 4
  Material ID             = -3 (N-BK7 Glass)
  Type                    = Cylinder
  Aero Mass               = 0.025000 kg
  Thermal Mass            = 0.025000 kg
  Dimensions (Dia x L)    = 0.030000 m x 0.030000 m

Item Number = 6
  Name                    = Solar Array Hinges
  Quantity                = 10
  Parent ID               = 4
  Material ID             = -1 (Nitinol)
  Type                    = Cylinder
  Aero Mass               = 0.002000 kg
  Thermal Mass            = 0.002000 kg
  Dimensions (Dia x L)    = 0.010000 m x 0.006000 m

Item Number = 7
  Name                    = PCBs
  Quantity                = 7
  Parent ID               = 2
  Material ID             = 23 (FR4/Epoxy Glass)
  Type                    = Box
  Aero Mass               = 0.100000 kg
  Thermal Mass            = 0.100000 kg
  Dimensions (W x L x H)  = 0.100000 m x 0.100000 m x 0.050000 m

Item Number = 8
  Name                    = Li Ion Battery
  Quantity                = 1
  Parent ID               = 2
  Material ID             = 19 (Lithium Cobalt Oxide Chemistry)
  Type                    = Box
  Aero Mass               = 0.350000 kg
  Thermal Mass            = 0.350000 kg
  Dimensions (W x L x H)  = 0.100000 m x 0.100000 m x 0.050000 m
```

```
Item Number = 9
  Name                     = Fasteners
  Quantity                 = 1
  Parent ID                = 2
  Material ID              = 54 (Stainless Steel)
  Type                     = Cylinder
  Aero Mass                = 0.050000 kg
  Thermal Mass             = 0.050000 kg
  Dimensions (Dia x L)     = 0.020000 m x 0.050000 m

Item Number = 10
  Name                     = Cameras
  Quantity                 = 2
  Parent ID                = 2
  Material ID              = 23 (FR4 Composite)
  Type                     = Box
  Aero Mass                = 0.050000 kg
  Thermal Mass             = 0.050000 kg
  Dimensions (W x L x H)   = 0.030000 m x 0.030000 m x 0.030000 m


[THERMAL ABLATION TIMELINE & REENTRY OUTPUT RESULTS]

--------------------------------------------------------------------------------
Object Name: SoFIE
Demise Altitude       = 78.000040 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: 3U_Frame_and_Tun_Can
Demise Altitude       = 76.151143 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Nitinol_Wire_Antennas
Demise Altitude       = 75.870655 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Solar Panel
Demise Altitude       = 75.407803 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Lens
```

```
Demise Altitude       = 73.703266 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Solar Array Hinges
Demise Altitude       = 73.254430 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: PCBs
Demise Altitude       = 75.385671 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Li Ion Battery
Demise Altitude       = 74.044761 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Fasteners
Demise Altitude       = 72.658911 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Cameras
Demise Altitude       = 74.273824 km
Debris Casualty Area  = 0.000000 m²


Use code with caution.

Impact Kinetic Energy = 0.000000 J

========================== End of Requirement 4.7-1 ==========================
06 28 2026; 12:41:15PM Project Data Saved To File
```

# APPENDIX B: NASA DEBRIS ASSESSMENT SOFTWARE (DAS) SIMULATION LOGS – Anomalous Stowed Configuration

**Project Name:** SoFIE (Solar Flare and Ionosphere Explorer)
**Simulation Execution Date:** June 28, 2026
**Software Version:** NASA DAS v3.2.7

```
06 28 2026; 12:45:51PM Activity Log Started

================================================================================
PROCESSING REQUIREMENT 4.3-1: LIMIT NUMBER OF OPERATIONAL DEBRIS
================================================================================
Return Status: Not Run (0 Objects Released)
--------------------------------------------------------------------------------
No Project Data Available
========================== End of Requirement 4.3-1 ==========================

================================================================================
PROCESSING REQUIREMENT 4.3-2: LIMIT LIFETIME OF OPERATIONAL DEBRIS
================================================================================
Return Status: Passed (Low Earth Orbit Mission / Non-GEO)
--------------------------------------------------------------------------------
No Project Data Available
========================== End of Requirement 4.3-2 ==========================

================================================================================
PROCESSING REQUIREMENT 4.5-1: COLLISION PROBABILITY WITH SPACE OBJECTS
================================================================================
Return Status: Passed

[RUN INPUT DATA]
Space Structure Name       = SoFIE
Space Structure Type       = Payload
Perigee Altitude           = 500.000 (km)
Apogee Altitude            = 500.000 (km)
Inclination                = 97.400 (deg)
RAAN                       = 0.000 (deg)
Argument of Perigee        = 0.000 (deg)
Mean Anomaly               = 0.000 (deg)
Final Area-To-Mass Ratio   = 0.0088 (m^2/kg)
Start Year                 = 2028.582 (yr)
Initial Mass               = 4.000 (kg)
Final Mass                 = 4.000 (kg)
Duration                   = 1.500 (yr)
Station-Kept               = False
```

```
Abandoned                   = True
Long-Term Reentry           = False

[SIMULATION OUTPUT]
Collision Probability       = 1.0738E-05
Returned Message            = Normal Processing
Date Range Message          = Normal Date Range
Status                      = Pass
========================== End of Requirement 4.5-1 ==========================

06 28 2026; 12:49:22PM Project Data Saved To File
06 28 2026; 12:49:25PM Requirement 4.5-2: Compliant
========================== End of Requirement 4.5-2 ==========================

================================================================================
PROCESSING REQUIREMENT 4.6: POST-MISSION ORBITAL LIFETIME (DISPOSAL)
================================================================================
Return Status: Passed

[PROJECT INPUT DATA]
Space Structure Name        = SoFIE
Space Structure Type        = Payload
Perigee Altitude            = 500.000000 (km)
Apogee Altitude             = 500.000000 (km)
Inclination                 = 97.400000 (deg)
RAAN                        = 0.000000 (deg)
Argument of Perigee         = 0.000000 (deg)
Mean Anomaly                = 0.000000 (deg)
Area-To-Mass Ratio          = 0.008750 (m^2/kg)
Start Year                  = 2028.582000 (yr)
Initial Mass                = 4.000000 (kg)
Final Mass                  = 4.000000 (kg)
Duration                    = 1.500000 (yr)
Station Kept                = False
Abandoned                   = True
PMD Perigee Altitude        = 494.473566 (km)
PMD Apogee Altitude         = 495.424926 (km)
PMD Inclination             = 97.460048 (deg)
PMD RAAN                    = 180.886407 (deg)
PMD Argument of Perigee     = 207.178327 (deg)
PMD Mean Anomaly            = 0.000000 (deg)
Long-Term Reentry           = False

[SIMULATION OUTPUT]
Suggested Perigee Altitude = 494.473566 (km)
Suggested Apogee Altitude  = 495.424926 (km)
```

```
Returned Error Message     = Passes LEO reentry orbit criteria.
Released Year              = 2035 (yr)
Requirement ID             = 61
Compliance Status          = Pass
========================== End of Requirement 4.6 ==========================

================================================================================
PROCESSING REQUIREMENT 4.7-1: COMPONENT NESTING HIERARCHY AND DEMISE RISK
================================================================================
Return Status: Passed

[ORSAT MODELING HARDWARE HIERARCHY INPUTS]
Item Number = 1
  Name                     = SoFIE
  Quantity                 = 1
  Parent ID                = 0 (Primary Core)
  Material ID              = 8 (Aluminum 6061-T6)
  Type                     = Box
  Aero Mass                = 4.000000 kg
  Thermal Mass             = 4.000000 kg
  Dimensions (W x L x H)   = 0.100000 m x 0.300000 m x 0.100000 m

Item Number = 2
  Name                     = 3U_Frame_and_Tun_Can
  Quantity                 = 1
  Parent ID                = 1
  Material ID              = 8 (Aluminum 6061-T6)
  Type                     = Box
  Aero Mass                = 3.064000 kg
  Thermal Mass             = 1.000000 kg
  Dimensions (W x L x H)   = 0.100000 m x 0.376000 m x 0.100000 m

Item Number = 3
  Name                     = Nitinol_Wire_Antennas
  Quantity                 = 4
  Parent ID                = 2
  Material ID              = -1 (User Defined Nitinol)
  Type                     = Cylinder
  Aero Mass                = 0.012500 kg
  Thermal Mass             = 0.012500 kg
  Dimensions (Dia x L)     = 0.001000 m x 2.500000 m

Item Number = 4
  Name                     = Solar Panel
  Quantity                 = 4
  Parent ID                = 2
```

```
  Material ID              = 25 (Silicon/Glass Composite)
  Type                     = Flat Plate
  Aero Mass                = 0.203500 kg
  Thermal Mass             = 0.186000 kg
  Dimensions (W x L)       = 0.100000 m x 0.300000 m

Item Number = 5
  Name                     = Lens
  Quantity                 = 2
  Parent ID                = 4
  Material ID              = -3 (N-BK7 Glass)
  Type                     = Cylinder
  Aero Mass                = 0.025000 kg
  Thermal Mass             = 0.025000 kg
  Dimensions (Dia x L)     = 0.030000 m x 0.030000 m

Item Number = 6
  Name                     = Solar Array Hinges
  Quantity                 = 10
  Parent ID                = 4
  Material ID              = -1 (Nitinol)
  Type                     = Cylinder
  Aero Mass                = 0.002000 kg
  Thermal Mass             = 0.002000 kg
  Dimensions (Dia x L)     = 0.010000 m x 0.006000 m

Item Number = 7
  Name                     = PCBs
  Quantity                 = 7
  Parent ID                = 2
  Material ID              = 23 (FR4/Epoxy Glass)
  Type                     = Box
  Aero Mass                = 0.100000 kg
  Thermal Mass             = 0.100000 kg
  Dimensions (W x L x H)   = 0.100000 m x 0.100000 m x 0.050000 m

Item Number = 8
  Name                     = Li Ion Battery
  Quantity                 = 1
  Parent ID                = 2
  Material ID              = 19 (Lithium Cobalt Oxide Chemistry)
  Type                     = Box
  Aero Mass                = 0.350000 kg
  Thermal Mass             = 0.350000 kg
  Dimensions (W x L x H)   = 0.100000 m x 0.100000 m x 0.050000 m
```

```
Item Number = 9
  Name                      = Fasteners
  Quantity                  = 1
  Parent ID                 = 2
  Material ID               = 54 (Stainless Steel)
  Type                      = Cylinder
  Aero Mass                 = 0.050000 kg
  Thermal Mass              = 0.050000 kg
  Dimensions (Dia x L)      = 0.020000 m x 0.050000 m

Item Number = 10
  Name                      = Cameras
  Quantity                  = 2
  Parent ID                 = 2
  Material ID               = 23 (FR4 Composite)
  Type                      = Box
  Aero Mass                 = 0.050000 kg
  Thermal Mass              = 0.050000 kg
  Dimensions (W x L x H)    = 0.030000 m x 0.030000 m x 0.030000 m


[THERMAL ABLATION TIMELINE & REENTRY OUTPUT RESULTS]

-------------------------------------------------------------------------------
Object Name: SoFIE
Demise Altitude       = 78.000040 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
-------------------------------------------------------------------------------
Object Name: 3U_Frame_and_Tun_Can
Demise Altitude       = 76.151143 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
-------------------------------------------------------------------------------
Object Name: Nitinol_Wire_Antennas
Demise Altitude       = 75.870655 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
-------------------------------------------------------------------------------
Object Name: Solar Panel
Demise Altitude       = 75.407803 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
-------------------------------------------------------------------------------
Object Name: Lens
Demise Altitude       = 73.703266 km
Debris Casualty Area  = 0.000000 m²
```

```
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Solar Array Hinges
Demise Altitude       = 73.254430 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: PCBs
Demise Altitude       = 75.385671 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Li Ion Battery
Demise Altitude       = 74.044761 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Fasteners
Demise Altitude       = 72.658911 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J
--------------------------------------------------------------------------------
Object Name: Cameras
Demise Altitude       = 74.273824 km
Debris Casualty Area  = 0.000000 m²
Impact Kinetic Energy = 0.000000 J


Use code with caution.


========================== End of Requirement 4.7-1 ==========================
06 28 2026; 12:49:34PM Project Data Saved To File
```