



WALLOPS
RANGE



Wallops: The Management of Rapid Change

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Chief, NASA's Wallops Range

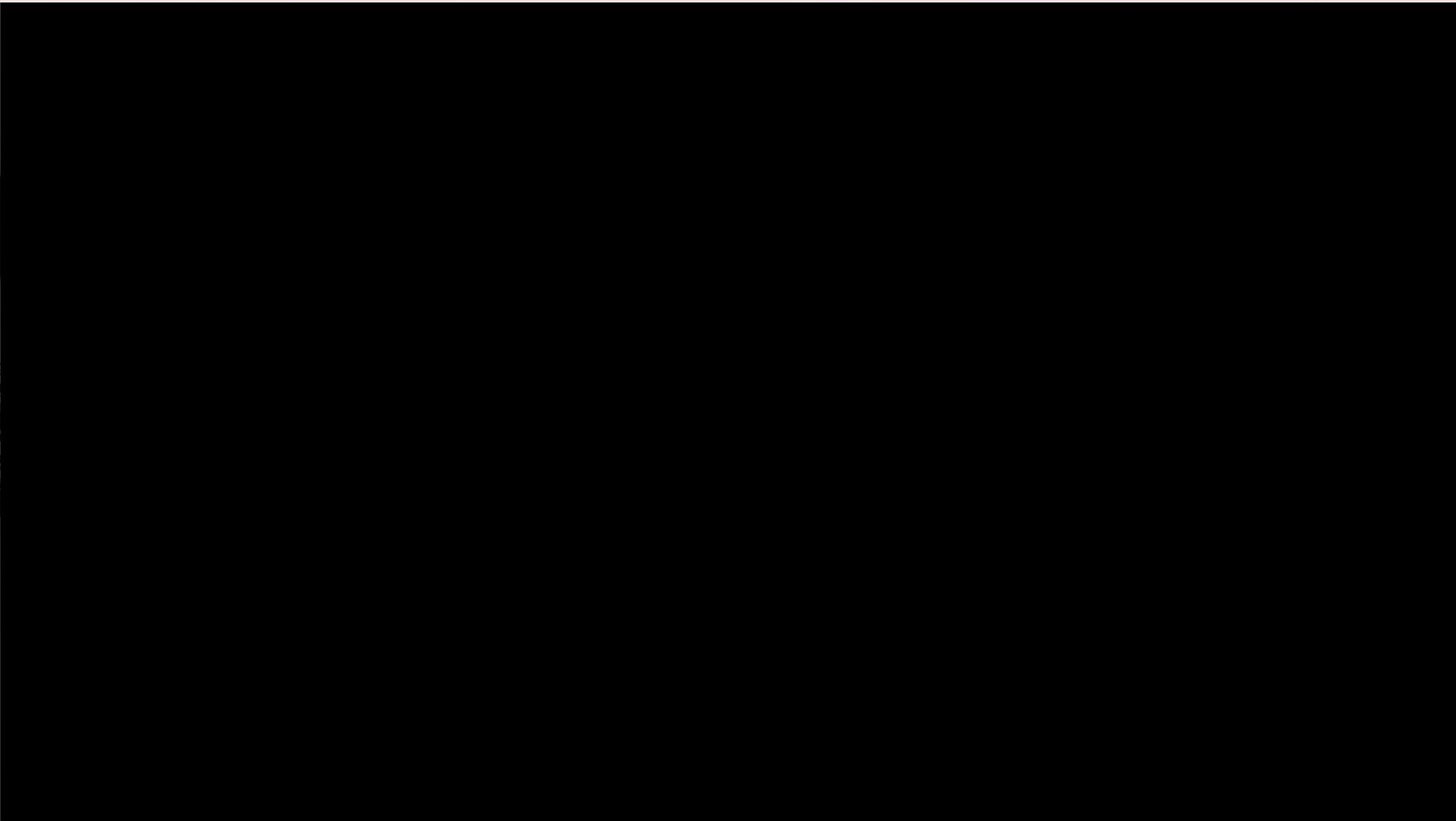
2007

2013

History and Wallops Overview



Wallops Research Range History



A unique national resource, Wallops Flight Facility's Research Range enables flexible, low-cost space access, in-flight science, and technology research for all of NASA and the nation. It is the only launch range that NASA owns.



Wallops Research Airfield

Enabling Science from Earth to Orbit and Beyond

- Vehicle Development and Risk Reduction Missions
- Proof of Concept Missions and Technology Testing
- Partnered with Mission Directorates and Centers



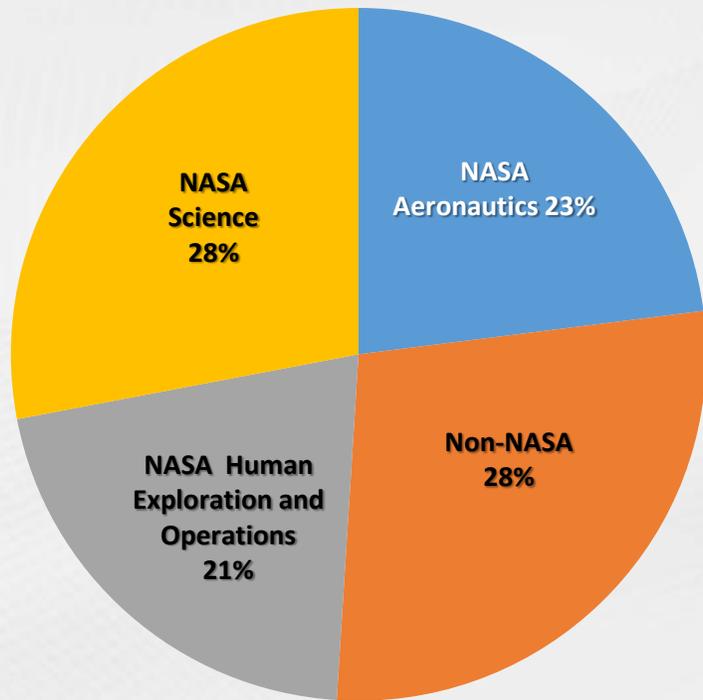
Wallops Island Launch Range

Island Facilities

- Southern 1/3 is dominated by Launchers and the UAV Runway
- Middle 1/3 is Mission Integration Facilities and Storage
- Northern 1/3 houses Instrumentation and Payload Processing Facilities as well as Navy Facilities

Wallops Range Usage

Average Annual Range Usage



HUMAN EXPLORATION AND OPERATIONS

Wallops Launch Range



The Wallops Range Charter

Provide operational access to orbital and suborbital flight regimes for NASA and for the Nation and serve as a “test range for ranges” to improve national range capability

- **Support:**
 - NASA Science & Technology (primary)
 - Department of Defense & other Government Agencies
 - Commercial Industry
- **Full suite of support services:**
 - Launchers
 - Processing Facilities & Logistics
 - Range Safety
 - Tracking & Data Services
- **Specialized focus:**
 - Suborbital & Small Orbital Launch Vehicles
 - Experimental Vehicles & Payloads
 - Responsive & Low-Cost Missions



The Flexible Organization

Sounding Rockets
Expendable Launch Vehicles
Aircraft
Mobile Campaigns
Balloon Program



Sounding Rockets: At Wallops

Suborbital flights are the core mission set

- NASA-sponsored science
- DoD (USN, MDA)
- Commercial

Sounding rockets demand responsiveness

- Short lead times
- Complex tracking and data acquisition requirements
- Transient science conditions
- Payload recovery

Campaigns require great flexibility

- Poker Flat, Alaska
- Norway
- Kwajalein Atoll



MRL Launcher

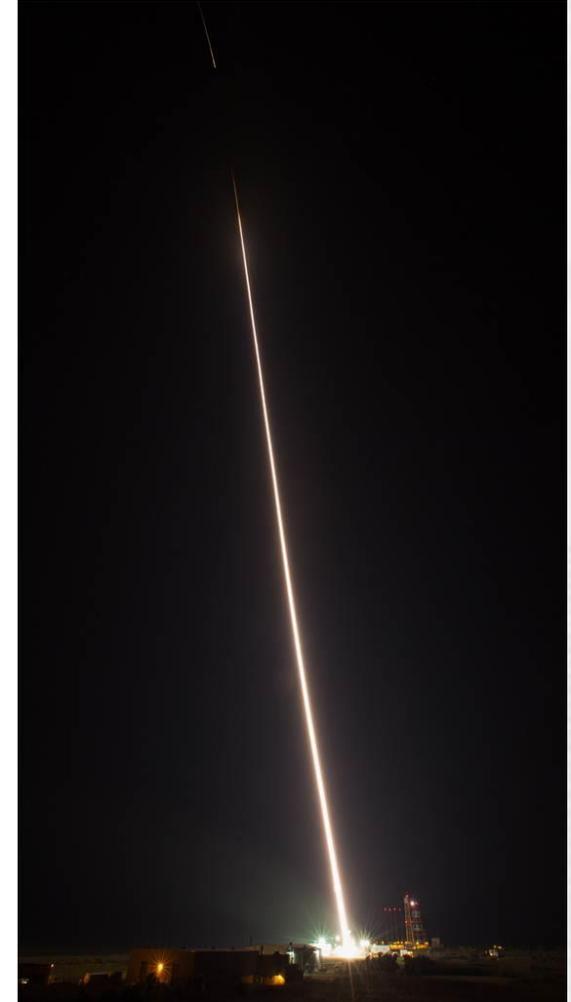
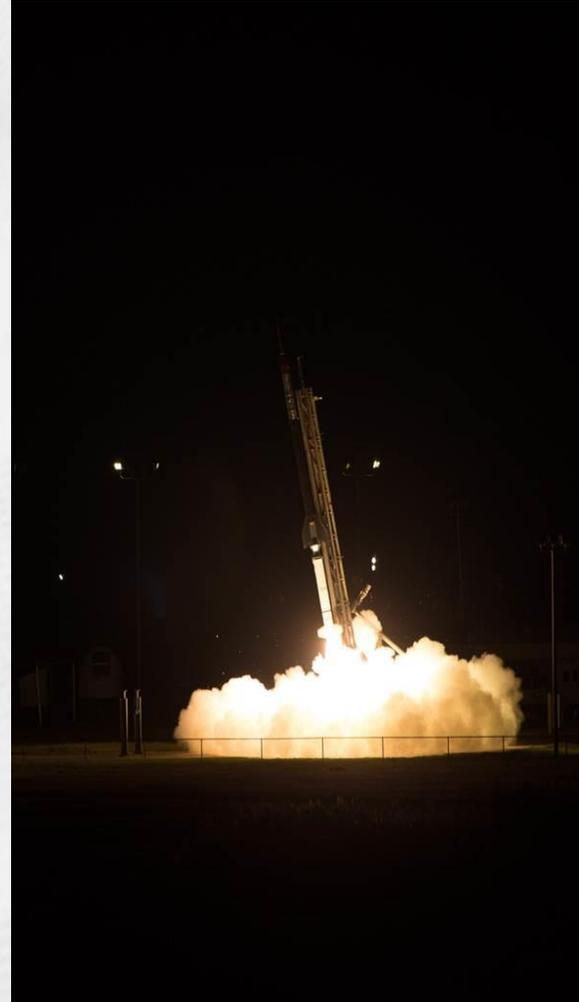


Mobile Range in
Norway

Sounding Rockets: Fast and Efficient

Hall Test Flight

- A sounding rocket test to verify fixes following a flight failure
- Necessary to enable science mission to follow one week later
- Project inception to launch in five weeks: Extreme project management approach and activities performed in parallel drove mission success
- Planning and configuration completed for Telemetry, Timing, RF, Precision Radar, Surveillance Radar, Data Processing and Display, Air and Sea Surveillance, Optical, Communications, and Meteorological Operations
- Flexibility and hard work paid off - Two successful launches within one week of each other



Sounding Rockets: Complex Requirements

FTX-19

- Three launch salvo to support MDA and US Navy fleet missile defense exercise
- Three Terrier-Oriole vehicles successfully launched in succession within 20 seconds from Wallops Flight Facility
- Wallops developed complex tracking plan and range support
 - Eight Telemetry assets for independent tracking, receiving, and relaying, recording, and readout capabilities.
 - Five fixed and mobile radars
 - High-speed video systems to capture motor ignition, umbilical release and vehicle egress from the rail as well as optical tracking data through flight
 - Launch System Integration Range surveillance
- Coldest February on record at Wallops



Mobile Campaigns: Norway, Alaska, Bermuda



Mobile: Norway/Alaska

- Wallops typically supports campaigns from Poker Flat Research Range (PFRR) in Alaska or Andoya Space Center (ASC) in Norway
 - PFRR is semi-permanent site; systems shipped to PFRR only when in-place systems are not adequate to meet requirements
 - ASC is a mobile range where all support systems are shipped from WFF
- Deployment planning begins at least six months prior to mission support
- Operations/Engineering personnel analyze the requirements to determine which assets are needed
- Set-up trips conducted in the summer to avoid the poor weather and test they systems well ahead of operations
- One month prior to first required support, a team of operators travel to the site to finish site preparations and perform integration testing with the vehicle
- Launch support is requires two-week deployment depending on type of mission (and cooperation of science conditions)
- Mobile Deployment Challenges:
 - Extreme cold temperatures
 - Minimal crew deployed
 - On-site spares and repair capabilities limited
 - Operating in a foreign country (Customs, ITAR, language, etc)



ELV: Rapid Expansion

Orbital won the initial Commercial Resupply Services (CRS) contract in 2008: Wallops chosen as launch site location by Orbital Sciences Corporation (Now Orbital-ATK). First Antares launch from Wallops in 2013!



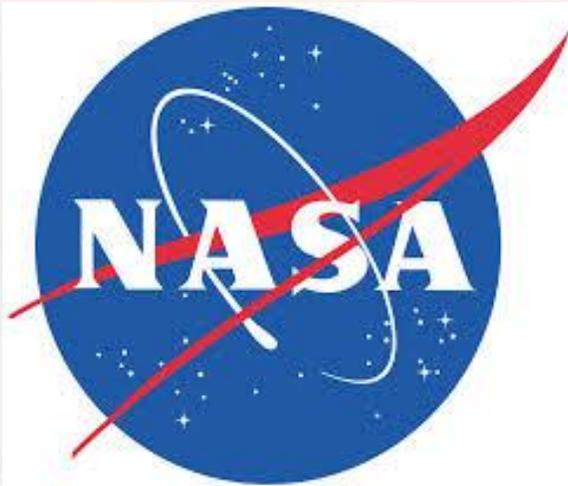
ELV: Infrastructure Development for ISS Resupply

Quick Development of Range Capabilities

- Significant upgrades to Wallops Ground processing had to be completed in short order to launch a liquid first stage with cargo for the International Space Station
- Ground infrastructure efforts included:
 - Pad OA and Liquid Fueling Facility (MARS)
 - Horizontal Integration Facility
 - Spacecraft Processing
 - Spacecraft fueling site: Hypergolic fuels



ELV Partnerships



Mobile: Bermuda

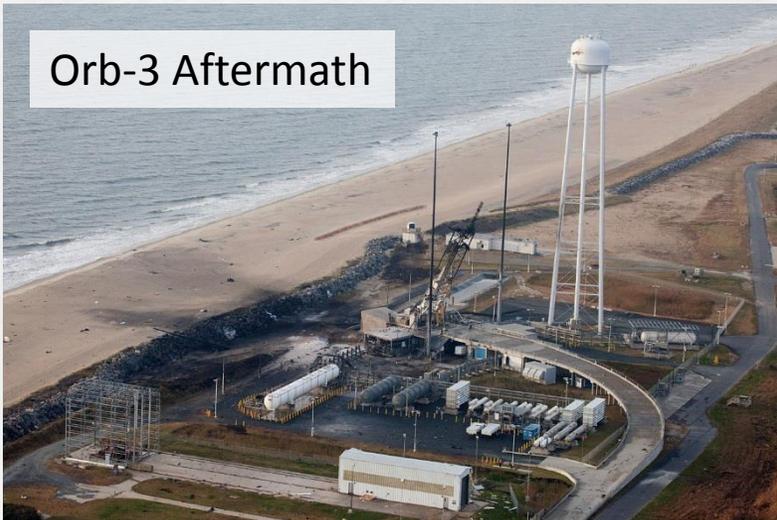
- Antares launches require deployment of a tracking site to Bermuda
 - Telemetry
 - Radar
 - Command
 - Power
 - Communications
- Support agreement between NASA/Bermuda developed by Wallops to enable this critical support
- Wallops developed solution to provide real-time data back to the Range Control Center to meet Safety and customer requirements



ELV: Orb-3 Failure and Range Recovery

- After four successful Antares missions, Orb-3 failed shortly after liftoff (28 Oct 14), causing great damage to the launch pad, as well as support facilities across an extensive area of the range
- The next day Wallops was working with its partners to assess damage to the facility, create a path forward to support future ELV launches from Wallops and repair damaged infrastructure
- One year after: Wallops is ready to once again support ELV missions with an improved posture
 - Pad Rebuild Complete 30 Sep 15
 - Performance Testing Complete 6 Nov 15
 - 50K Sounding Rocket launcher relocated further from Pad 0A
- Current Antares schedule:
 - New Antares engine testing scheduled for the end April
 - OA-5 likely to launch in June

Orb-3 Aftermath



Pad-0A Recovered



50K Launcher Relocated and Rebuilt



ELV: Orb-3



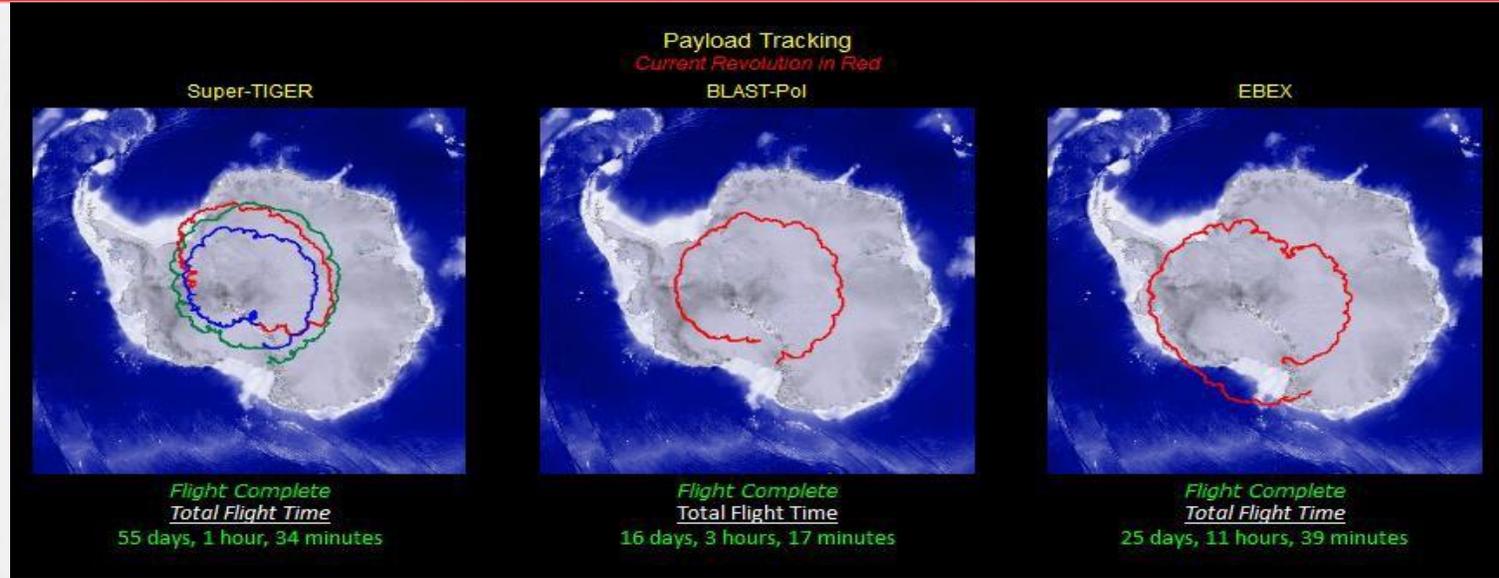
Wallops Airfield: Dynamic Use

- Our airfield hosts multiple customers with a diverse mission set during each year
 - Resident NASA aircraft conducting science missions
 - US Navy airframe testing (Patuxent River)
 - US Navy Field Carrier Landing Practice
 - NASA/NOAA Global Hawk hurricane science
 - NASA/DoD/Commercial UAS development
- DoD customer funding has enabled ongoing runway/hanger upgrades
- WFF is designated test site for Mid-Atlantic Aviation Partnership

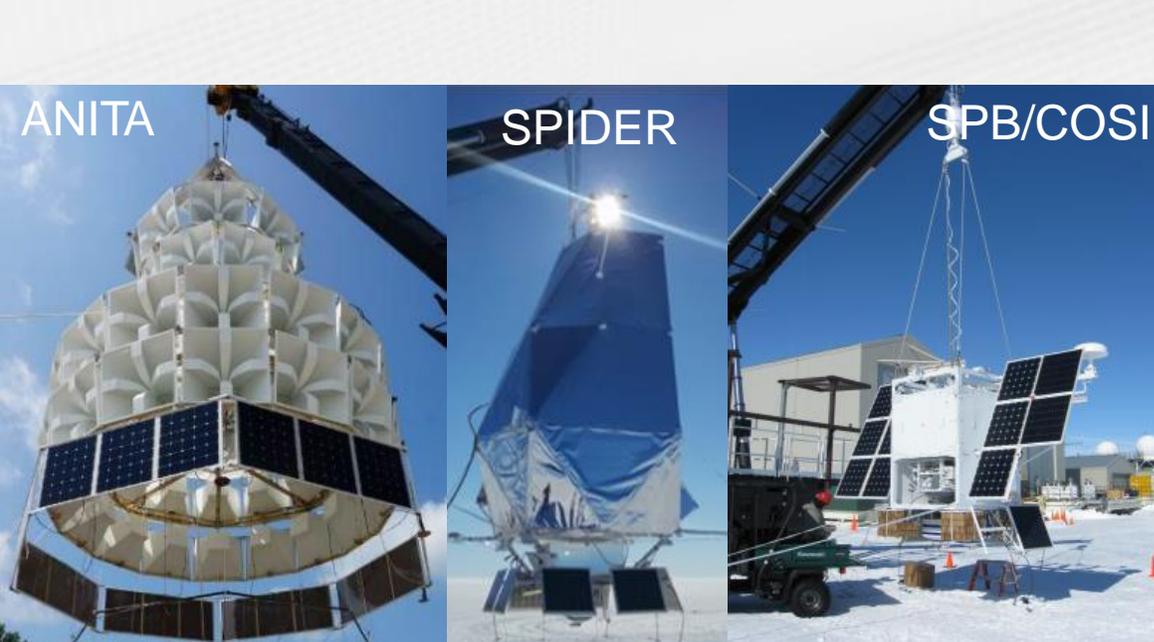


Balloon Program

- Worldwide mission capabilities
- Low-cost, long-duration flights capable of collecting high-altitude data for extended periods



FY15 Antarctica Payloads



The Backbone of Flexibility

Onsite Capabilities
Mobile Capabilities



Our Backbone: Onsite Capabilities

Wallops Range Control Assets



Aeronautical Control Center



Safety



Breakout Room



Air Control Tower



Range Control Center



Data Acquisition & Processing Room



Surveillance

Our Backbone: Onsite Capabilities

Wallops Island Fixed Radar Assets

Not Pictured:
WISSRDS-S Sea
Surveillance Radar



Our Backbone: Onsite Capabilities

Wallops Fixed Telemetry Assets



8 Meter



3.0 Meter

Receiving & Readout
N-162



9 Meter



7.3 Meter #1 & #2



2.4 Meter

Our Backbone: Onsite Capabilities

Wallops Island Meteorological Assets



**300-Foot
Anemometer Tower**

**160-Foot Tower
Wind Weighting**



**Met Ops
Balloon Facility**



**Atmospheric Science
Research Facility**

SPANDAR

UHF Radar

Our Backbone: Onsite Capabilities

Wallops Optical Tracking Assets



Camera Station X85



Camera Station V100



Camera Station U80



**Camera Station M1
Mobile Platform**



Camera Station X65

Our Backbone: Mobile Capabilities

Wallops Range Mobile Telemetry Assets

Other Mobile TM Systems:

20 Foot

7 Meter #1

7 Meter #2

10 Foot



Mobile Integrated Telemetry System



**Mobile Operations Center
(Part of Transportable
Command and Telemetry
Systems - TCATS)**



**Directional Command and
Tracking Antennas
(TCATS Antennas)**

Our Backbone: Mobile Capabilities

Wallops Range Radar, Telemetry & Command Assets at Bermuda

Radar 8

7-Meter #1

Mobile Integrated
Telemetry System

Mobile Power System #1

Radar 8 Control Van

Mobile Command
System #1A



Wallops Assets at Launch Range in Alaska



Partnerships at Wallops

Navy: FCLP, PAX, Aegis

MARs/ Orbital

Other NASA centers

NOAA



Navy: SCSC, FCLP, PAX

Wallops' partnership with the Navy allows for amazing opportunities

- **Field Carrier Landing Practice:** E-2 and C-2 pilots practice landing on a simulated aircraft carrier in order to qualify for carrier operations. We host multiple detachment of 150 personnel multiple times each year to qualify new pilots and refresh qualified pilots with safe daily operations.
- **Surface Combat Systems Center:** Our Navy tenant has based its Aegis training facility on Wallops Island to provide a location close to Norfolk for students to get hands-on experience without the cost of training at sea
- **Patuxent River Aircraft Support:** Providing Range services for the test and development of Navy aircraft has been an ongoing project at WFF since 1996. Requirements are primarily for Patuxent (PAX) River Navy Test Flights of the F-35 Joint Strike Fighter (JFS) to relay telemetry from the aircraft through Wallops and back to PAX. The Range also supports additional Navy aircraft events for the F-18 Hornet, P-8 Poseidon, MH-60 Romeo helicopters, and MQ-4C Triton as requested.



MARS and Orbital ATK

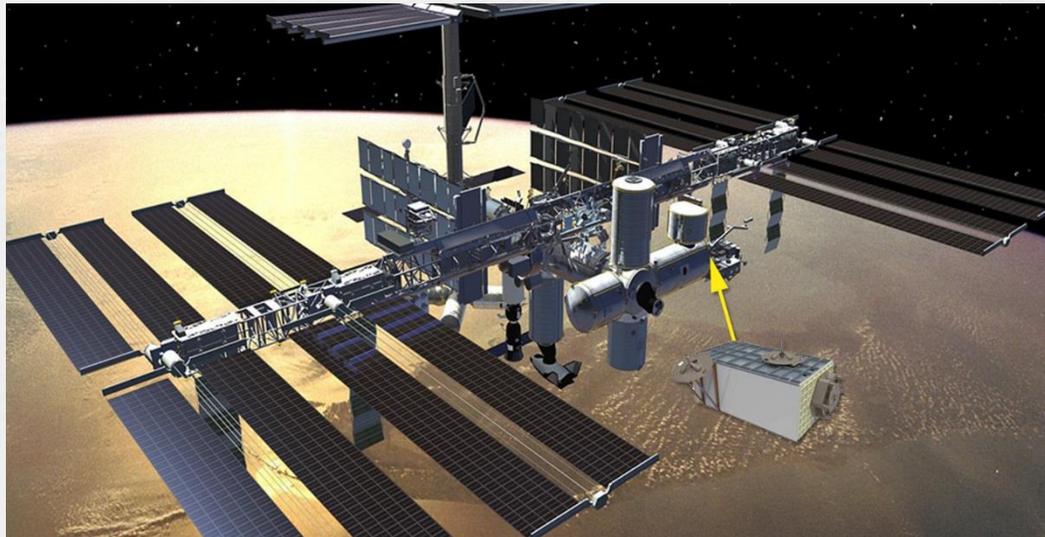
A beneficial partnership between the state of Virginia, a commercial company and NASA working together for the advancement of scientific discovery



Other NASA centers

Wallops has a strong relationship with other NASA centers and collaborates on projects

- Armstrong: Hurricane Sentinel (HS3)
- Goddard and KSC: ISS CREAM
- JPL: Long-Duration Supersonic Decelerator (LDSD)



NOAA is a long term tenant at Wallops and provides the nation with up-to date weather information available to the public.

The support NOAA provides the nation and Wallops makes Wallops Flight Facility a stronger operational hub than if the two agencies were not co-located



Key to Success



Keys to Our Success: Lean and Flexible

Wallops Range has a relatively small staff of civil servant and contracting personnel conducting an diverse and changing mission schedule while also completing engineering project to advance Range capabilities

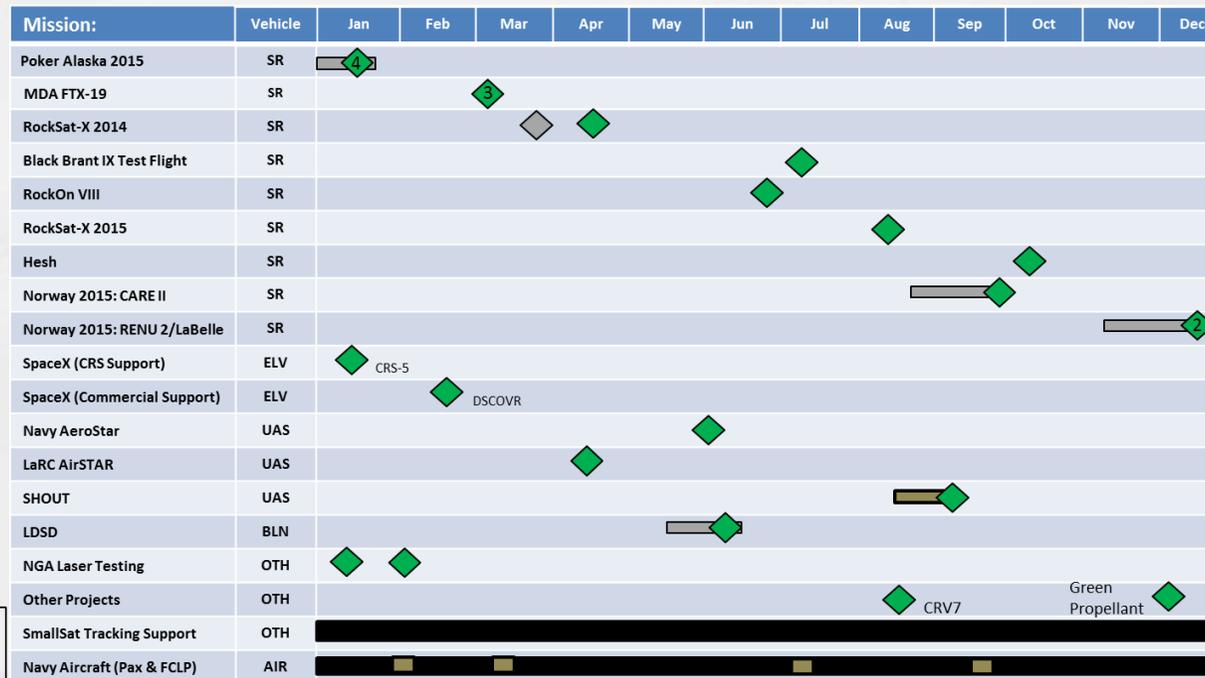
A Year in Review 2015

10 Sounding Rocket Missions

Deployments to Alaska, Hawaii, and twice to Norway

3 UAS Missions including a long duration detachment

4 Navy FCLP detachments



Vehicle Types:
 SR: Sounding Rocket
 ELV: Expendable Launch Vehicle
 UAS: Unmanned Aerial System
 BLN: Balloon
 AIR: Aircraft
 OTH: Other

Completed Mission
 Scrubbed Mission
 Scheduled Mission
 Remote Campaign
 Detachment
**The number inside the diamond signifies multiple launches*

Keys to Our Success: Knowledgeable staff



Program Manager Jack Vieira and Range Services Manager Dawna Marr discuss the MDA Shark launch.



Jeff Reddish puts in his donation for the Fed Families Stuff a Rocket event. The event collected 175 pounds of food, which helped surpass the 1,000 pound mark to 1,127 collected for the summer.



Jordan West and John Dickerson have their pre-launch lunch.



Delaware Sen. Tom Carper receives the Wallops Range Annual Report from Range Deputy Chief Robert Jameson.



From left, Brian Abresch, Eugene Guidry, Center Director Chris Scolese, and Dr. Michael Gazarik observe the Low-Density Supersonic Decelerator project.



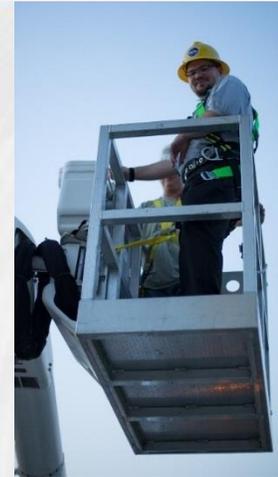
Mission Operations Lead Joe Jimmerson is on point for the MDA Shark launch.



John VanKleef prepares to set the clock for the mission.



Bob Swift checks the telemetry readouts before a mission.



Jason Rausch practices his height training.



Lauren Neely looks over her mission checklist.

Keys to Our Success: Selective Upgrading

- **Range Control Center**

- Built in 1993 with numerous incremental changes to system
- Video wall, main room console furniture, and individual video displays at each user workspace have not been upgraded for 15 years

- **Complete overhaul objectives:**

- 1) Replace the existing video wall a new LCD-based video wall to display multiple modern HD formats
- 2) Replace the existing eight consoles on the RCC main floor with 32 user workspaces, to allow for increased demand from range customers
- 3) Replace the existing monitors at each user workspace with higher resolution monitors in laptop friendly stations
- 4) Replace the existing analog video distribution subsystem with digital HD
- 5) Remove existing motorized wheelchair lift and build a fixed wheelchair ramp to conform with ADA standards
- 6) Improve location of HVAC vents to better balance the airflow for equipment and personnel comfort



Keys to Our Success: Selective Upgrading

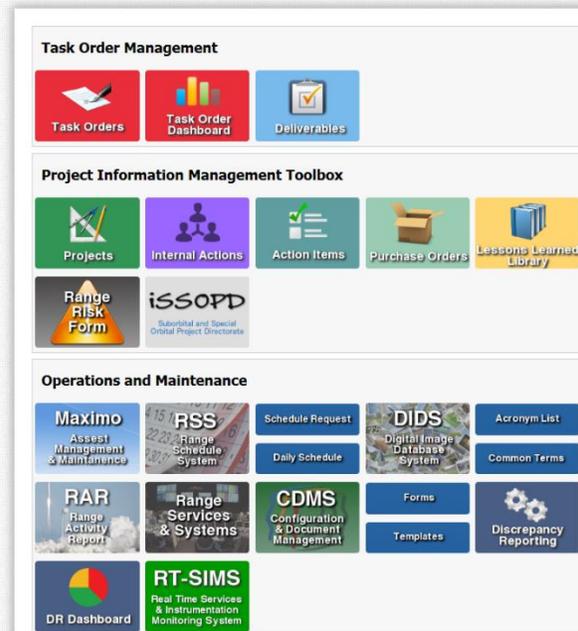
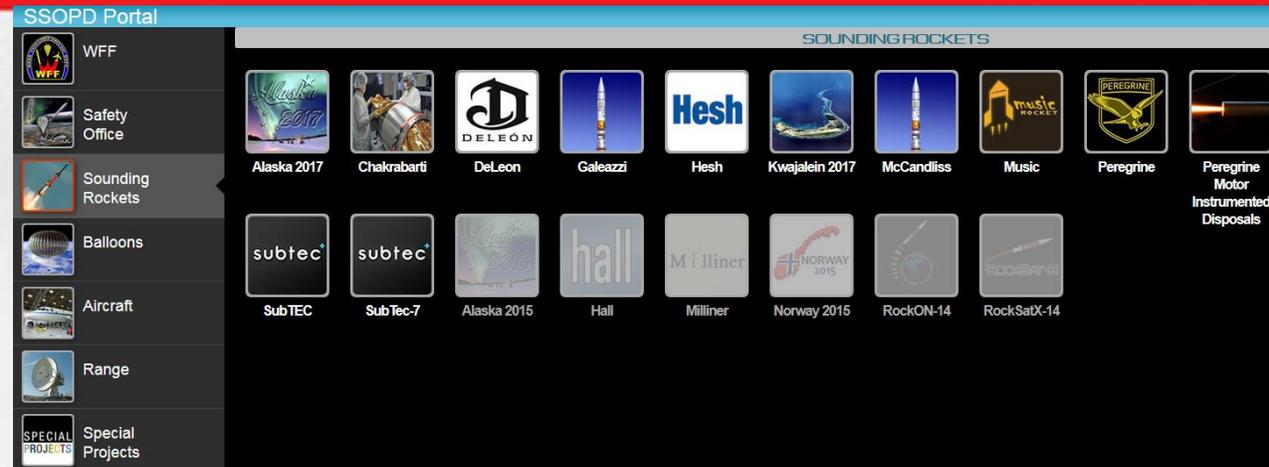
- Mobile Optical Tracking Station (MOTS)
 - Go-anywhere, high-definition video tracking
- Mobile Integrated Telemetry System (MITS)
 - Redundant multiple-link mobile system specifically designed for Antares deployment support
- Transportable Command and Telemetry System (TCATS)
 - Two complete integrated self-sufficient mobile systems



Keys to Our Success: Selective Upgrading

- Wallops Range has developed and fielded multiple internet-based tools to provide faster communication at different levels of project management

- SSOPD: Management staffing and documentation repository
- ROMS: Range schedule, project management, Action Item tracking, Lessons Learned, maintenance tracking, configuration management, imagery search and storage, discrepancy reporting
- OTS: Task assignment and tracking system



Due to Wallops' agility and smaller size we are often capable of providing services at costs significantly lower than other Ranges

- The process for conducting a project at Wallops Flight Facility varies depending on the type of project and the type of customer organization. In general, the process follows the paths described below:
 - Contact is initiated with the Advanced Projects Office to discuss feasibility of a prospective project
 - If NASA/Wallops and the customer agree that the project is feasible, frequently a Technical Interchange Meeting is scheduled (usually at Wallops) to familiarize Wallops personnel and identify key issues and actions
 - Wallops and the customer agree that technical and schedule requirements can be met
 - Wallops and the customer establish necessary terms and agreement



Negotiating Roadblocks



Negotiating Roadblocks: Range Clearance

- Hazard Area Clearance:

- There are more than 20 fishing tournaments per year that can impact our ability to launch
- Close communication with local captains and robust planning is required
- WFF employs commercial aircraft (radar and visual), commercial boats, the USCG and VMRC to clear potential range foulers



- Offshore drilling and windmill encroachment

- There is a potential of offshore drilling and wind power generation off of the Atlantic coast near Wallops. Currently working with federal agencies to identify the impact to the services Wallops provides the nation as part of the cost/ benefit analyses of any new activity.

Negotiating Roadblocks: Bermuda Site Development

- To reduce maintenance and replacement costs for systems deployed to Bermuda, WFF is currently implementing plan to protect our assets utilizing a hardened facility and radomes
 - Challenge to obtain NASA and State Dept approvals for modifications to operations center (unoccupied on-site building owned by Bermuda government)
 - Scheduling upgrades to occur between Antares missions
 - Estimated operating cost savings of \$4.6M over five years

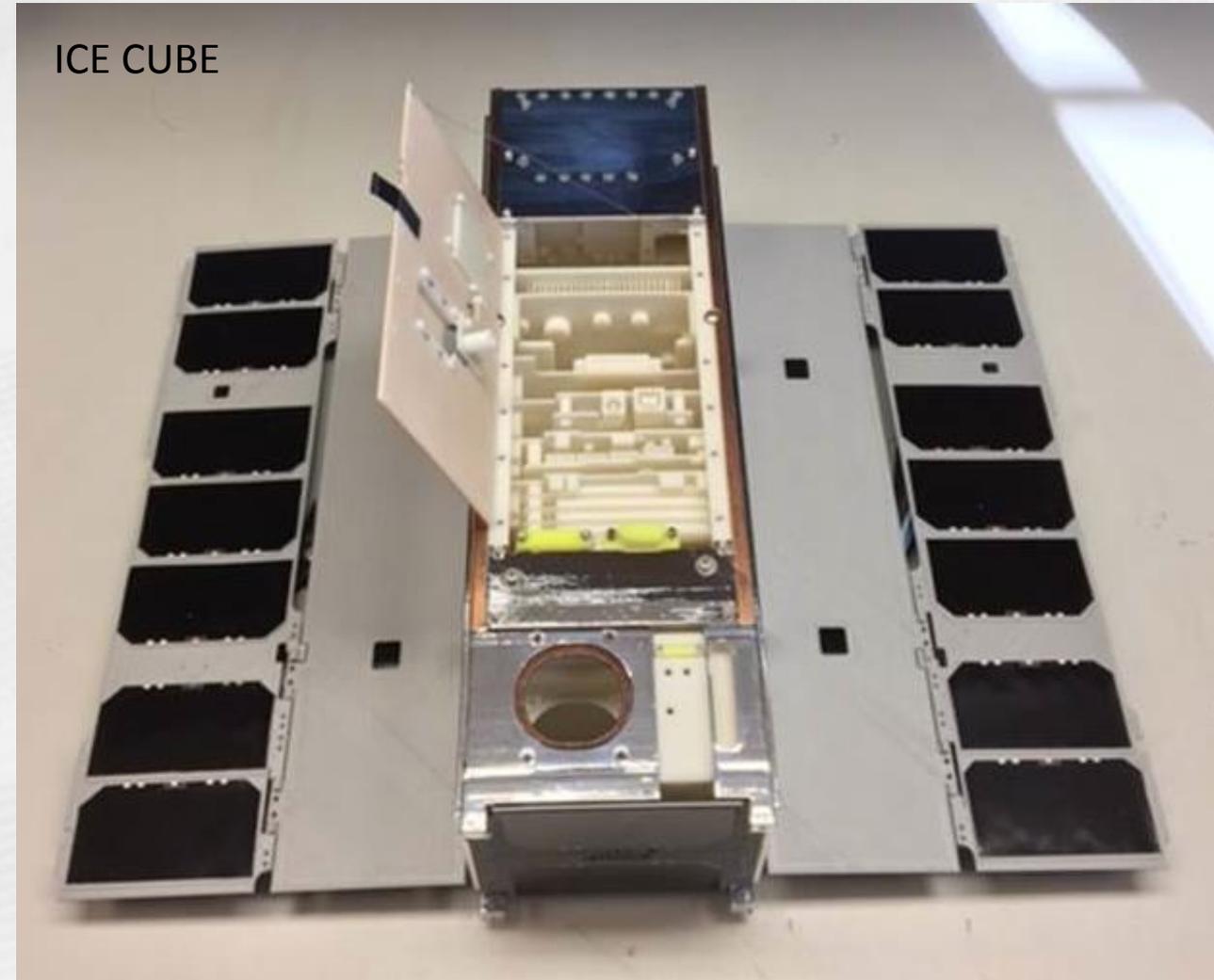


Looking Forward



Looking Forward: Small Sats

- Wallops is working with personnel from the Greenbelt campus to develop Cube Stats in-house. This provides a low-cost platform to gather scientific information from space
- Wallops 45' UHF antenna is high-demand asset for small sat communication
 - Upgrading capability to support ~10 customers simultaneously



Looking Forward: ISS

- **Award of Commercial Resupply Contract (CRS2)**

Jan. 14, 2016

RELEASE: 16-007

NASA Awards International Space Station Cargo Transport Contracts

NASA has awarded three cargo contracts to ensure the critical science, research and technology demonstrations that are informing the agency's journey to Mars are delivered to the International Space Station (ISS) from 2019 through 2024. The agency unveiled its selection of Orbital ATK of Dulles, Virginia; Sierra Nevada Corporation of Sparks, Nevada; and SpaceX of Hawthorne, California to continue building on the initial resupply partnerships with two American companies.



- Award of CRS2 to Orbital ATK ensures continued ISS Resupply operations from Wallops through 2019

Looking Forward: Navy Global Hawk

- US Navy considering Wallops as a site to base their Global Hawk operations
- Entails housing and operations for 6 airframes
- Proposed plan includes additional hangar space to accommodate and maintain the aircraft



Wallops Flight Facility



WALLOPS ISLAND, VA

Questions?

