National Aeronautics and Space Administration

21st Annual Small Payload Rideshare Symposium

NASA Wallops Overview of Rideshare Mission Integration Capability

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WALLOPS FLIGHT FACILITY
WALLOPS ISLAND VIRGINIA

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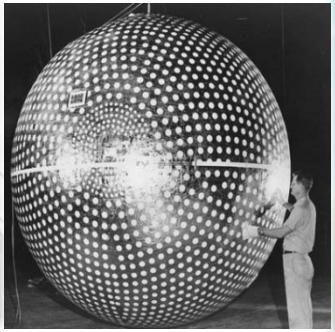
Wallops History

National Aeronautics and Space Administration

Small Payload Rideshare Symposium

- 1940's: Supersonic aircraft design tests
- 1950's & 60's: Early human spaceflight technology tests
- 1970's to present: Science & technology missions
- 16,000+ total launches conducted during 74 year history
- ~40 satellite missions launched (1st launched 2/16/61)



Wallops Overview

National Aeronautics and Space Administration

Salient Features Today

- *Wallops provides agile, low-cost flight and launch range services to meet NASA science, government and commercial sector needs for accessing flight regimes worldwide from the surface to the moon and beyond*
- *285 NASA civil servants, 850 contractors, and 600 tenant personnel*
- *$1.2B in assets on Wallops Island*
- *Mobile assets provide world-wide range capability*
- *Celebrating 75th Anniversary in June 2020*

Rideshare Focus

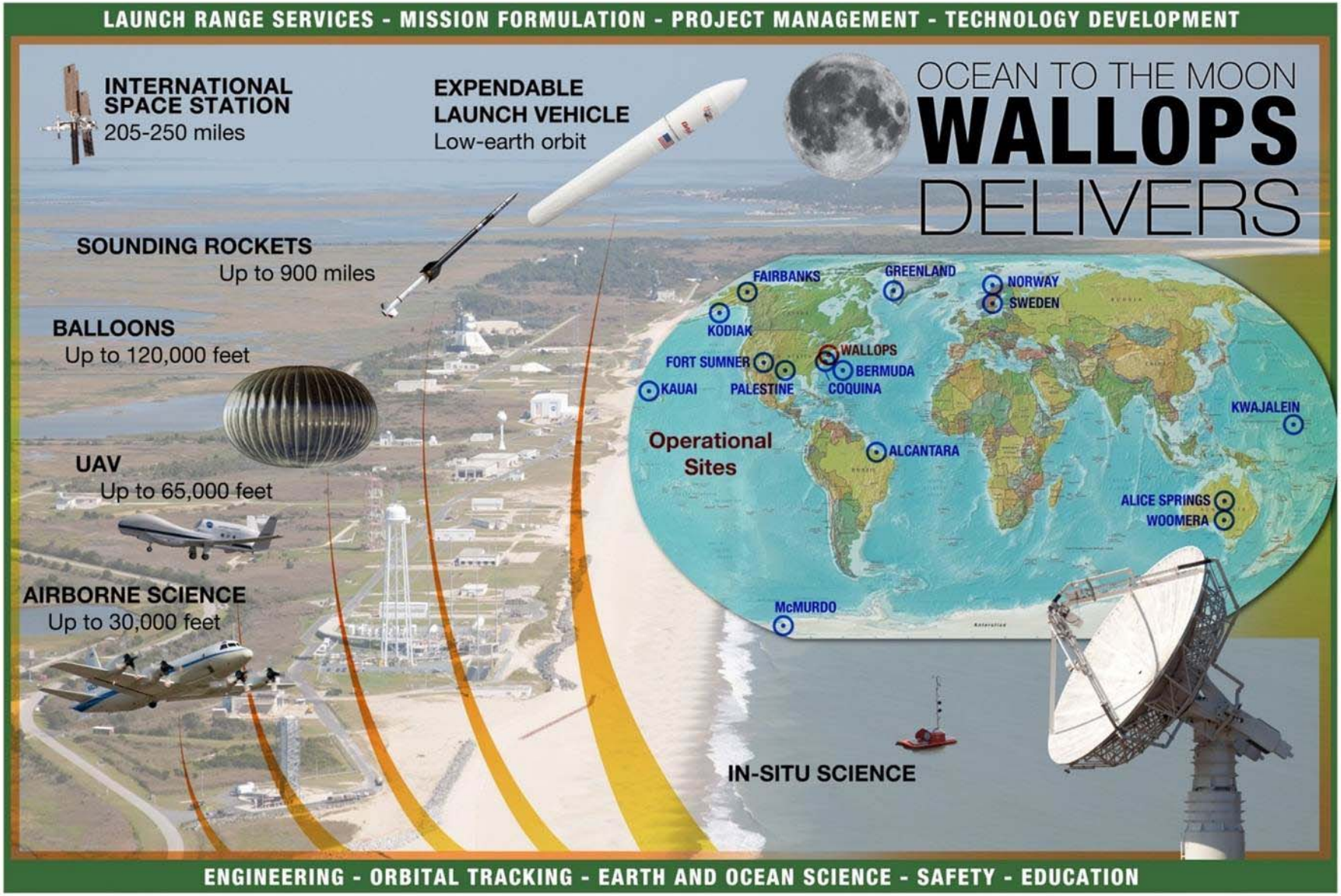
- *Demonstrate capability and expertise to integrate multiple secondary payloads onto future Evolved Expendable Launch Vehicle Secondary Payload Adapter ESPA/ESPA Grande flight systems*

What We Bring

- *Highly experienced with spacecraft development, integration and test, combined with expert project management*
- *Expert Secondary Payload Integration Management*
- *Agile and Cost Effective Integration Facilities*
- *Suite of existing test chambers, machine shop and test equipment to support ESPA integration*

Wallops Core Programs Overview

National Aeronautics and Space Administration



Agency Driver

"The agency will plan to fly an ESPA ring with every science mission."

"We're not going to ask whether we need it. You have to convince us that we don't need it."

Credit: 2018 Small Satellite Conference

Why Wallops as Rideshare Integrator

- Background and experience to serve in the role of Rideshare System Integrator for missions utilizing ESPA and other secondary payload accommodations.
- Consistent with previous Wallops role in Shuttle era (GAS, Hitchhiker) where a proactive intermediary was necessary to move secondary payloads through the integration process
- Worked successfully as a Liaison between spacecraft, Launch Vehicle (LV) providers, and the Launch Services Program (LSP) previously: SMART team work with Launch Services Program (LSP) on the LADEE mission
- Relationship with LV providers on multiple fronts:
  - SpaceX Coupled Loads interfaces for the ISS-CREAM mission
  - Northrop Grumman via Cygnus spacecraft payload accommodations and secondary payload accommodation planning on the Antares upper stage
- Operates ideal Integration & Test facilities for ESPA and small spacecraft integration: High Bay processing facilities, Clean rooms, Environmental test facilities
- Currently managing SmallSats for Goddard, which is now evolving from CubeSats to larger ESPA-class SmallSats

Engineering Support

- Goddard's Engineering and Technology Directorate has 4 branches located at Wallops providing end-to-end engineering support for programs and projects
- Multi-disciplinary branches including Mechanical, Electrical, Software (includes Mission Planning Lab), and Systems Engineering/Guidance Navigation and Control
  - Rideshare: MGSE, EGSE, I&T process development, systems engineering, mission assurance support
- Reach-back and specialized support available from other Engineering Directorate personnel located at Goddard/Greenbelt campus.
  - Rideshare: Interface V&V, CLA awareness
- Contractor support is easily obtained from Indefinite Delivery Indefinite Quantity (IDIQ) Wallops Engineering Services Contract (WESC).
  - Rideshare: Integration & Test personnel ("Touch Labor")

Partnership Highlight

- Mid-Atlantic Regional Spaceport (MARS)

Get Away Special as a Model

- Initiated as a method for adjusting Orbiter gravimetrics, Get Away Special evolved into Hitchhiker and resulted in an entire program of flight opportunities for over 20 years
- Standard pre-qualified hardware
- Standard processes; “payload customers” participated within well-defined boundaries (Fit in the box or you don’t fly)
- Payload customers did not have to understand the “LV interface”

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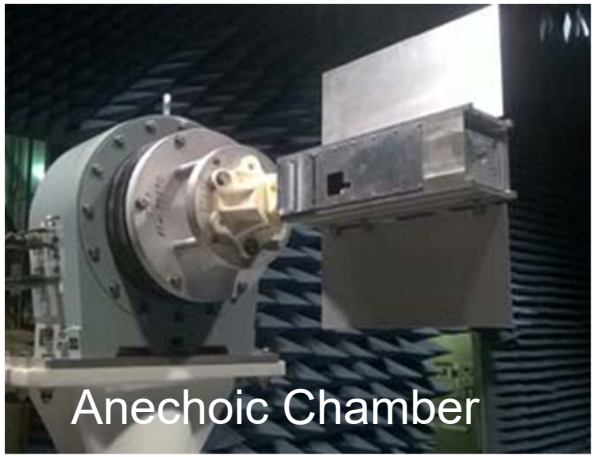
F-7 Integration Facility

- Renovated in early 2000's specifically for integration and test of small payloads and spacecraft
- Facilities aligned with ESPA Concept of Operations
- High Bay Cleanroom
  - High Bay – 60'L x 40'W x 30H – 2,400 SF; Class 100K (Level 4) CWA
  - High Bay 2– 60'L x 30'W x 40'H – 3,200 SF; NCWA
- Offline integration spaces
- Supporting test areas (T-Vac, EMI/EMC, etc.)
- Fabrication support
- Transient office space for project personnel

High Bay Cleanroom



Anechoic Chamber

LDSD Mission Tvac

H-100 Integration Facility

- High bay clean room processing
- Offline integration spaces
- Transient office space for project personnel
- Past use by Max Launch Abort System shown on lower left
- Currently utilized for Cygnus ISS Cargo mission integration shown on lower right
- Proximity to WFF airfield (by design)

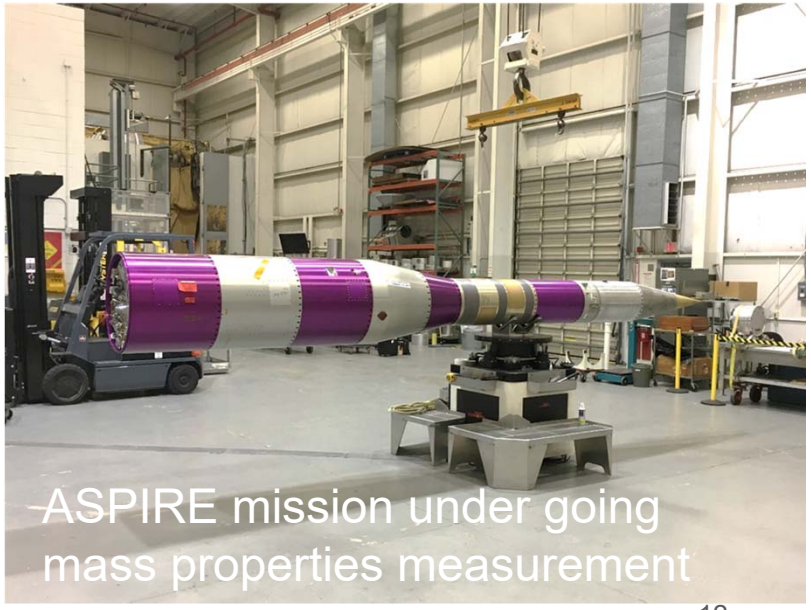
F-10 Sounding Rocket Facility

- 26,000 square foot machine shop
- Capabilities include developing and fabricating mechanical systems, optical instrumentation, and payload components for flight research
- Environmental testing of complete payloads, subassemblies, and components verifies flight readiness when exposed to an intended flight environment


Machine Shop & Fabrication


Spin Balance


Vibration Testing

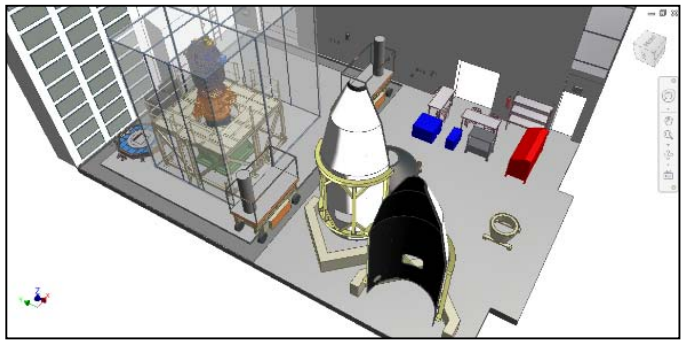

ASPIRE mission under going mass properties measurement

Delivery of ESPA to Launch Site

- Wallops Airfield.
  - Runway 04/22: 8750 ft. x 150 ft.
  - Runway 10/28: 8000 ft. x 200 ft.
  - Runway 17/35: 4820 ft. x 150 ft.

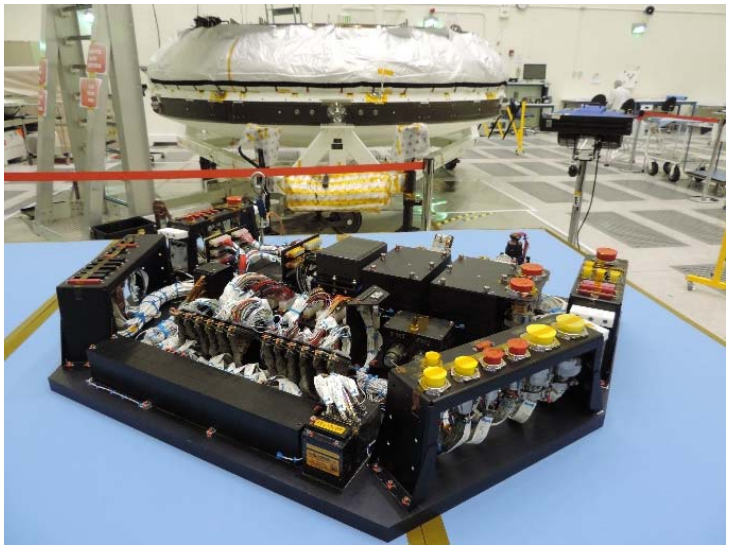
Past Example at WFF: LADEE

- Lunar Atmospheric & Dust Environment Explorer (LADEE):
  - NASA Ames spacecraft with GSFC instruments
  - Required unique processing prior to integration with LV
  - WFF utilized unique facilities and engineering experience with small payload processing to accomplish mission
  - WFF worked closely with KSC's LSP on LV interfaces
  - Utilized virtual I&T pathfinder modeling shown below to plan complex I&T flow



Past Example at WFF: LDSD

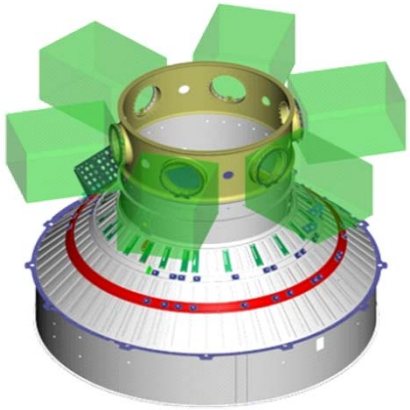
- Low Density Supersonic Decelerator (LDSD):
  - Balloon-dropped re-entry vehicle developed by JPL
  - Wallops designed, built and tested avionics pallet for 3 test vehicles
  - Successfully launched two from United States Navy's Pacific Missile Range Facility on Kauai, Hawaii



Past Example at WFF: ISS-CREAM

- Converted NASA Balloon scientific instrument to an International Space Station instrument which was installed on the Japanese Experiment Module (Exposed Facility shown on bottom right)
- Provided project management, engineering design & analysis, fabrication, safety oversight, integration & test services
- Integration of primary and secondary instruments occurred in Wallops F-7 Clean Room
- Worked closely with SpaceX (photo below) on their custom FSE (attach hardware to Dragon), working issues with coupled loads and thermal analysis

Integrator Capability Snapshot

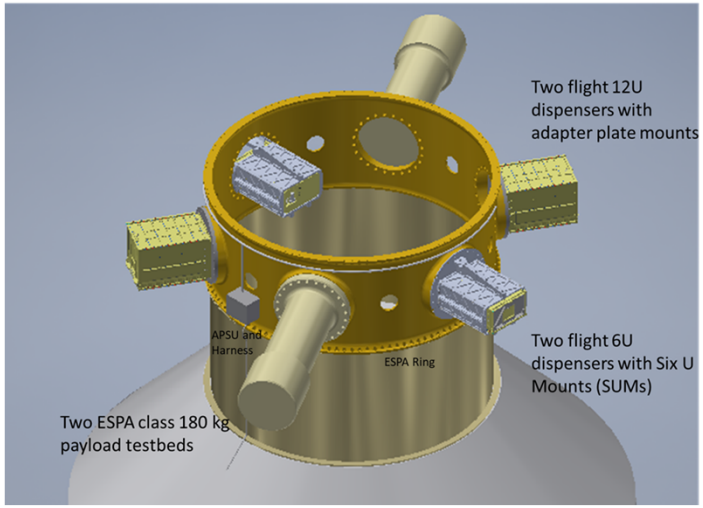


- Provide integration facilities and all ground support equipment necessary for the receipt, assembly, integration and test of the ESPA Integrated Flight System.
- Design, develop, integrate, and test ESPA Integrated Flight System including deployment mechanisms.
- Manage and perform the physical integration of RPLs to ESPA including the development of operational procedures for mating of RPLs to ESPA
- Deliver the ESPA Integrated Flight System to the launch site and acquire appropriate Department of Transportation approval.
- Support launch integration planning activities for the integrated ESPA Flight System.
- Support stack-mate between the ESPA Integrated Flight System and the primary payload, payload fairing encapsulation of the combined stack, and launch site processing of the launch stack including the integrated ESPA Integrated Flight System at launch site.
- Support contingency planning and operations at the launch site.

Landsat 9 ESPA Flight System (L9EFS)

- L9 EFS, similar to the silver ring shown at right, is a co-manifested spacecraft riding under Landsat 9, stacked on an ATLAS V, launched from Vandenberg Air Force Base
- It is a separate project from Landsat 9, but will be closely associated with L9 for ensuring no harm is done. This is the prime requirement for L9EFS.

L9 ESPA Flight System Baseline



- L9 EFS is a NASA project funded by the USAF as a pathfinder to demonstrate the capability of integrating and delivering to orbit up to six secondary payloads on an adapter ring
- NASA Goddard will manage all aspects of the project, though NASA Kennedy's Launch Service Program will provide launch vehicle services and Wallops will integrate the EFS
- It is intended that this will streamline future EFS Rideshare opportunities for projects such as JPSS2 EFS and possibly PACE EFS

QUESTIONS

BACK-UP SLIDES

Integration Flow at WFF