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LAUNCH SERVICES PROGRAM

NASA LAUNCH SERVICES PROGRAM

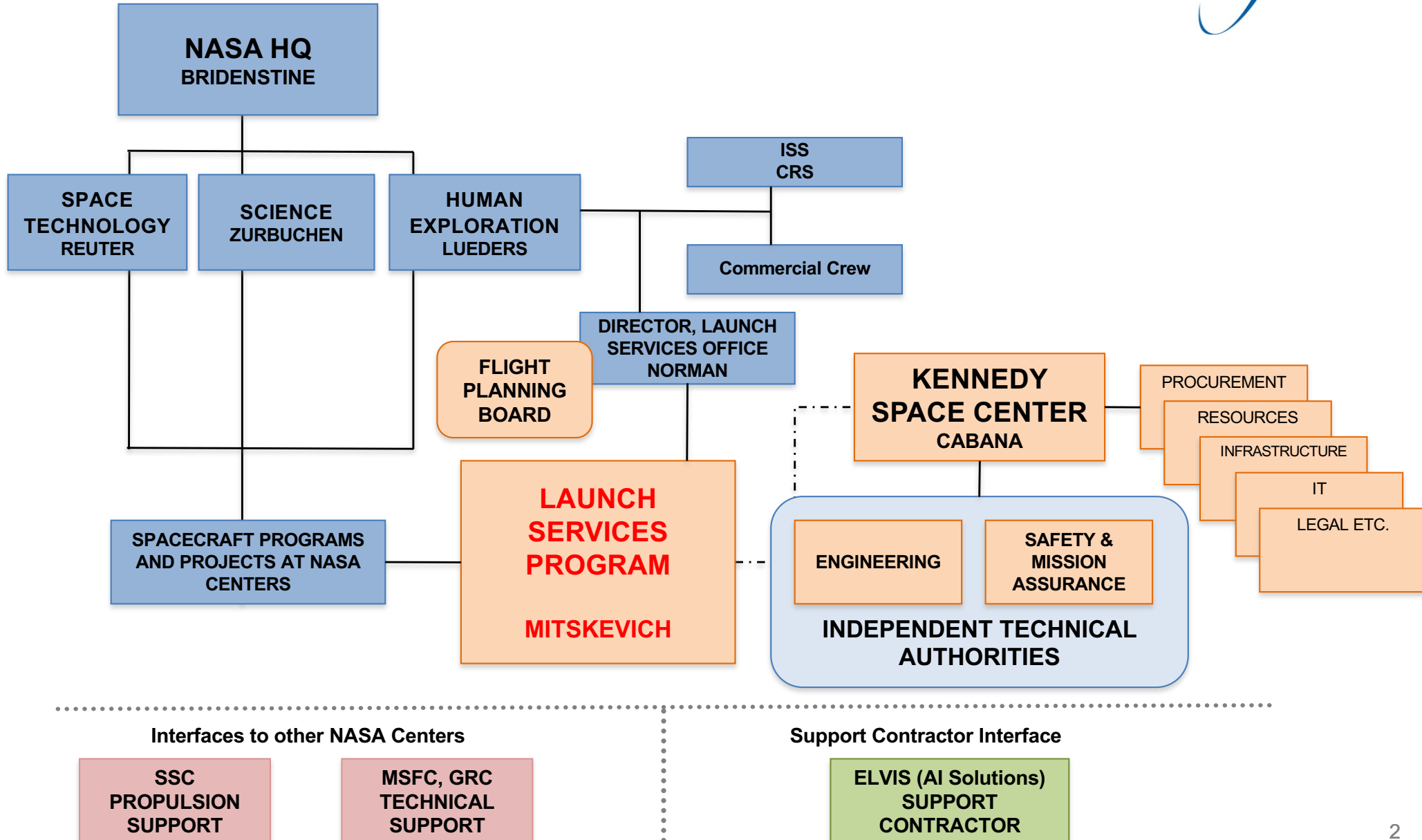
EVM-3 AO PRE-PROPOSAL CONFERENCE DECEMBER 17, 2020

Garrett L Skrobot
Flight Projects Office



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

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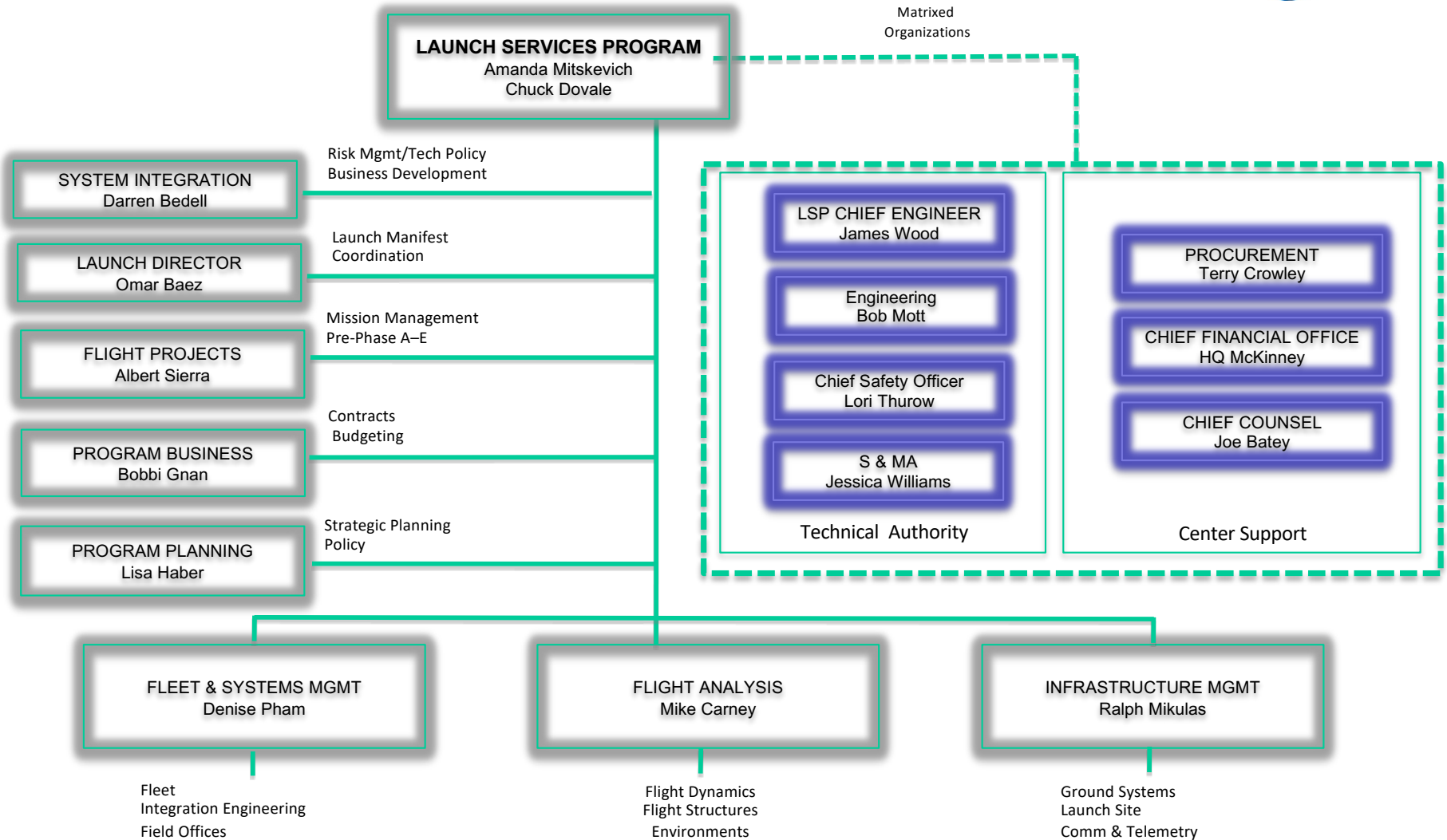


NASA LSP Organizational Structure

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NASA LSP Functional Structure



- **NASA Launch Services Program (LSP) procures/provides a Launch Service**
 - Its 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



Options available for this AO



Several options are available to proposers for the EVM-3 AO

- **AO-Provided Expendable Launch Vehicle Launch Services**
 - » Launch services expected to be provided under NLS II Contract
 - » Domestic launch vehicle certified as category 1, 2 or 3 per NPD 8610.7D
 - » PI-Managed Mission Costs must cover services beyond standard launch service offered (see ELV Launch Services Program Information Summary)
- **AO-Provided Commercial FAA-Licensed Launch Services**
 - » Launch services expected to be provided under new VADR Contract
 - » Domestic launch vehicle certified as category 1 per NPD 8610.7D
 - » Modified technical oversight approach per NPD 8610.7D *Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions* will be executed for EVM-3 for Class D payloads.
 - » PI-Managed Mission Costs must cover services beyond standard launch service offered (see Commercial FAA-Licensed Launch Services Program Information Summary)
- **AO-Provided Rideshare Access to Space**
 - » Via ESPA/ESPA Grande as a secondary payload
 - » May utilize one or multiple ESPA ports



Options available for this AO



Several options are available to proposers for EVM-3 AO(cont.)

- **Alternative Access to Space arrangements by PI are permitted under this AO**
 - » **PI will be required to meet NPD 8610.23C *Launch Vehicle Technical Oversight Policy***
 - » **If selected mission uses a Launch Service that is not certified to Cat 1 per NPD 8610.07D *Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions*, PI will be responsible for conducting the certification.**
 - » **LSP will not be performing an advisory role for a mission using Alternative Access to Space.**
 - **Upon award of a PI provided service, LSP will be available to answer PI questions about meaning within NPD 8610.7 and NPD 8610.23 for class D missions.**
 - **A library of FAQ's will be established over time and available to all PI's. Initially this will include any example RFP and SOW.**



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NASA/Earth Ventures Launch Service Budget



- **Under the AO-Provided Access to Space for EVM-3 , 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**
 - » **GN2 or pure air purge prior to T-0**
 - » **Class 100,000 integration environment**



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AO-Provided Expendable Launch Vehicle Launch Services LSP Procured



NASA 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**



NASA Launch Services (cont'd)



- **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**
 - Includes a single expendable launch vehicle with all standard and some mission unique services.
 - Provided at a cost of \$61M, which is to be reflected as a reduction in the Adjusted AO Cost Cap.
 - Acquisition process begins at approximately L-36 months
 - Authority to Proceed (ATP) concurrent with Task Order Award at approximately L-30 months
 - Examples of costs not covered by the cost stated above include:
 - » Payload-caused Launch delay costs
 - » Some mission unique services such as a custom payload adapters, auxiliary propulsion, or costs due to a requirement for a unique launch site may require additional funding (See Attachment 2 of ELV Launch Services Program Information Summary)



Examples of Non-Standard Services/ Mission Unique Costs



Additional Options	Launch Date NLT	Total (\$M)
Mission Unique Adapter	02/2027	0.5
Multiple Spacecraft Deployment Launch Vehicle Analyses	02/2027	0.75
Deployable Spacecraft telemetry tracking asset (ocean vs airborne vs ground)*	02/2027	1.4 – 4.0*
Supplemental Propulsion**	02/2027	Contact LSP POC

*Cost depends on locations of spacecraft separations and type of asset required (Contact LSP POC for cost for your specific configuration)

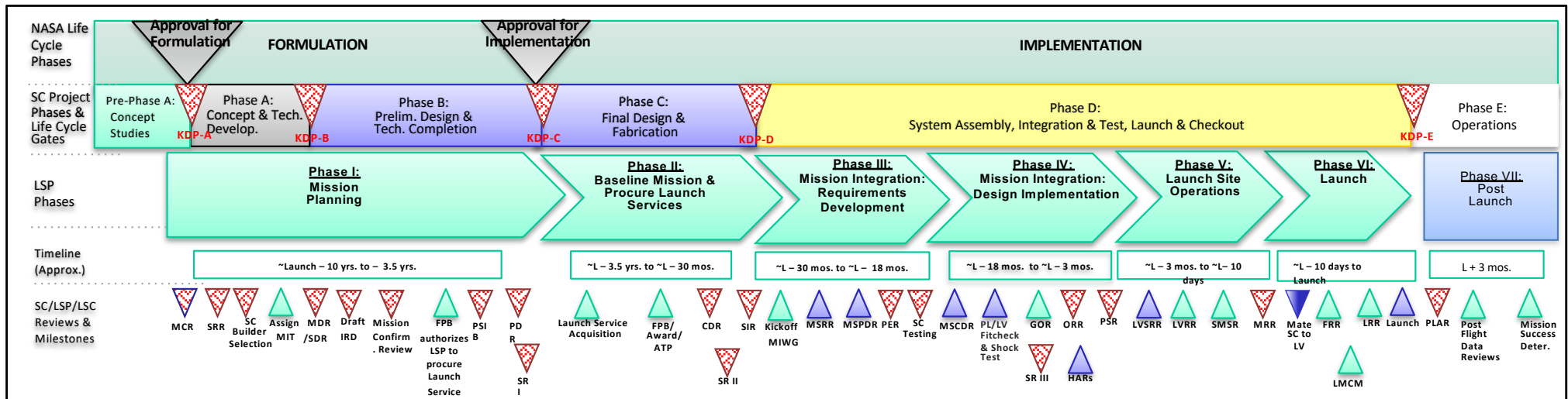
**Due to the multiple launch vehicle configurations within the launch vehicle class, supplemental propulsion systems must be defined and described by the proposer to meet mission requirements. The system proposed and the spacecraft shall remain within the fairing envelopes provided.



Launch Vehicle Acquisition



- The acquisition of an AO-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. Update: Dec. 2015



Available Vehicles under NLS II Contract



- **Likely candidate/competitive vehicles for this EVM-3 AO that are currently available on the NLS II contract are:**
 - Pegasus XL
 - Minotaur-C (formerly Taurus XL)
 - Falcon 9 Full Thrust
- **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 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”**

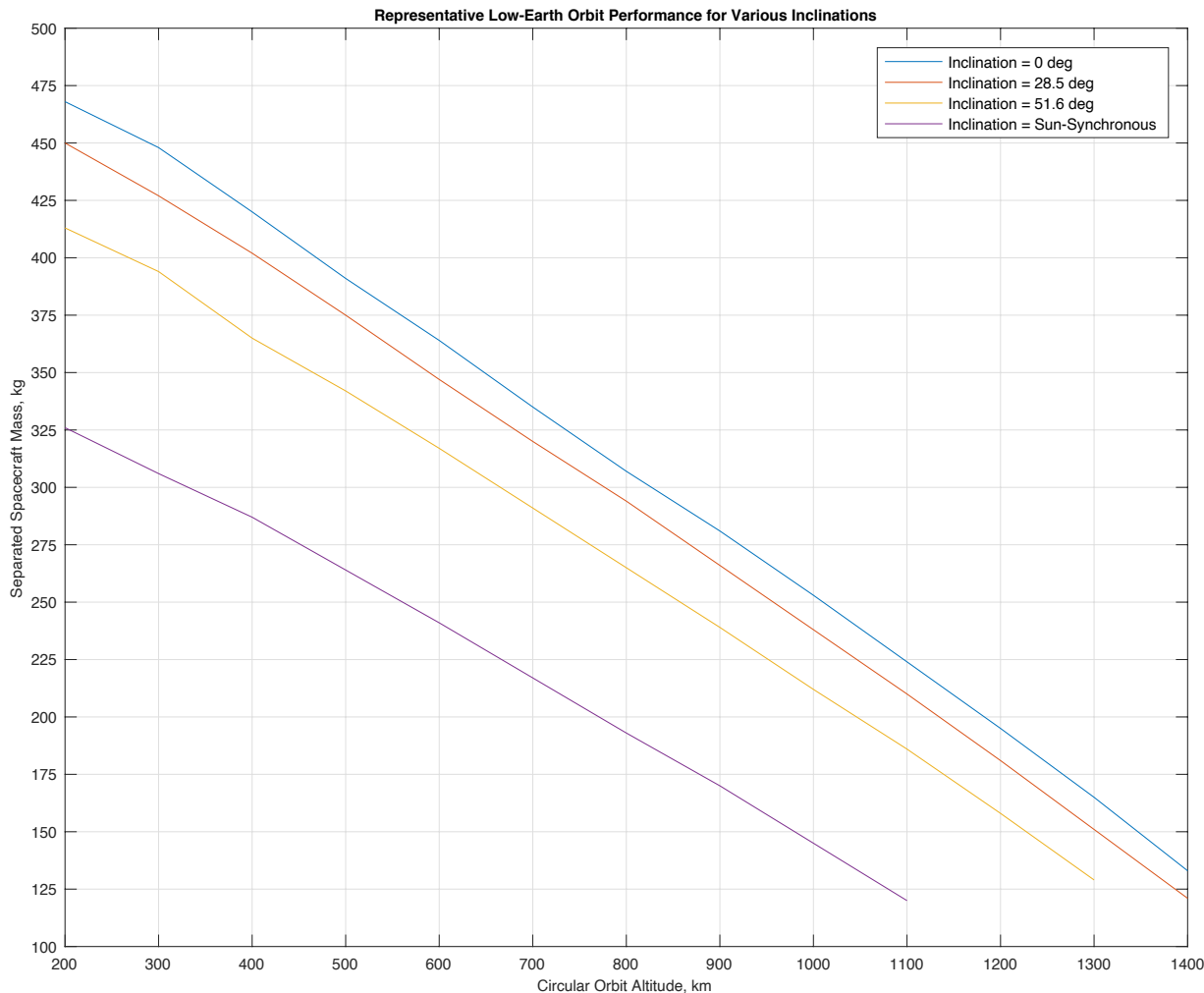
<i>Launch Vehicle</i>	Pegasus XL	Minotaur-C	Falcon 9 FT
<i>Provider</i>	NGIS	NGIS	SpaceX
<i>Approx Perf @ 600km Sun Sync</i>	240 kg	800 kg	8000+ kg
<i>Certification Category</i>	Cat 3	Cat 2	Cat 3
<i>Launch Sites</i>	CCAFS WFF KWAJ VAFB	CCAFS WFF VAFB	CCAFS VAFB

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

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



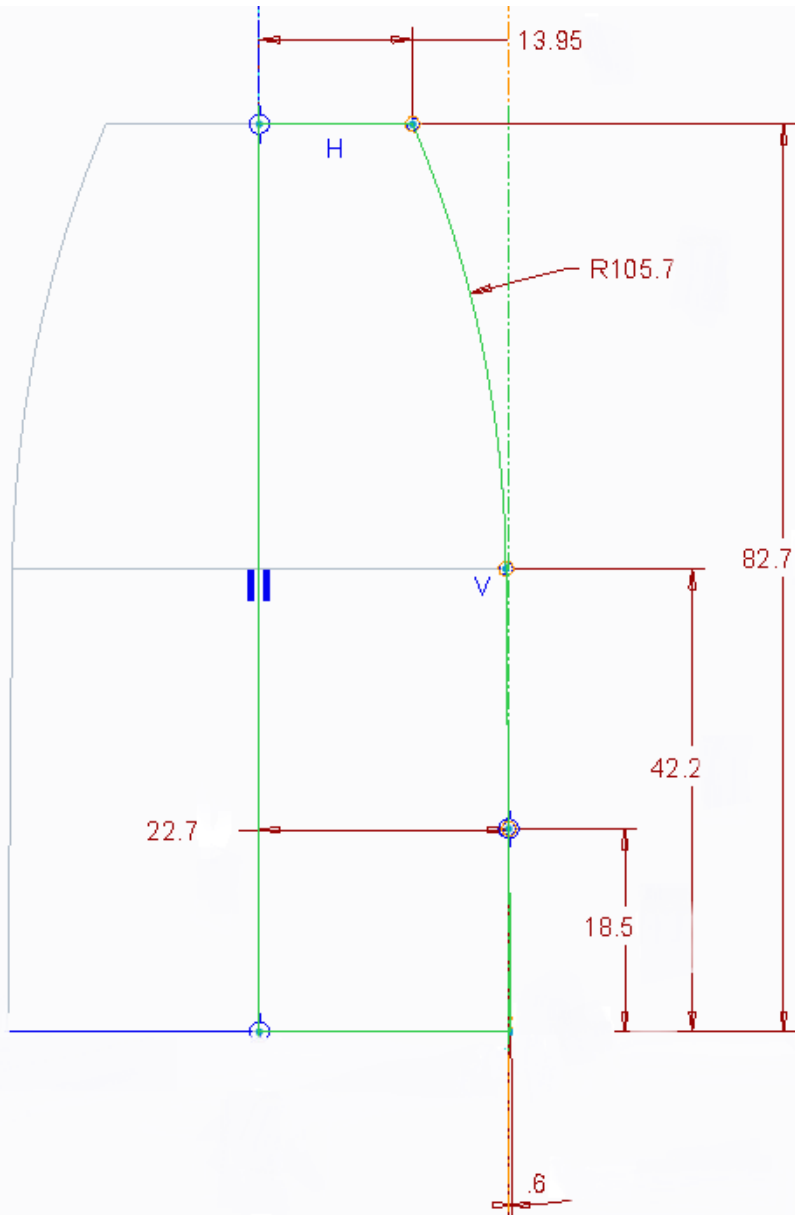
Enveloping Performance Curves



- Figure depicts expected representative nominal performance to a common range of altitudes/inclinations (circular orbits).
- Vehicle-specific injection dispersion capabilities will determine the accuracy to which the orbit targets can be achieved.
- Performance is for a baseline LV configuration; non-standard, mission-unique hardware is not included and will require additional assessment
 - If a payload isolation system is needed, the available performance shown should be reduced by 10 Kg.



Static Payload Fairing Envelope



- Proposals should include sufficient S/C dimensions to validate fit within this PLF static envelope, including any close approaches.
- Figure has been reduced by 1.5" to account for a typical payload isolation system. If the proposer is providing own isolation system, or one is not needed, 1.5 inches may be added to overall height shown.



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AO-Provided Commercial FAA-Licensed Launch Services LSP Procured



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Commercial FAA-Licensed Launch Services

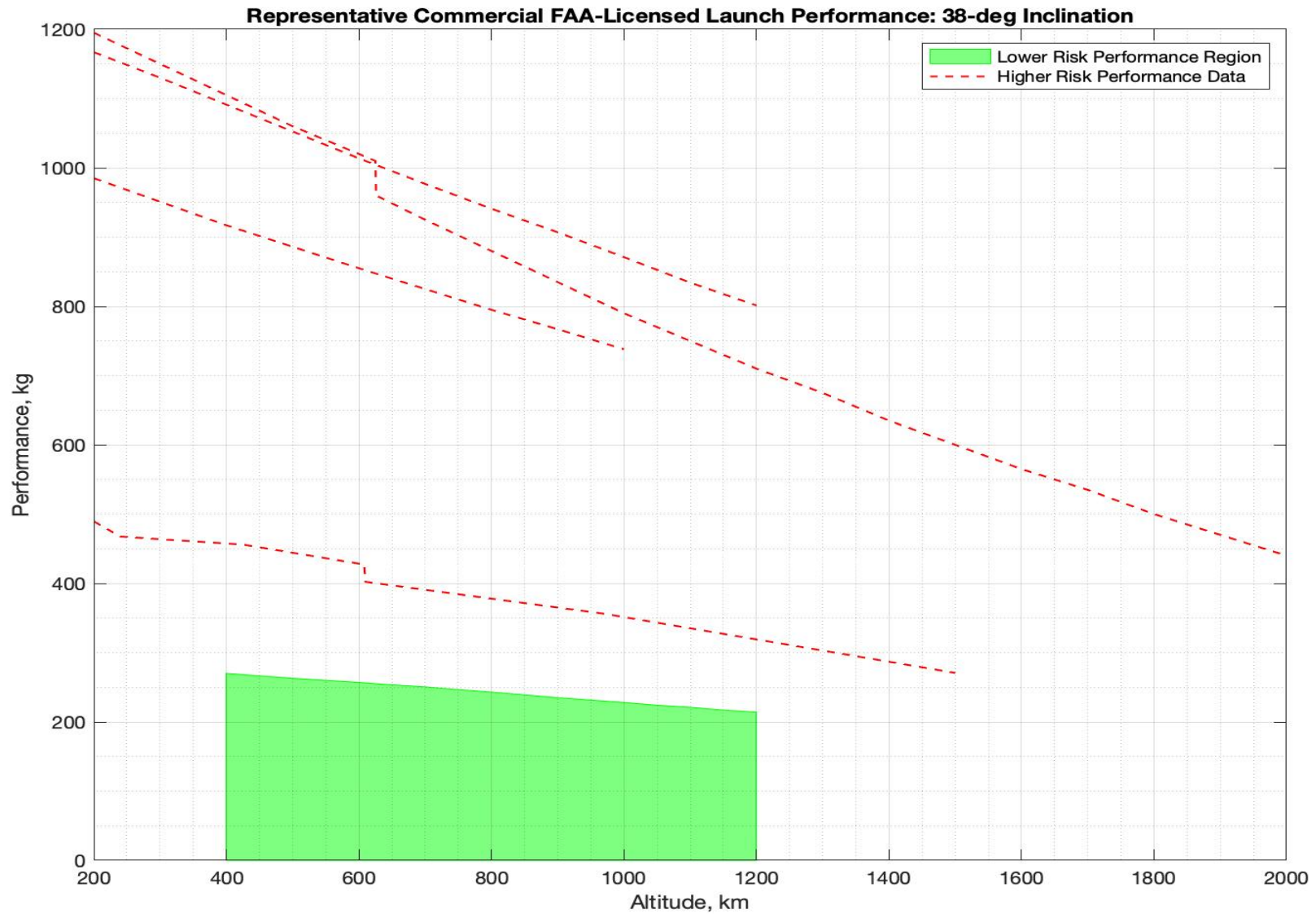


- **Likely candidate/competitive vehicles for EVM-3 AO are broken into Low and High-Risk categories:**
 - Low Risk indicates that the LV has had a successful launch
 - High Risk are those LV still in development and has not had a successful launch
- **Assumption of a specific launch vehicle configuration 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 the launch vehicle summary through spacecraft Preliminary Design Review.**
 - **Payload design should accommodate the limiting/enveloping launch characteristics and capabilities included in “Commercial FAA-Licensed Launch Services Program Information Summary” document**
- **Domestic launch vehicle on its first flight will be permitted; however, prior to launch the vehicle will be certified as Category 1 per NPD 8610.7D, *Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads/Missions* (see EVM-3 Library).**
- **A modified technical oversight approach per NPD 8610.7D Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions will be used for Class D missions.**



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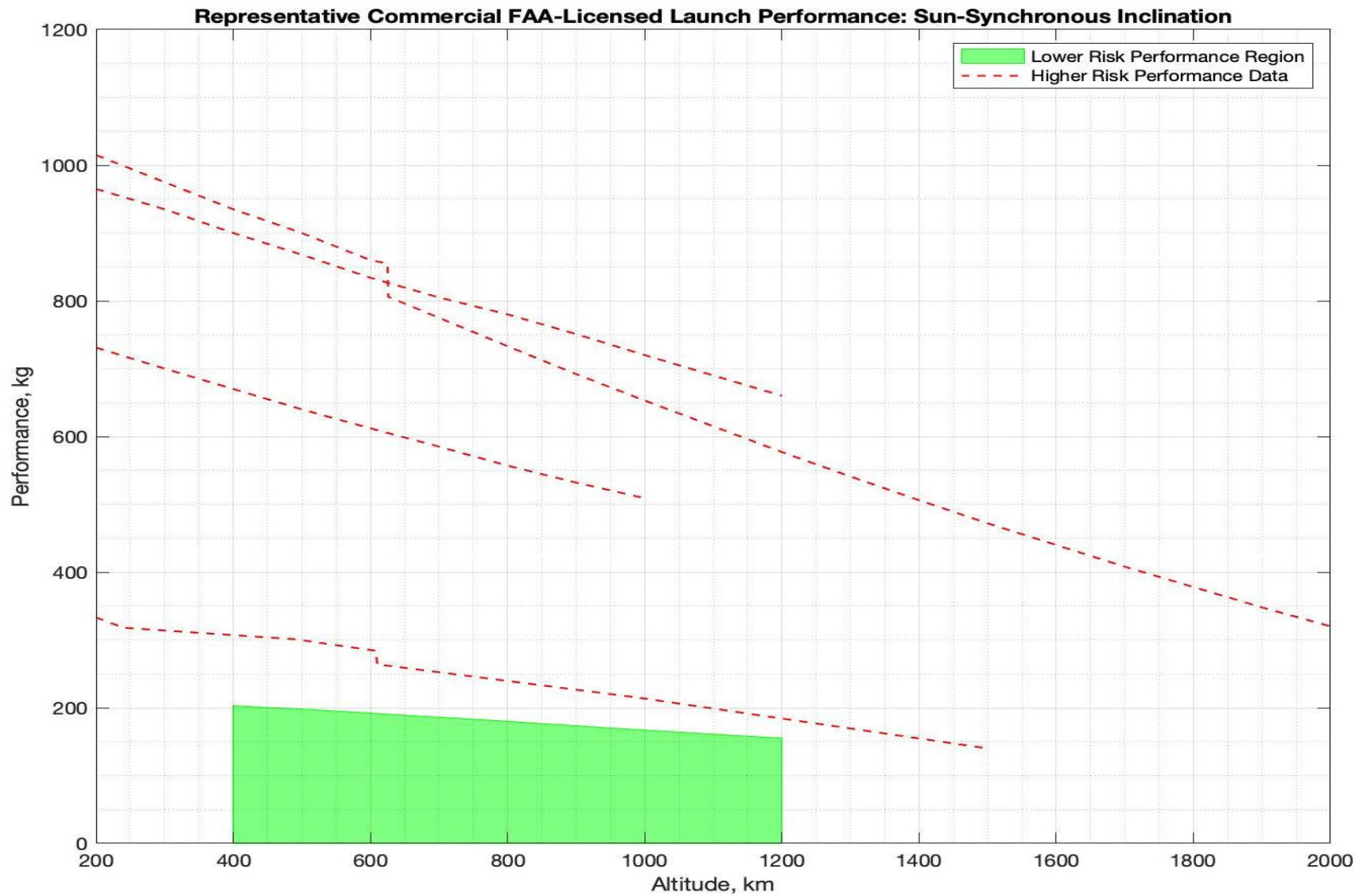
Commercial FAA-Licensed Launch Services Performance





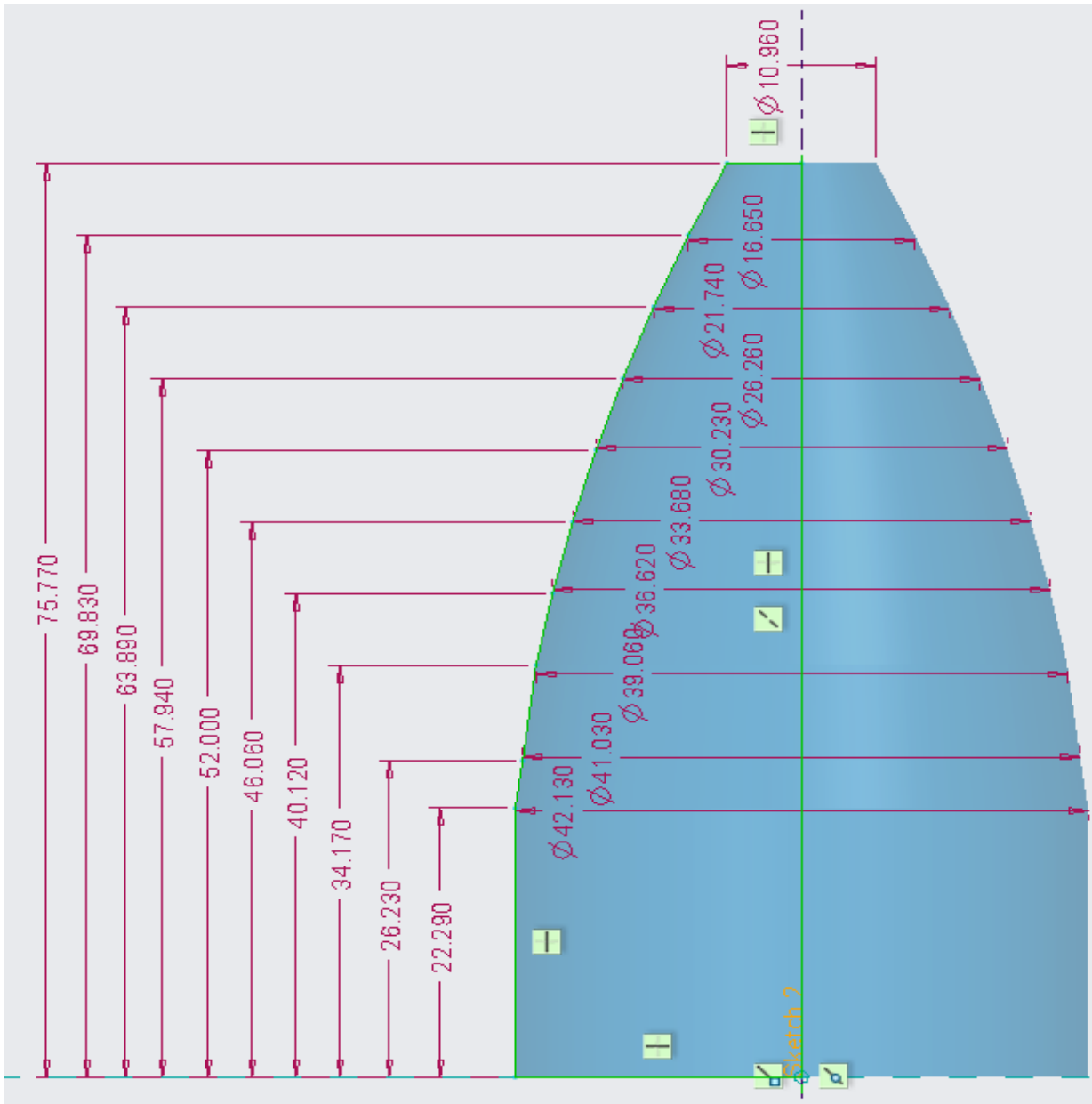
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Commercial FAA-Licensed Launch Services Performance





Commercial FAA-Licensed Launch Services Performance



- **Static Fairing Envelope (in.)**
- **Proposals should include sufficient S/C dimensions to validate fit within this PLF static envelope, including any close approaches.**



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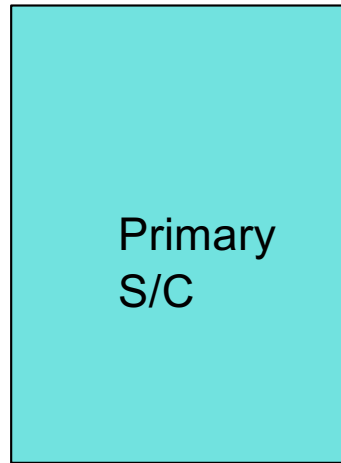


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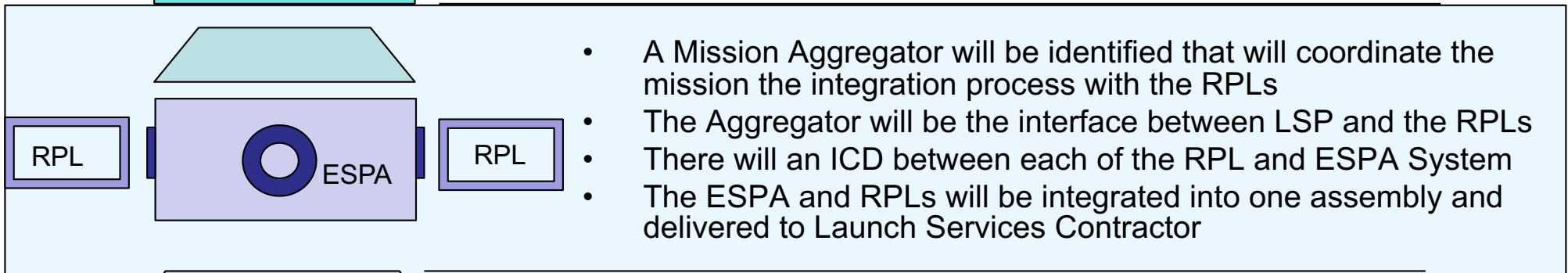
AO-Provided Rideshare Access to Space LSP Procured



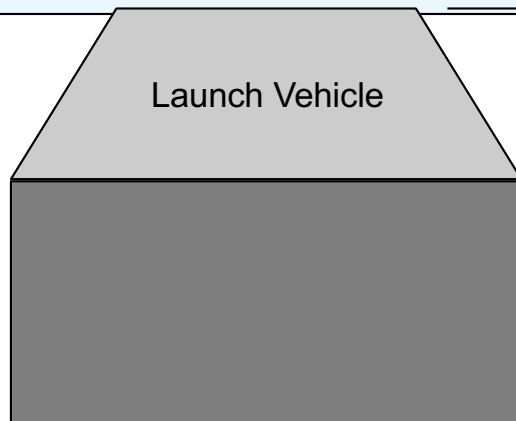
ESPA Configuration



- LSP will procure the launch service for the Primary spacecraft and the ESPA ring through the Launch Service Task Order (LSTO) process
- LSP will coordinate the mission integration process with the Launch Service Contractor, the Primary spacecraft customer, and the ESPA mission aggregator



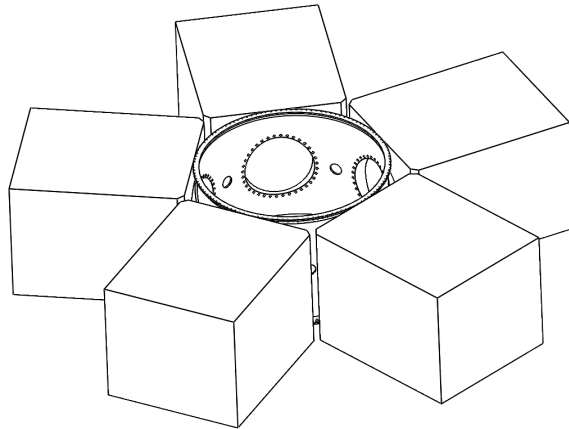
- A Mission Aggregator will be identified that will coordinate the mission the integration process with the RPLs
- The Aggregator will be the interface between LSP and the RPLs
- There will an ICD between each of the RPL and ESPA System
- The ESPA and RPLs will be integrated into one assembly and delivered to Launch Services Contractor



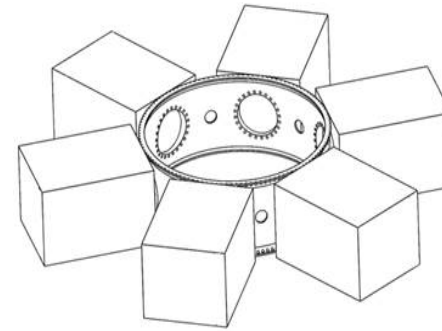
- The Launch Service Contractor is responsible for the build and check out of the launch vehicle with NASA involvement/insight



ESPA Interfaces

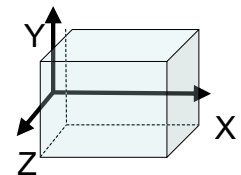


ESPA Grande



ESPA

ESPA	Max RPL Mass	Allowable RPL Volume	RPL Interface
ESPA Grande 5 Port	465 kg	42"x46"x38" Y, Z, X	24" circular
ESPA 6 Port	220 kg	24"x28"x38" Y,Z,X	15" circular



**NASA will provide the Separation System as GFE: RUAG PAS 381S (15") for ESPA
 RUAG PAS 610S (24") for ESPA Grande
 PSC MkII MLB (15" or 24")**

Please see the NASA Science Mission Directorate (SMD) Launch Vehicle Secondary Payload Adapter Rideshare Users Guide (updated 8/21/2020). Earth Venture Mission-3 (EVM-3) Library



RPL Do No Harm



All ESPA class RPL will be subject to a Do-No-Harm (DNH) assessment process to ensure that they will not pose a threat to the mission success of the Primary spacecraft or Launch Vehicle (LV) – Some general DNH considerations include:

- RPL Design
 - Design should be done to Aerospace standards including appropriate safety factors for tested and untested hardware
 - Design must physically comply with the space allotted and remain constrained and sufficiently stiff to not make contact with launch vehicle or other spacecraft hardware during flight
 - Dynamic modes of the auxiliary payload must be sufficiently understood and communicated to ensure no detrimental dynamic loading onto the launch vehicle or primary spacecraft
 - RPL must maintain integrity and not separate prematurely under worst case predicted loads and environments (acoustic, shock, vibe, thermal, depressurization)



RPL Do No Harm



- Flight Risks
 - Separation analysis must ensure no re-contact with the LV, Primary spacecraft, or other RPLs during RPL separation event(s)
 - RPL separation indications must be included in the LV telemetry stream
 - Mitigations are in place to ensure any potentially hazardous functions are redundantly inhibited until well after the RPL is clear of the LV, Primary spacecraft, or other RPLs
 - RPLs must not generate debris that may contact the LV, Primary spacecraft, or other RPLs
 - RPLs contamination sources must be understood and provided to the LV, Primary spacecraft, or other RPLs for impact assessment
 - RPLs must not generate environments (e.g. thermal, separation shock, etc.) which detrimentally impacts the qualification of the LV, Primary spacecraft, or other RPLs



RPL Do No Harm



- Launch Schedule Support
 - RPL integration schedules must support launch vehicle/primary payload integration schedules
 - RPLs must not impact the launch date for the primary mission in the event that the RPL is not able to support launch date – This is typically accomplished by having a mass simulator available and ready to integrate
 - RPLs must support the full launch window defined by the primary spacecraft
- Personnel Safety
 - RPLs must comply with applicable OSHA, DOT AFSPCMAN 91-710
 - RPLs must be stable and safe without services (power, commodities) once integrated

Please see the NASA Science Mission Directorate (SMD) Launch Vehicle Secondary Payload Adapter Rideshare Users Guide (updated 8/21/2020). Earth Venture Mission-3 (EVM-3) Library



Documents



Applicable Documents

NASA-STD-8719.24	NASA Expendable Launch Vehicle Payload Safety Requirements
2020 SMD ESPA RUG – EVM-3	NASA Science Mission Directorate (SMD) Launch Vehicle Secondary Payload Adapter Rideshare Users Guide (2020 SMD ESPA RUG)
NPR 8715.6B NASA	Procedural Requirements for Limiting Orbital Debris
NASA-STD-6016	Standard Materials and Processes Requirements for Spacecraft
NPR 8715.7B NASA	NASA Payload Safety Program
2018-09-18-IMAP-ESPA-SIS	Specific Evolved Expendable Launch Vehicle Secondary Payload Adapter System Interface Specifications For Heliophysics Missions of Opportunity
ASTM E2900	Standard Practice for Spacecraft Hardware Thermal Vacuum Bakeout
IEST-STD-CC1246	Product Cleanliness Levels and Contamination Control Program

Reference Documents

(SPD-32 Rev 1)	<u>ESPA Secondary Payloads Rideshare SMD Policy Document</u>
EELV RUG	Evolved Expendable Launch Vehicle Rideshare User's Guide (SMC/LE)
TOR-2016-02946	Rideshare Mission Assurance and the Do No Harm Process –Aerospace Report
GSFC-STD-7000	General Environmental Verification Standard (GEVS) for GSFC Flight Program and Projects
MMPDS	Metallic Materials Properties Development and Standardization
MIL-HDBK-5	Military Handbook 5, Metallic Materials and Elements for Aerospace Vehicle Structures
MIL-STD-1540C	Military Standard Test Requirements for Launch, Upper-Stage, and Space Vehicles
NASA-STD-8719.24	NASA Expendable Launch Vehicle Payload Safety Requirements
EELV SIS	Evolved Expendable Launch Vehicle Standard Interface Specification
LSP-REQ-317.01B	Launch Services Program (LSP) Program Level Dispenser and CubeSat Requirements Document
AFSPCMAN 91-70	Air Force Space Command Manual 91-710, Range Safety User Requirements Manual, 1 July 2004
MIL-STD-461F	Requirements for the control of Electromagnetic Interference Characteristics of Subsystem and Equipment



Summary



- It is the NASA 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:

Garrett Skrobot
Mission Manager
NASA Launch Services Program Code VA-C
Kennedy Space Center, FL 32899
Phone: 321-266-4841
Email: garrett.l.skrobot@nasa.gov

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