EARTH SYSTEM EXPLORER MEDIUM EXPLORERS (MIDEX) 2023
ANNOUNCEMENT OF OPPORTUNITY (AO)
LAUNCH SERVICES INFORMATION SUMMARY

NASA-Provided Launch Services Ground Rules/Policy

This document provides additional information for NASA-provided launch services. This launch service will be provided by NASA and will be procured and managed by the NASA/Launch Services Program (LSP) using government contracts.

Under this AO, the Proposer may not arrange alternative access to space.

Under the provisions of the NASA Launch Services II (NLS II) contract, the launch service includes the Launch Vehicle (LV) and associated standard services, non-standard services (mission-unique options), all engineering and analysis, and minimum performance standards. LSP also provides technical management of the launch service, technical insight into the LV production/test, coordinates and approves mission-specific integration activities, provides mission unique LV hardware/software development, provides payload-processing accommodations, and manages the launch campaign/countdown.

At the appropriate time following mission selection, LSP will competitively select a launch service provider and award a launch service for the mission based on customer requirements. The launch service is awarded to the Contractor that provides the best value in launch services to meet the Government's requirements based on technical capability/risk, reasonableness of proposed price, and past performance. Accordingly, assumption of a specific launch vehicle configuration as part of the AO proposal will not guarantee that the proposed LV configuration will be selected unless there is firm technical rationale for sole source. Any such rationale should be clearly identified and explained in the proposal.

All NASA-procured launch services will be consistent with NASA Policy Directive (NPD) 8610.7D, NASA Launch Services Risk Mitigation Policy. Launch services acquired by NASA will be managed in accordance with NPD 8610.23C, Launch Vehicle Technical Oversight Policy, and NPD 8610.24C, Launch Services Program (LSP) Pre-Launch Readiness Reviews. These NPDs can be accessed through the AO library.

Launch Vehicle Information/Configuration/Performance

Three scenarios are depicted in this summary, which must be addressed in the proposal (see Requirement 96 in the AO). Any areas that are not compatible with the launch vehicle scenario's capabilities and characteristics must be addressed in the proposal along with any impacts needed to meet these areas (see Requirement 96 in the AO).

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Launch Service Costs

The Astrophysics Explorers Program within the Science Mission Directorate will hold the launch service costs. Standard services provided in the launch service costs to be covered by the Astrophysics Explorer Program are:

- the launch vehicle, engineering, analysis, and minimum performance standards and services provided by the NLS II contract in place at the time of LV selection;
- mission integration;
- launch site payload processing;
- range safety support;
- down range telemetry support (launch vehicle only);
- nominal allocation for non-standard/mission unique launch vehicle modifications/services – items typically necessary to customize the basic vehicle hardware to meet spacecraft driven requirements (see attachment 2 within this document);

The Baseline launch service for this AO is based upon a medium/intermediate-class vehicle.

The Earth Science launch service budget set aside for MIDEX 2022 does not include funding for PI/payload-caused launch delays.

Evaluation Criteria

Attachment 3 shows a preliminary Risk Assessment checklist that will be used as a guide for the launch service evaluators during the proposal evaluation phase. This checklist should provide an indication of the types of information that are expected to be in the proposals. If the proposal does not provide sufficient information, the launch vehicle section of the proposal may not be evaluated for full content and may be listed as a finding.

NASA Launch Services Program Point of Contact (POC) for Additional Information

Additional information including performance quotes for other orbits/destinations, mission integration inquiries, standard services, and non-standard/mission unique services costs may be obtained from the point of contact below. Other questions must be directed as indicated in the Section 6.1.5 of the AO.

Hamilton Fernandez
Mission Manager
NASA Launch Services Program
Code VA-C
Kennedy Space Center, FL 32899
Phone: 321-501-8591 (Mobile)
Email: hamilton.fernandez@nasa.gov

Attachment 1 – LV Launch Services Characteristics/Capabilities

PERFORMANCE INFORMATION/CAPABILITIES

The performance listed for each representative orbit contains the equivalent maximum mass allowed under the standard launch service for the purposes of this AO. Note that other inclinations/altitudes/orbit energies are also available. In some scenarios, an increase in performance may be available, please contact LSP for feasibility.

Table 1 lists some reference orbits/destinations for Scenario 1, with expanded curves provided in Figure 1. Table 2 lists some reference orbits/destinations for Scenario 2, with expanded curves provided in Figure 2. Table 3 lists some reference orbits/destinations for Scenario 3, with expanded curves provided in Figure 3.

Ground Rules (valid for all scenarios):

- The LV performance available on NLS-II generally does not include impacts associated with orbital debris compliance; this must be evaluated on a mission specific basis. Depending on LV design, this could result in a significant performance impact to ensure full compliance with orbital debris policy.
- Guidance reserves have been allocated to account for 3-sigma flight performance.
- Performance is for a Baseline LV configuration; non-standard, mission-unique hardware will require additional assessment.
- Assumes a 47-inch (1194 mm) separation system.
- Mass of entire separation system is book-kept on the launch vehicle side.

Scenario 1:

Reference Orbit (Altitude, Inclination)	Performance	Volume
600 km, 0 deg	360 kg	PLF Scenario 1

Table 1: Scenario 1 Performance Capability at Reference Altitude

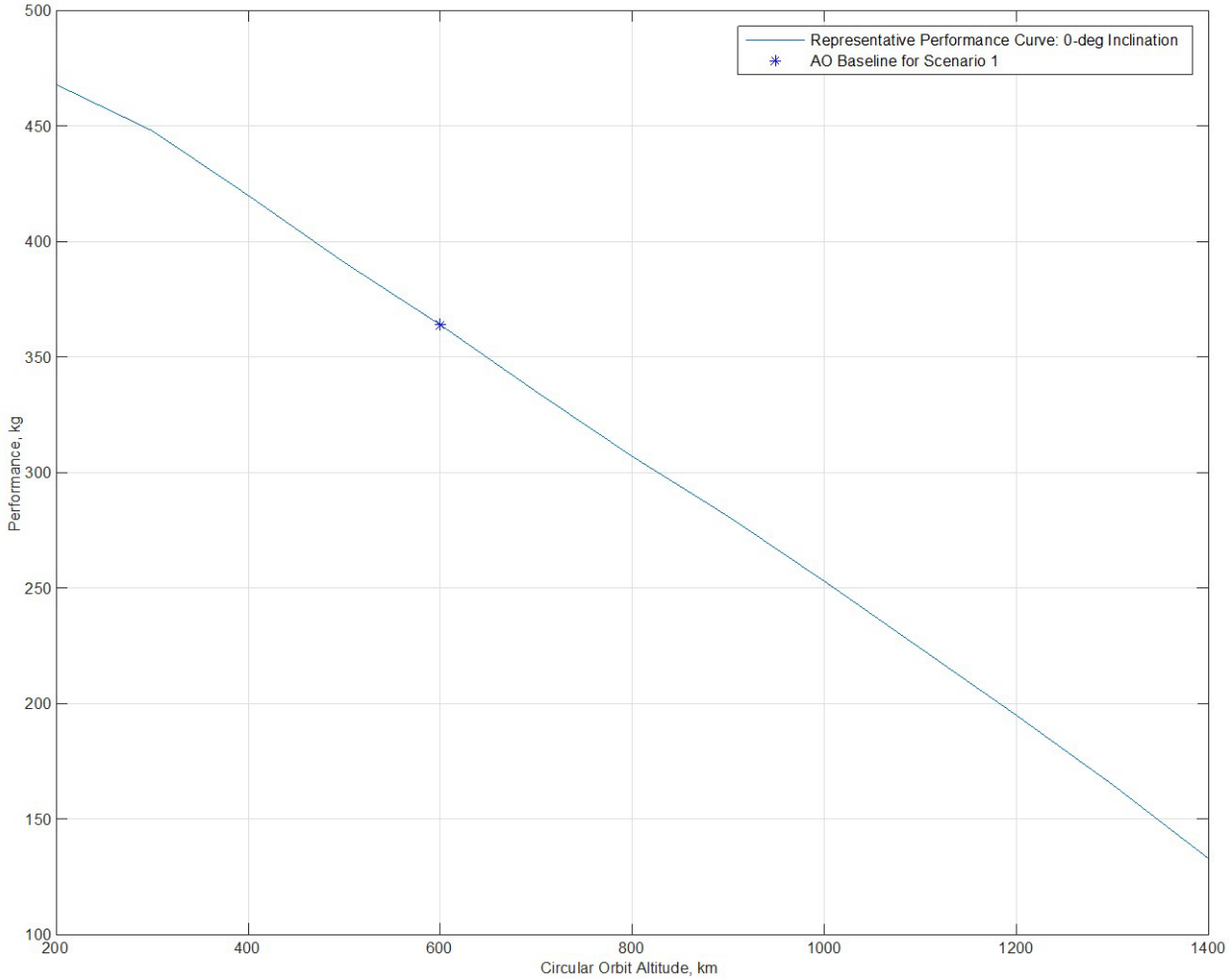

Figure 1: Scenario 1 Representative Performance Capability at 0-deg Inclination

Scenario 2:

Reference Orbit (Altitude, Inclination)	Performance	Volume
600 km, 28.5 deg	8320 kg	PLF Scenario 2

Table 2: Scenario 2 Performance Capability at Reference Altitude

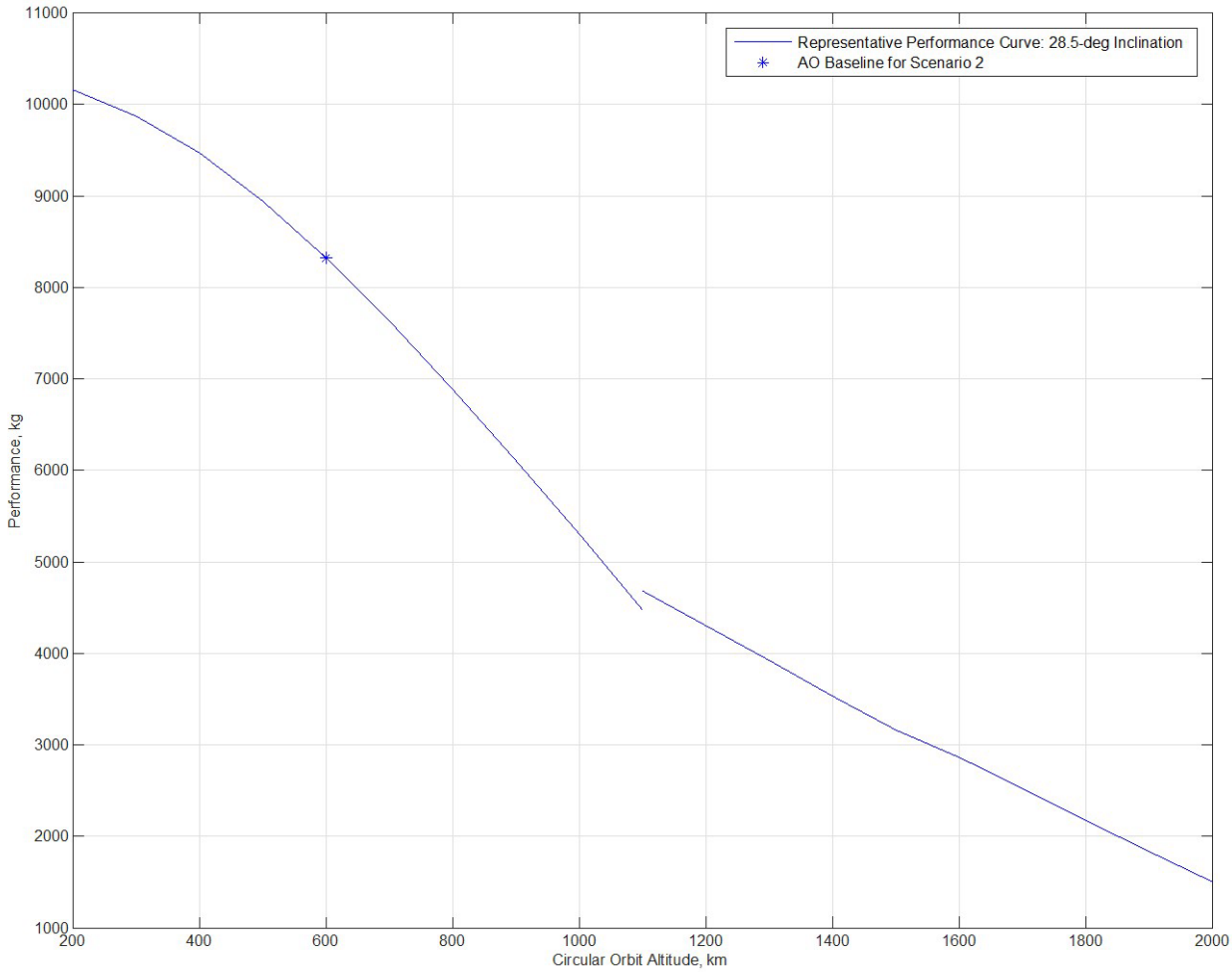

Figure 2: Scenario 2 Representative Performance Capability at 28.5-deg Inclination

Scenario 3:

Reference Orbit (Altitude, Inclination)	Performance	Volume
700 km, Sun-Synchronous	6050 kg	PLF Scenario 3

Table 3: Scenario 3 Performance Capability at Reference Altitude

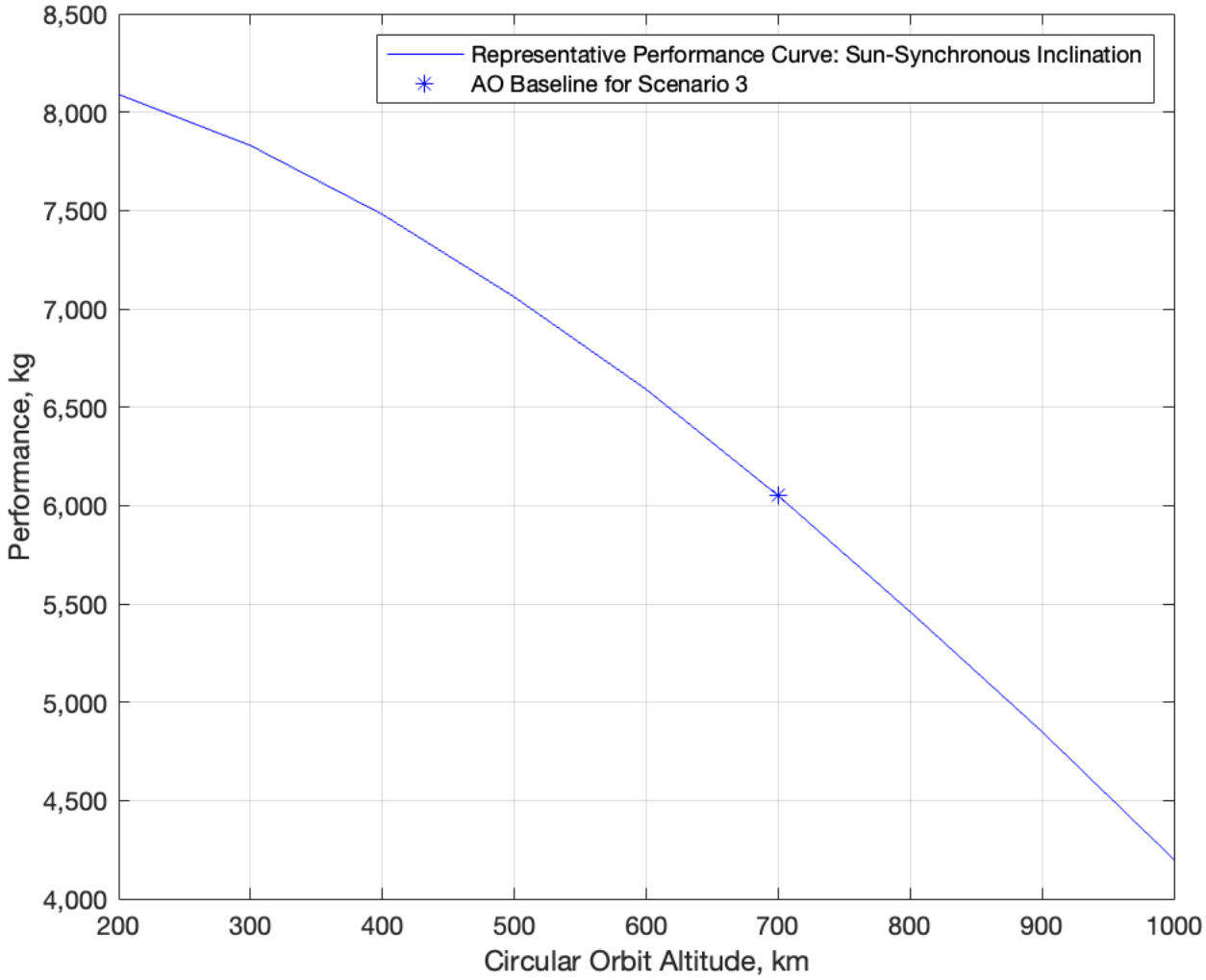

Figure 3: Scenario 3 Representative Performance Capability at Sun-Synchronous Inclination

PAYLOAD ENVELOPES

There are 3 different scenarios for payload fairing volumes allowed under the standard launch service for the purposes of this AO.

Scenario 1

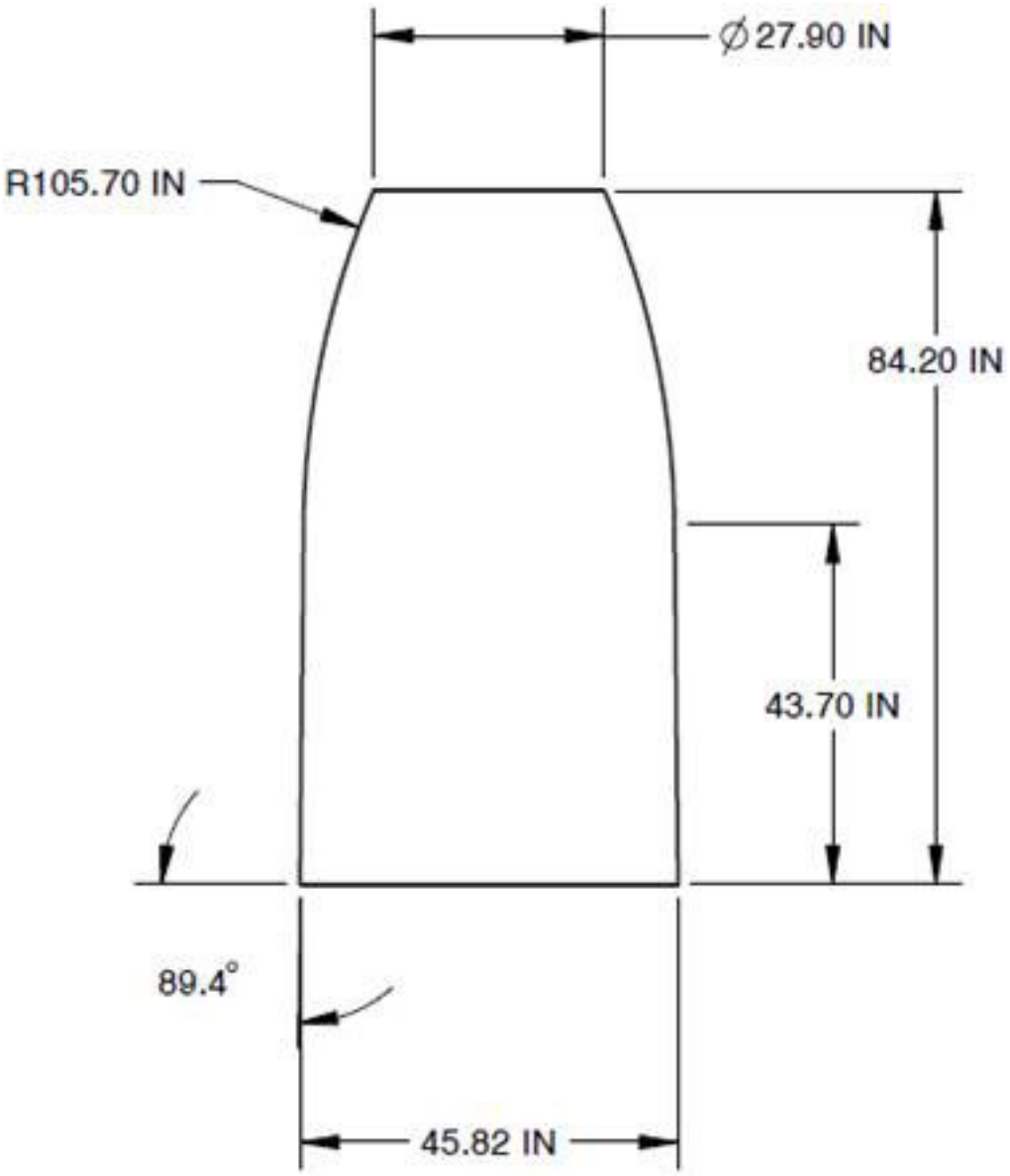

Figure 4: Scenario 1 PLF Static Envelope (inches)

Scenario 2

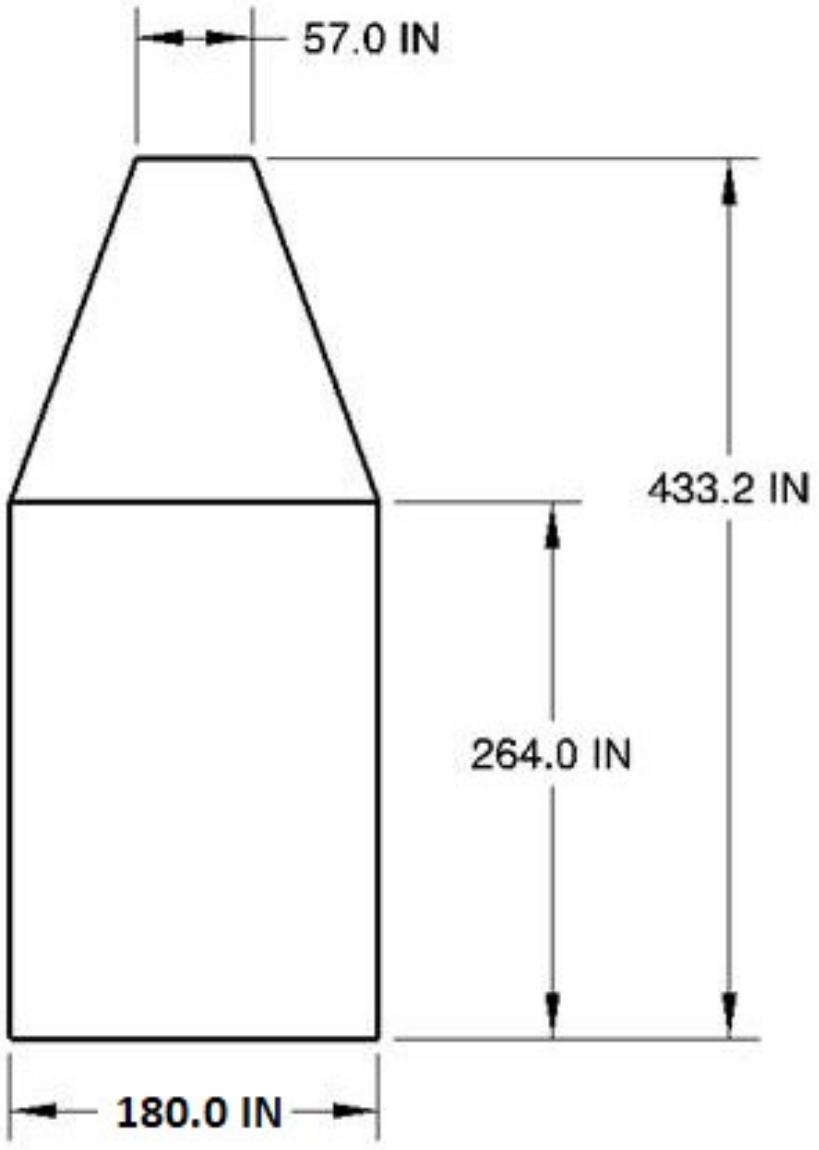

Figure 5: Scenario 2 PLF Static Envelope (inches)

Scenario 3

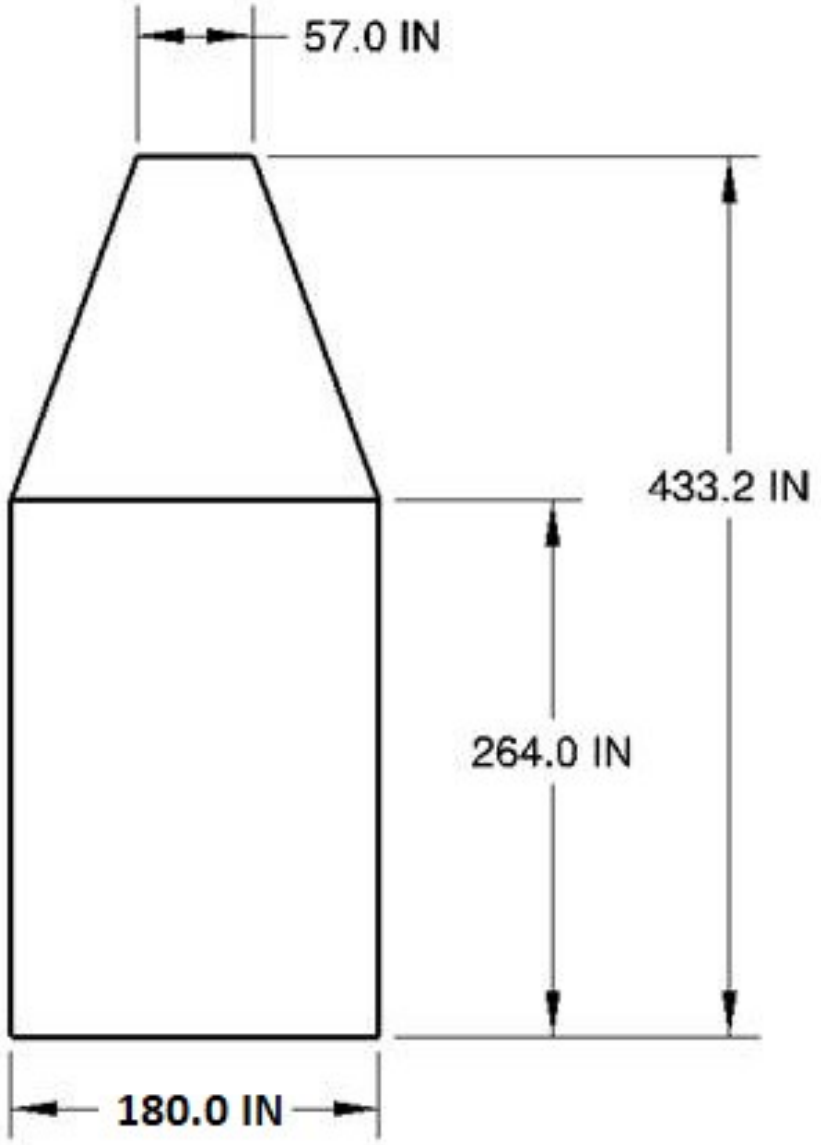

Figure 6: Scenario 3 PLF Static Envelope (inches)

LAUNCH VEHICLE ENVELOPING ENVIRONMENTS

Equivalent Sine Environment:

Scenario 1:

Envelope			
Frequency (Hz)	Axial	Frequency (Hz)	Lateral
5	0.5	5	0.5
20	0.8	85	0.5
35	0.8	100	0.6
65	1.85		
75	1.85		
100	1.2		

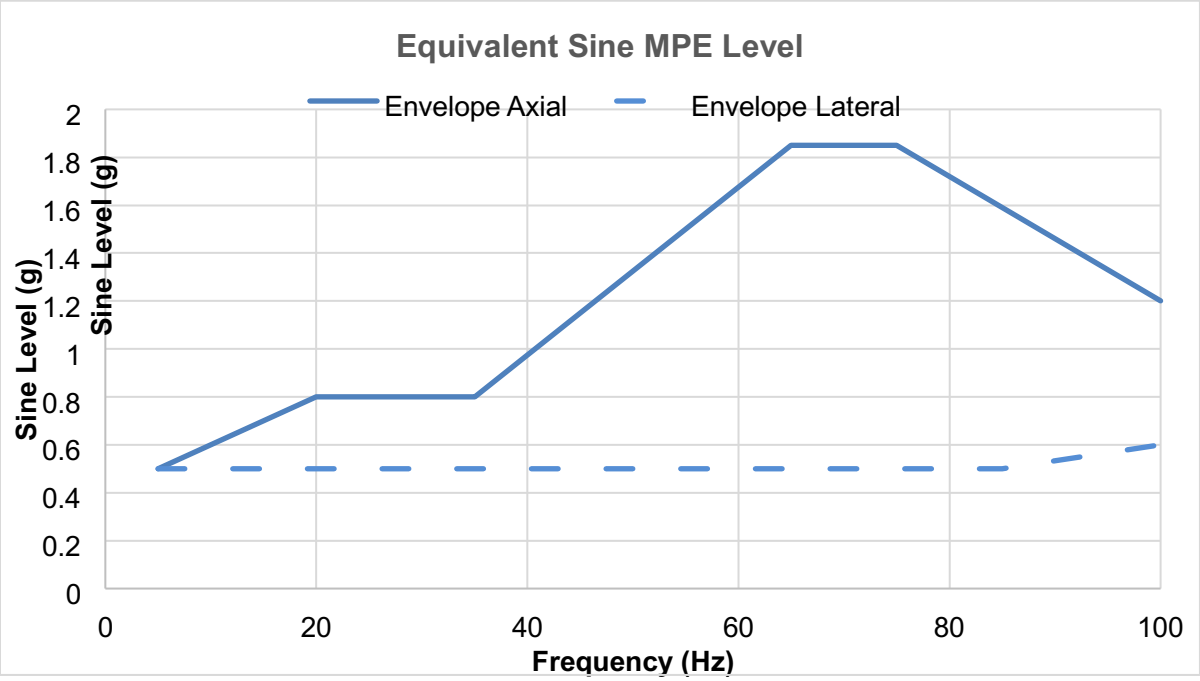

Figure 7: Scenario 1 Enveloping Equivalent Sine – Flight Level

Scenario 2:

Envelope			
Frequency (Hz)	Axial	Frequency (Hz)	Lateral
5	0.6	5	0.5
10	0.6	80	0.5
20	0.8	80	0.55
35	0.8	85	0.55
35	0.6	85	0.6
60	0.6	100	0.6
60	0.8		
82	0.8		
85	0.9		
100	0.9		

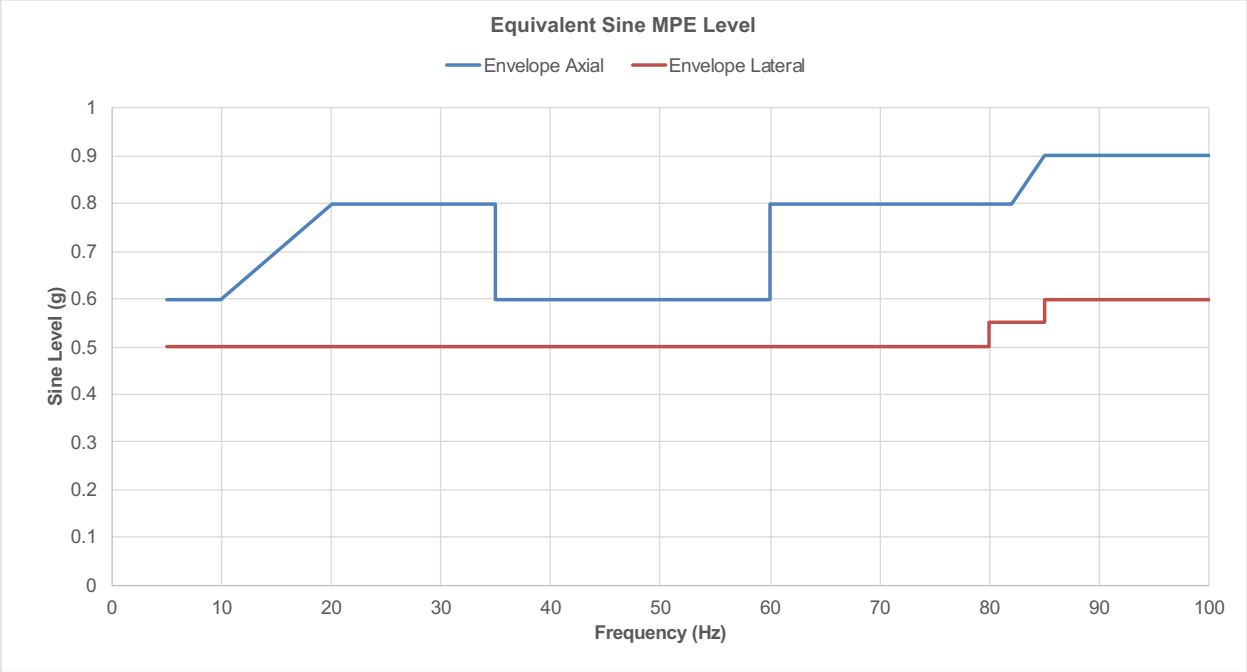

Figure 8: Scenario 2 Enveloping Equivalent Sine – Flight Level

Scenario 3:

Enveloping Equivalent Sine Environment for Scenario 3 is the same as Scenario 2.

CG Loads Factors:

Scenario 1:

Envelope	
Lateral (g's)	Axial (g's)*
1.7	10.1
3.6	4.7
3.7	1
6.75	0.5
6.75	-0.5
3.7	-1
3.15	-1.2
3	-1.5
2	-1.5
2	-4
-2	-4
-2	-1.5
-3	-1.5
-3.15	-1.2
-3.7	-1
-6.75	-0.5
-6.75	0.5
-3.7	1
-3.6	4.7
-1.7	10.1
1.7	10.1

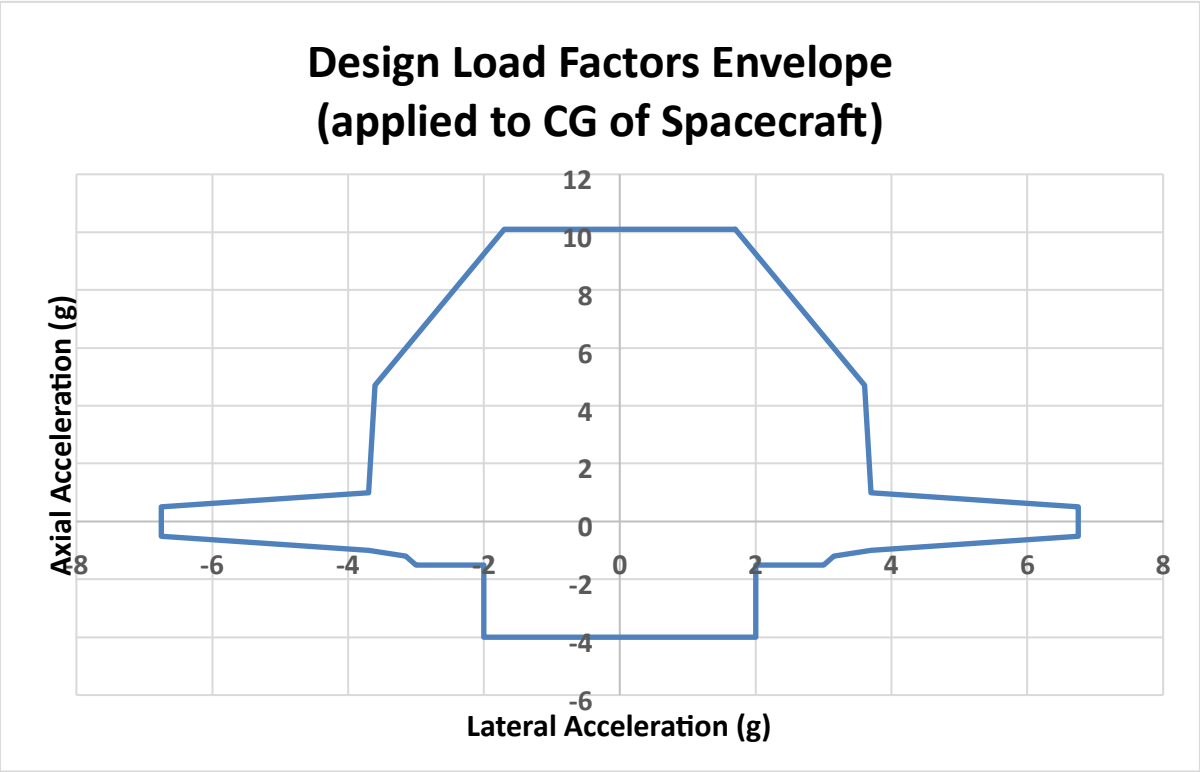

Figure 9: Scenario 1 Enveloping Design Load Factors (to be applied to CG of Spacecraft)

Scenario 2:

Envelope	
Lateral (g's)	Axial (g's) *
0.5	6.5
0.5	4.5
2	3.5
2	-1.5
0.6	-1.5
0.6	-2
-0.6	-2
-0.6	-1.5
-2	-1.5
-2	3.5
-0.5	4.5
-0.5	6.5
0.5	6.5

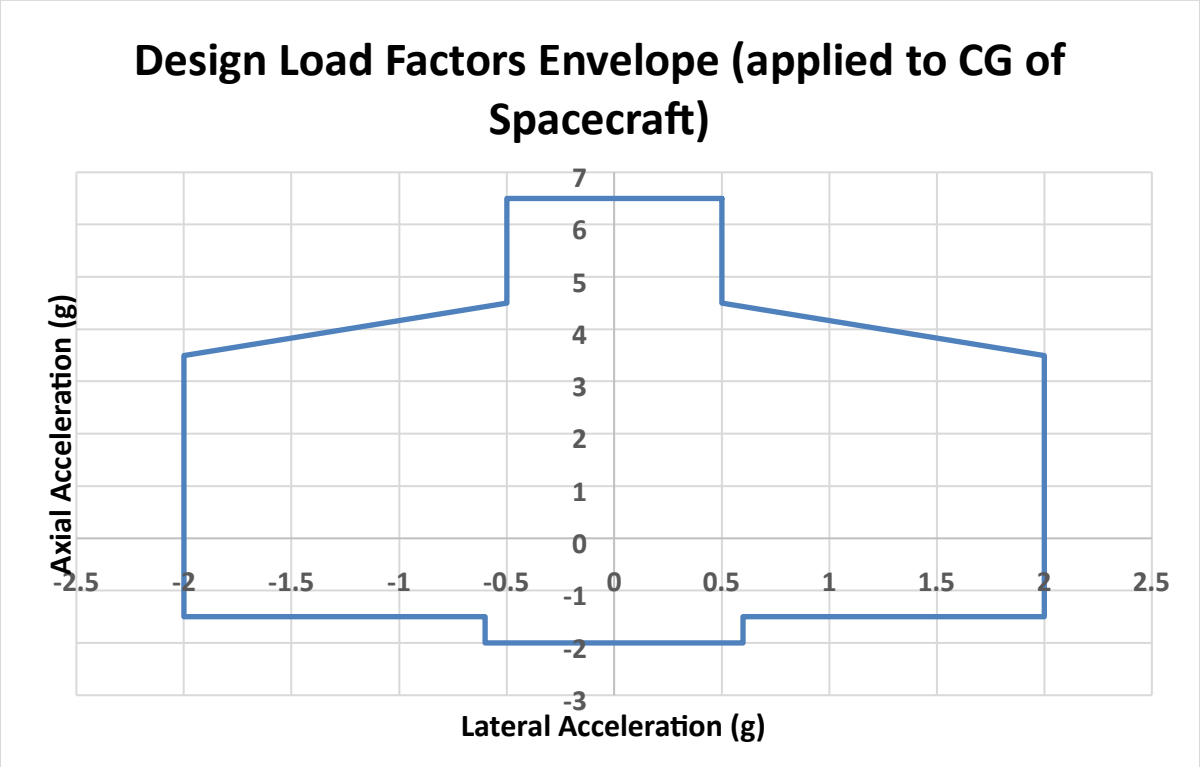

Figure 10: Scenario 2 Enveloping Design Load Factors (to be applied to CG of Spacecraft)

Scenario 3:

Enveloping CG Loads Factor for Scenario 3 is the same as Scenario 2.

Acoustic Environment:

Scenario 1:

Candidate LV Payload Acoustics Design Envelope (P95/50 MPE)	
Frequency [Hz]	**SPL [dB]**
12.5	108
16	108
20	108
25	105
31.5	105
40	105
50	103
63	103
80	103
100	103
125	105.5
160	108
200	110
250	110
315	110
400	110
500	111.5
630	115
800	119
1000	114
1250	114
1600	111.5
2000	111

2500	108
3150	106.5
4000	106
5000	102
OASPL	**124.8**

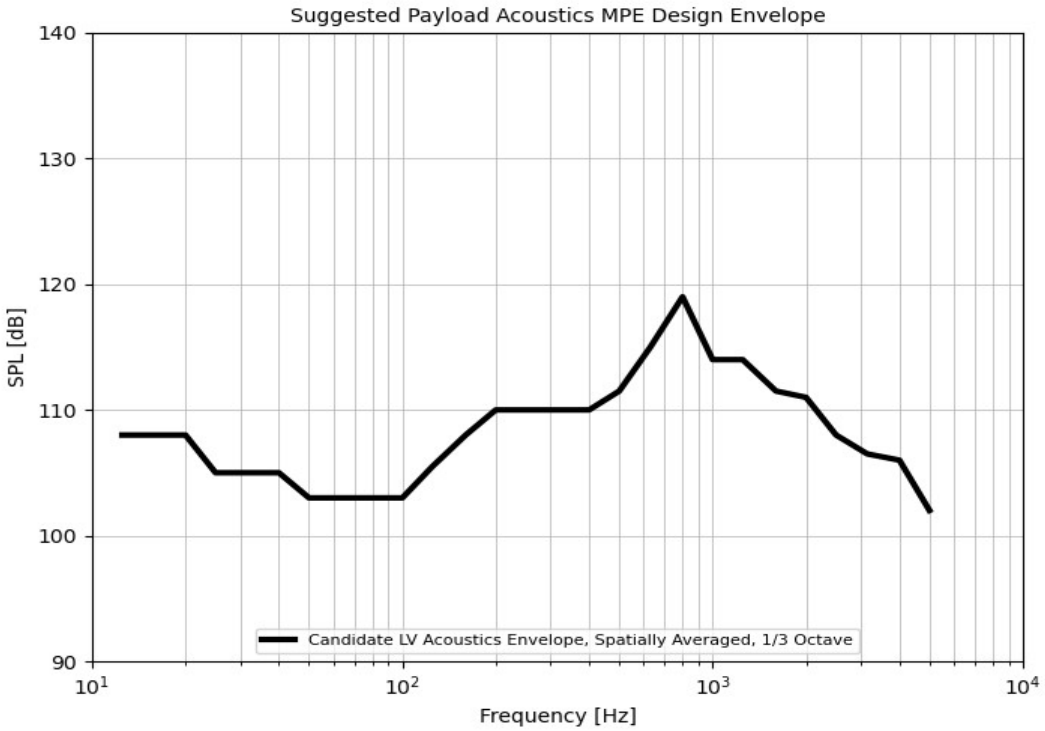

Figure 11: Scenario 1 Enveloping Payload Acoustics MPE – 1/3 Octave Band SPL

Scenario 2

Candidate LV Payload Acoustics Design Envelope (P95/50 MPE)	
Frequency [Hz]	**SPL [dB]**
25	120
31.5	123
40	126.5
50	127
63	127
80	128
100	130
125	131
160	131
200	131
250	130
315	128
400	126
500	124
630	122
800	119.5
1000	117.8
1250	116.4
1600	114.5
2000	112.5
2500	111
3150	109
4000	108
5000	107

6300	106
8000	104
10000	102
OASPL	**139.9**

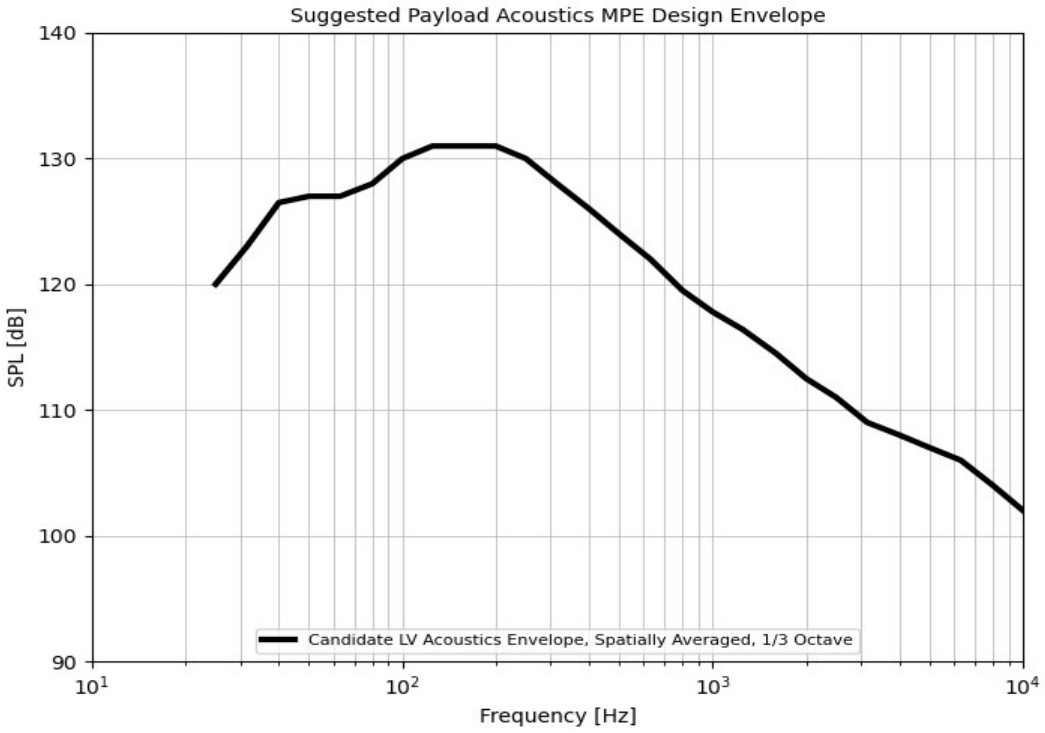

Figure 12: Scenario 2 Enveloping Payload Acoustics MPE – 1/3 Octave Band SPL

Scenario 3

Acoustic Environments for Scenario 3 are the same as Scenario 2.

Shock Environment:

Scenario 1

Candidate LV Separation Shock Design Envelope (P95/50 MPE)	
Frequency [Hz]	**SRS [G-peak]**
100	55
1000	3500
10000	3500

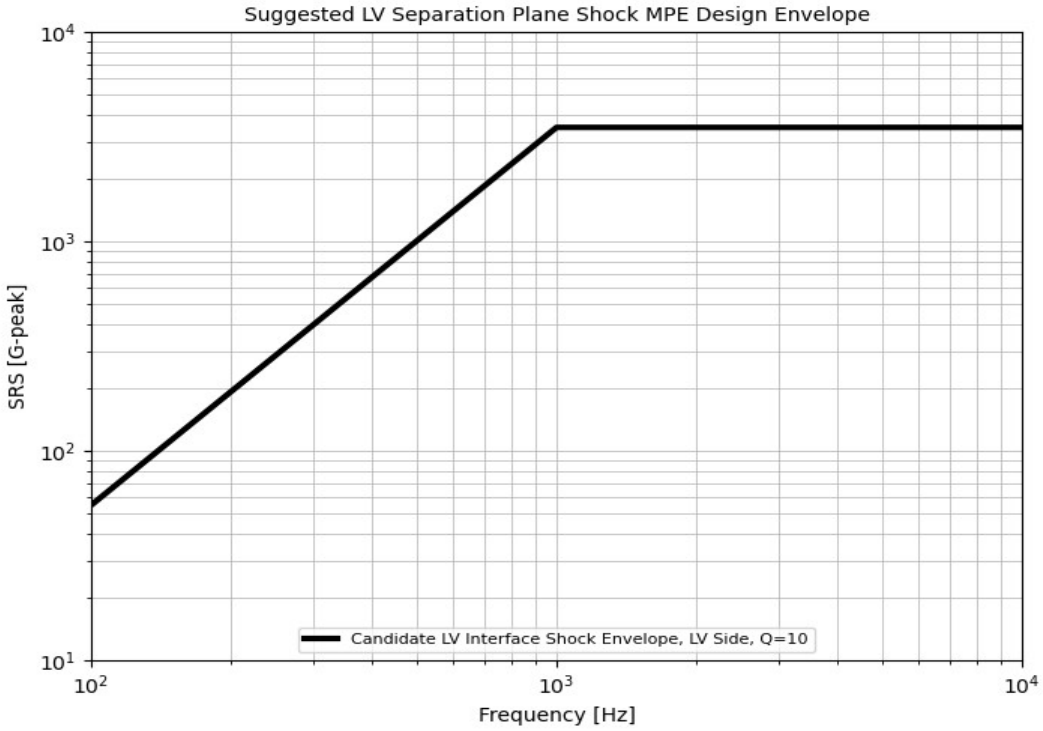

Figure 13: Scenario 1 Shock Environment at Separation Plane (LV side)

Scenario 2

Candidate LV Separation Shock Design Envelope (P95/50 MPE)	
Frequency [Hz]	**SRS [G-peak]**
100	74
1000	2000
10000	2000

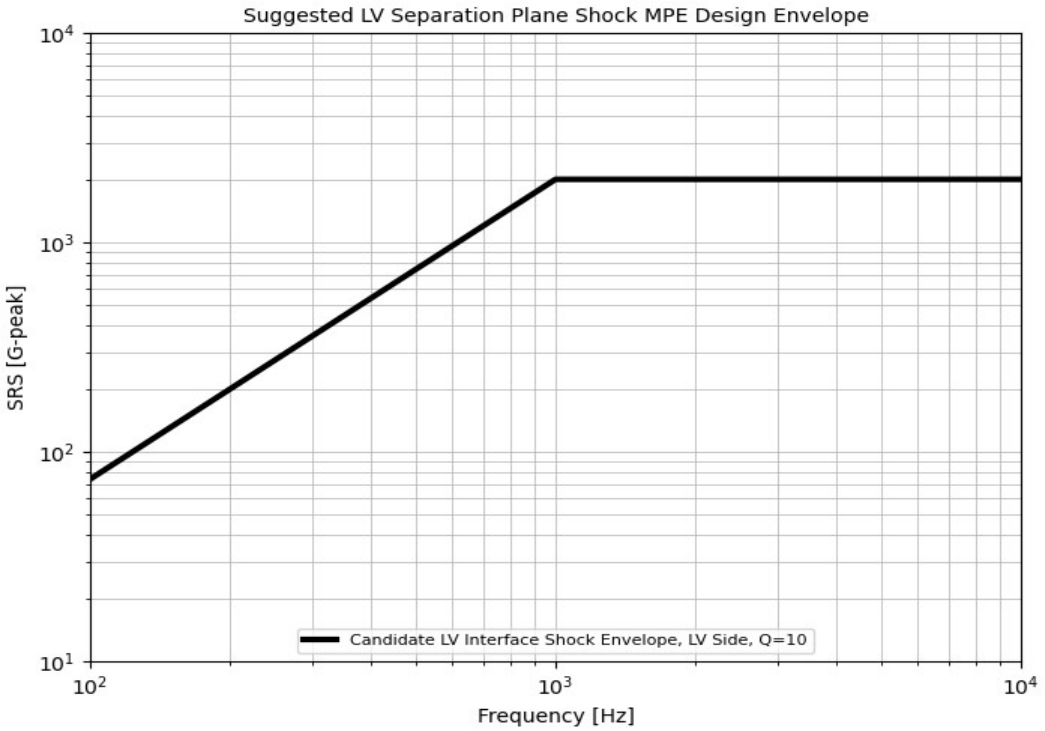

Figure 14: Scenario 2 Shock Environment at Separation Plane (LV side)

Scenario 3

Shock Environments for Scenario 3 are the same as Scenario 2.

Random Vibe Environment:

Scenario 1

Candidate LV Random Vibration Design Envelope (P95/50 MPE)	
Frequency [Hz]	**PSD [G^2/Hz]**
20	0.004
35	0.004
40	0.008
70	0.008
85	0.004
100	0.0008
400	0.0008
500	0.004
600	0.005
800	0.005
2000	0.001
Grms	**2.23**

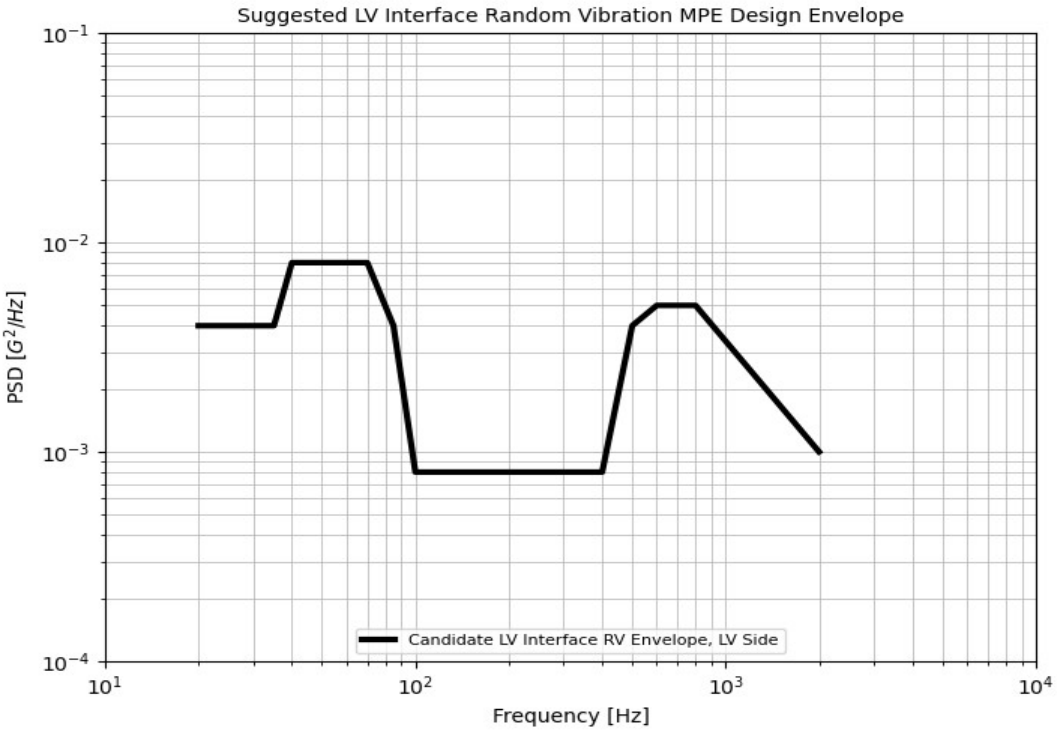

Figure 15: Scenario 1 Payload Interface Random Vibration Max Envelope

Scenario 2

Candidate LV Random Vibration Design Envelope (P95/50 MPE)	
Frequency [Hz]	**PSD [G^2/Hz]**
20	0.0044
100	0.0044
300	0.01
700	0.01
800	0.03
925	0.03
2000	0.00644
Grms	**5.13**

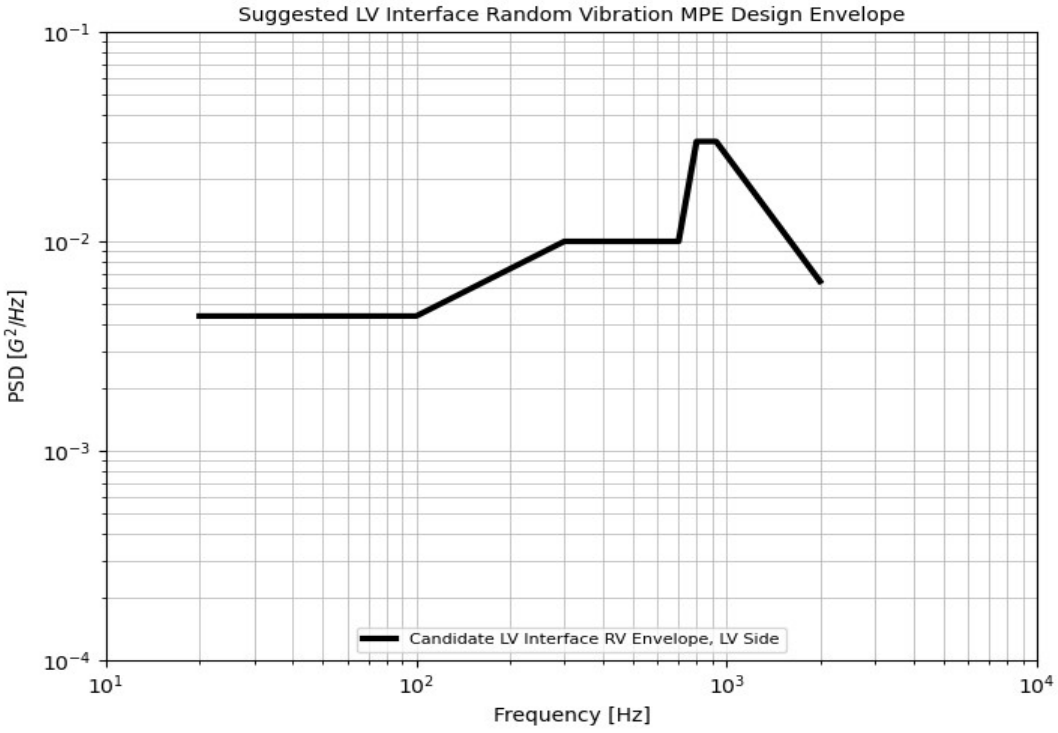

Figure 16: Scenario 2 Payload Interface Random Vibration Max Envelope

Scenario 3

Random Vibe Environments for Scenario 3 are the same as Scenario 2.

Attachment 2 – NASA LSP Standard Launch Services

NASA-LSP STANDARD LAUNCH SERVICES

This list provides an overview of the standard and mission-specific services that the spacecraft customer receives with the NASA-LSP Baseline launch service for this AO. If additional services are required but not listed herein, or for any questions, please contact the NASA LSP POC listed in this document.

Integrated Services:

- Range support and services
- Payload processing facility and support
- Contractor Engineering support
- Base Support contractors and logistics
- Hazardous support

Launch Vehicle:

- Launch vehicle that meets customer's performance needs
- Payload Fairing with approximately 2 access doors in standard locations, with thermal and/or acoustic blankets
- Standard LV-provided Payload Separation System
- Standard Payload Adapter
- Standard Test Payload adapter availability
- Spacecraft Spin/De-spin capability for separation (if required)
- Single-Spacecraft Collision/Contamination Avoidance Maneuver (CCAM) capability if needed
- Electrical interface connectors (approximately 3 sets)
- Mission-Unique Reviews (approximately 3)
- Readiness Reviews (approximately 4)
- Risk Management
- Launch Vehicle insight and approval per NPD 8610.23
- Mission integration management & engineering support
- Launch campaign management
- Down range telemetry assets for LV data

Baseline Mission-Unique Services

- Mission-Unique payload isolation system
- T-0 Grade B GN2 or pure air Purge
- ISO 14644-1 Class 7 (Class 10K) integration environment
- Pre-ATP studies such as coupled loads and/or trajectories analysis
- Although use of low-level radioactive sources (i.e., with an A2 mission multiple less than 10, as defined in NPR 8715.3, Chapter 6 and Appendix D) is a non-standard service, there is no charge to the PI-Managed Mission Cost, as any charges are minimal (such as radiological storage during payload processing). Note that costs associated with environmental review and launch approval are separate from these activities (reference AO Section 5.2.4).

The following list provides a few examples of non-standard/mission-unique services that are not included in this AO's NASA-provided launch service, and whose cost would need to be included as part of the Principal Investigator-Managed Mission Cost. Contact the LSP POC for further information on these and other non-standard/mission-unique services.

- Custom payload adapters
- Auxiliary Propulsion for target orbit achievement
- Deployable telemetry tracking assets for multiple spacecraft missions
- LV mods/analyses for non-separating interface with multiple SC deployment

Attachment 3 – NASA LSP Risk Assessment/Evaluation Form

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Attachment 3 – NASA LSP Risk Assessment/Evaluation Form

Proposal Name: _____

Proposal #: _____

Evaluator POC: _____

Phone: _____

Email: _____

Launch Service Risk Evaluation:

Overall Assessment: Given the ground rules in the AO, is the proposed launch vehicle (LV), standard services, mission-unique services, performance class, costs and concept feasible for this application? (____Yes or ____No)

Areas of risk: _____

LV Performance: Area of risk/concern? (____Yes or ____No)

Proposed LV configuration: _____

Proposed Launch Date: _____

Launch Period (MM/DD/YYYY to MM/DD/YYYY): _____/____/_____ to _____/____/_____

Launch Window (On any given day of the launch period Minutes:Seconds): _____ : _____

Orbit requirements: Apogee: _____ km Perigee: _____ km Inclination: _____deg.

High Energy requirements: C_3: _____ km^2/sec^2 DLA: _____deg RLA: _____deg

Proposed LV Performance: _____

CBE Mass (including reserves) Dry Mass: _____ kg Wet Mass: _____ kg

NTE Mass (including reserves) Dry Mass: _____ kg Wet Mass: _____ kg

Dry Mass Margin: _____ kg _____ %

Wet Mass Margin: _____ kg _____ %

Formulas:

Mass Margin kg = LV Performance – S/C Mass (including reserves)

Mass Margin % = [(Mass Margin kg)/ S/C Mass (including reserves) kg] X 100

LV Performance Comments/issues/concerns/risks:

_____

_____

_____

LV Integration: Area of risk/concern? (____Yes or ____No)

Does the proposer have experience in LV integration? (____Yes or ____No)

Attachment 3 – NASA LSP Risk Assessment/Evaluation Form

LV to Spacecraft Interface: Area of risk/concern? (____Yes or ____No)

Proposed Payload Fairing (PLF): _____

Spacecraft (S/C) Dimensions: Radial: _____ m Height: _____ m

Any intrusions outside of the AO Baseline PLF usable **STATIC** volume? (____Yes or ____No)

Are there any special access requirements post-fairing encapsulation? (____Yes or ____No)

If so, list risks: _____

Mechanical Interface:

Standard Adapter: _____ Custom Adapter: _____

Electrical Interface: Are there unique electrical interfaces proposed? (____Yes or ____No)

Standard _____ Pin(s) Connector(s): (____Yes or ____No)

Mission-Unique or Non-Standard Requirements:

Instrument T-0 GN_2 Purge: (____Yes or ____No)

T-0 S/C Battery Cooling: (____Yes or ____No)

Planetary Protection Requirements: (____Yes or ____No)

Contamination Control Requirements: PLF: (____Yes or ____No) LV adapter: (____Yes or ____No)

Cleanliness Level: _____ other: _____

List of Mission-Unique or Non-Standard Services proposed that are not part of the AO Baseline launch service offered:

_____

_____

Unique Facility Requirements: (____Yes or ____No)

Pad: _____

S/C Processing Facility: _____

S/C Environmental Test Plans:

Environmental Test Plan/Flow described: (____Yes or ____No)

Test Levels provided: (____Yes or ____No)

Test Schedule provided: (____Yes or ____No)

Comments/issues/concerns/risks:

_____

_____

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Attachment 3 – NASA LSP Risk Assessment/Evaluation Form

Launch Service Budget Assessment Summary: Area of risk/concern? (____Yes or ____No)

Are the additional Mission-Unique or Non-standard Services, not included in the AO Baseline service, covered by mission flex funding allocated by LSP? (____Yes or ____No)

If not, list risks: _____

Has additional funding been identified in the PI-Managed Mission Cost (PI-MMC)? (____Yes or ____No)

If not, list risks: _____

Spacecraft Summary Schedule: Area of risk/concern? (____Yes or ____No)

Launch Service Integration time 30+/-3 months? (____Yes or ____No)

SC Environmental Test program end date L-_____months

Delivery of verified SC loads model delivery to LSP at L-10 months or earlier? (____Yes or ____No)

SC Ship date L-_____months

SC to LV integrated operations L-_____days

Describe risk of missing the proposed launch date due to spacecraft schedule (environmental testing, launch processing, LV integration): _____

Missions with Radiological material: Area of risk/concern? (____Yes or ____No)

List the Radiological Sources: _____

Are facilities, not already approved for use, required to store/process the Rad Sources? (____Yes or ____No)

Are any LV modifications not included in the AO Baseline service required for additional safety or Launch approval? (____Yes or ____No)

Other identified cost, technical, schedule risks: Area of risk? (____Yes or ____No)

List Risks:

_____

_____

_____

_____

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