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NASA Science Mission Directorate Rideshare Office

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ABSTRACT

A Rideshare Office has been recently established within NASA's Science Mission Directorate (SMD) and is focused on implementing the SMD-wide rideshare strategy outlined in the SMD Rideshare Policy (Science Policy Directive SPD-32). The goal of the office is to foster the maximizing of science, exploration, and technology return on investment by enabling rideshare or accommodation opportunities for secondary payloads on SMD primary mission launches. Sharing access to space is possible when a primary payload's launch configuration has excess performance that can be shared with compatible secondary payloads. The SMD Rideshare Office will serve as the single point of contact in SMD for coordinating the rideshare opportunities between compatible payloads and the SMD launch opportunities. SMD's policy also supports rideshare partnerships across NASA, other U.S. Government Agencies, and NASA's international partners. The Rideshare Office coordinates and guides rideshare opportunities through: the SMD Rideshare 101 document, which outlines the basic definitions of rideshare; the SMD Do No Harm Requirements and Rideshare User Guide documents, which outlines requirements and specifications to ensure all mission partners that payloads will do no harm to each other and which offers guidelines for rideshare missions to design their secondary payloads for maximum compatibility. The Rideshare Office is also working to standardize Announcement of Opportunity language and requirements to further enhance the development of rideshare payload candidates. The SMD Rideshare Office is supporting current rideshare opportunities on upcoming SMD missions, including the IMAP, SPHEREx, PUNCH, and Psyche launches. By providing a leadership role across SMD and the rideshare community, the Rideshare Office will provide consolidated resources for guidance and solutions to the unique challenges of rideshare.

NASA SMD Rideshare Policy & Rideshare Office

In October of 2018, the Associate Administrator for NASA's Science Mission Directorate, Thomas Zurbuchen, established the Science Mission Directorate (SMD) policy for utilizing the excess ascent performance and other mission resources on SMD missions by supporting the integration of secondary payloads onto Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) rings.

It is SMD policy to enable rideshare or launch accommodation opportunities using Secondary Payload Adapters as part of the launch service procured for an SMD primary payload. SMD determines the potential for excess capacity, as identified by Launch Services Program (LSP), after selection of the primary payload (once launch requirements are known). If excess capacity is identified, SMD will utilize the identified excess capacity on SMD primary payload missions for the launch of SMD-sponsored secondary payloads, either competed or directed, that meet science, technology, and exploration goals. The policy allows SMD to offer any excess capacity not utilized for SMD investigations to other NASA Mission Directorates (MD), other U.S. Government Agencies, or NASA's International partners in accordance with international agreements for international collaborative efforts relating to science, technology, and exploration goals.

This policy resulted in the establishment of the SMD Rideshare Office (SRO) in 2020 which serves as the principle contact in SMD for coordinating the sharing of launch opportunities between compatible payloads. The goal of the SRO is to provide a single point of contact for SMD Rideshare-related inquiries for both our NASA and external partners. The SRO also maintains the overall knowledge and tracking of all rideshare activities for SMD missions, and is tasked to ensure the best utilization of excess launch vehicle performance in order to obtain maximum science on SMD missions.

The SRO supports all NASA SMD Divisions and works with all the NASA Center rideshare POC's to create a unified NASA/SMD Rideshare message and process. The office will assist NASA directorates in filling rideshare-capable launches procured by NASA. The SRO will also provide training to principle investigators and program offices on their responsibilities during the rideshare process.

The SMD Rideshare Office mission is to enable coordination between primary spacecraft, secondary spacecraft, and launch vehicles and to support dynamic partnerships across NASA, government agencies, international partners, and commercial vendors.

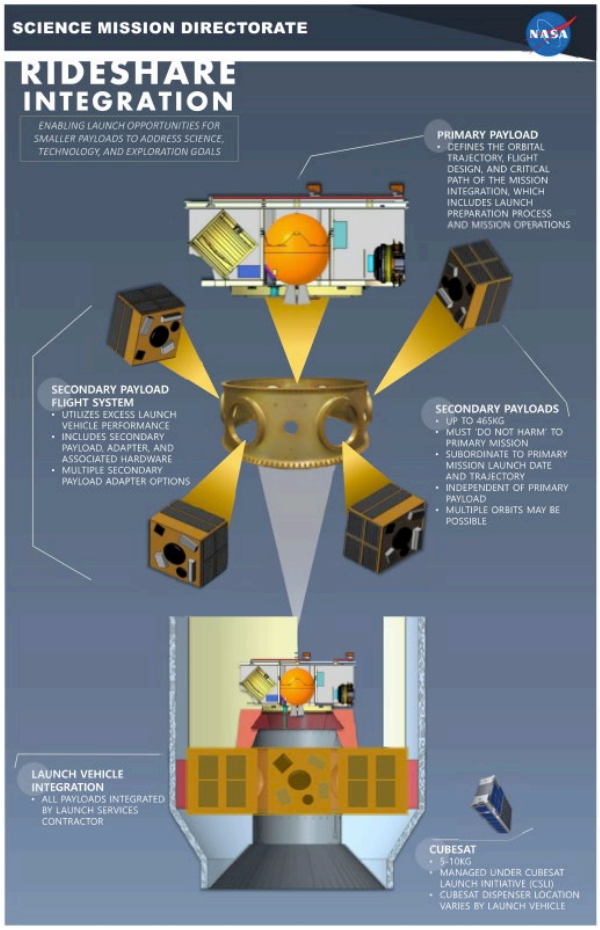

Figure 1: Rideshare Integration

NASA SMD SmallSats for Science

NASA SMD regularly funds and sponsors a number of launch campaigns for a variety of primary spacecraft missions to both Earth orbits and deep space destinations. These missions may have available excess launch performance, which will be made available to other NASA-sponsored missions. The use of small spacecraft for scientific discovery is rapidly gaining acceptance within NASA and related science communities.

SmallSats are central to NASA's technology development, maturation, and demonstration missions with robust programs in SMD's Earth Sciences, Planetary Sciences, Astrophysics, and Heliophysics

programs that exploit a number of SmallSat form factors. These NASA science missions intend to utilize the available performance margin to launch and deploy these missions.

Awards of SMD missions comprising of ESPA-Class spacecraft have greatly increased over the last five years.

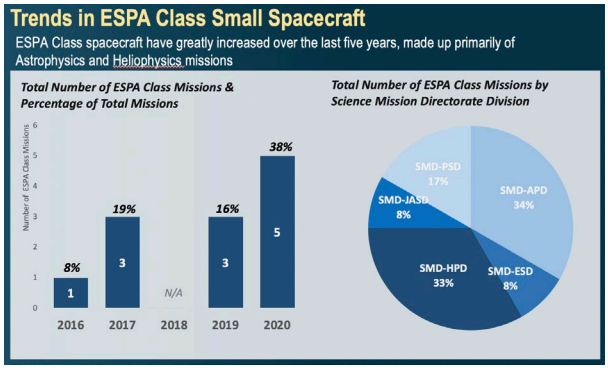

Figure 2: SMD ESPA Class Missions Trends

SMD is managing several full-fledged rideshare missions under multiple launch vehicle contracts managed by NASA's Launch Service Program (LSP). LSP is responsible for the contract management of the NASA SMD mission's launch services and, as such, LSP provides mission assurance oversight of the NASA mission's launch service accommodations. LSP identifies, negotiates, and implements the required modifications to the primary NASA mission's launch service contracts to accommodate the rideshare options. LSP also provides the necessary support and resources at the launch site to safely conduct rideshare flight systems processing and supports flight system integration with the primary NASA mission launch vehicle.

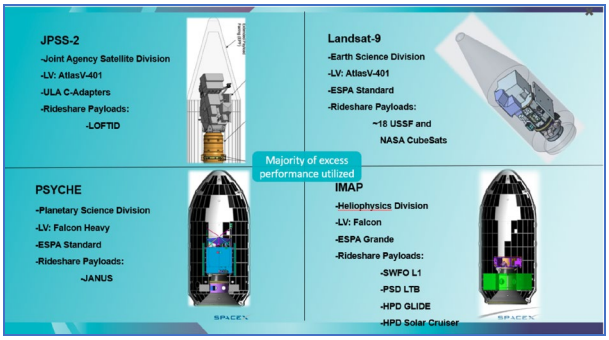

Figure 3: Example Configurations for Current NASA SMD Missions

Lessons Learned: Rideshare Mission Flexibility

As the Rideshare Office has been following the acquisition and development of secondary payloads, a few lessons learned can be shared.

In the past, it was typical for the science associated with a mission to be very specific both in the science captured and where the science would be physically captured (orbit, trajectory). For missions strongly being considered to fly as rideshares, a different perspective is beginning to form. Secondary payload missions should contemplate a more flexible approach. It may be of higher value to propose science such that the level 1 requirements can be accomplished from different orbits or trajectories. As a rideshare mission, this will create more opportunities for flight.

Payloads that have more strict requirements, have fewer compatible launch opportunities. Payloads should design for flexiblity in orbit and launch requirements. Payloads that have more strict requirements, have fewer compatible launch opportunities.

For increased launch opportunities, rideshare mission principal investigators should ask themselves:

1) Will it be less appealing in the future if there is only one way/location to meet the level 1 science requirements?
2) Can instruments be designed for a wider range of environments?
3) Can the spacecraft provider bring a spacecraft with features that allow for adaptability if the ride changes?

This approach can open up the possibilities for launch as a rideshare.

Whether the acquisition has a defined primary mission to fly with, or a ride has not been selected, history has shown that the same flexibility will improve the chances of finding a compatible ride. Even though a secondary could be determined compatible with a primary mission, there are numerous reasons that can arise where the secondary mission could be demanifested and would need to match up with a different launch opportunity. Incompatibilities like changing primary mission trajectories, tight contamination control requirements, magnetic cleanliness, and negative coupled loads results are all examples of what could potentially cause a secondary to be demanifested. In general, secondaries can Do No Harm to the primary mission. While a solution may be discovered to overcome the incompatibility, cost or

schedule to implement the change may force the secondary off a particular launch opportunity.

Rideshare payloads should make sure all launch requirements are up to date with the SRO in order to enable consideration with compatible launch opportunities. Out-of-date information could result in lost or failed rideshare opportunities.

Further, the expected maturation of "venture-class" small launch vehicles add another dimension for increased access to space for SmallSats. Can your mission concept have the flexibility to fly either as a rideshare on an ESPA-type secondary payload adapter or as a primary payload on a venture-class launch vehicle?

NASA SMD Rideshare References

The SMD "Rideshare 101" document is a high-level reference document intended as an informational source for mission developers and investigators who are new to rideshare to help delineate the framework of the NASA SMD's philosophy and general information that is useful to manifest and launch small spacecraft on NASA launch vehicles using rideshare. The SMD Rideshare 101 document can be found on the Small Spacecraft Virtual Institute website: https://www.nasa.gov/smallsat-institute/resources

The SMD "Launch Vehicle Secondary Payload Adapter Rideshare User Guide with Do No Harm" document was recently updated as a combination of guidelines and requirements for Rideshare Payload proposals submitted to the Science Mission Directorate solicitations that will utilize an Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) or ESPA Grande-type accommodations. The NASA SMD "RUG" also defines rideshare standard services and outlines the specific services provided by the launch vehicle contractor under contracts administered by NASA's Launch Service Program (LSP). This document also includes Rideshare Mission Assurance and Do No Harm requirements and criteria that focus on ensuring safety of flight for the primary mission, other rideshare payloads, or to any operational aspect of the launch. Where possible, the guidelines and requirements included in the updated NASA SMD RUG mirrors the United States Space Force (USSF) RUG, to allow NASA payloads to be compatible with Space Force rideshare opportunities and Space Force payloads to compatible with primary NASA SMD missions. The SMD RUG is included in all NASA SMD ESPA-class payload solicitations to support secondary mission developers, including principal investigators, concept development teams, and project teams in conceiving and preparing their mission submissions.

For SMD Rideshare inquiries, contact the SMD Rideshare Office at:
HQ-SMD-Rideshare@mail.nasa.gov