RIDESHARE

Aly Mendoza-Hill - SMD Rideshare Lead, HPD Program Executive
Nicky Fox, HPD Division Director
Peg Luce, HPD Deputy Division Director
Alan Zide, SMD HPD Program Executive

Advisors:
Pete Wilczynski, SMD JASD JPSS Program Executive
Charles Norton, SMD Special Advisor, Small Spacecraft Missions
Florence Tan, SMD Deputy Chief Technologist
Agenda

1. SMD Organization & Leadership
2. SMD Rideshare Snapshot
3. Access 2 Space Workshop
4. IMAP Rideshare Example
5. SMD Rideshare Opportunities
6. Notional Rideshare Schedule
NASA SMD Rideshare

- We are currently developing a robust rideshare program to utilize excess mass to orbit and enable additional launch opportunities for the science community.
- The Science Mission Directorate has issued a rideshare policy and established a Rideshare Office to develop standard rideshare processes for the SMD Directorate.
  - The Heliophysics Division will now be the lead for NASA SMD on rideshares.
  - Aly Mendoza-Hill is our new lead for rideshare opportunities.
- The Committee on Solar and Space Physics (CSSP) issued a report earlier this year on short-notice rideshare opportunities.
  - Presented at Access2Space.
  - Released publicly on Friday, June 26th.
- Our upcoming IMAP mission will be the first major NASA/HPD mission to implement rideshare for multiple science and technology demonstration missions.
  - SIMPLEX Lunar Trailblazer and NOAA Space Weather Follow On L-1 will be accommodated for rideshare with IMAP.
  - Two Heliophysics Mission of Opportunity payloads.
NASA HQ SMD Rideshare Organization

SMD AA, Thomas Zurbuchen, established SMD's initial Rideshare Policy in late 2018

SMD Rideshare Office
Lead: Aly-Mendoza-Hill
- Nicky Fox
- Peg Luce
- Alan Zide
- David Cheney

SMD Centers
GSFC, LaRC, MSFC, KSC, etc.

Notes:
- Acting
- Reports to GSFC

Updated: June 7, 2020
Workshop Purpose: Solicit community inputs on the creation and management of a secondary payload pipeline for NASA Science Mission Directorate (SMD) ESPA class missions

Format: “Workshop” based to facilitate discussion. Oral presentations on the first morning only. The purpose was to share NASA SMD’s latest policies, implementations and plans going forward with respect to utilizing ESPA class Rideshare. Two Poster sessions: first one (Tuesday) focuses on Users and second (Wednesday) focuses on Providers of Rideshare

Workshop organized around 5 “splinter” groups

- Each splinter group consists of 4 focused sub-groups meeting in parallel
- Splinters are 2-hours long and focused on a single topic
- Subsequent splinters built on the previous splinter information discussed and captured

The workshop gathered over 154 participants:
- All SMD divisions participated
- Approximately 33 participants from Academia
- Approximately 47 participants from Industry
- Approximately 70 participants from NASA

Note: This workshop was focused on ESPA class missions. We shared with the participants that we will address other Access 2 Space topics such as Venture class opportunities, and hosted payloads in the future
**Splinter Sessions and Sub-groups**

**Splinter 1:** Science that Drives the Pipeline Based on Destination  
Subgroups: LEO, GEO, Cis-Lunar, and Deep Space

**Splinter 2:** Instrument Types and Configurations that Drive the Pipeline Based on Science  
Subgroups: Earth Science, Heliophysics, Planetary Science, and Astrophysics

**Splinter 3:** Launch Vehicle Barriers and Issues that Hinder the Pipeline  
Subgroups: Secondary Payload Programmatics, New Space Launch Provider Programmatics,  
Documentation & Interfaces, and Secondary Payload Configuration Constraints

**Splinter 4:** Small Spacecraft Technology Challenges that Hinder the Pipeline  
Subgroups: Propulsive ESPA, Multi-Spacecraft Missions, Sub-Systems Development, and Technology Development

**Splinter 5:** Programmatic Challenges that Hinder the Pipeline  
Subgroups: AO/MO Call Approaches, Oversight and Deliverables, Standards and Risk Assessment, and Diversity
• Many unique science measurements were identified as enabling and achievable using ESPA class secondary payloads.
• Community showed strong enthusiasm and support that SMD has created a Rideshare Office with a single POC for the community, industry, OGA, and academia.
• Small instrument technology programs (PICASSO/MatISSE/DALI/SIMPLEX, APRA/PIONEERS, ACT/IIP/AIST/INVEST, HTIDeS/HFORT, …) are feeder programs into Small Sat missions and should be continued/expanded.
• This workshop focused on ESPA class missions, however, dedicated small launchers may be the better solution for some SmallSat missions.
• Earth orbiting SmallSat technologies can be leveraged from industry. More work is needed to develop technologies for Deep Space SmallSat missions.
• Interest was high to have generic opportunity calls that specified “lanes” when soliciting rideshares (e.g. Sun Synchronous, Polar Orbiting, L1), as well as opportunities for specific launches (using the IMAP and SIMPLEx models as good examples). For targeted launch opportunities, early and specific launch information is needed.
• Soliciting ESPA payloads directly with the AO primary mission was preferred over matchmaking payloads to primaries later.
• The most often mentioned challenge for small universities and new PIs is the lack of continuity of funding. In order to support the minimal engineering staff requires 4-5 PIs bringing in new projects and grants.

ESPA class rideshare has tremendous potential for NASA to increase science return and science technology maturation.
Nominal ESPA RPL Mass, Volume Interface Requirements for 4-meter Fairing

<table>
<thead>
<tr>
<th>ESPA</th>
<th>Port Mass Capacity$^5$</th>
<th>Allowable RPL Volume$^{1, 2, 3, 4, 6}$</th>
<th>RPL Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESPA Grande 4 Port</td>
<td>465 kg</td>
<td>42”x46”x38” Y, Z, X</td>
<td>24” circular</td>
</tr>
<tr>
<td>ESPA 6 Port</td>
<td>220 kg</td>
<td>24”x28”x38” Y, Z, X</td>
<td>15” circular</td>
</tr>
</tbody>
</table>

(1) X-dimension assumes a 4-meter fairing; ESPA Grande on 5-meter fairing allows 56”.

Secondary Payloads:
- SWFO-L1 (NOAA)
- Lunar TrailBlazer (JPL)
- Helio Tech Demo MoO
- Helio Science MoO

4-port Secondary Payload Adapter

Images not to scale
## SMD Missions: Current Rideshare Missions

*Note: Dates are estimates and subject to change, excess launch capacity on some flights still TBD*

<table>
<thead>
<tr>
<th>Mission</th>
<th>Org</th>
<th>LV Class</th>
<th>Trajectory</th>
<th>LRD</th>
<th>Rideshare Adapter</th>
<th>RPLs</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPSS-2</td>
<td>JASD</td>
<td>AtlasV</td>
<td>SSO, Polar 810 km 1325 LTAN</td>
<td>03/31/22</td>
<td>ULA C-Adapters</td>
<td>LOFTID</td>
</tr>
<tr>
<td>Psyche</td>
<td>PSD</td>
<td>Falcon Hvy (ATP 2/28/20)</td>
<td>C3 = ~30</td>
<td>July - Aug 2022</td>
<td>ESPA Standard</td>
<td>JANUS C3=14 EscaPADE C3=14</td>
</tr>
<tr>
<td>PUNCH</td>
<td>HPD</td>
<td>Small/Medium</td>
<td>SSO, 570 km 06:00 MLTAN</td>
<td>02/01/23</td>
<td>ESPA Grande (TBD)</td>
<td>TRACERS (TBD) inside ESPA-G 22:30 MLTAN</td>
</tr>
<tr>
<td>SPHEREx</td>
<td>APD</td>
<td>Intermed</td>
<td>SSO, 700 km 6am MLTAN</td>
<td>06/01/24</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>IMAP</td>
<td>HPD</td>
<td>Intermed</td>
<td>L1 C3 max &lt;= -0.5 28deg incl</td>
<td>10/1/2024</td>
<td>ESPA Grande</td>
<td>SWFO-L1 / PSD LTB / HPD TD MO / HPD Sci MO</td>
</tr>
</tbody>
</table>
# SMD Missions: Potential Rideshare Opportunities

*Note: Dates are estimates and subject to change, excess launch capacity on most flights still TBD*

<table>
<thead>
<tr>
<th>Mission</th>
<th>Org</th>
<th>LV Class</th>
<th>Trajectory</th>
<th>LRD</th>
<th>Rideshare Adapter</th>
<th>RPLs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentinel 6B</td>
<td>ESD</td>
<td>Intermed/Large?</td>
<td>LEO (1336km; 66deg (tbd))</td>
<td>Nov 2025</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>NEO Surveyor</td>
<td>PSD/PDCO</td>
<td>Intermed/Large?</td>
<td>L1 (C3 tbd)</td>
<td>2025</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>MIDEX AO</td>
<td>HPD</td>
<td>Intermed</td>
<td>TBD</td>
<td>NLT Feb 2026</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>JPSS-3</td>
<td>JASD</td>
<td>Intermed</td>
<td>LEO SSO 13:30 MLTAN</td>
<td>2027</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Dragonfly (MMRTG)</td>
<td>PSD</td>
<td>Large</td>
<td>Heliocentric (Saturn)</td>
<td>April 2026</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Discovery AO</td>
<td>PSD</td>
<td>Intermed/Large?</td>
<td>Diff targets (Venus, Neptune, 2 Jupiter) C3 =17,18,24,31</td>
<td>2025/26-2027/28</td>
<td>TBD</td>
<td>TBD</td>
</tr>
</tbody>
</table>
NOTIONAL MILESTONES FOR SECONDARY PAYLOAD INTEGRATION

ESPA-Class Secondary Payloads

Launch Vehicle Milestones

- FPB FOR FINAL LV CONFIGURATION
- LV SELECTION | SELECTED LV
- EXCESS PERFORMANCE KNOWN
- FPB DIRECTION TO LSP
- SECONDARY LSIRD’S TO LSP
- SP’s PRELIMINARY DETAILS TO BE INCLUDED IN THE LAUNCH SERVICE REQUIREMENTS FOR THE LSTO PROCUREMENT PROCESS
- RSO REQUESTS POTENTIAL EXCESS PERFORMANCE FROM LSP

Spacecraft Milestones

- PRIMARY MISSION COUPLED LOADS IS SCHEDULE DRIVER FOR IDENTIFYING SECONDARY PAYLOAD CONFIGURATION
- CONTINUOUS COMPATIBILITY AND DNH ASSESSMENTS FOR POTENTIAL SPs
- CONTINUE SP SEARCH, IF NEEDED
- LRD APRIL 2025
- L – 33 (~JULY 2022)
- NLT L – 24 (APRIL 2023)
- ~L – 33 (~JULY 2022)
- ~L – 40 (~DEC 2021)
- ~L – 41 (~NOV 2021)
- ~L – 33 (~JULY 2022)
- SEPTEMBER 2020
- ~JUNE 2020
- SELECTION/DIRECTED
- TBD
- TBD
- TBD
- TBD
- TBD

FPB: FLIGHT PLANNING BOARD
LSIRD: LAUNCH SERVICEIRD
LSTO: LAUNCH SERVICE TASK ORDER
PER: PRE-ENVIRONMENTAL TEST REVIEW

SPs: SECONDARY PAYLOADS
SPA: SECONDARY PAYLOAD ADAPTER
CLA: COUPLED LOADS ANALYSIS
FDLC: FINAL DESIGN LOADS CYCLE
FEM: FINITE ELEMENT MODEL

Primary Mission spacecraft CDR
SECONDARY FEM’S required FOR FDLC (supports Primary PER)
SECONDARY FEM’S (If available) FOR PRELIMINARY CLA (supports Primary CDR)

Primary Mission PER

Key secondary payload deliverables (ESPA-class payloads)

SP Mass Simulators ready for contingency

~7 MONTHS PRIOR TO PER
~6 MONTHS PRIOR TO CDR

IF NO SPs BY L-24 MONTHS, THE PRIMARY MISSION GOES TO FPB TO DECIDE EITHER TO REMOVE THE SPA OR KEEP IT (ASSESS IMPACTS: COST, SCHEDULE, TECHNICAL)