Heliophysics Missions of Opportunity

Launch Service Interface Requirements Document (LSIRD) Secondary Payload Supplement

September 3, 2019 Rev. 1
# DOCUMENT CHANGE LOG

<table>
<thead>
<tr>
<th>Date</th>
<th>Pages Affected</th>
<th>Reason for Change</th>
<th>Version/Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Document Instructions

_About this document – Launch Service Interface Requirements Document (IRD) “boilerplate” for secondary payloads._

This document is intended as a guide to be used by the secondary spacecraft customer in creating a Launch Service Interface Requirements Document (LSIRD) for being manifested with primary missions under the NLS II contract.

Instructions will be in _italics_. Information intended to be provided is identified within the brackets.

An (R) will denote information that is _required_ by the Launch Services Program (LSP) in the section title, information that is _desired_ by LSP will denoted by a (D).

**Section 3.6** is intended for additional secondary Space Vehicle (SV) requirements that may drive Mission Unique Requirements or Non-Standard Services that fall out of scope of the previous (3.1-3.5) sections.

The NASA standard is _metric units_; please provide all units in metric.

For the purposes of this document the SV can be defined such that SV = SC (spacecraft) + payload(s)/instrument(s). SV acronym is synonymous with RPL acronym.

LSP recommended layout of the SV LSIRD can be found below.

Please provide rationale for each of the secondary SV requirements, LSP needs to understand the rationale behind your requirement.
CONTENTS

1 INTRODUCTION & SCOPE 5

1.1 DOCUMENT PURPOSE 5

1.2 DOCUMENT OBJECTIVES 6

2 DOCUMENTS 6

2.1 APPLICABLE DOCUMENTS 6

2.2 REFERENCE DOCUMENTS 6

3 INTERFACE REQUIREMENTS 7

3.1 MECHANICAL INTERFACES 7

3.1.1 Structural Interfaces 7

3.1.2 Mass Properties 8

3.2 ELECTRICAL INTERFACES 8

3.2.1 Airborne Interfaces 8

3.3 ENVIRONMENTAL INTERFACES 9

3.3.1 Contamination (D) 9

3.4 MISSION DESIGN 9

3.4.1 Orbit Insertion Requirements (R) 9

3.4.2 Separation Requirements (D) 9

3.5 GROUND PROCESSING REQUIREMENTS 10

3.5.1 Spacecraft Hazards (R) 10

3.6 MISSION UNIQUE REQUIREMENTS (D) 10
1 INTRODUCTION & SCOPE

Provide a brief description of the Space Vehicle (SV) and its mission. Include the following items at a minimum:

- Mission objective
- Payload(s) and/or instrument(s) description
- NET/NLT Launch target dates
- Picture/drawing of SV in Launch Configuration

Figure 1-1: Mission of Opportunity Secondary SV Overview

1.1 DOCUMENT PURPOSE

This document defines the Mission of Opportunity to Secondary Payload Adapter (SPA) interface/integration requirements and constraints necessary to assure technical compatibility and to contribute to mission success.

Secondary payloads are those payloads that will have no authority to impact mission integration cycle for the primary mission. This includes but is not limited to launch date, go-no-go call for launch and drive environmental conditions within the fairing.
1.2 DOCUMENT OBJECTIVES

1. To provide a definition of the Mission of Opportunity Space Vehicle (SV) to Secondary Payload Adapter (SPA) integration and interface requirements as necessary to permit their design and implementation.

2 DOCUMENTS

Please list all applicable and reference documents that are pertinent to your spacecraft. Below is a sample of commonly used documents.

2.1 APPLICABLE DOCUMENTS

SIS 9-3-19 rev3

Launch Vehicle Secondary Payload Adapter System Interface Specification for Heliophysics Missions of Opportunity

2.2 REFERENCE DOCUMENTS
3 INTERFACE REQUIREMENTS

This section establishes the Secondary Payload Adapter (SPA) interface design requirements for the Missions of Opportunity project.

This document is to be used in conjunction with the Launch Vehicle Secondary Payload Adapter System Interface Specifications (SIS) for Heliophysics Missions of Opportunity. The SIS provides the baseline for requirements the RPL will need to meet for environments, standard services/configurations supported. The mission unique section of this document (section 3.6) is intended to be used for the RPL to define their requirements which differ from the information/guidelines in the SIS for Heliophysics missions of opportunity. Common example sections titles are provided. In addition, in some cases, the primary SV on the mission will drive requirements the secondary SV must meet/accept (example: primary has tighter contamination restrictions than the secondary. The secondary will be required to meet cleanliness levels of the primary to ensure “do not harm” restrictions are met).

3.1 MECHANICAL INTERFACES

3.1.1 Structural Interfaces

The structural interface between the secondary SV and LV Secondary Payload Adapter consists of the secondary SV/LV SPA interface at the base of the secondary SV, electrical connections, and purge connections.

3.1.1.1 SPA Interface (R)

Provide enough detail of the secondary SV/SPA interface; include drawing of secondary SV mechanical interface to the SPA if available, so LV can define the appropriate separation system

If your interface is already designed, please define desired SPA interface.

![Figure 3.1.1.1-1: Spacecraft LV Interface](image)
3.1.1.2 SV Coordinate System (R)
Secondary SV shall use coordinate system defined below

![Figure 3.1.2-1: SPA and secondary SV Coordinate System](image)

3.1.1.3 SV Maximum Dimensions (R)
Provide maximum envelope for the secondary SV in length, width and height.

3.1.1.4 Hardware past the Separation Plane (D)
Identify any spacecraft hardware that protrudes past the SPA interface plane including inboard of the separation system.

3.1.2 Mass Properties
3.1.2.1 Not to Exceed Mass (R)
Define the secondary SV Not to Exceed (NTE) mass.
Example: The spacecraft shall not exceed a mass of XXX kg.

3.1.2.2 Stiffness (R)
Define RPL SV primary fundamental frequency in the SPA axial and lateral axis.

3.2 ELECTRICAL INTERFACES
3.2.1 Airborne Interfaces

3.2.1.1 Electrical Connectors (D)
At a minimum, provide needed electrical pin count, power loops, and data loops
Table 3.2.1-1: Electrical Connector Requirements (D)

<table>
<thead>
<tr>
<th>Power</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td></td>
</tr>
<tr>
<td>Separation loops on SPA/LV side (SV use)</td>
<td></td>
</tr>
<tr>
<td>Separation loops on SV side (LV use)</td>
<td></td>
</tr>
</tbody>
</table>

3.3 ENVIRONMENTAL INTERFACES

3.3.1 Contamination (D)

*Provide details on your contamination control requirements*

3.4 MISSION DESIGN

3.4.1 Orbit Insertion Requirements (R)

*Below are terms you may use to define your orbit. Fill in Table 3.4.3-1 as applicable to the secondary SV or define your own orbit.*

Table 3.4.3-1: Injection Orbit Characteristics in Coordinates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-Major Axis (km)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eccentricity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inclination (deg)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.4.2 Separation Requirements (D)

*For each of the separation parameters/requirements, include allowable tolerances. The separation system will be provided by the launch vehicle.*
### Table 3.4.8-1: Separation Requirements

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude of SV (X&lt;sub&gt;SV&lt;/sub&gt;, Y&lt;sub&gt;SV&lt;/sub&gt;, Z&lt;sub&gt;SV&lt;/sub&gt;) axis</td>
<td></td>
</tr>
<tr>
<td>SV spin rates</td>
<td></td>
</tr>
<tr>
<td>Angular acceleration</td>
<td></td>
</tr>
<tr>
<td>Separation velocity</td>
<td></td>
</tr>
</tbody>
</table>

### 3.5 GROUND PROCESSING REQUIREMENTS

#### 3.5.1 Spacecraft Hazards (R)

*Identify any secondary SV hazards such as propulsion type, nuclear, lasers, etc…*

### 3.6 MISSION UNIQUE REQUIREMENTS (D)

*Provide details on Mission Unique requirements that the secondary SV may have*

#### 3.6.1.1 SV RF Susceptibility

#### Table 3.3.5.3-1: SV Radiated Susceptibility

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>E-Field Limit (V/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 3.6.1.2 SV Magnetic Sensitivity

*Describe any secondary SV magnetic sensitivity requirements.*

#### 3.6.1.3 SC Propulsion System

*Describe type of propulsion system and any fueling requirements*
3.6.1.4 SC T-0 or drag on GN2 purge  
Describe flow rate, pressure, cleanliness, purity and location of purge

3.6.1.5 SV Environments  
Provide environmental limits which the secondary SV needs to be addressed which exceed the limits defined in the Heliophysics SIS (examples, shock, acoustics, and temperature)

3.6.1.6 Serial Telemetry  
Describe your telemetry needs; does the secondary SV need data up to T-0 or after? If the secondary SV needs data after T-0, then fill out Table 3.2.2-1 below.

<table>
<thead>
<tr>
<th>Interleaved Telemetry Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data line channel quantity</td>
</tr>
<tr>
<td>Data rate per channel (kbps)</td>
</tr>
<tr>
<td>SV Data format (example: NRZ-L)</td>
</tr>
</tbody>
</table>
## Appendix A – Common Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Celsius</td>
</tr>
<tr>
<td>CBOD</td>
<td>Clamp Band Opening Device</td>
</tr>
<tr>
<td>CCAM</td>
<td>Collision and Contamination Avoidance Maneuver</td>
</tr>
<tr>
<td>CCR</td>
<td>Configuration Change Request</td>
</tr>
<tr>
<td>CG</td>
<td>Center of Gravity</td>
</tr>
<tr>
<td>deg</td>
<td>Degree</td>
</tr>
<tr>
<td>ECS</td>
<td>Environmental Control System</td>
</tr>
<tr>
<td>EGSE</td>
<td>Electrical Ground Support Equipment</td>
</tr>
<tr>
<td>ERB</td>
<td>Engineering Review Board</td>
</tr>
<tr>
<td>ESPA</td>
<td>EELV Secondary Payload Adapter</td>
</tr>
<tr>
<td>F</td>
<td>Fahrenheit</td>
</tr>
<tr>
<td>ft</td>
<td>Foot</td>
</tr>
<tr>
<td>GN2</td>
<td>Gaseous Nitrogen</td>
</tr>
<tr>
<td>GSE</td>
<td>Ground Support Equipment</td>
</tr>
<tr>
<td>HEPA</td>
<td>High-Efficiency Particulate Air</td>
</tr>
<tr>
<td>hr</td>
<td>Hour</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>ICD</td>
<td>Interface Control Document</td>
</tr>
<tr>
<td>I/F</td>
<td>Interface</td>
</tr>
<tr>
<td>IFD</td>
<td>In-Flight Disconnect</td>
</tr>
<tr>
<td>in</td>
<td>Inch</td>
</tr>
<tr>
<td>IRD</td>
<td>Interface Requirements Document</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards Organization</td>
</tr>
<tr>
<td>kbps</td>
<td>Kilobits per Second</td>
</tr>
<tr>
<td>km</td>
<td>Kilometer</td>
</tr>
<tr>
<td>KSC</td>
<td>John F. Kennedy Space Center</td>
</tr>
<tr>
<td>l</td>
<td>Liter</td>
</tr>
<tr>
<td>lb</td>
<td>Pound</td>
</tr>
<tr>
<td>LRD</td>
<td>Launch Readiness Date</td>
</tr>
<tr>
<td>LSP</td>
<td>Launch Services Program</td>
</tr>
<tr>
<td>LSTO</td>
<td>Launch Services Task Order</td>
</tr>
<tr>
<td>LV</td>
<td>Launch Vehicle</td>
</tr>
<tr>
<td>LVC</td>
<td>NASA Launch Vehicle Contractor</td>
</tr>
<tr>
<td>m</td>
<td>Meter</td>
</tr>
<tr>
<td>MGSE</td>
<td>Mechanical Ground Support Equipment</td>
</tr>
<tr>
<td>MIT</td>
<td>Mission Integration Team</td>
</tr>
<tr>
<td>MLT</td>
<td>Mean Local Time</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeter</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>NLS</td>
<td>NASA Launch Services</td>
</tr>
<tr>
<td>NLT</td>
<td>No Later Than</td>
</tr>
<tr>
<td>NRZ-L</td>
<td>Non-Return to Zero – Phase L</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>NTE</td>
<td>Not to Exceed</td>
</tr>
<tr>
<td>NVR</td>
<td>Non-Volatile Residue</td>
</tr>
<tr>
<td>OASPL</td>
<td>Overall Sound Pressure Level</td>
</tr>
<tr>
<td>OPM</td>
<td>Orbital Parameters Message</td>
</tr>
<tr>
<td>PAC</td>
<td>Percent Area Coverage</td>
</tr>
<tr>
<td>PAF</td>
<td>Payload Attach Fitting</td>
</tr>
<tr>
<td>PLA</td>
<td>Payload Adapter</td>
</tr>
<tr>
<td>PLF</td>
<td>Payload Fairing</td>
</tr>
<tr>
<td>Psia</td>
<td>Pounds Per Square Inch Absolute</td>
</tr>
<tr>
<td>Psig</td>
<td>Pounds Per Square Inch Gauge</td>
</tr>
<tr>
<td>PPF</td>
<td>Payload Processing Facility</td>
</tr>
<tr>
<td>PTC</td>
<td>Passive Thermal Control</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>RLSP</td>
<td>Request for Launch Services Proposal</td>
</tr>
<tr>
<td>RPL</td>
<td>Rideshare Payload = SV</td>
</tr>
<tr>
<td>SIS</td>
<td>System Interface Specification</td>
</tr>
<tr>
<td>SPA</td>
<td>Secondary Payload Adapter</td>
</tr>
<tr>
<td>SV</td>
<td>Space Vehicle or Spacecraft</td>
</tr>
<tr>
<td>SVC</td>
<td>Space Vehicle Contractor</td>
</tr>
<tr>
<td>SCAPE</td>
<td>Self-contained Atmospheric Protective Ensemble</td>
</tr>
<tr>
<td>SCFH</td>
<td>Standard Cubic Foot Per Hour</td>
</tr>
<tr>
<td>SCFM</td>
<td>Standard Cubic Foot Per Minute</td>
</tr>
<tr>
<td>SI</td>
<td>Systeme International d'Unites</td>
</tr>
<tr>
<td>SOW</td>
<td>Statement of Work</td>
</tr>
<tr>
<td>SRS</td>
<td>Shock Response Spectrum</td>
</tr>
<tr>
<td>SSF</td>
<td>Spacecraft Structural Frame</td>
</tr>
<tr>
<td>SV</td>
<td>Space Vehicle</td>
</tr>
<tr>
<td>TML</td>
<td>Total Mass Loss</td>
</tr>
<tr>
<td>TOD</td>
<td>True of Date</td>
</tr>
<tr>
<td>VDC</td>
<td>Volts – Direct Current</td>
</tr>
</tbody>
</table>