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LAUNCH SERVICES PROGRAM

# NASA LAUNCH SERVICES PROGRAM

**ASTROPHYSICS EXPLORERS MIDEX 2016  
ANNOUNCEMENT OF OPPORTUNITY  
PRE-PROPOSAL CONFERENCE**

**OCTOBER 6, 2016**

**Chuong Nguyen  
Flight Projects Office**



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# Launch Vehicle considerations

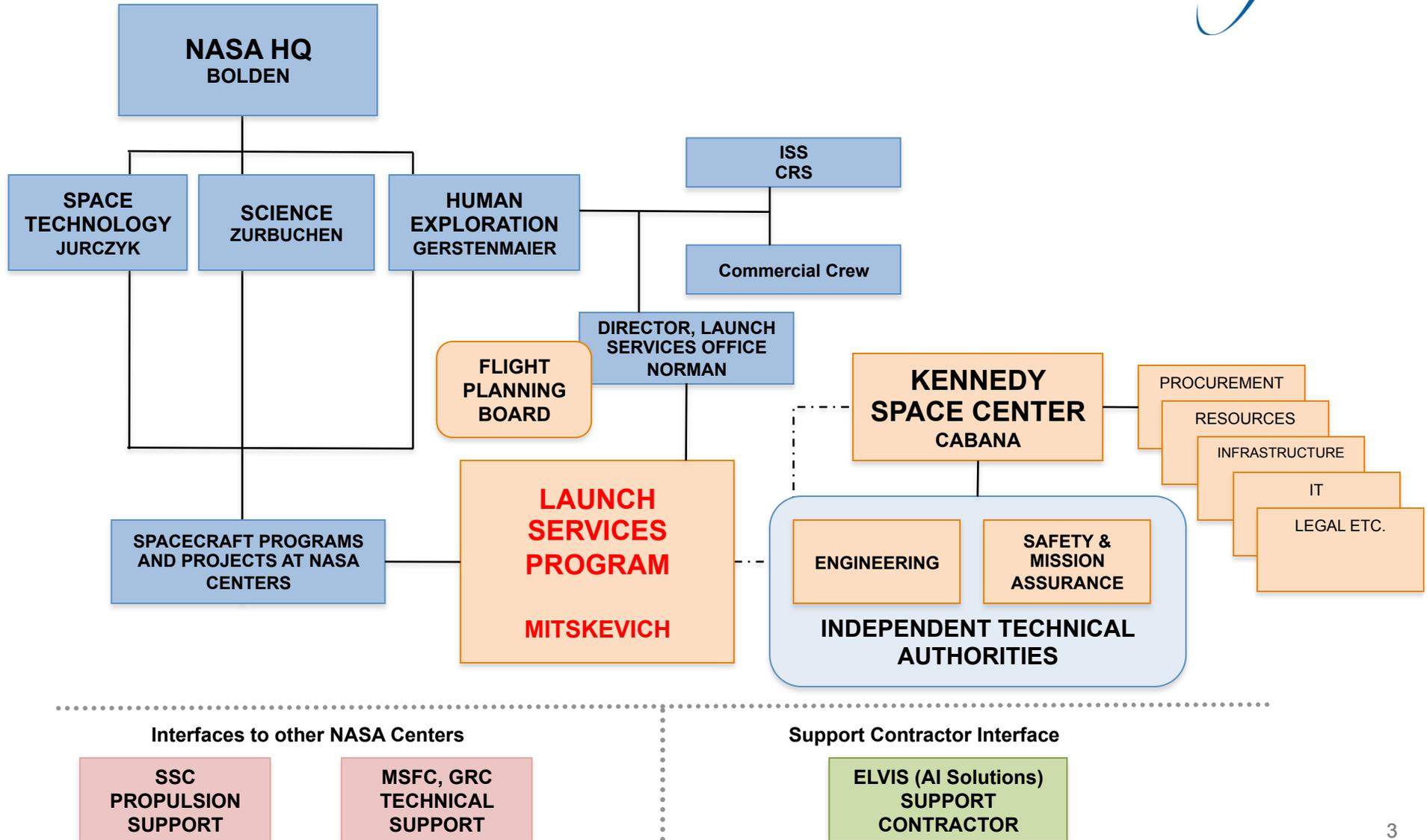


- **NASA provided standard launch services utilizing a domestic launch vehicle certified as category 2 or 3**
- **Contributed launch services cannot be proposed or considered under this AO**
- **Standard launch service provides the performance and volume of a medium class launch vehicle**
- **Any launch service beyond the standard launch service offered must be funded out of the PI-Managed Mission Cost**
- **Launch delay costs as a result of spacecraft or payload delays must be funded out of the PI-Managed Mission Cost**



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# Launch Services Program Relationships (NASA/HEOMD/KSC)





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# Launch Services Program



**The Launch Services Program provides**

- **Management of the launch service**
- **Technical oversight of the launch vehicle production/test**
- **Coordination and approval of mission-specific integration activities**
- **Mission unique launch vehicle hardware/software development**
- **Payload-processing accommodations**
- **Launch campaign/countdown management**



# 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**

## 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"



## 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**





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# LSP Functional Structure



- **LSP procures/provides the Launch Service**
  - It's more than the basic launch vehicle
  - We don't buy a tail number
  - 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 manufacturer'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 Independent Technical Authorities**
  - Engineering
  - Safety and Mission Assurance



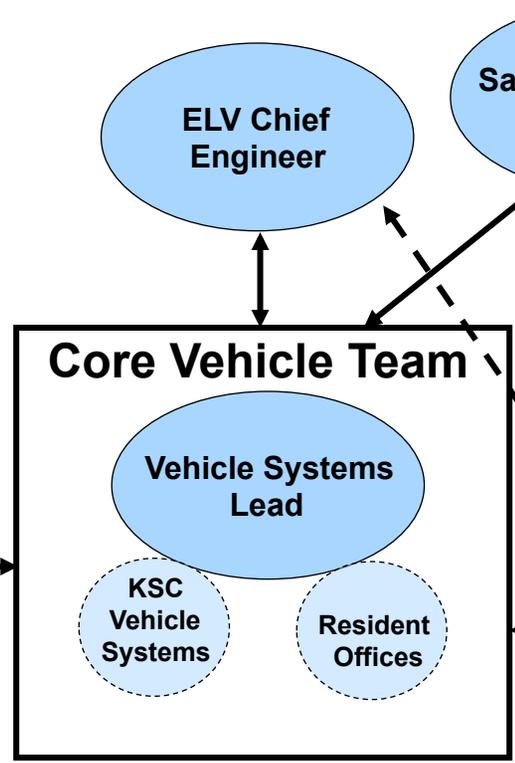
# Technical Information flow into the MIT



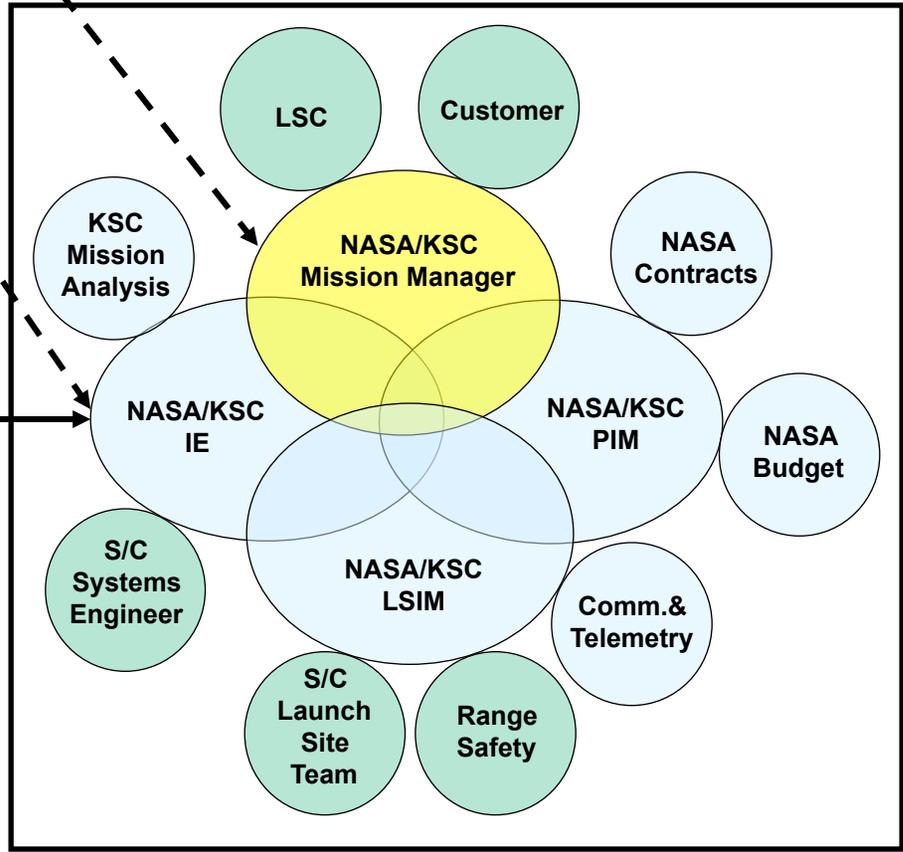
## Core Vehicle Test & Build

Integration & Test Facilities

Integrated Product Teams



## Mission Integration





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# NASA Provided Launch Services



- **The NLS II Contract is LSP's primary method to acquire all classes of Category 2 and Category 3 commercial launch services for spacecraft 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
- **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
  - Costs not covered by the Astrophysics Explorers Program include
    - » Spacecraft or Payload caused Launch delay costs
    - » Some mission unique services such as a custom payload adapters, auxiliary propulsion, extreme cleanliness or contamination sensitivities
  - 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



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## NLS II Contracts Overview – Cont'd



- **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



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# Launch Service Budget



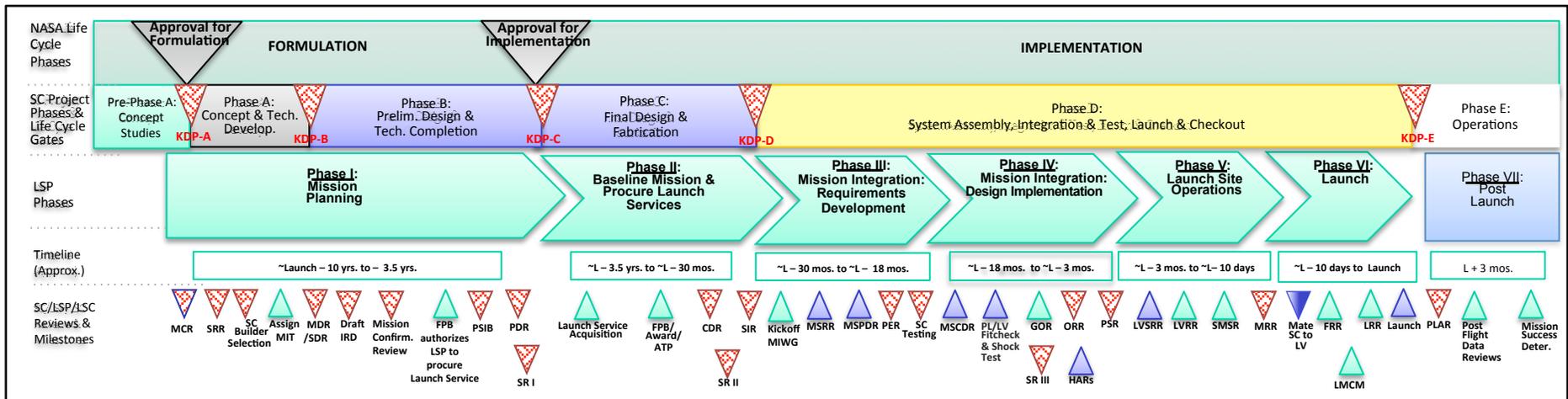
- **Under a NASA provided Launch Service a standard launch service includes:**
  - **The launch vehicle, engineering, analysis, and minimum performance standards and services provided by the contract.**
  - **Mission integration**
  - **Launch Site Payload Processing**
  - **Range Support**
  - **Down Range Telemetry support (launch vehicle only)**
  - **Standard Mission Uniques – these are items typically necessary to customize the basic vehicle hardware to meet spacecraft driven requirements. 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.**
  - **Potential additional funding needed to support selectees requiring launch from sites other than the LV base launch complex**
- **Budget does not include launch delays**



# Launch Vehicle Acquisition



- The acquisition of a NASA-provided domestic expendable launch vehicle proposed for this AO will be procured and managed by the NASA/Launch Services Program (LSP) via the NASA Launch Services II (NLS II) contract.
- The LSP will competitively select a launch service provider for these missions based on customer requirements and NASA Flight Planning Board (FPB) approval.



Printed documents may be out of date; please validate with the LSP Flight Projects Office (FPO) prior to use.

Spacecraft reviews shown in red.



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## Available Vehicles 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 ELV 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 medium/intermediate class vehicles that are expected to be available through spacecraft Preliminary Design Review.**
  - **Payload design should accommodate the limiting/enveloping launch characteristics and capabilities included in “ELV Launch Services Program Information Summary” document**

*For mission specific information, utilize the LSP performance website and/or the LSP POC.*

<http://elvperf.ksc.nasa.gov/Pages/Default.aspx/>



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# Performance Capability at Reference Orbits



Reference Orbit		Performance (kg)	Volume
LEO low inclination	600 km, 5 deg	1500	Large PLF
	600 km, 10 deg	TBP	Large PLF
LEO due east	600 km, 28.5 deg	7215	Large PLF
LEO Sun Sync	700 km, SS	2865	Standard PLF
L2	C3 = -0.5	1500	Standard PLF
Lunar	C3 = -1.8	1550	Standard PLF

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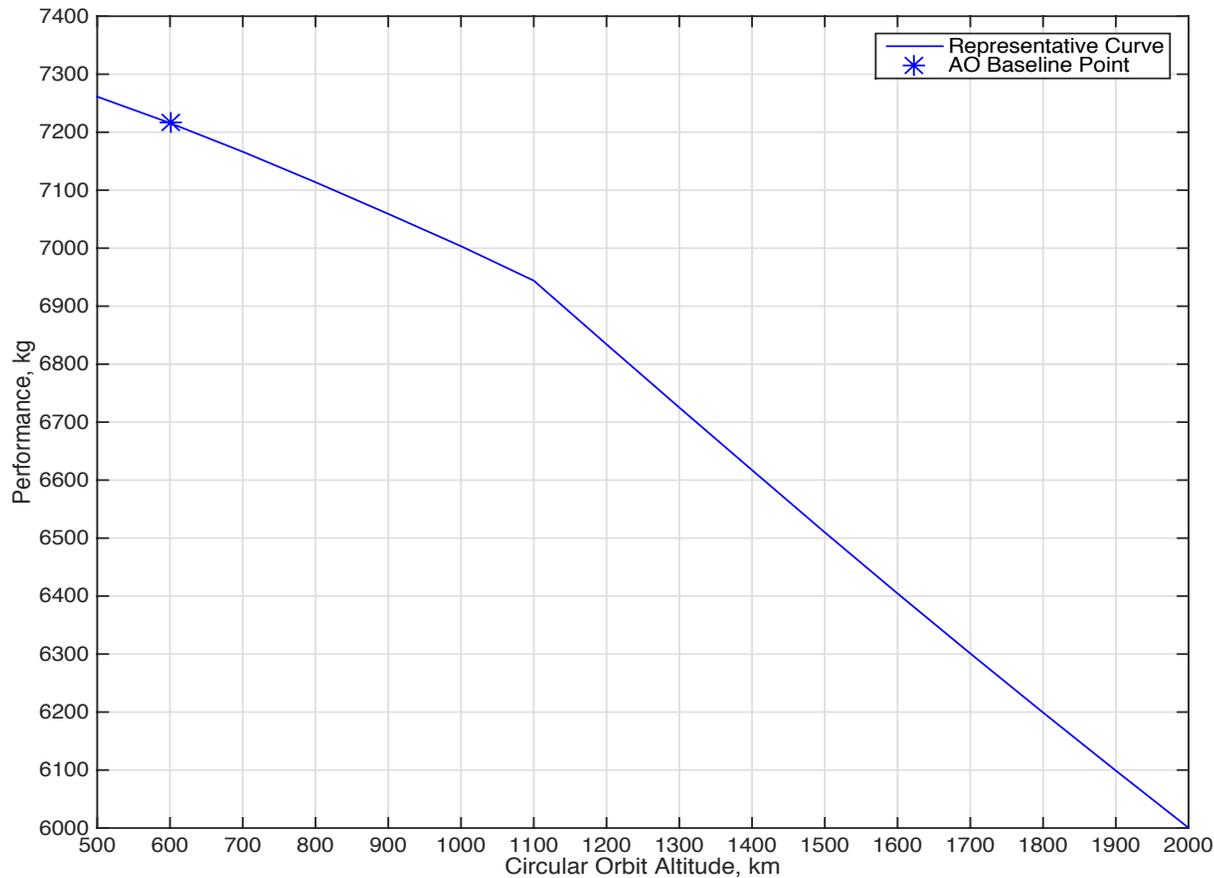


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# Enveloping Mass Performance at 28.5 Deg Inclination



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## Limiting Orbit Performance Curve

Figure depicts representative nominal performance at 28.5 degree inclination. Vehicle injection dispersion capabilities will determine the accuracy of targeting this orbit.



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# Enveloping Mass Performance at Sun-Synchronous Inclination



## Limiting Orbit Performance Curve

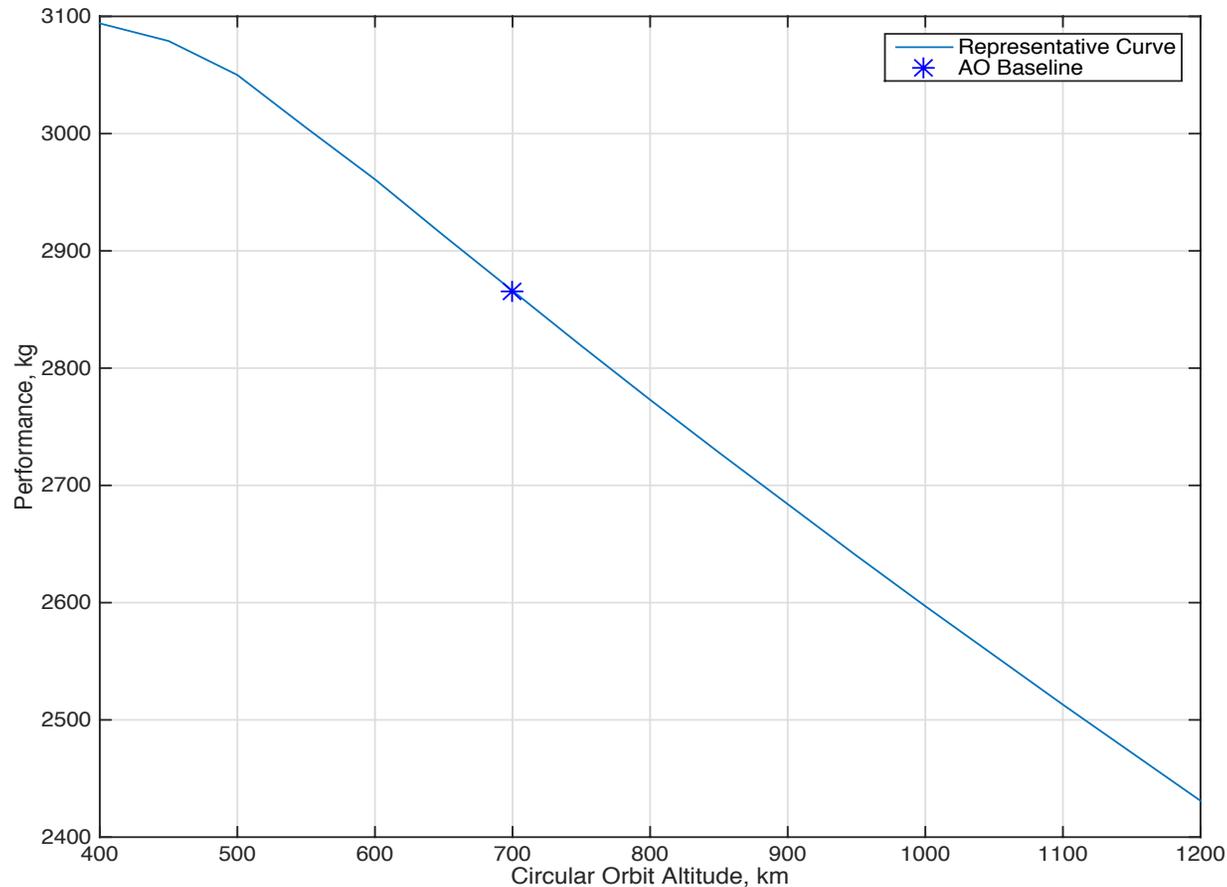


Figure depicts representative nominal performance at Sun-Synchronous inclination. Vehicle injection dispersion capabilities will determine the accuracy of targeting this orbit.



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# Enveloping Mass Performance to High Energy Orbits



## Limiting Orbit Performance Curve

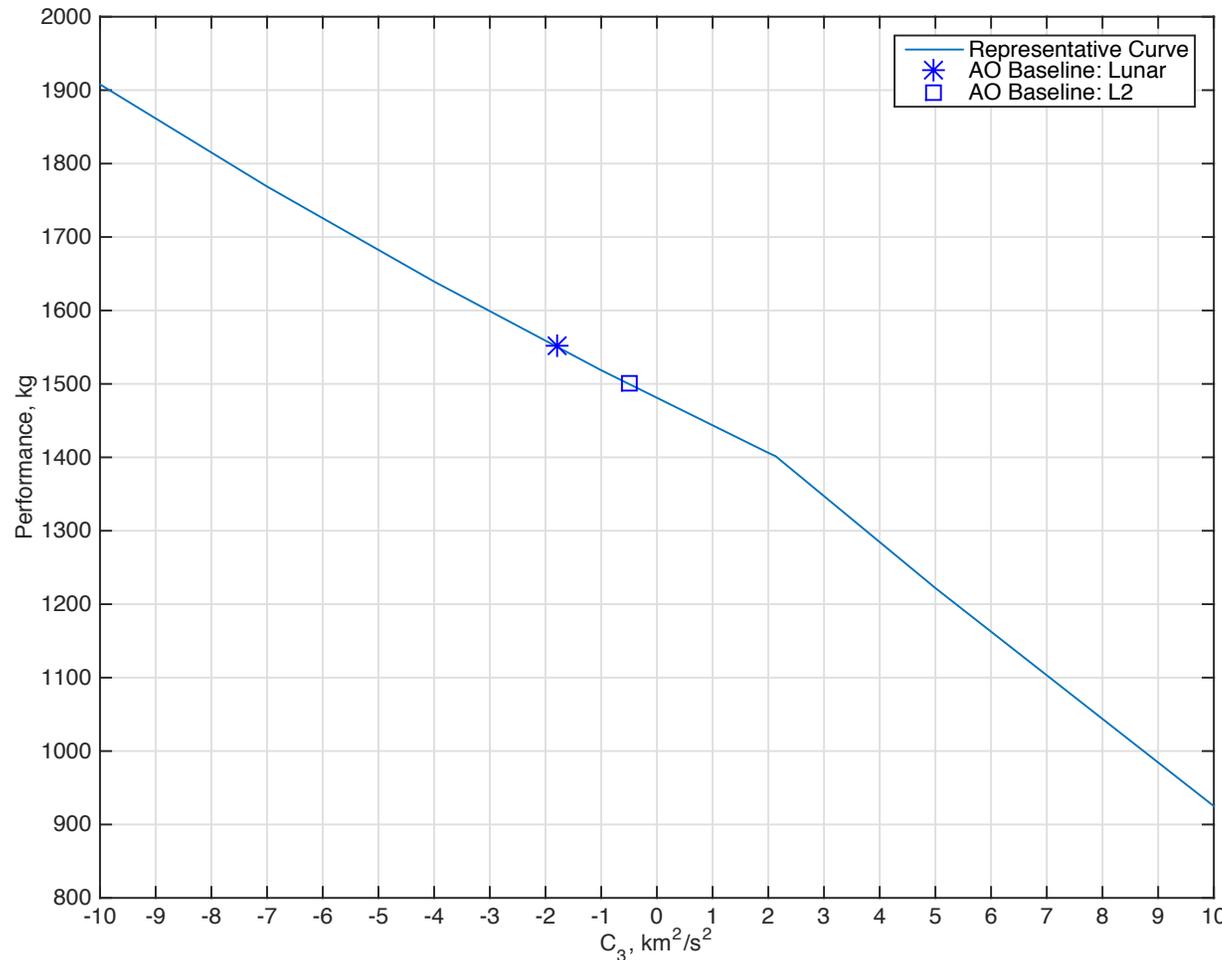


Figure depicts representative nominal performance to High Energy Orbits. Vehicle injection dispersion capabilities will determine the accuracy of targeting these orbits.

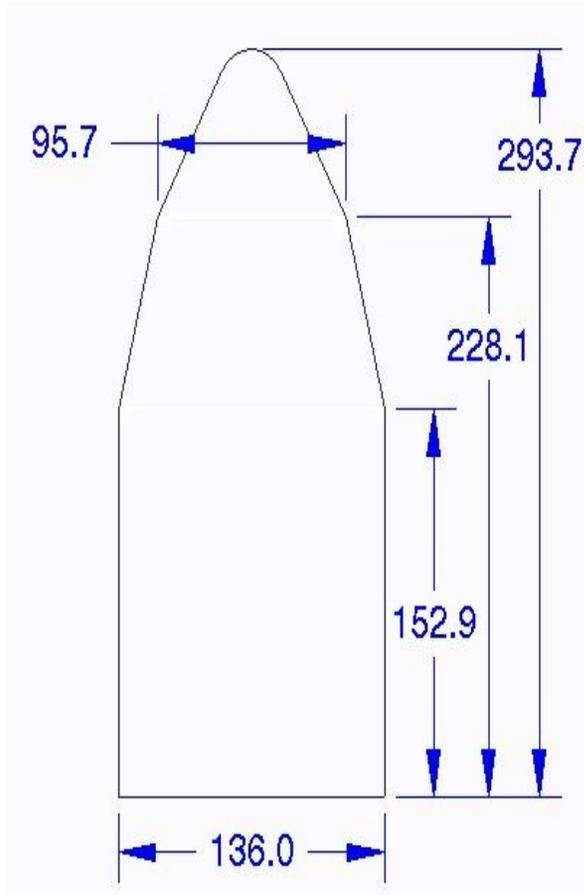


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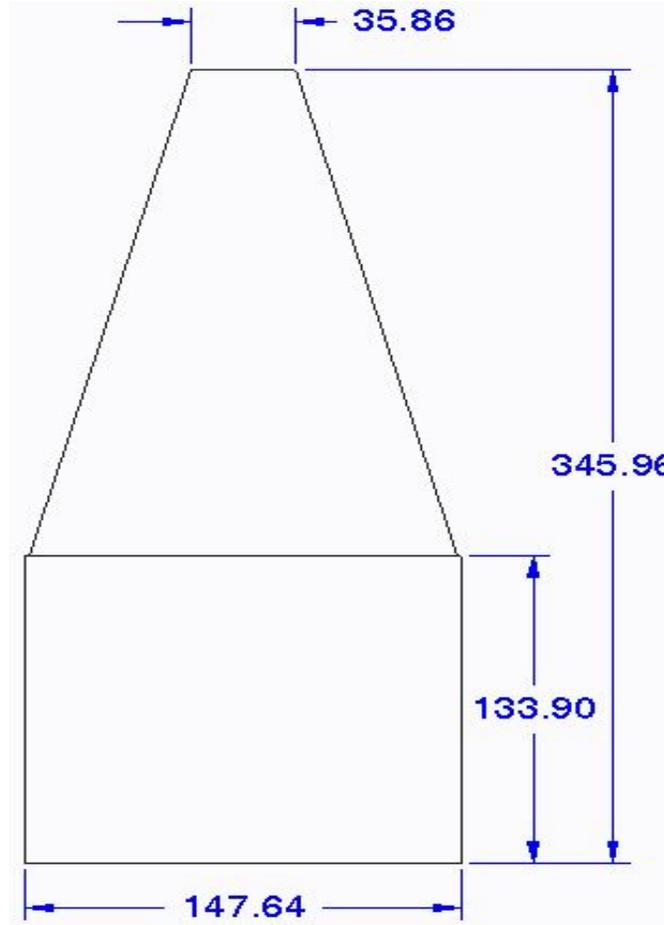
# Standard and Large Static Payload Fairing Envelopes



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Standard PLF Static Envelope (inches)



Large PLF Static Envelope (inches)  
(Dimensions shown assume co-manifest of a 24 inch ESPA ring)

\* Depending on the orbit required, different payload fairing volumes are allowed under the standard launch service.

\* Proposals should include sufficient S/C dimensions to fit within these PLF static envelopes, including any close approaches.



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# Launch Vehicle Enveloping Environments



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



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# 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:

**Jim Hall**  
**Mission Manager**  
**NASA Launch Services Program Code VA-C**  
**Kennedy Space Center, FL 32899**  
**Phone: 321-867-6218**  
**Email: [James.L.Hall@nasa.gov](mailto:James.L.Hall@nasa.gov)**

***LSP is ready to respond to your mission specific questions.***



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# Back Up



# Evaluation



• **Launch Service Technical Evaluation:**

- **Overall Assessment:** - Given the ground rules in the AO, is the proposed launch vehicle (LV) concept feasible for this application? (Yes or No)

-

**Comments:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

• **LV Performance: Area of 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): \_\_\_\_\_ : \_\_\_\_\_ .



# Evaluation



## • LV Performance: Area of concern (cont)

- Orbit requirements: Apogee: \_\_\_\_\_ km Perigee: \_\_\_\_\_ km  
Inclination: \_\_\_\_\_ deg.
- High Energy requirements:  $C_3$ : \_\_\_\_\_  $\text{km}^2/\text{sec}^2$  DLA: \_\_\_\_\_ deg RLA: \_\_\_\_\_ deg
- Proposed LV Performance: \_\_\_\_\_
- 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:



# Evaluation



- **Launch Service Cost Assessment: Area of concern (Yes or No)**
  - Is there additional funding for any mission unique modifications/ services? (Yes or No)
- **LV Integration: Area of concern (Yes or No)**
  - Does the proposer have experience in LV integration? (Yes or No)
- **LV to Spacecraft Interface: Area of concern (Yes or No)**
  - Proposed Payload Fairing (PLF) \_\_\_\_\_
  - Spacecraft (S/C) Dimensions: Radial: \_\_\_\_\_ m Height \_\_\_\_\_ m
  - Any intrusions outside of the PLF usable Static volume? (Yes or No)
  - **Mechanical Interface:**
  - Standard Adapter: \_\_\_\_\_ Custom Adaptor: \_\_\_\_\_
  - **Electrical Interface:**
  - Standard \_\_\_\_\_ Pin(s) Connector(s): (Yes or No)



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# Evaluation



- **LV to Spacecraft Interface: Area of concern (Yes or No)**
- **Mission Unique requirements:**
  - Instrument T-0 GN2 Purge: (Yes or No)
  - T-0 S/C Battery Cooling: (Yes or No)
  - Planetary Protection Requirements: (Yes or No)
  - Multiple Spacecraft Deployment: (Yes or No)
  - Telemetry Requirement thru Launch: (Yes or No)
  - Contamination Control Requirements: PLF: (Yes or No) LV adapter: (Yes or No)
  - Cleanliness Level: \_\_\_\_\_ other: \_\_\_\_\_
  - **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: \_\_\_\_\_



# Evaluation



- **Spacecraft Schedule: Area of concern (Yes or No)**
  - Adequate timing of: Launch Service Integration Start Time: (Yes or No)
  - S/C Environmental Test Program: (Yes or No)
  - Delivery of Verified S/C Model @ L-9 months: (Yes or No)
  - S/C ship date: (Yes or No)
  - S/C to LV integrated Operations: (Yes or No)
- **Missions with Radiological material Area of concern (Yes or No)**
  - List the Radiological Sources:  

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  - Are unique facilities required to store/process the Radiological Sources? (Yes or No)
  - Any LV modifications required for additional safety or Launch approval? (Yes or No)