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

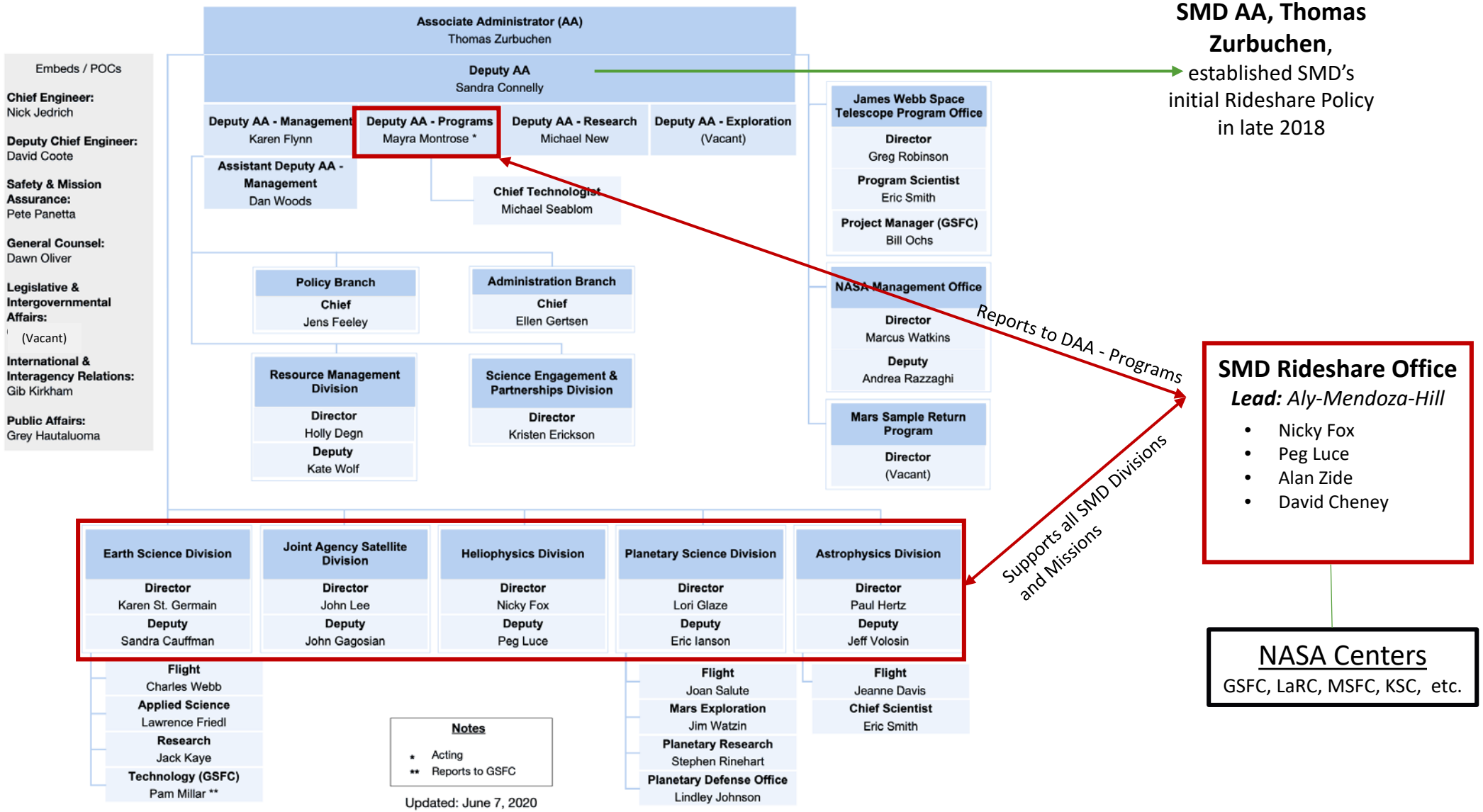
Agenda

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
- Held an Access2Space Workshop at APL in Feb 2020
- 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

NASA Centers

GSFC, LaRC, MSFC, KSC, etc.

ACCESS 2 SPACE
WORKSHOP
Increased Science Return through Rideshare
FEBRUARY 25–27, 2020

National Aeronautics and Space Adminstration

Hosted by the Johns Hopkins Applied Physics Laboratory

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

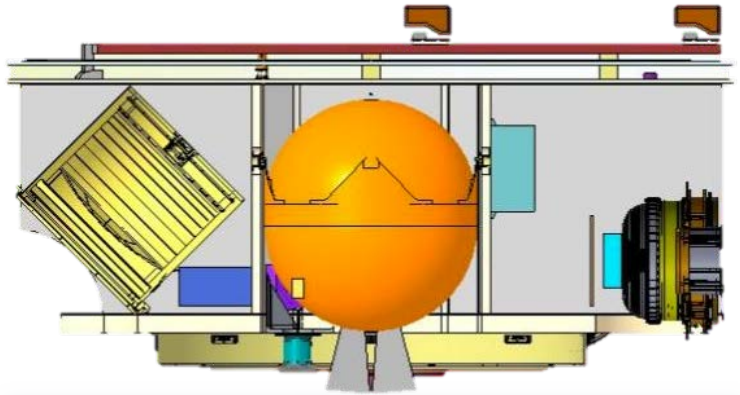
National Aeronautics and Space Adminstration
NASA
Hosted by the Johns Hopkins Applied Physics Laboratory

Bottom Line Up Front

- 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

IMAP Rideshare Example



IMAP

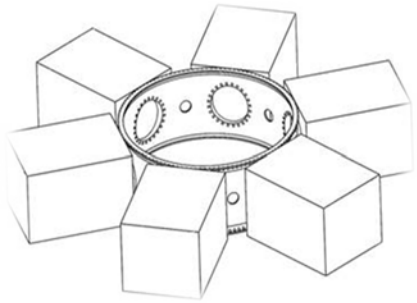
Secondary Payloads:

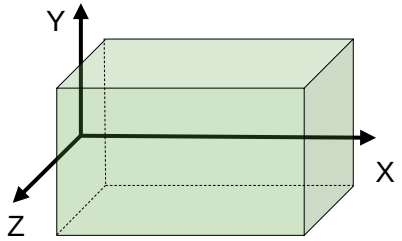
- SWFO-L1 (NOAA)
- Lunar TrailBlazer (JPL)
- Helio Tech Demo MoO
- Helio Science MoO

4-port Secondary Payload Adapter

Images not to scale

Nominal ESPA RPL Mass, Volume Interface Requirements for 4-meter Fairing





ESPA	Port Mass Capacity(5)	Allowable RPL Volume(1, 2, 3,4,6)	RPL Interface
ESPA Grande 4 Port	465 kg	42”x46”x38” Y, Z, X	24” circular
ESPA 6 Port	220 kg	24”x28”x38” Y,Z,X	15” circular

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

SMD Missions: *Current Rideshare Missions*

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

Mission	Org	LV Class	Trajectory	LRD	Rideshare Adapter	RPLs
Landsat-9	ESD	AtlasV-401	Polar, 700km	4/8/21	ESPA Standard	~18 USSF & NASA cubesats
JPSS-2	JASD	AtlasV	SSO, Polar 810 km 1325 LTAN	03/31/22	ULA C-Adapters	LOFTID
Psyche	PSD	Falcon Hvy (ATP 2/28/20)	C3 = ~30	July - Aug 2022	ESPA Standard	JANUS C3=14 EscaPADE C3=14
PUNCH	HPD	Small/ Medium	SSO, 570 km 06:00 MLTAN	02/01/23	ESPA Grande (TBD)	TRACERS (TBD) inside ESPA-G 22:30 MLTAN
SPHEREx	APD	Intermed	SSO, 700 km 6am MLTAN	06/01/24	TBD	TBD
IMAP	HPD	Intermed	L1 C3 max <= -0.5 28deg incl	10/1/2024	ESPA Grande	SWFO-L1 / PSD LTB/ HPD TD MO/ HPD Sci MO

SMD Missions: *Potential Rideshare Opportunities*

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

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

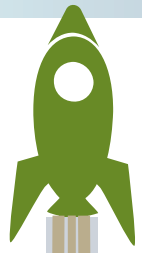
NOTIONAL MILESTONES FOR SECONDARY PAYLOAD INTEGRATION

ESPA-Class Secondary Payloads

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

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

★ **Key secondary payload deliverables (ESPA-class payloads)**



Launch Vehicle Milestones

FPB FOR FINAL LV CONFIGURATION — *NLT L – 24 (APRIL 2023)*

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)

LV SELECTION | SELECTED LV EXCESS PERFORMANCE KNOWN — ~L – 33 (~JULY 2022)

FPB DIRECTION TO LSP — ~L – 40 (~DEC 2021)

SECONDARY LSIRD'S TO LSP — ~L – 41 (~NOV 2021)

SPs PRELIMINARY DETAILS TO BE INCLUDED IN THE LAUNCH SERVICE REQUIREMENTS FOR THE LSTO PROCUREMENT PROCESS

RSO REQUESTS POTENTIAL EXCESS PERFORMANCE FROM LSP — ~SEPTEMBER 2020

CONTINUE SP SEARCH, IF NEEDED

INITIAL ID OF POTENTIAL SPs

CONTINUAL COMPATIBILITY AND DI/H ASSESSMENTS FOR POTENTIAL SPs

Spacecraft Milestones

APRIL 2025 — LRD

SP Mass Simulators ready for contingency

TBD — Primary Mission PER

~7 MONTHS PRIOR TO PER — **SECONDARY FEM'S** required FOR FDLC **(supports Primary PER)** ★

TBD — Primary Mission spacecraft CDR

~6 MONTHS PRIOR TO CDR — **SECONDARY FEM'S** (If available) FOR PRELIMINARY CLA **(supports Primary CDR)** ★

PRIMARY MISSION COUPLED LOADS IS SCHEDULE DRIVER FOR IDENTIFYING SECONDARY PAYLOAD CONFIGURATION

TBD — Primary Mission KDP-C

TBD — Primary Mission PDR

~June 2020 — Primary Mission SELECTED/DIRECTED