NASA
LAUNCH SERVICES PROGRAM

HELIOPHYSICS EXPLORERS MIDEX 2019
CONCEPT STUDY KICK-OFF
OCTOBER 7, 2020

Garrett Skrobot/
Hamilton Fernandez
Flight Projects Office
Launch Services Program Relationships
(NASA/HEOMD/KSC)

- NASA HQ
  - Bridenstine
  - SPACE TECHNOLOGY
    - Reuter
  - SCIENCE
    - Zurbuchen
  - HUMAN EXPLORATION
    - Bowersox
  - DIRECTOR, LAUNCH SERVICES OFFICE
    - NORMAN
  - FLIGHT PLANNING BOARD
  - SPACECRAFT PROGRAMS
    AND PROJECTS AT NASA
    CENTERS
  - LAUNCH SERVICES
    PROGRAM
    - MITSKEVICH
  - ISS
    - CRS
  - Commercial Crew
  - KENNEDY SPACE CENTER
    - CABANA
  - INDEPENDENT TECHNICAL
    AUTHORITIES
    - ENGINEERING
    - SAFETY & MISSION ASSURANCE
  - PROCUREMENT
  - RESOURCES
  - INFRASTRUCTURE
  - IT
  - LEGAL ETC.

Interaces to other NASA Centers
- SSC PROPULSION SUPPORT
- MSFC, GRC TECHNICAL SUPPORT

Support Contractor Interface
- ELVIS (AI Solutions)
  - SUPPORT CONTRACTOR
The Launch Services Program (LSP) provides:

• Procurement and management of the launch service
• Technical insight/approval of the launch vehicle (LV) production/test
  – Mission Management and engineering support
  – Oversight (approval) of mission unique launch vehicle hardware/software development
• Launch campaign/countdown management – formal readiness reviews
• Risk management for launch service
• Payload-processing accommodations
• Downrange telemetry assets for launch vehicle data
Launch Services Program

NASA Strategic Plan 2014

**Strategic Goal 3:**
Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure.

**Objective 3.2:**
Ensure the availability and continued advancement of strategic, technical, and programmatic capabilities to sustain NASA’s Mission

**Key Strategy:**
Provide access to space

Lead Office: HEOMD
Contributing Program: LSP

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Key Strategy “Provide access to space” citation:

“...certify and procure domestic commercial space transportation services for the launch of robotic science, communication, weather, and other civil sector missions”

“...provide robust, reliable, commercial and cost-effective launch services”

“...assured access to space through a competitive ‘mixed Fleet’ approach utilizing the breadth of U.S. industry’s capabilities”

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LSP Strategic Goals 2014

**Goal 1:** Maximize Mission Success

**Goal 2:** Assure Long-Term Launch Services

**Goal 3:** Promote Evolution of a U.S. Commercial Space Launch Market

**Goal 4:** Continually Enhance LSP’s Core Capabilities
LSP Functional Structure

- LSP procures/provides a Launch Service
  - It's more than the basic launch vehicle
  - We don’t buy a tail number
  - This is a commercial FFP procurement with additional insight and oversight

- To enable this, LSP has two functional sides
  - Mission integration
    » Mission Integration Team (MIT) assigned to each mission
    » Manages mission specific procurement, integration, and analysis
    » Includes launch site integration and processing
  - Fleet management
    » Personnel assigned to each contracted rocket
    » Includes resident offices within the production facilities of all active providers
    » We watch the production and performance of entire fleet – we certify the manufacture’s production line, not just a particular unit (tail number)
    » We have a say in any change/upgrade/anomaly

- LSP maintains the final go or no-go for launch
- Interface with Safety and Mission Assurance
  - Safety
  - Quality
Technical Information flow into the MIT

Core Vehicle Test & Build

Integration & Test Facilities

Integrated Product Teams

Core Vehicle Team

Vehicle Systems Lead

ELV Chief Engineer

Safety & Mission Assurance

Mission Integration

NASA/KSC Mission Manager

KSC Mission Analysis

NASA/KSC IE

NASA/KSC PIM

S/C Launch Site Team

Range Safety

S/C Systems Engineer

Comm. & Telemetry

NASA Budget

NASA Contracts

Customer

LSC

NASA/KSC LSIM

NASA/KSC IE
The NASA Launch Services (NLS) II Contract is LSP’s primary method to acquire all classes of commercial launch services for spacecraft (SC) customers.

Provides NASA with domestic launch services that are safe, successful, reliable, and affordable.

Provides services for both NASA-Owned and NASA-Sponsored payloads through multiple Indefinite Delivery Indefinite Quantity (IDIQ) Launch Service Task Order (LSTO) contracts with negotiated Not To Exceed (NTE) Prices.

Provides services on a Firm-Fixed-Price (FFP) basis:
- Incorporates best commercial practices to the maximum extent practical
- Includes Standard and Non-Standard services
- Mission unique modifications
- Special studies

Allows LSP to turn on a Task Assignment or Non-Standard Service at any time for analyses.
NLS II Contracts Overview

- Launch Services Risk Mitigation Policy for NASA-owned and/or NASA-sponsored Payloads/Missions can be found under NPD 8610.7. Document can be found at http://nodis3.gsfc.nasa.gov
  - Risk Category 1: Low complexity and/or low cost payloads-Classified as Class D payloads pursuant to NPR 8705.4
  - Risk Category 2: Moderate complexity and/or moderate cost payloads-Classified as Class C payloads and, in some cases, Class B payloads, pursuant to NPR 8705.4
  - Risk Category 3: Complex and/or high cost payloads-Classified as Class A payloads and, in some cases, Class B payloads, pursuant to NPR 8705.4

- Each Provider has their own unique Launch Delay Table
  - Delay terms are identical for both parties (Contractor/NASA)
  - No-fault Launch delays
    » Include: range constraints, floods, acts of God, strikes and other conditions
    » No adjustment made to mission price
    » No limit on number of days

- For the remaining delay cases grace days are based on sliding scale for both Contractor and NASA delays
  - 150 days of grace at ATP through L-24
  - Sliding down to 7 days of grace at L-10 days
NLS II Contracts Overview – Cont’d

• NLS II Launch Service Costs
  – Acquisition process begins at approximately L-36 months
  – Authority to Proceed (ATP) concurrent with Task Order Award at approximately L-30 months

• The standard launch service includes:
  – Procurement and management (including risk management) of the launch service, technical insight/approval of the launch vehicle production/test and mission unique launch vehicle hardware/software development
    » Engineering, analysis, and minimum performance standards and services provided by the contract (insight and approval)
  – Mission integration management
  – Launch site payload processing facility and support, logistics, hazardous support
  – Range support and services, contractor engineering support, base support contracts
  – Down Range Telemetry support (launch vehicle only)
  – Launch campaign/countdown management – formal readiness reviews

• Mission Uniques already budgeted for are items like Pre-ATP studies such as coupled loads and/or trajectories analysis, payload isolation system, a GN2 or pure air purge prior to T-0 and 10,000 Class integration environment.
Launch Service Budget

• The standard launch service includes:
  – Procurement and management (including risk management) of the launch service, technical insight/approval of the launch vehicle production/test and mission unique launch vehicle hardware/software development
    » Engineering, analysis, and minimum performance standards and services provided by the contract (insight and approval)
  – Mission integration management
  – Launch site payload processing facility and support, logistics, hazardous support
  – Range support and services, contractor engineering support, base support contracts
  – Down Range Telemetry support (launch vehicle only)
  – Launch campaign/countdown management – formal readiness reviews

• There is no charge to the PI-Managed Cost for the 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) as a non-standard service

• Mission Uniques already budgeted for are items like Pre-ATP studies such as coupled loads and/or trajectories analysis, payload isolation system, a GN2 or pure air purge prior to T-0 and 10,000 Class integration environment.
• The following non-standard/mission unique launch services are examples of items NOT covered under the LSP budget and cost must be included in the PI-Managed Mission Cost:
  – Nuclear launch services utilizing a RHU/MMRTG
  – Enhanced contamination control, planetary protection, operational clean enclosures
  – Cameras on the LV to capture spacecraft separation etc...
  – Extended mission integration periods (in excess of 33 months)
  – LV mods/analyses for non-separating interface with multiple SC deployments (separation, trajectory, controls, flight software, etc...)
  – Deployable spacecraft telemetry tracking asset
  – Auxiliary propulsion for target orbit achievement
  – Mission Unique payload adapter
  – LV hardware modifications required to accommodate unique payload configuration
  – Spacecraft or Payload caused Launch delay
Launch Vehicle Acquisition

- The acquisition of the launch service will include a domestic Category 2 or 3 certified launch vehicle procured and managed by the NASA/Launch Services Program (LSP)
- Contributed launch services cannot be proposed or considered under this AO
- The LSP will competitively select a launch service provider for these missions based on customer requirements and NASA Flight Planning Board (FPB) approval.
- Standard launch service provides the performance and volume of a medium class launch vehicle
Vehicles Projected to be Available Under NLS II

- Performance with reference orbits, Environments, and Fairing Dimensions for candidate launch vehicles for this MIDEX AO available on the NLS II contract are listed in the Launch Services Program Information Summary document.
- Assumption of a specific launch vehicle configuration as part of the AO proposal will not guarantee that the proposed LV configuration will be selected.
- Proposers are advised to plan for compatibility with all of the medium/intermediate class vehicles that are expected to be available through spacecraft Preliminary Design Review.
  - Payload design should accommodate the three scenario’s launch characteristics and capabilities included in “Launch Services Program Information Summary” document.
  - If there are areas that are not compatible with the S/C requirements/design, the impacts on the S/C to meet these areas need to be addressed in the proposal.

For mission specific information, utilize the LSP performance website and/or the LSP POC.
# Performance Capability Scenarios at Reference Orbits

<table>
<thead>
<tr>
<th>Scenario 1:</th>
<th>Reference Orbit</th>
<th>Performance (kg)</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEO</td>
<td>700 km, Sun-Synch</td>
<td>3385</td>
<td>PLF Scenario 1</td>
</tr>
<tr>
<td>L2</td>
<td>(C_3 = -0.5 \text{ km}^2/\text{s}^2)</td>
<td>1695</td>
<td>PLF Scenario 1</td>
</tr>
<tr>
<td>Lunar</td>
<td>(C_3 = -1.8 \text{ km}^2/\text{s}^2)</td>
<td>1750</td>
<td>PLF Scenario 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 2:</th>
<th>Reference Orbit</th>
<th>Performance (kg)</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEO</td>
<td>700 km, Sun-Synch</td>
<td>7960</td>
<td>PLF Scenario 2</td>
</tr>
<tr>
<td>L2</td>
<td>(C_3 = -0.5 \text{ km}^2/\text{s}^2)</td>
<td>1810</td>
<td>PLF Scenario 2</td>
</tr>
<tr>
<td>Lunar</td>
<td>(C_3 = -1.8 \text{ km}^2/\text{s}^2)</td>
<td>1925</td>
<td>PLF Scenario 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 3:</th>
<th>Reference Orbit</th>
<th>Performance (kg)</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEO</td>
<td>700 km, Sun-Synch</td>
<td>6605</td>
<td>PLF Scenario 3</td>
</tr>
<tr>
<td>L2</td>
<td>(C_3 = -0.5 \text{ km}^2/\text{s}^2)</td>
<td>3065</td>
<td>PLF Scenario 3</td>
</tr>
<tr>
<td>Lunar</td>
<td>(C_3 = -1.8 \text{ km}^2/\text{s}^2)</td>
<td>3150</td>
<td>PLF Scenario 3</td>
</tr>
</tbody>
</table>

For mission specific information, utilize the LSP performance website and/or the LSP POC.
Scenario 1: Mass Performance at Sun-Synchronous Inclination

Figure depicts representative nominal performance at Sun-Synchronous inclination. Vehicle injection dispersion capabilities will determine the accuracy of targeting this orbit.
Figure depicts representative nominal performance to High Energy Orbits. Vehicle injection dispersion capabilities will determine the accuracy of targeting these orbits.
Scenario 2: Mass Performance at Sun-Synchronous Inclination

Figure depicts representative nominal performance at Sun-Synchronous inclination. Vehicle injection dispersion capabilities will determine the accuracy of targeting this orbit.
Scenario 2: Mass Performance to High Energy Orbits

Figure depicts representative nominal performance to High Energy Orbits. Vehicle injection dispersion capabilities will determine the accuracy of targeting these orbits.
Scenario 3: Mass Performance at Sun-Synchronous Inclination

Figure depicts representative nominal performance at Sun-Synchronous inclination. Vehicle injection dispersion capabilities will determine the accuracy of targeting this orbit.
Figure depicts representative nominal performance to High Energy Orbits. Vehicle injection dispersion capabilities will determine the accuracy of targeting these orbits.
Payload Fairing Envelopes

Scenario 1 PLF Static Envelope (inches):
- 95.7 in
- 315.3 in
- 249.7 in
- 175.8 in
- 136.0 in

Scenario 2 PLF Static Envelope (inches):
- 57.0 in
- 407.1 in
- 237.8 in
- 181.1 in

Scenario 3 PLF Static Envelope (inches):
- Ø 35.86 IN
- 350.71 IN
- 138.65 IN
- 147.64 IN
Launch Vehicle Enveloping Environments

• Different payload fairing volume scenarios are depicted for this AO.

• Proposals should identify impacts that these scenarios would have on S/C requirements. Include sufficient S/C dimensions to fit within these PLF static envelopes, including any close approaches.

• Details regarding launch vehicle environments are found in the Launch Services Program Information Summary (In MIDEX AO Program Library)
  – Shock
  – Equivalent Sine (all scenarios)
  – Design Load Factors (all scenarios)
  – Payload Acoustics (all scenarios)
Summary

• It is the Launch Service Program’s goal to ensure the highest practicable probability of mission success while managing the launch service technical capabilities, budget and schedule.

• Questions must be officially submitted to:

  Hamilton Fernandez
  Mission Manager
  NASA Launch Services Program Code VA-C
  Kennedy Space Center, FL 32899
  Phone: 757-817-7709
  Email: hamilton.fernandez@nasa.gov

LSP is ready to respond to your mission specific questions.
Back Up
Available Vehicles under NLS II

- The Agency policy, NPD 8610.7 “Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Mission”
  - Requires one successful launch of vehicle configuration in order to bid for a proposal
  - Launch Services Program initiates the procurement of a launch service under the NLS II contract via a Launch Services Task Order (LSTO)
• HQ Flight Planning Board (FPB) notifies LSP of mission requirement
  – Launch Services Interface Requirements Document (LSIRD) has already been developed by SC customer & provided to HQ FPB and to LSP (LSP works with SC customer to develop LSIRD)
• Launch Services Program Manager notifies procurement officer of requirement and provides recommended technical personnel for LSTO evaluation team
• Procurement officer establishes LSP evaluation team with designated contracting officer and lead tech evaluator
  – Note that the team includes up to 2 or 3 reps from the spacecraft project team
• LSTO evaluation team performs the following:
  – Develop tech requirements based on mission definition
  – Assures FAR guidelines are being followed
  – Determines and documents LSTO evaluation criteria
  – CO issues Request for Launch Services Proposition (RLSP) to multiple contractors
LSTO Process (cont’d)

• LSTO evaluation team performs the following (cont’d):
  – Evaluate contractor proposals in accordance with LSTO procedures
  – Complete evaluation and brief to procurement officer, LSP Program Manager, FPB, sponsoring Program/Project on evaluation results
  – Verify status of Authority To Proceed (ATP)
• Launch Services Program Manager makes selection and coordinates with KSC Contracting Officer (CO)
• KSC CO awards LSTO for mission launch service
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: C3: ______ km2/sec2 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
Risk Assessment/Evaluation

LV Performance (cont’d):

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)

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:__________________________________
LV to Spacecraft Interface (cont’d):

Mechanical Interface:
Standard Adapter: _______________  Custom Adaptor: _______________________

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 GN2 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: ___________________________
LV to Spacecraft Interface (cont’d):
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:
________________________________________________________________________
________________________________________________________________________

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-_______mo
- Delivery of verified SC loads model delivery to LSP at L-10 months or earlier? (Yes or No)
- SC Ship date L-_______mo
- 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: ________________________________________________________________

_____________________________________________________________________________