Research Range Services

2015 Annual Report

National Aeronautics and Space Administration

Goddard Space Flight Center
Wallops Flight Facility

wallops range

Dedication

Larry Duffy

For more than 30 years, Larry served as the Launch Pad Manager at Wallops Flight Facility. In this critical role, Larry was instrumental in the successful launch of hundreds of missions over the years and led the Wallops Range team through a very successful transition to a NASA-critical launch site for commercial resupply of International Space Station cargo. Larry decided to retire in 2015 and his talents, leadership, and work ethic will be sorely missed by his friends at Research Range Services.

Roy Tolbert

Dedicating his professional life to Wallops Flight Facility for more than 30 years, Roy entered retirement in 2015. Roy set the standard for what NASA needs in the unique field of Range/launch support technician. After serving in the U.S. Air Force, Roy joined the Wallops community and supported launch operations with ordnance handling, rocket motor staging operations, unmanned aerial vehicle flights, and launch pad coordination and management. His retirement ends his time at Wallops but also marks a new beginning his friends at Wallops hope he enjoys.

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Research Range Services tackles challenging year

The Research Range Services (RRS) Program started Fiscal Year 2015 with an extremely challenging mishap when the Antares Orb-3 vehicle suddenly experienced a malfunction, resulting in the complete destruction of the vehicle. After the safety and security of everyone on and near the Range was secured, the long process of damage analyses and the eventual rebuild put RRS personnel to the test throughout 2015.

This past year also marked the 70th anniversary of the Wallops Range. The Range launched its first rocket on June 27, 1945, and on that very same day 70 years later, the Range was instrumental in sharing its story and history with thousands of visitors.

"Today, Wallops leads NASA's suborbital programs: airborne science, scientific ballooning, and sounding rockets," said Bill Wrobel, Wallops Director, in the Wallops 70th anniversary program. "Furthermore, Wallops is home to NASA's only owned and operated launch range, one of only four ranges in our nation where payloads can be launched into orbit."

RRS also tended to its normal mission-set during this time frame, which included another year of the Global Hawk conducting hurricane research, a Missile Defense Agency mission, Honda Jet completing water ingestion testing, student sounding rocket launches, and other missions. RRS' strong technical performance and Range readiness provided its partners the opportunity to successfully complete their missions.

RRS also continued its support of the project seeking to safely land crew and cargo on another planet, known as the Low-Density Supersonic Decelerator (LDSD). Testing is conducted in Hawaii but relies on RRS for project management, range surveillance and recovery services.]\

In all, RRS engineers and technicians supported more than 20 launch events at locations around the world, and at our home base of Wallops Flight Facility on the Eastern Shore of Virginia. RRS offered consistent superior support to a myriad of customers, including two of NASA's mission directorates, The Department of Defense, other U.S. government agencies, colleges and universities, civilian corporations and the worldwide scientific community. Services provided include tracking, telemetry, meteorological, optical, command and control, and Range operations services for the Wallops Range, Poker Flat Research Range (PFRR) near Fairbanks, Alaska, and other remote locations such as Cooper's Island, Bermuda.

Operations and maintenance make up only one component of the overall RRS mission. Fiscal Year 2015 saw measurable progress in many engineering efforts. World-class instrumentation systems sustainment and project management services helped to underwrite Wallops Range's widely recognized status as a low-cost, flexible, full-service, and customer-friendly launch facility. RRS project managers drove several engineering projects to completion, including a mobile command antenna control unit, surveillance radar at PFRR, a Range scheduling system, and a command Time Domain Multiplexers upgrade.

Systems and capabilities under the auspices of

the RRS Program include:

- A Range Operations Management System tool which allows effective management and control of launch range configurations and documentation, maintenance, operations scheduling, asset management, and discrepancy reporting, and a new digital imaging database for all NASA employees to utilize

- A fully equipped, state-of-the-art Range Control Center with a full complement of command and control equipment, as well as an extensive bank of monitors to provide real-time display of all flight events and Range status

- An aeronautical research airport with three runways, plus a separate runway dedicated to Unmanned Aerial Systems platforms

- Fixed and mobile radar systems for tracking launch vehicles, satellites, and aircraft

- Fixed and mobile telemetry systems to collect state-of-health, position, and science experiment data

- Fixed and mobile command and control systems to provide event commanding to vehicles in flight

- Fixed and mobile optical systems

- Ground-based and aerial video and photography, professional archiving, printing, and post-production services

- A comprehensive suite of meteorological instrumentation, radars and weather balloons used in collecting atmospheric measurements to provide real-time weather forecasts

- Radio frequency spectrum allocation, monitoring, management, and coordination

- Master station time equipment to synchronize Range activities and data

This Fiscal Year 2015 Annual Report highlights the projects that continued our long track record of successfully, safely, efficiently, and professionally enabling research worldwide. RRS is thrilled with our continued superior performance during this 12 month period, as well as the outstanding working relationship and partnership we enjoy with our customers and partners. Our goal is to make the Wallops Range the most successful, efficient, and economical Range facility available. We believe we are excelling toward that goal.

NASA Project Manager Jack Vieira and Range Services Manager Dawna Marr discuss countdown procedures during a recent mission. Photo Credit: NASA/Jamie Adkins

Program Management focuses on reaching mission goals

WALLOPS ISLAND, Virginia — The Range and Mission Management Office (RMMO) is a team of highly-skilled project management professionals charged with the responsibility of marrying the skills of scientists, engineers, NASA test directors, resource advisors, airfield managers, technicians, and other personnel into one cohesive team. Their objective is to conduct operations for data collection from many different flight platforms all around the globe.

Program Management Overview
Directorate: Science Mission Directorate
Division: Heliophysics
Program Executive: Mr. George Albright
Program Manager: Mr. Steven Kremer
Lead Center: Goddard Space Flight Center
Performing Facility: Wallops Flight Facility
Program Type: Research Range Services

By implementing fundamental project management strategies, RMMO narrows its focus, reaches desired goals and achieves those goals within specific time and cost perimeters. The final result is that everyone comes out a winner — which just may be project management's best benefit of all.

RRS Project Management provides the Wallops Range and its customers with:

Governance

The structure, process, and procedure to control operations and changes to performance objectives. This includes metrics to indicate the health and progress of the project.

Alignment

The program must support higher level visions, goals, and objectives.

Assurance

All projects must verify and validate the program, ensuring adherence to standards and alignment with the vision.

Management

Project managers (PM) must ensure there are regular reviews and accountability, and that management of projects, stakeholders, and suppliers is in place.

Integration

All projects ensure that component parts fit together properly to make the intended whole. Each project must optimize performance across the program value chain, functionally and technically.

Finances

Projects must conform to the budget and track costs.

Infrastructure

Project managers are charged with gathering a project team to ensure the Range's infrastructure can support the requirements of any mission.

Planning

Project managers must develop the overall plan and manage subsets that include resources, time scales, monitoring and control, lessons learned, and other areas.

Improvement

Not only do NASA project managers ensure mission success, but they also take the time to develop and research new capabilities and systemically apply learning and knowledge to the project.

As part of the RMMO, the Research Range Services (RRS) Program supports NASA project managers and their missions by providing a myriad of services such as radar and optical tracking, telemetry downlink, meteorological services, command and control, surveillance and recovery, financial analysis, and engineering services to allow these missions to take place in a safe, ready environment.

The RRS program employs many highly experienced range service managers (RSM) who work arm-in-arm with their NASA counterparts. In tandem, the PM and RSM build, coordinate, and manage cohesive teams that combine the efforts of engineers and technicians to configure a mobile and fixed Range that provides launch range services around the globe.

All operations conducted at the Wallops Range (WR) and other remote launch ranges, such as Poker Flat Research Range near Fairbanks, Alaska, and Andoya Space Center in Norway, require state-of-the-art technologies and multi-million dollar systems to support unmanned aerial vehicles, sounding rockets, expendable launch vehicles or any other flight platform.

In 2015, project managers were responsible for Range instrumentation support for NASA orbital and sub-orbital programs, and also programs for other government and civilian agencies. They assured near 100 percent success for a multitude of programs executed at WR while simultaneously managing remote campaigns in Alaska and downrange tracking/command sites in Norway and Bermuda.

From the initial thoughts of a principal investigator, through the completion of data analysis, the RMMO project manager in coordination with the RRS RSM is the glue that bonds the talents and efforts of the extended team of professionals needed to ensure successful completion of every mission.

Research Range Services Assets: $317.14 million

Telemetry Systems	Per Unit	Quantity	Total ($M)
7.3-Meter Fixed Antenna	$1.5	2	$3.0
7-Meter Mobile Antenna	$1.5	2	$3.0
Mobile Telemetry Van	$1.5	1	$1.5
20-Foot Mobile System	$2.0	1	$2.0
Mobile Super Van	$2.5	1	$2.5
10-Foot Mobile Antenna	$0.5	1	$0.5
8-Foot System	$0.4	2	$0.8
8-Foot Mobile Antenna	$0.4	1	$0.4
8-Meter Antenna	$2.5	2	$5.0
16-Foot System	$0.5	1	$0.5
9-Meter Redstone	$6.0	2	$12.0
9-Meter System	$4.0	1	$4.0
Transportable Command and Telemetry System (TCATS)	$15	2	$30.0
Mobile Integrated Telemetry System	$2.5	1	$2.5
11-Meter Antenna	$2.7	1	$2.7
Atmospheric Radars	**Per Unit**	**Quantity**	**Total**
Space Range Radar (SPANDAR)	$20.0	1	$20.0
Ultra High Frequency (UHF)	$18.0	1	$18.0
S-band Weather (Tropical Ocean Global Atmosphere)	$5.0	1	$5.0
NASA Polarimetric (NPOL)	$5.0	1	$5.0
Tracking Radars	**Per Unit**	**Quantity**	**Total**
Range Instrumentation Radar – 778	$6.0	4	$24.0
Range Instrumentation Radar – 716	$7.0	2	$14.0
Range Instrumentation Radar – 706	$70.0	1	$70.0
TPQ-39 Radar	$1.5	1	$1.5
19-17 Radar	$1.5	1	$1.5
Weibel Debris Radars MFTR-2100	$10.0	2	$20.0
Surveillance Radars	**Per Unit**	**Quantity**	**Total**
Airport Surveillance Radar (ASR-8)	$10.0	1	$10.0
Sea Surveillance (S- and X-Band, WISSRDS)	$1.0	2	$2.0
PSTAR	$0.5	2	$1.0
Active Protective System (APS-143)	$2.5	1	$2.5
LSTAR	$0.35	4	$1.4

Command & Support Systems	Per Unit	Quantity	Total ($M)
Fixed UHF Command System	$4.0	1	$4.0
Fixed Poker UHF Command System	$1.5	1	$1.5
Mobile Command System	$2.5	2	$5.0
Mobile Range Control System	$2.1	1	$2.1
Radio Frequency Communication	$3.0	1	$3.0
Timing System	$0.8	1	$0.8
Mission Operations Voice Enhancement (MOVE) System	$4.0	1	$4.0
Optical Systems	**Per Unit**	**Quantity**	**Total**
Video Tracking Stations	$1.0	5	$5.0
Photographic Stations	$0.3	5	$1.5
Radar-Slaved Mobile Optical Tracker	$0.4	1	$0.4
Video Distribution and Recording	$2.1	1	$2.1
Meteorological Systems	**Per Unit**	**Quantity**	**Total**
Electric Field Mills	$0.02	7	$0.14
Leading and Environmental Display System	$0.30	1	$0.30
Range Control	**Per Unit**	**Quantity**	**Total**
Range Control Center	$20.0	1	$20.0

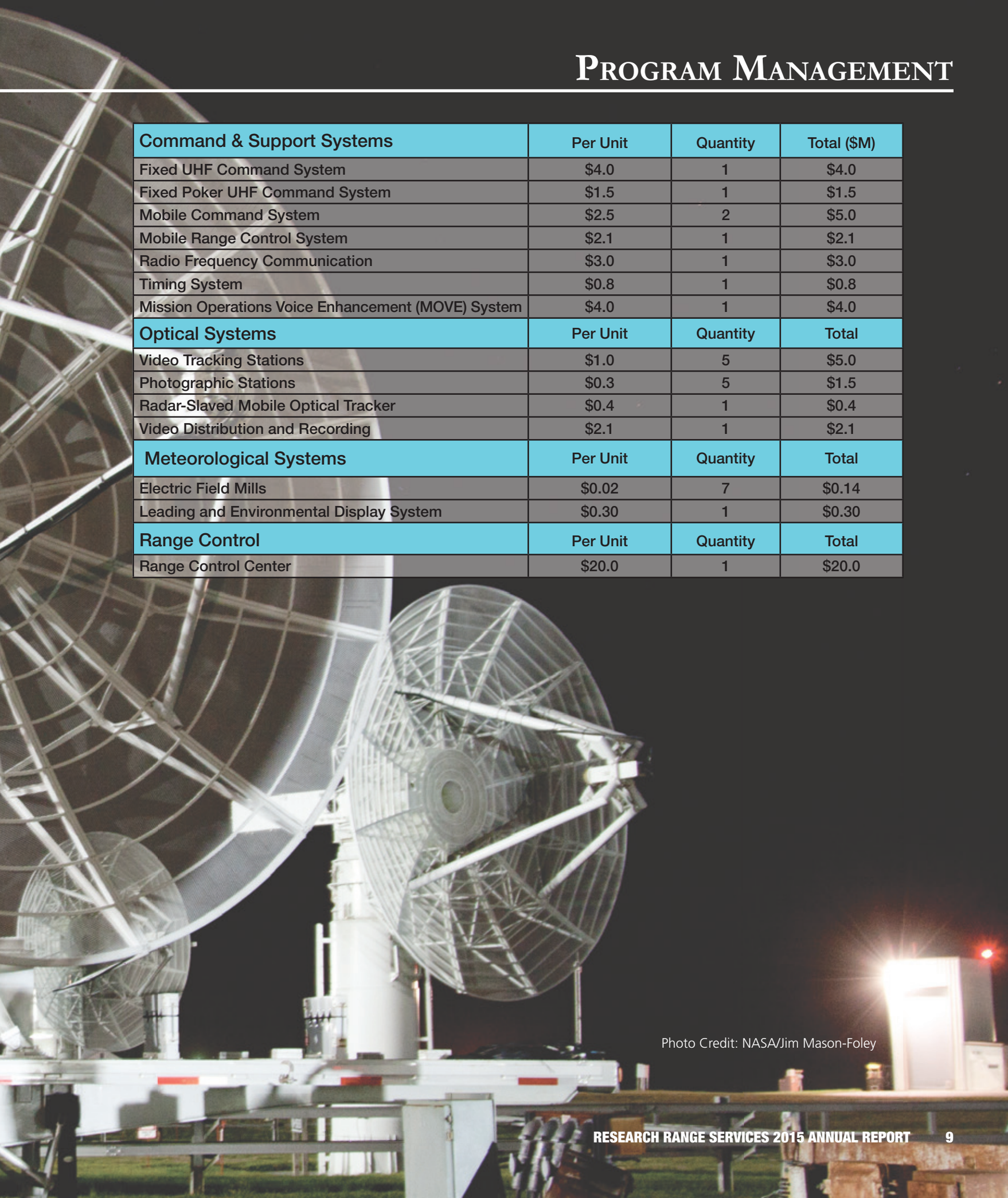


Photo Credit: NASA/Jim Mason-Foley

The 70th Anniversary Open House attracted more than 6,000 visitors on June 27, 2015. Photo Credit: NASA/Terry Zaperach photos

Range celebrates 70 years in aerospace

WALLOPS ISLAND, Virginia — Wallops Range celebrated its 70th birthday this past year on June 27, 2015, when it hosted 7,000 residents from Virginia, Maryland, and Delaware. The history of Wallops Range dates back to the early beginnings of NASA when it was developed under NASA's predecessor the National Advisory Committee on Aeronautics, or NACA.

In April 1945, Congress appropriated funds for the Pilotless Aircraft Research Station on Wallops Island and conducted its first launch on June 27 and its first official research mission just a week later on July Fourth.

Research Range Services personnel configured many of the attractions that day with static displays showcasing its telemetry, radar, and optical tracking assets, and also provided tours of the Range Control Center. In all, Wallops featured more than 60 exhibitors, special presentations, static display aircraft, and a 5K run event.

Congressman Scott Rigell, representing Virginia's 2nd Congressional District, spoke to the crowd at the opening ceremony event.

From right, Congressman Scott Rigell, Virginia State Senator Lynwood Lewis, and Virginia Delegate Rob Bloxom listen to opening remarks during the 70th Anniversary.

The Transportable Command and Telemetry System (TCATS) was displayed at the 70th Anniversary Open House.

The Wallops Fire Department was on hand during the 70th Anniversary Open House

"NASA Wallops partners with the local communities, surrounding states, our U.S. military, and schools from all over the Commonwealth and country," Rigell said. "Americans rightfully demand value in return for their tax dollars and Wallops, including Mid-Atlantic Regional Spaceport, is delivering that."

Goddard Space Flight Center Director Chris Scolese read a certificate from U.S. Senator Barbara Mikulski recognizing Wallops as "a world-class international launch site celebrating 70 years of science and innovation."

Wallops Director Bill Wrobel touched on the importance of inspiring the next generation during the event.

"STEM programs here like the Virginia Space Coast Scholars, the Virginia Space Flight Academy, the Eastern Shore Community College work experience, as well as the Summer Institute in Science, Engineering and Research are helping to inspire and grow the next generation," Wrobel said. "We could not have accomplished anything over the past 70 years or in the 70 to come if not for an energized, talented workforce."

DID YOU **KNOW?**

Wallops Flight Facility had many names through the decades:

1945-1958	Pilotless Aircraft Research Station
1958-1974	Wallops Station
1974-1981	Wallops Flight Center
1981-Now	Wallops Flight Facility

Antares Orb-3 undergoes readiness checks on Pad 0A. Photo Credit: NASA/Joshua Murray

RRS overcomes Orb-3 Mishap

WALLOPS ISLAND, Virginia — The space launch industry is an inherently risky business, and although NASA and its partners tend to make launches look routine, there is the occasional mishap. The date was Oct. 28, 2014, a nice autumn day which featured the launch of the Antares vehicle carrying the Cygnus payload known as Orb-3 at Wallops Flight Facility (WFF). The spacecraft was carrying roughly 5,000 pounds of supplies to the International Space Station.

Moments after liftoff, the Antares vehicle descended back down to the Wallops Range completely destroying the vehicle and the supplies destined for the ISS. For debris containment and the safety of everyone, an 8,500-foot cordon was established around the rocket before flight and a vast area expanding out in the Atlantic Ocean (1,400 square miles) was cleared of boats and airplanes prior to launch.

Many outside of the NASA network may look at this mission as a complete failure; however, The Research Range Services (RRS) Program views the Orb-3 mission as a success from a Range support and emergency response standpoint.

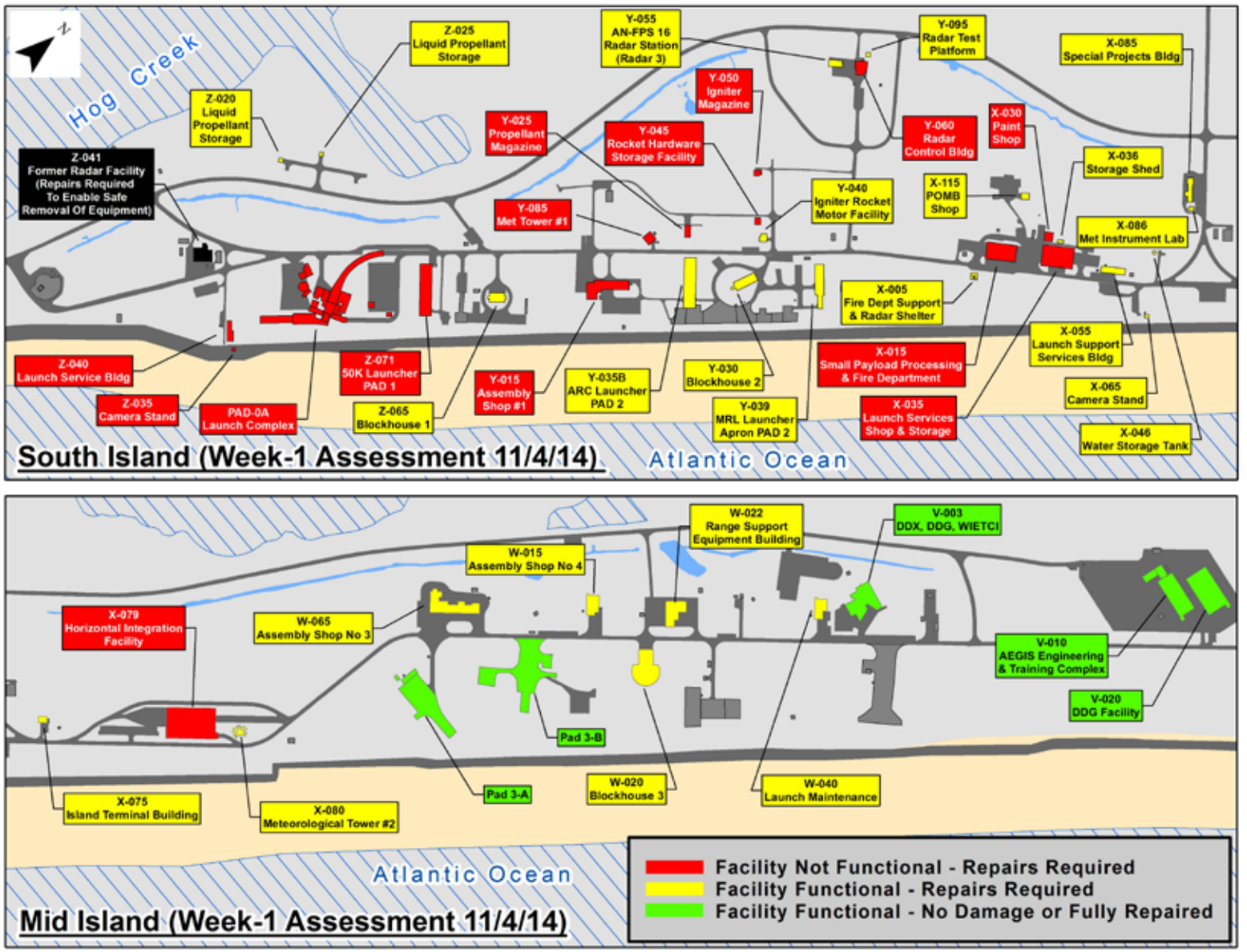
Within minutes after the accident, the NASA Range Safety Officer released control of the Range to the RRS Emergency Operations Center (EOC) which activated the Wallops Emergency Operations Plan. EOC personnel's first duty is to ensure the safety of Wallops staff working the launch, and anyone visiting the Range to watch the anticipated launch. Astonishingly, the EOC was able to move everyone and verify their safety within six minutes of the mishap.

Once everyone was accounted for, the EOC handed command to the Interim Response Team (IRT) which was tasked with securing the mishap site and gathering information and evidence to start the investigative process.

Safety is the number one priority for NASA, the Wallops Range, and the RRS – due to safety awareness at the Range, no one was injured during the Orb-3 mishap.

"I want to praise the launch team, Range Safety, all our emergency responders and those who provided mutual aid and support on a highly-professional response that ensured the safety of our most important resource – our people," said Bill Wrobel, Wallops Director. "There's no doubt in my mind that we'll rebound stronger than ever."

While the EOC was initiating their post-mission mishap procedures, others areas of the RRS team were busy collecting data for the eventual investigation. All radar,



Graphic courtesy of Wayne Johnson

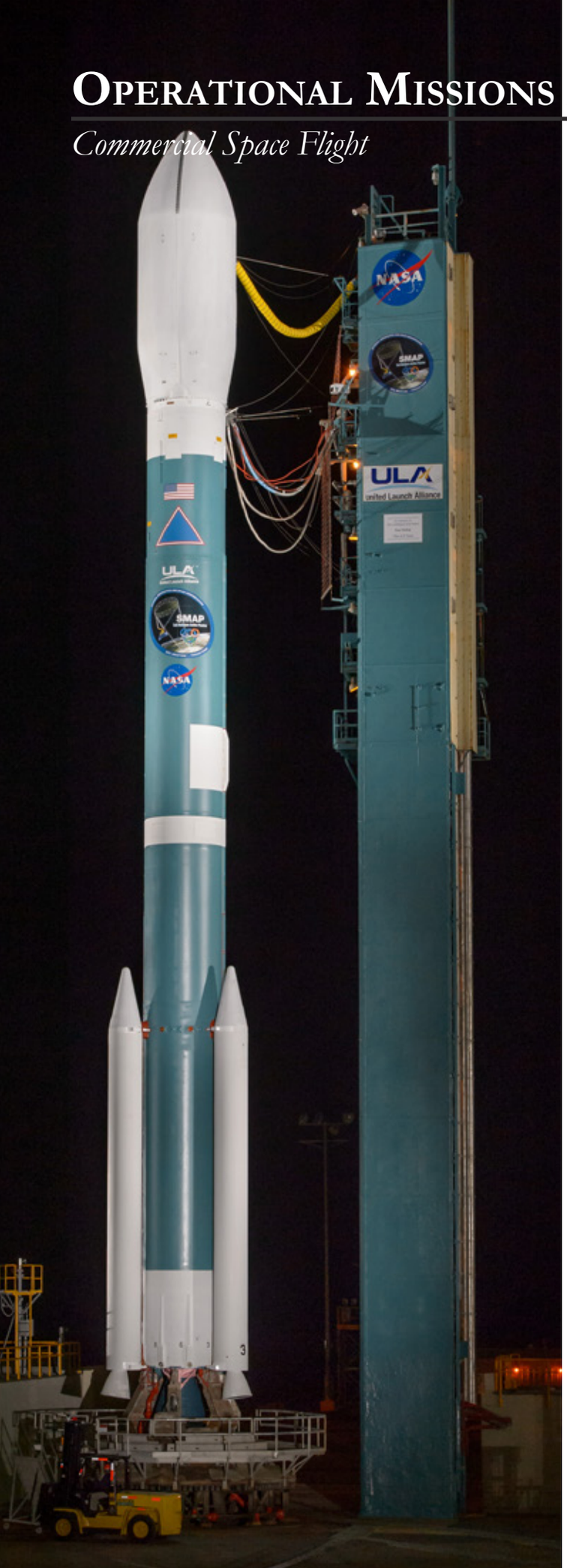
telemetry, and optical tracking assets stayed locked onto the vehicle and kept recorders rolling. Once the data was saved, it was impounded for the investigation. RRS personnel then worked with the Orbital ATK investigation team to analyze the data.

The morning after the unsuccessful launch, the IRT team was granted accessed the north end of Wallops Island to start the process of collecting debris from the Antares vehicle. Re-entry to the south end of Wallops Island was an exercise of extreme caution, as teams had to determine if there was unexploded ordnance and if the atmosphere surrounding the pad was hazardous.

Eventually, the EOC deployed two Damage Assessment Teams to begin the process of determining which Range assets were destroyed, damaged or undamaged.

Since October, areas of the Range and the Pad 0A complex have been rebuilt and repaired and the Antares vehicle will soon take to the skies from the Wallops Range in 2016. The Orb-3 mission and mishap is testament to the skills, responsiveness, safety, and professionalism of the entire RRS team and its partners.

Orbital ATK plans on putting Antares back in business with the OA-5 mission slated for Fiscal Year 2016. The entire RRS team is readying the fixed and mobile Range, and providing ground operations support, to prepare for the hot fire and subsequent launch of the Antares vehicle.



Range services supports Delta, SpaceX launches

WALLOPS ISLAND — For the past several years the Research Range Services (RRS) program has been providing telemetry (TM) and radar tracking services to the Eastern Range (ER) and SpaceX Fiscal Year 2015 was no different.

During launches out of Cape Canaveral Air Force Base, Florida, RRS personnel provide an excellent down-range tracking site with the infrastructure to send real-time data to the ER or the SpaceX Mission Control in Hawthorne, CA.

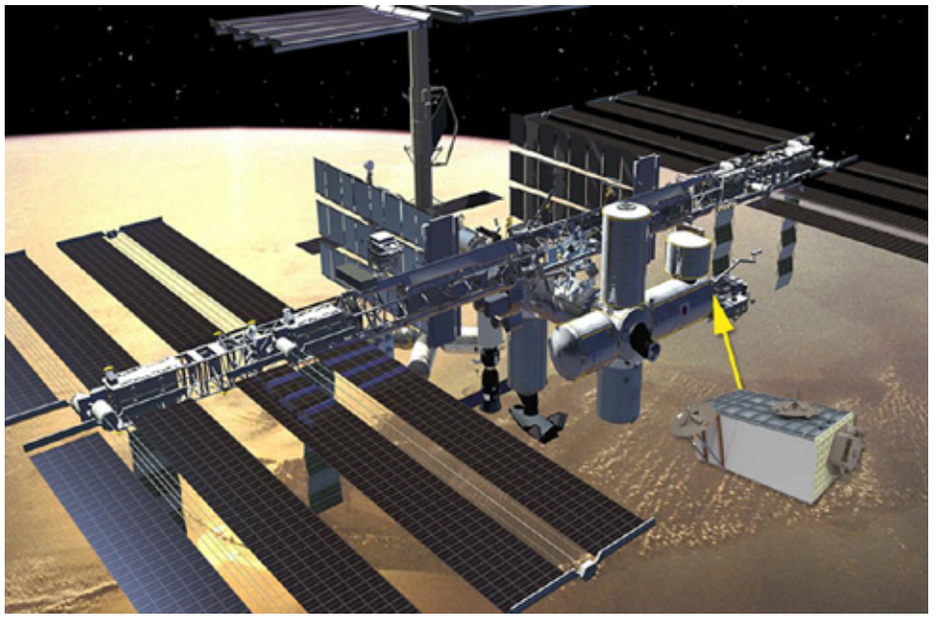
This year, RRS provided flawless TM tracking support directly to SpaceX during the launch of their Falcon 9 for the CRS-5 mission in January, and RRS provided additional radar tracking data to the ER for the same mission. RRS was also able to support the launch of the National Oceanic and Atmospheric Administration satellite, Deep Space Climate Observatory (DSCOVR) in late-January.

VEHICLE	MISSION	LAUNCH DATE
Falcon 9	Commercial Resupply Services CRS-5	January 10, 2015
Delta II	Soil Moisture Active Passive (SMAP)	January 31, 2015
Falcon 9	Deep Space Climate Observatory (DSCOVR)	February 11, 2015

The United Launch Alliance Delta II rocket with the Soil Moisture Active Passive (SMAP) observatory onboard is seen after the mobile service tower was rolled back, at the Space Launch Complex 2 on Jan. 30, 2015. Photo Credit: NASA/Bill Ingalls

ISS-CREAM progresses

WALLOPS ISLAND, Virginia — While Research Range Services (RRS) is most known for its support of rockets and other Wallops Range missions, there is another side not as well known: Special projects, such as ISS-CREAM. The acronym stands for International Space Station Cosmic Ray Energetics and Mass and it started as a long-duration balloon (LDB) project with a goal of extending direct measurements of cosmic-ray composition to the highest energies practical with balloon flights in Antarctica.



The ISS-CREAM project will attach to the Japanese Experiment Module Exposed Facility section of the International Space Station.

Six successful LDB flights of the CREAM payload within six years accumulated about 160 days of data, the longest known exposure for a single balloon project. Using the proven science concept, ISS-CREAM has now taken the next step – residing on NASA's share of the Japanese Experiment Module Exposed Facility (JEMEF) of the ISS.

Its goal is to precisely measure energy spectra of individual nuclei over the proton-to-ion elemental range from 1010 electron volt (eV) to approximately 1015 eV, and will address the long-standing fundamental science questions such as:

1. Do supernovae really supply the bulk of cosmic rays?

2. What is the history of cosmic rays in the galaxy?

3. Can the energy spectra of cosmic rays result from a single mechanism?

4. What is the origin of the "knee" in the cosmic ray all-particle energy spectrum?

These questions have been difficult to answer because no space mission capable of measuring the low fluxes of particles at energies approaching the cosmic ray "knee" around 3x1015 eV has yet been flown.

The ISS-CREAM mission would be the first experiment to have the data set needed to pursue these questions effectively. The ISS-CREAM project consists of a collaboration of the University of Maryland, Penn State University, and Northern Kentucky University) as well as foreign universities such as Sungkyunkwan University and Kyungpook National University from South Korea. Multiple NASA facilities are also engaged such as NASA Headquarters, Goddard, Johnson, Marshall and Kennedy space centers, and other collaborative efforts from the Japanese Aerospace Exploration Agency (JAXA) and Laboratoire de Physique Subatomique et de Cosmologie (LPSC) in France.

By working closely with the Johnson Space Center (JSC) ISS Program Payloads Office, Wallops Flight Facility is managing, with contractor and civil servant support from the Applied Technology and Engineering Directorate and the RRS program, the integration and test of the payload to meet the Dragon Lab/Space-X launch vehicle and the Japanese Experiment Module-Exposed Facility mission requirements.

At completion of system-level qualification to be performed at Goddard Space Flight Center, the instrument payload will be integrated at the Kennedy Space Center (KSC) into SpaceX's Dragon trunk. The payload is currently scheduled to be cleaned, inspected, retested, and repackaged for storage until its launch date in April 2016 from KSC.

Human Exploration and Operations Mission Directorate

LDSD continues steps toward Mars

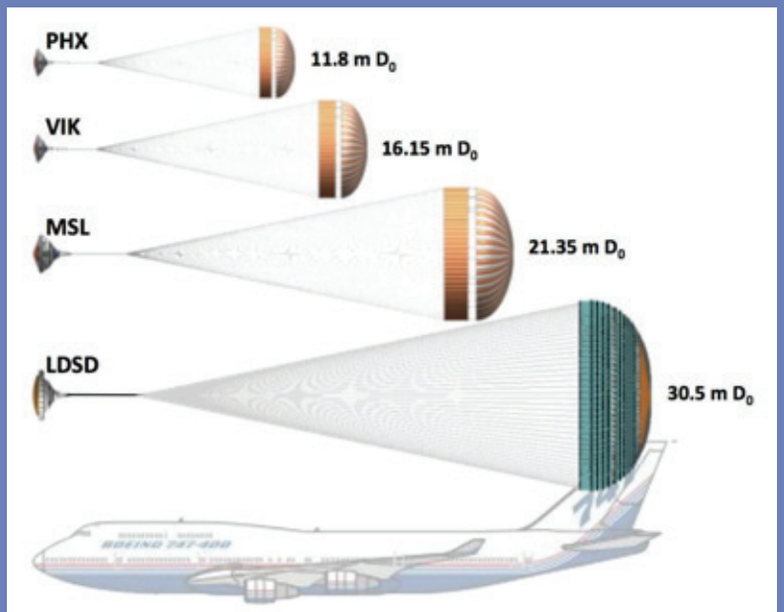
PACIFIC MISSILE RANGE FACILITY, Hawaii — NASA's Low-Density Supersonic Decelerator (LDSD) project completed its second flight test June 8, 2015, when the saucer-shaped craft splashed down safely in the Pacific Ocean off the coast of the Hawaiian island of Kauai. The LDSD project established a test architecture for the development and full-scale testing of decelerator technologies at representative conditions to those found on the planet Mars. The last time an architecture near this scope was attempted was part of the 1970s NASA Viking Program.

A NASA high-altitude balloon carrying the LDSD test vehicle was launched from the Pacific Missile Range Facility (PMRF), and the vehicle separated from the balloon hours later at about 120,000 feet above the ocean. An onboard rocket motor then took the vehicle to 180,000 feet, where the first braking technology, the Supersonic Inflatable Aerodynamic Decelerator (SIAD), deployed at about Mach 3.

Fourteen seconds after SIAD inflation, the test vehicle's parachute was released into the supersonic slipstream, according to plan. This 100-foot-wide parachute is the largest supersonic parachute ever flown. It has more than double the area of the parachute used for the Mars Science Laboratory mission that carried the Curiosity rover to the surface of Mars. The chute began to generate large amounts of drag and a tear appeared in the canopy at about the time it was fully inflated.

NASA Wallops Flight Facility is the primary partner to the NASA Jet Propulsion Laboratory (JPL) for the execution of the LDSD 2015 test campaign. Wallops personnel serve in key leadership roles during mission build-up and the launch operations, managing and providing mission critical hardware and operational elements to enable the successful deployment and test of the JPL technologies. This was the second year that all Wallops-provided mission support areas functioned successfully.

The Research Range Services (RRS) program, supported by the Range Safety Office, provided launch services and acted as the mission execution agency for JPL at the host test range, the PMRF. Range Safety worked closely with PMRF safety and JPL to develop new balloon trajectory risk assessment tools to add in determination of acceptable pre-launch mission decision making. These tools have direct applicability to other balloon missions.



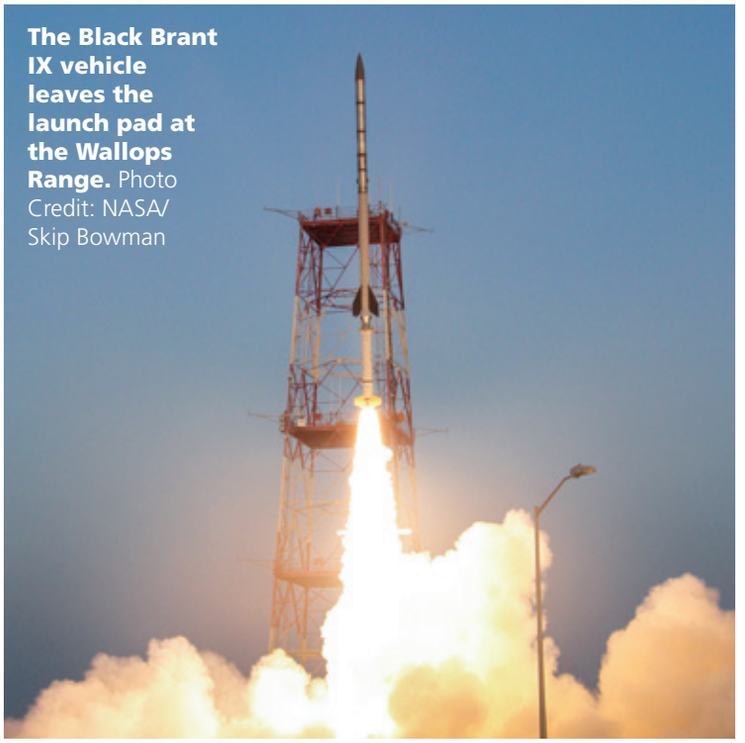
Comparison of Mars Supersonic Parachutes to LDSD Test Parachute

RRS personnel also coordinated a complex recovery operation of both the test vehicle and the expended balloon. Recovery of the balloon carcass from the ocean was required in order to protect the surrounding ocean environment. Recovery of the test vehicle was mission critical due to onboard memory modules and to allow post flight examination of the supersonic parachute. The LDSD project contracted with a local marine transportation company to provide ships and personnel for recovery operations. The recovery operation included three ships and two PMRF C-26 aircraft used as spotters.

Other Wallops directorates also contributed significantly in the LDSD project. The Applied Engineering and Technology Directorate provided the primary electronics pallet, on-board telecommunications systems, and Electronics Ground support equipment for the Test Vehicle. The Balloon Program Office provided the balloon launch platform and custom static launch tower, delivering the Supersonic Flight Dynamics Test vehicle to its drop point in the Pacific Ocean west of Kauai.

Photo Credit: NASA/Keith Koehler

Black Brant test flight helps with two NASA center experiments



The Black Brant IX vehicle leaves the launch pad at the Wallops Range. Photo Credit: NASA/ Skip Bowman

LAUNCH VEHICLE	Terrier MK70 Black Brant Mk1
MISSION:	Black Brant IX (36.313)
WALLOPS ID:	NRW-5624
LOCATION:	WFF: Pad 2, ARC
LAUNCH DATE/TIME:	July 7, 6:15 a.m. EDT

WALLOPS ISLAND — Research Range Services (RRS) added to local July Fourth fireworks with an aerial display of its own: the successful launch of a Terrier MK70 Black Brant Mk1 sounding rocket in the early morning hours of July 7, 2015. This sounding rocket carried not one, but two important NASA experiments.

The first experiment, from Ames Research Center, was the Sub-Orbital Aerodynamics Re-entry Experiment (SOAREX-8) Exo-brake. The Exo-brake is a passive means of de-orbiting an object — a specially-designed braking device that operates similar to a parachute at extremely high speeds and low-air pressures. A new de-orbit technique, Exo-brakes are being considered as possible solutions for returning cargo from the International Space Station (ISS) and orbiting platforms, or as possible landing mechanisms in low-density atmospheres.

The second experiment, from Glenn Research Center, was the Radial Core Heat Spreader (RCHS). The RCHS is an innovative thermal control system, proving a method of passive thermal energy conversion is greatly needed to address the growing electrical power requirements of future space missions. The objective of this experiment was to test the RCHS's thermal performance throughout the launch environment and subsequently into microgravity.

The Black Brant IX Test flight mission presented very unique challenges that the entire RRS team overcame with resounding success. The Black Brant IX experimental mission payloads were to be ejected at 79 seconds into vehicle flight, and critical mission objectives required the tracking of these payloads and the smooth receipt of their telemetry data. However, the radar beacons and telemetry transponders were not to be turned on until 20 seconds and 79 seconds (post ejection) respectively due to particular customer mission constraints.

This presented a distinctive problem: how to ensure that RRS radar and telemetry would capture the beacon and transponders that were not turned on at T-0 in order to obtain the mandatory mission data. Additionally, there were no trajectory files available for the payloads post-separation; rather, only a notional idea of expected separation speeds. This added yet another degree of difficulty to the mission planning.

Finally, the payload customer had a fifth telemetry link transmitted via WiFi to a receiver provided by them. They required assistance in determining how to connect to a Wallops Range antenna. The RRS team studiously analyzed this challenging Range support parameter and developed a reliable, comprehensive plan that offered the best chance of capturing the transponders or locating the payloads with vehicle skin tracking.

The result of this spectacular RRS team effort was a perfect dawn launch at 6:15 a.m. EST, with range assets tracking all assigned transponders and the teams from Ames and Glenn Research Centers receiving valuable test data for their respective experiments.

Science Mission Directorate

Five rockets presents challenge for RRS mobile teams

FAIRBANKS, Alaska — For the seventh straight year, the Research Range Services (RRS) program traversed deep into the Alaskan interior to support multiple sounding rocket launches from the Poker Flat Research Range (PFRR) just outside Fairbanks.

This was a particularly challenging year where the term "campaign" was truly embraced because the team was called on to support the launch of not just one, but five rockets. The first four vehicles were launched Jan. 26, 2015, within a 45-minute window: two were launched one minute apart and the second set of vehicles were sent in to the aurora borealis just 30 minutes later.

RRS personnel then had to reset and prepare the range for yet another mission. Two days later, Jan. 28, 2015, one of the most complicated payloads ever launched in a deployed environment successfully lifted off and was ultimately deemed a "raging success" by the Principal Investigator (PI), Dr. Charles Swenson. RRS personnel were able to successfully support all five vehicles and provide data which allowed the scientists to better understand the behavior of the aurora borealis and our atmosphere in general.

An RRS radar technician tracks one of the many sounding rockets from Poker Flat Research Range. Photo Credits: NASA/ Jamie Adkins photos

With the complexity of this year's campaign, the number of engineers and technicians required to support was considerably greater than it had been in the past. In order to better prepare for the mission, RRS deployed a scout team prior to the main body to ensure some of the more challenging instrumentation configurations were ready for the opening of the launch window. The vehicle team also sent a contingent of personnel to prep two of the rockets before their entire team arrived. This allowed the RRS team to work with the vehicle team and complete integration testing which in turn helped alleviate the schedule when the primary deployment began.

As the window opened, the team realized they had a new puzzle to solve. Each night of the count, the RRS team routinely executes certain tests to ensure that all systems are ready to support an actual launch. Some of these tests are conducted with the vehicle, some are internal to the RRS team. Normally, the team has roughly two hours to complete their internal tests before being required to support vehicle interface tests.

In past years, this had not been an issue because with only one vehicle, the tests did not take long to complete. This year, with three missions, the team had to develop a streamlined order of execution for these tests to ensure the most efficient completion time possible. Even then, it was a struggle to finish on time, but good communication with the NASA campaign manager ensured the team was able to complete these tests without sacrificing a launch opportunity.

With all pre-mission testing challenges successfully resolved, the team settled in for the long, cold, dark nights of the count. Weather caused some issues as one of the scientists needed completely clear skies, and despite

RRS Range Services Manager Lauren Neely reviews the countdown during the Alaska campaign.

some spectacular aurora displays, the "right" kind of aurora remained elusive. As the window was rapidly reaching its close, the team began to think that this would be a repeat of last years' experience and that a return trip for a second window would be required.

Luckily on Jan. 26, the clouds cleared and the first four rockets screamed into the sky with the tracking assets following right along with them. Two days later, on the last available day of the launch window, after several tense "false alarms", the PI determined science conditions were good and the final rocket blasted off. This final rocket had been a technical challenge during the planning stage due to the number of payloads to be tracked and their cross-pattern path. The planning paid off, however, as the PI was able to receive good data from all payloads, paving the way for capturing a more complete picture of aurora behavior.

Ultimately, this campaign was a huge success for the RRS team. These missions involved not only the increase in manpower support described above, but also an increase in instrumentation. The team had previously transported two telemetry antennas and their supporting control van across the entire continent where they then had to set up and configure that equipment. Another group had to work to expand the fiber infrastructure that would allow all of the ground support equipment to "talk" to each other. Even those with instrumentation already in place had to develop and practice new procedures for vehicle tracking during fly-out. Despite these challenges, with good technical knowledge and teamwork across the entire Wallops community, the RRS team was able to help bring this complex chess game of a campaign to successful closure.

LAUNCH VEHICLE	Talos-Terrier Mk70-Oriole-Nihka (one vehicle)
MISSION:	Swenson 49.002 (ASSP)
WALLOPS ID:	NRO-5552
LOCATION:	PFRR: Pad 4
LAUNCH DATE/TIME:	Jan. 28 6:41 a.m. EST

LAUNCH VEHICLE	Terrier Improved Orion (two vehicles)
MISSION:	Larsen MIST (41.111/41.112)
WALLOPS ID:	NRO -5553/NRO-5554
LOCATION:	PFRR: Pads 2 & 5
LAUNCH DATE/TIME:	Jan. 26 41.111 at 6:14 a.m. EST 41.112 at 6:47 a.m.= EST

LAUNCH VEHICLE	Terrier Mk-12 Improve Malemute (two vehicles)
MISSION:	Collins MTeX (46.009/46.010)
WALLOPS ID:	NRO-5460/NRO-5461
LOCATION:	PFRR: Pads 1 and 3
LAUNCH DATE/TIME:	Jan. 26 46.009 at 5:13 a.m. EST 46.010 at 5:46 a.m. EST

Science Mission Directorate

Mobile Range travels to Arctic Circle

Norway 2014 — C-REX and CAPER

ANDØYA SPACE CENTER, Norway — After a three-year hiatus, the Research Range Services (RRS) team returned to northern Norway in order to support two sounding rocket campaigns out of Andøya Space Center (ASC) near Andenes, Norway. A four-stage Talos-Terrier Mk70-Black Brant-Nihka sounding rocket launched in the early morning hours of Nov. 24, 2014, carrying the Cusp-Region Experiment (C-REX). Unfortunately, the other mission, known as the Cusp Alfven and Plasma Electrodynamics (CAPER) payload, was atop another four-stage Talos-Terrier Mk70-Oriole-Nihka, but never left the rail despite the best efforts of the team.

The RRS staff briefly deployed to Norway in late August and completed the setup of a remote site at ASC which consisted of a 7.3-meter antenna, SuperVan (telemetry receiving, recording, and readout system), mobile power system, and boresite antenna. The team returned to the site in late October to gear up for campaign support. In addition to providing tracking support at ASC, RRS also deployed a two-man crew to both Tromsø and Svalbard, Norway. RRS contracted with Kongsberg Satellite Services (KSAT) for downrange tracking in order to meet the science requirements of the CAPER mission, and to provide redundancy in tracking. Both downrange sites were set up with a full suite of telemetry equipment.

The first day of the launch window kicked off on Nov. 19 with only CAPER on the rail staged to launch, with all sites green. As luck would have it, varying wind conditions coupled with slack science conditions would not provide a favorable launch environment during the first several days of the launch window. By Nov. 24, 2014, the C-REX sounding rocket was loaded onto the launch rail and was readied for launch. At approximately two hours into the countdown the science did not look promising for the CAPER payload. The ASC and Tromsø station were switched over to support C-REX. It turns out the first day would bring nearly perfect conditions for the C-REX experiment, which flew off the launch rail without a hitch.

It's worth noting that the Svalbard station was left off the list of supporting stations during the launch. Not only did weather prevent launch opportunities, but it also presented unique problems for crew transportation to and from the station at Svalbard, located high above the arctic circle. On several occasions the Svalbard team was unable to access the site because of road closures due to large snow drifts and a risk of avalanches. A few times the team was lucky enough to catch a ride via helicopter to the top of the mountain where the equipment is situated. In an attempt to provide the necessary support to the mission, the team would often spend 2 or 3 days at the station and utilize the on-site bunks.

Following the launch of C-REX, the team concentrated its efforts on CAPER. Sixteen launch attempts were completed, but the right combination of weather and science would never synchronize. The mission was finally scrubbed on Dec. 7, 2014, and a second attempt will be made during Fiscal Year 2016.

Photo Credit: NASA/Brea Reeves

LAUNCH VEHICLE	Talos-Terrier MK70-Black Brant-Nihka
MISSION:	Conde 52.001 (C-REX)
WALLOPS ID:	NRO-5448
LOCATION:	ASC: U3 Launcher
LAUNCH DATE/ TIME:	Nov. 24, 2014 4:05 a.m. EST

Norway 2015 — CARE II

The CARE II payload launches into low cloud cover at Andoya Space Center. Photo Credit: NASA/ Chris Perry photos

The Range Research Services (RRS) team returned to Andenes, Norway for the second year in a row, but this time to much nicer weather. The RRS team deployed in mid-August in support of the Charged Aerosol Release Experiment II (CARE II). The longer summer days put a pep in everyone's step, resulting in near-flawless setup and testing (though this could be attributed to an extremely productive July maintenance trip). The RRS mobile tracking station, which had been deployed in support of the 2014 Winter Campaign, was ready for action.

The launch window opened on Sept. 7, 2015, with what the team initially perceived to be easily obtainable science conditions. Typically a principal investigator (PI) in Norway is looking for what is commonly referred to as "good science", or an extremely active aurora borealis. For this particular mission, the PI was essentially looking for no science, with an undisturbed ionosphere. Sounds easy, but the team quickly realized that calms skies at this time of year were not as easily obtained as initially thought. On several nights, the team was treated to an extremely active display of aurora borealis.

After the first several nights of counting, the team settled in as the countdown gained a familiar feeling. Fortunately that feeling was not meant to last — on the 10th day of the window, atmospheric conditions looked promising. All was silent in the sky, except for the CARE II vehicle which roared through the low-lying clouds on September 16, 2015, at 1906 UTC. As with the rest of the campaign, the launch went extremely smoothly for everyone involved and was highly successful for RRS and the mission customers.

Following the launch, all RRS systems were secured for the team's return in early November in support of the second Norway campaign in November 2015 in the next fiscal year. The team can only hope the science conditions observed during this trip will remain come November.

Sarah Blankenship receives telemetry readout data in the mobile super van.

LAUNCH VEHICLE	Talos, Taurus, Black Brant
MISSION:	Bernhardt 39.012 (CARE II)
WALLOPS ID:	NRO-5412
LOCATION:	ASC: U3 Launcher
LAUNCH DATE/TIME:	Sept. 16, 1:06 p.m. EST

Telemetry technician Corbin Williams runs a test during setup procedures.

Mobile Range telemetry assets are set up at Andoya Space Center.

Science Mission Directorate

Range helps in success of CubeSat programs

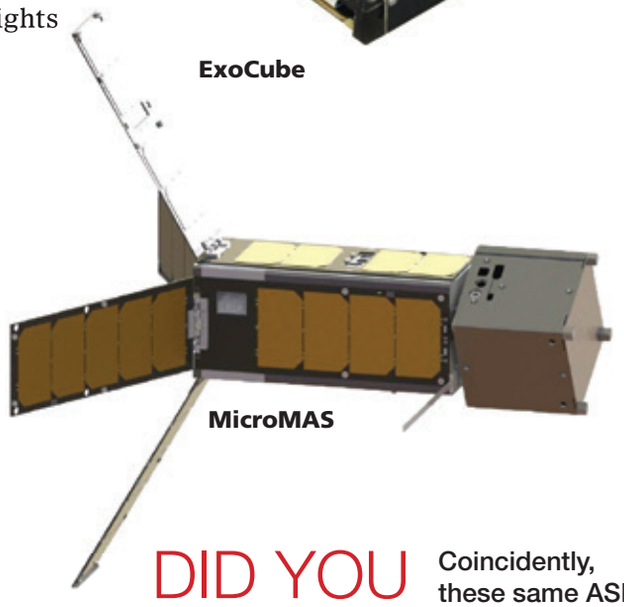
WALLOPS ISLAND — The Research Range Services (RRS) program continued to play a major role in the success of the CubeSat mission set not only at Wallops Flight Facility but within the entire CubeSat community. This year much of the RRS Atmospheric Sciences Research Facility (ASRF) staff spent time supporting the Massachusetts Institute of Technology Micro-sized Microwave Atmospheric Satellite (MIT MicroMAS) CubeSat mission. Originally schedule for release in September 2014, the mission was delayed until March 2015 due to an issue with the launch mechanism aboard the International Space Station (ISS). Leading up to the release, RRS technicians conducted multiple-mission dress rehearsal and ground stations tests to ensure all systems were a go. As with the majority of CubeSat missions supported by RRS, MicroMAS was no different in that the RRS Ultra High Frequency (UHF) Radar slated to support was the sole system responsible for communications with MicroMAS.

Following the release of MicroMAS, the RRS teams spent countless hours during the next several months working with the MIT team trying to locate and communicate with the CubeSat. After nearly 3 months of ongoing efforts to communicate with the CubeSat, it was determined the MicroMAS radio was not functioning and efforts to locate the CubeSat were cancelled. While this mission was unsuccessful from MIT's point of view, it highlights the RRS team's determination and dedication to the mission.

Amidst the tracking efforts of MicroMAS, the RRS Program received a unique request to help locate ExoCube which had been unable to communicate with its planned ground station. The ExoCube is a weather satellite sponsored by the National Science Foundation. The life of the CubeSat was limited so quick action was paramount. RRS immediately started processing the necessary paper work and approvals which were received in June. Given the large Wallops mission set, for which RRS is responsible, it came as no surprise the integration and testing of the ExoCube ground station came into direct conflict with another mission.

The RRS team managed to de-conflict all personnel and systems in order to support both missions. After successfully integrating the ground station, the ASRF team attempted to make contact with ExoCube utilizing the UHF system and made contact on the first attempt. Following the successfully contact, RRS personnel became the primary ground station for supporting ExoCube and saved the mission, providing months of tracking support.

ExoCube



MicroMAS

DID YOU KNOW? Coincidently, these same ASRF Radar systems used today to support MIT's CubeSats were originally built by MIT and NASA to track and study hyper-velocity re-entry bodies from 1958-1965 for a program called "Trailblazer."

Unique project tests laser technologies

WALLOPS ISLAND, Virginia — The Research Range Services (RRS) program is able and willing to support any type of project no matter how unique it may be. RRS personnel hosted the National Geospatial-Intelligence Agency (NGA) at the Wallops Range to calibrate and test laser equipment and software.

The close proximity to Washington, D.C., made the Wallops Range an attractive destination, and the Range was able to fulfill all testing requirements on the Unmanned Aerial System (UAS) runway on Wallops Island. NGA personnel worked with the RRS and Range Safety team to ensure all certifications to emit lasers were completed, received, and approved from the laser clearing house and the Federal Aviation Administration.

The Range then secured a portable building for office and testing space on the runway and connected the building to the island power supply in order to keep the equipment within operating temperatures and to keep power to the testing equipment. With the assistance of Wallops Security, NGA was able to leave their equipment on site, and configured for the three months of testing, which allowed them to save configuration time and conduct multiple beneficial deployments to the Wallops Range to calibrate and test vital equipment.

On one deployment, the Range worked with NGA to ensure that their deployment was successful even though the wind was playing havoc on their equipment, causing problems with calibrating the lasers. RRS personnel erected a wind barrier within hours of the request to minimize the effects of the wind on their testing components which led to a successful testing period.

Photo Credit: NASA/Daniel Walsh

Science Mission Directorate

NASA, NOAA study hurricane

WALLOPS ISLAND, Virginia — Major storms and hurricanes can be devastating, and accurate forecasting is essential in the protection of people and property. For the past six years, the National Oceanic Atmospheric Administration (NOAA) has teamed up with NASA to get an inside look at how hurricanes form and intensify over the Atlantic Ocean with help from the NASA Global Hawk Unmanned Aerial System (UAS).

Operating from the aircraft ground control station at the Research Range Services (RRS) program's airfield this past August, NOAA worked with NASA scientists on SHOUT, or Sensing Hazards with Operational Unmanned Technology. SHOUT will move the Global Hawk closer to operational use as a weather forecast observations tool with the ability to observe long-duration flights over large oceanic areas. This makes it an important potential observing platform for the Wallops Range and RRS, who were poised to host such crucial research this past August through September.

Support for SHOUT began in spring 2015, with RRS collecting requirements and coordinating support for weather, communications, hangar space, fueling, and air traffic control. Support ran smoothly even when a potential scheduling conflict occurred due to a Navy project sharing space in Hangar D-1 during two weeks of the SHOUT mission and the strict communications security (COMSEC) required for SHOUT. RRS took a proactive approach and responded diligently by gathering customer requirements and concerns, drafting a comprehensive memorandum that thoroughly detailed a space sharing plan and responsibilities of both project teams, and ensuring a seamless execution of both missions with no loss of mission time or dislocation of either customer while complying with all COMSEC needs.

The initial NASA flight team arrived at the Range on Aug. 9, 2015, and RRS daily support began the very next day with the start of dry runs of tailored daily weather briefings. For the next two weeks, the RRS Weather Office supported these dry runs through and then began daily operational briefings continuing throughout the mission. Weather support to the SHOUT mission was a total success, with RRS meteorologists in concert with NOAA and NASA throughout planning and every step of the mission. Coordinating weather briefing support prior to the Global Hawk's arrival on August.

Though initially scheduled to arrive at Wallops Flight Facility on Aug. 20, the Global Hawk arrived on Aug. 22 due to several weather delays. The first science mission took off on Aug. 26 and successfully returned Aug. 27 collecting data on Hurricane Danny. A second science mission to investigate Tropical Storm Erika flew Aug. 29 and returned Aug. 30. Finally, Hurricane Fred form and a science mission was conducted on Sept. 5-6. Due to predicted lack of future storm tracking opportunities in the Atlantic, NOAA decided to end the mission and departed for Armstrong Flight Research Center on Sept. 8. The SHOUT mission was a success and RRS effectively supported all mission requirements.

"I was so impressed with the great teamwork and the positive 'can do' attitude that I witnessed during my three days at Wallops," said Robbie Hood, director of NOAA's UAS Program. "I now know this is a great team from NASA Armstrong to NASA Wallops."

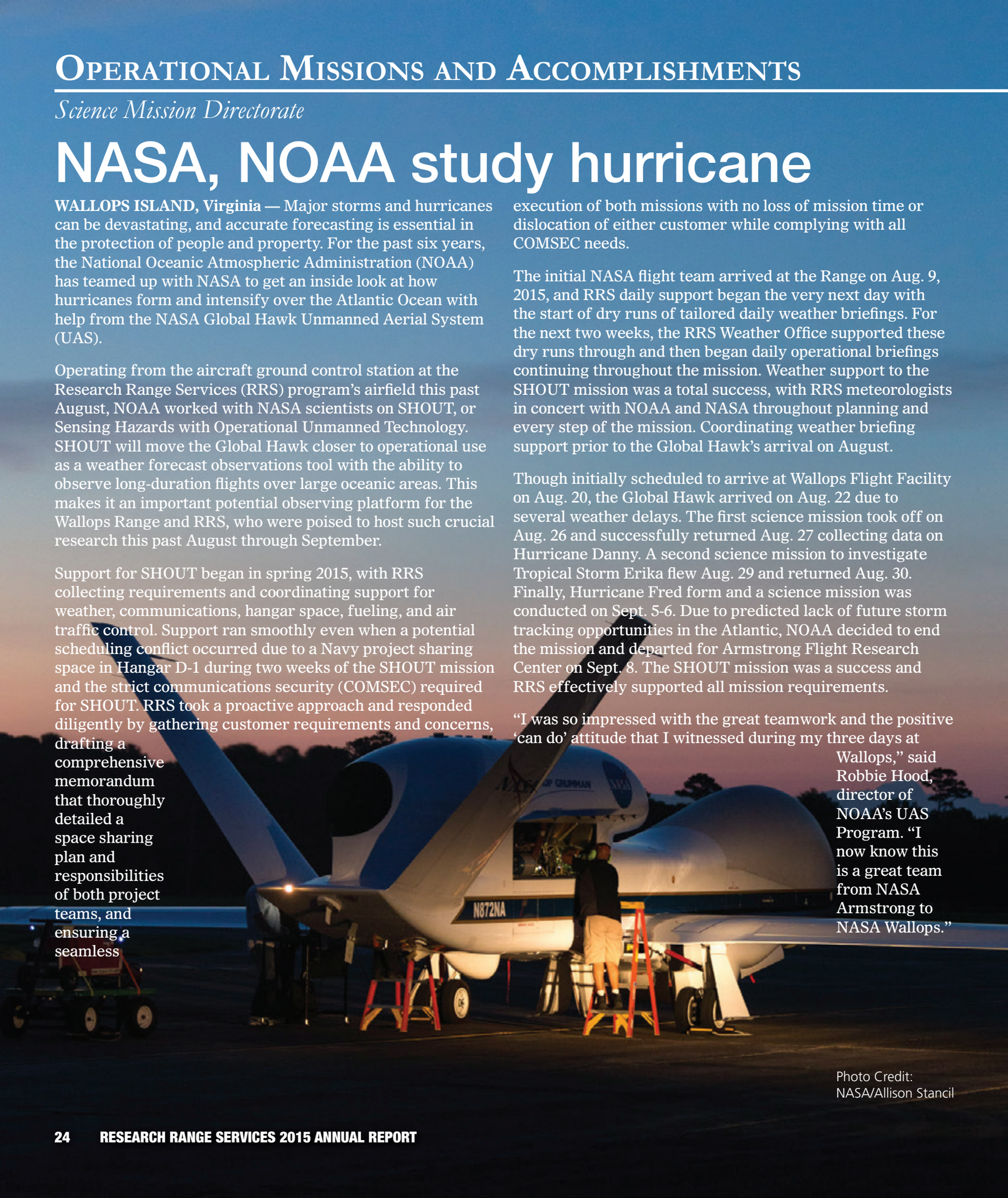


Photo Credit: NASA/Allison Stancil

RRS Airfield fosters UAS missions

WALLOPS ISLAND, Virginia — Research Range Services (RRS) continues its strong support of the ongoing effort to integrate new technology into Unmanned Aerial Systems (UAS) during 2015, benefitting both manned and unmanned flight. This year saw a new contingent of unique project vehicles in addition to the now-familiar Global Hawk. NASA Langley Research Center's (LARC) Airborne Subscale Transport Aircraft Research (AirSTAR) program continues, and an additional vehicle, the Navy's AeroStar UAS, also flew from the Wallops Airfield this spring.

AirSTAR

Who as a child, or even as an adult, didn't want to fly a remote-controlled airplane through open skies? The team from NASA LARC took that dream to the next level when they arrived with the BAT-4, a remotely piloted subscale aircraft model which they flew over the Wallops Range during the first few weeks in April. However, these flights weren't recreational: the LaRC team was part of the AirSTAR program, a test program using remote controlled scalable aircraft, or small Unmanned Aerial Vehicles (UAV), that will improve safety of new and legacy aircraft.

RRS personnel supported this valuable program by providing a variety of Range services, which included providing hangar and ramp space, communications, and air tower operations. During its time at the Wallops Range the BAT-4 conducted several aircraft Range checks, a low-speed taxi test, a high-speed taxi test, first flight testing, and proceeded to restricted airspace to conduct general and beyond visual range (BVR) operations and testing.

An important support capacity where the RRS team shined was in safety support. This was the "first flight" of this BAT-4 at the Wallops Range, so public and property safety was of paramount concern. The RRS team developed a comprehensive safety review and coordinated with local law enforcement to temporarily close Chincoteague Road, Virginia Route 175 which runs adjacent to Wallops, to local traffic for the 12-minute inaugural flight.

Weather support, a primary flight concern for AirSTAR, was flawless. RRS was able to provide the very detailed and specific data required by LARC in a timely and professional manner. Winds were of a very particular concern to the LARC team, and RRS was able to respond with little advance notice to every request to provide additional wind balloon launches to support the ever-changing flight schedule over the three week mission period. The result was that no flight opportunity was lost due to insufficient weather or wind data.

The LARC team declared project completion on April 16, 2015. The RRS team received praise for their outstanding support. LARC management especially noted the flexibility of the air traffic control and weather personnel in responding to real-time schedule changes, ensuring maximum flight opportunities and mission success. The team was able to fly 18 out of 20 flight cards, for a total of 4-6 nautical miles for 58 minutes.

AeroStar

The Navy's AeroStar UAS is a fixed-wing aircraft with twin tail booms used for research, development, test and evaluation, and science/technology missions. RRS assisted the Navy this year by providing the Range and its accompanying services, at the level of quality the Navy has come to expect. AeroStar successfully flew between May 30 and 31, 2015, aided by the professional and dedicated RRS personnel who helped the flights occur smoothly.

The purpose of the project was to perform target data acquisition in support of naval operations. The air vehicle was planned to maneuver within the Range's restricted airspace. The maneuvers were intended to present certain air vehicle aspects while data was collected. The flight events were scheduled using RRS facilities which are capable of accommodating the UAS and its support equipment while providing resources, project management services, and Range Safety officer support necessary to complete the proposed project.

RRS personnel supported this project by providing a variety of Range services, to include communications, scheduling, safety, HAZMAT material storage, optical support, electric power supply, frequency management, equipment storage facilitation, and air tower operations.

During its time at the Wallops Range, the NASA project team was able to accomplish all support tasks associated with the mission. This project provided the perfect blend of contractor, military, and NASA synergy which provides a successful test atmosphere.

AeroStar

National Defense testing continues with fourth MDA Shark launch

Photo Credit: NASA/Brea Reeves

WALLOPS ISLAND, Virginia — Mission preparedness is a staple of the Department of Defense (DoD), and the Research Range Services (RRS) program is ready to assist the DoD when the need arises. For the past few years, the Missile Defense Agency (MDA) has partnered with Wallops Range to conduct sounding rocket missions in support of national defense, and Fiscal Year 2015 was no different.

The purpose of the MDA Shark mission was to provide ballistic tracking entities for off-board tracking systems and instrumentation data collection. Two Terrier-Lynx vehicles, Shark No. 3 and Shark No. 4, were to be launched about two weeks apart from the Wallops Range.

The launch of the first vehicle, Shark No. 3, took place near the close of Fiscal Year 2014; while the second vehicle, Shark No. 4, became the first launch at Wallops in Fiscal Year 2015. The count began on the evening of October 11, 2014, with the launch occurring shortly after midnight on October 12, 2014.

The RRS team provided ground instrumentation, communication, surveillance, optical, meteorological, and ground operations support for the mission.

The offshore hazard area was located at a distance offshore that limited surveillance capabilities to radar aircraft only; however, the final location of the hazard area was in an area of low-ship density and created no additional challenges to surveillance. Wallops beach replenishment efforts introduced dredge boat operations inside of the near-shore hazard area, but the crews had all necessary information and maintained communications to provide a clear Range for launch.

The end customer was the Naval Surface Warfare Center Port Hueneme Division Detachment out of White Sands Missile Range, N.M., who served as MDA's empowered mission integrator.

LAUNCH VEHICLE	Terrier-Lynx
MISSION:	MDA Shark 4
WALLOPS ID:	DRW-5572
LOCATION:	Pad 2
LAUNCH DATE/ TIME:	October 12, 2014 12:27 a.m. EST

Photo Credit:
NASA/Allison Stancil

Missile Defense Agency Salvo puts RRS to the test

WALLOPS ISLAND, Virginia — No mission puts the Research Range Services (RRS) Program's capabilities to the test quite like a sounding rocket salvo consisting of multiple vehicles being launched in close succession. In February 2015, the U.S. Navy Aegis Ballistic Missile Defense (BMD) Program, and the Sea-Based Missile Defense (SMD) element of the Missile Defense Agency (MDA), challenged RRS personnel with such an operation.

The mission was conducted to launch a salvo of three sounding rockets to simulate engagement of a missile raid against Navy ships. Three Navy Aegis Readiness Assessment Vehicles (ARAV Type-B) Terrier-Oriole vehicles served as simulated attack missiles tracked by Navy ships.

RRS personnel arrived during the evening of Feb. 23, 2015, for a launch attempt the following day. The three-rocket salvo successfully occurred during a period of twenty seconds in the early morning hours of February 24, 2015. The Terrier Oriole vehicles were launched in succession from the MRL Launcher and the ARC Launcher on Pad 2, and the 50K Launcher on Pad 1.

RRS personnel provided telemetry services from vehicle turn on to horizon loss of sight for each of the three rockets, utilizing a combination of eight fixed and mobile assets for tracking and receiving, as well as relaying, recording, and readout capabilities. Alongside telemetry assets, five tracking radar sites were in a primary configuration. Additionally, optical systems personnel recorded high-speed video data to capture motor ignition, umbilical release and vehicle egress from each launcher rail. Visible optical tracking provided data through flight until loss of sight. Launch System Integration services were provided along with surveillance services.

Supporting this salvo operation required a significant commitment from RRS services during the coldest February on record at Wallops. February routinely has the most challenging weather of the year at Wallops, typically with wintry weather, low clouds/visibilities, and winds often impacting most operations, and this February did not give the range any breaks. Extended periods of cold weather created expansive surface ice within local harbor areas, freezing surveillance assets in place. RRS was able to break through the ice to support the mission despite freezing spray conditions throughout launch operations.

LAUNCH VEHICLE	MDA Raid FTX-19
MISSION:	Three Terrier-Orioles
WALLOPS ID:	DRW-5589, DRW-5603, DRW-5604
LOCATION:	Pad 1 and Pad 2
LAUNCH DATE/ TIME:	February 24, 10:30:00 p.m. EST, 10:30:08 p.m. EST, 10:30:20 p.m. EST

Navy's Pax River utilizes RRS restricted air space

WALLOPS ISLAND, Virginia — Patuxent Naval Air Station, simply known as Pax River, in southern Maryland is a mainstay customer of the Research Range Services (RRS) Program. RRS provided support to Pax River for 890 scheduled events throughout the course of 257 days during the 2015 fiscal year.

RRS personnel have been providing Range services for the test and development of Naval Air Warfare Center Aircraft Division (NAWCAD) aircraft since 1996. Service requirements continued through this past fiscal year with RRS staff supporting up to six days of operational support per week. Requirements are primarily for Navy test flights of the F-35 Joint Strike Fighter (JSF). These flights are "bent pipe" telemetry flows, relaying telemetry from the aircraft back to Pax River. Air Traffic Management services were provided for all off-shore flights of the F-35 aircraft as the Pax Search and Rescue (SAR) Helicopter deploys to RRS Airport when such operations are being conducted.

In addition to fulfilling the requirement for near-daily telemetry and airfield support for the F-35 aircraft during this fiscal year; several specific testing objectives required the additional instrumentation support of Precision Tracking Radar, Meteorological Operations and NASA Communications (NASCOM). RRS supported additional Navy aircraft events for MH-60 Romeo helicopters, and a T-2 Buckeye suffering mechanical issues which was grounded at the Wallops Range for a week.

Demonstrating flexibility, RRS staff supported additional aircraft, such as the F-18 Hornet and P-8 Poseidon, in order to meet ever-changing customer needs.

The RRS airport also served as primary divert location for the X-47B Unmanned Aerial System (UAS) between the Patuxent Naval Air Station and an offshore carrier again this year during 21 scheduled operational flights. Coordination was conducted between NOAA, NASA, the Navy, and the Orbital Tracking Station (OTS) as the upper S-band frequencies utilized by the UAS posed potential damage to telemetry systems.

Photo Credit:
NASA/Joshua Murray

The U.S. Navy's E-2C aircraft practices "touch-and-go landings" during the FCLP project. Photo Credit: NASA/Terry Zaperach

RRS Airfield makes upgrades to accommodate growing operations

WALLOPS ISLAND — The Research Range Services (RRS) airfield is abuzz with the sounds of E-2 Hawkeye and C-2 Greyhound aircraft completing training for the Navy's ongoing Field Carrier Landing Practice (FCLP) program. Pilots utilize two simulated carrier decks on Runway 10-28 to practice the harrowing task of landing on an aircraft carrier without the hefty risk of a real carrier landing, thanks to this workhorse program. This unique program partnership is highly efficient and greatly beneficial to the Navy's long-term goals, thanks to the RRS airfield's professional, skilled staff who work to create the best flight practice environment possible.

From our airfield manager, airfield operations, and fueling personnel to the U.S. Department of Agriculture Wildlife Management technicians, the staff has worked tirelessly in support of this vital service RRS provides. New Navy pilots are afforded a realistic training environment prior to going to the ship for Carrier Qualifications and landing on the deck of an aircraft carrier. This year alone, an impressive 1,043 flight hours and 1,673 passes have been conducted. RRS support also includes landing "touch-n-goes" operations on a daily basis, as well as full detachment support multiple times a year. Airfield staff work daily with the customer to adjust scheduled flight periods in order to support the Navy's daily flight windows. The airfield is constantly looking at ways to improve project support and ensure that the team is ready to tackle new and evolving requirements.

To that end, the RRS airfield is undergoing a constant state of physical improvement. The D-1 hangar has undergone upgrades to better accommodate more than two hundred personnel, with work spaces and ready rooms for all sizes of operations and aircraft as large as a C-130. In addition to hangar improvements, a multi-year face lift on the airfield's surfaces is underway to resurface and repair aging substrate in order to provide our customers with a higher quality operating area. Our staff works with our customers to adjust runway construction schedules to support any mission's requirements and ensure no FOD (Foreign Object and Debris) on active runway surfaces. A state of the art runway sweeper conducts cleaning of all active surfaces, allowing for worry-free and safe aircraft operation. Other upgrades currently in process include advances in our power, lighting, and communication abilities on the airfield to better be able to meet all current and future customers' needs.

1,043 Flight Hours **1,673** passes

The Wallops Fire Department help create a pool of water that will help analyze the effects of water being ingested into an aircraft's engines.

Honda Jet completes second round of water ingestion testing

WALLOPS ISLAND, Virginia — The Range Research Services (RRS) program played a vital role in the pursuit of aviation safety in December 2014 with the hosting of the Honda Jet Water Ingestion project.

Water ingestion testing measures the response of aircraft components and systems during exposure to the spray produced when the aircraft encounters standing water on the runway. This testing, though not obviously necessary at first glance, is hugely important and necessary to aircraft manufacturers and the Federal Aviation Administration (FAA).

The testing verifies that water spray patterns an aircraft may encounter on a runway do not result in any engine behavior, engine indications, or significant airspeed fluctuations that might cause the pilot to abort takeoff or landing.

Historically, RRS has provided water ingestion testing support to government, commercial, and military aircraft due to the unique site configuration and runway water trough availability. In fact, the RRS Airport is one of only three sites nationally where this type of testing can be done.

The Honda Jet Water Ingestion project was certainly a success story, not without its fair share of interesting hurdles. The challenges began with environmental considerations: attempting to conduct a test of this nature with 10 knot-wind and 5 knot-crosswind constraints, along with required dry (no precipitation) conditions in the middle of winter along the coastal Mid-Atlantic region. This meant accurate weather forecasting was critical for mission success. RRS meteorologists responded by developing a customized twice-daily airfield weather outlook brief for the HondaJet team — this in addition to the standard daily Range weather briefs.

LAUNCH VEHICLE	Honda Jet HA420
MISSION:	Water Ingestion Testing
WALLOPS ID:	CAW-5447
LOCATION:	Runway 04-22
MISSION DATE/ TIME:	December 8-15, 2015 between 5 a.m.-5 p.m. EST

Weather forecasts caused the HondaJet team to cancel runs for most of the first week, but RRS scrambled the following week, assisting the HondaJet crew surge effort to complete all testing within the second week. By mission's end, the RRS team provided Range instrumentation support for six water ingestion test runs during the two-week mission. This sucessful testing will contribute vital information to the future of aviation safety.

RRS hosts aircraft for Ocean City air show

WALLOPS ISLAND, Virginia — On top of normal daily operations during a packed summer schedule, many different Wallops Range teams came together the week of June 8-15, 2015, to support visiting civilian and military aircraft scheduled to perform in the 2015 Ocean City Air Show. The Research Range Services (RRS) program was instrumental with air traffic control, fueling services, scheduling, and project management for this event as the RRS airfield was the base of operations for the air show.

This summer's lineup was an exciting collection of "firsts", with many demonstration teams making both their Wallops Range and Ocean City Air Show debut.

The U.S. Navy Blue Angels brought eight F-18 Hornets as well as their signature support aircraft, a C-130 Hercules named "Bert". Prior to the two highly anticipated shows performed over the Ocean City beach on June 13 and 14, the aircraft staged in the D-1 Hangar at Wallops Flight Facility. Along with the nine aircraft came almost 100 Navy personnel comprised of pilots, flight crews, and ground support teams.

The Breitling Jet Team, widely considered the "Blue Angels of Europe", included the Ocean City Air Show on their American Tour for the first time this year. Seven L-39 Albatross aircraft, along with their pilots and ground crew, staged behind the N-159 Hangar at Wallops during the week prior to the show.

Two F-22 Raptors also made their first Ocean City Air Show appearance and were also staged in a secured area near N-159. Security for these elite aircraft was intense to the point of requiring armed Range officers to guard the cordoned-off area, surrounding the F-22 Raptors at all times while the ground crew was not present.

Through the dedication, hard work, and expertise of all RRS and Range teams involved, from the security services, the airfield, the fire department, and many others, the visiting teams reported exceptional care and support.

F-22 Raptor

U.S. Navy Blue Angels

C-130 Hercules "Bert"

Breitling Jet Team

Photo Credit: NASA/Terry Zaperach photos

RRS nurtures STEM initiatives

WALLOPS ISLAND, Virginia — Every year, Research Range Services (RRS) hosts student-driven missions to help further educate and introduce students into the world of NASA rocketry. These missions usually include one RockOn! and one RockSat-X launch each summer; however, this year added an extra challenge as RRS aided students on three missions – the usual RockOn! and two RockSat-X missions.

RRS supports students in STEM programs – Science, Technology, Engineering, and Math – with the idea that fostering this course work and affording them the opportunity to launch their own developed payloads into the atmosphere will give them insight into the space industry and inspire them to someday bring their talents to NASA.

RockSat-X 2014

A little under a year after the 2014 RockSat-X mission was scheduled to launch, the Terrier Mk12-Improved Malemute took to the sky on April 18, 2015. The RRS team geared up to support the familiar RockSat-X student outreach launch in the summer of 2014, but the mission was unfortunately put on hold. The launch vehicle scheduled to take the student experiments into the sub-orbital environment was reassigned and the mission postponed.

Fast forward to late March 2015 – all systems were "go" for RockSat-X, but late winter weather conditions proved difficult for the mission. In order to meet all mission success criteria, the payload needed to be recovered about 100 kilometers offshore, and heavy winds and high seas prevented a launch during the first planned window.

Determined to get the student experiments into the sky, RRS secured a second launch window approximately two weeks later. Holding out for the right weather conditions proved to be the right call, as the payload was successfully recovered following the April 18, 2015, launch.

This year, the following colleges and universities participated:

- University of Nebraska Lincoln
- Virginia Tech
- University of Colorado Boulder
- Northwest Nazarene University
- University of Puerto Rico

LAUNCH VEHICLE	MK12 Terrier Improved Orion
MISSION:	RockSat-X 2014
WALLOPS ID:	NRW-5588
LOCATION:	Pad 2 - ARC
LAUNCH DATE/ TIME:	April 18, 2015 7:01 a.m. EDT

Photo Credit: NASA/Allison Stancil

RockOn! VIII

The RockOn! VIII mission successfully launched from Pad 2 aboard an MK12 Terrier-Improved Orion sounding rocket at the Wallops Range on June 25. The rocket carried a payload with student experiments from the RockOn!/RockSat-C program. This mission was a continuation of the annual hands-on, university-level rocket flight training workshop which is a collaborative effort by the Colorado Space Grant Consortium, the Virginia Space Grant Consortium, and Wallops Flight Facility.

The following colleges and universities participated:

- Mitchell Community College, Statesville, North Carolina
- Old Dominion University, Norfolk, Virginia
- Stevens Institute of Technology, Hoboken, New Jersey
- Oregon State University, Corvallis, Oregon
- Linn Benton Community College, Lebanon, Oregon
- Carthage College, Kenosha, Wisconsin
- Hobart and William Smith Colleges, Upstate, New York
- Community College of Denver, Denver, Colorado
- West Virginia University, Morgantown, West Virginia
- Temple University, Philadelphia, Pennsylvania

LAUNCH VEHICLE	MK12 Terrier Improved Orion
MISSION:	RockOn! VIII
WALLOPS ID:	NRW-5600
LOCATION:	Pad 2 - MRL
LAUNCH DATE/ TIME:	June 25 6 a.m. EDT

Photo Credit: NASA/Rusty Etheridge

Education and Public Outreach

An MK12 Terrier-Improved Malemute sounding rocket undergoes vertical tests on Pad 2. Photo Credit: NASA/Skip Bowman

RockSat-X 2015

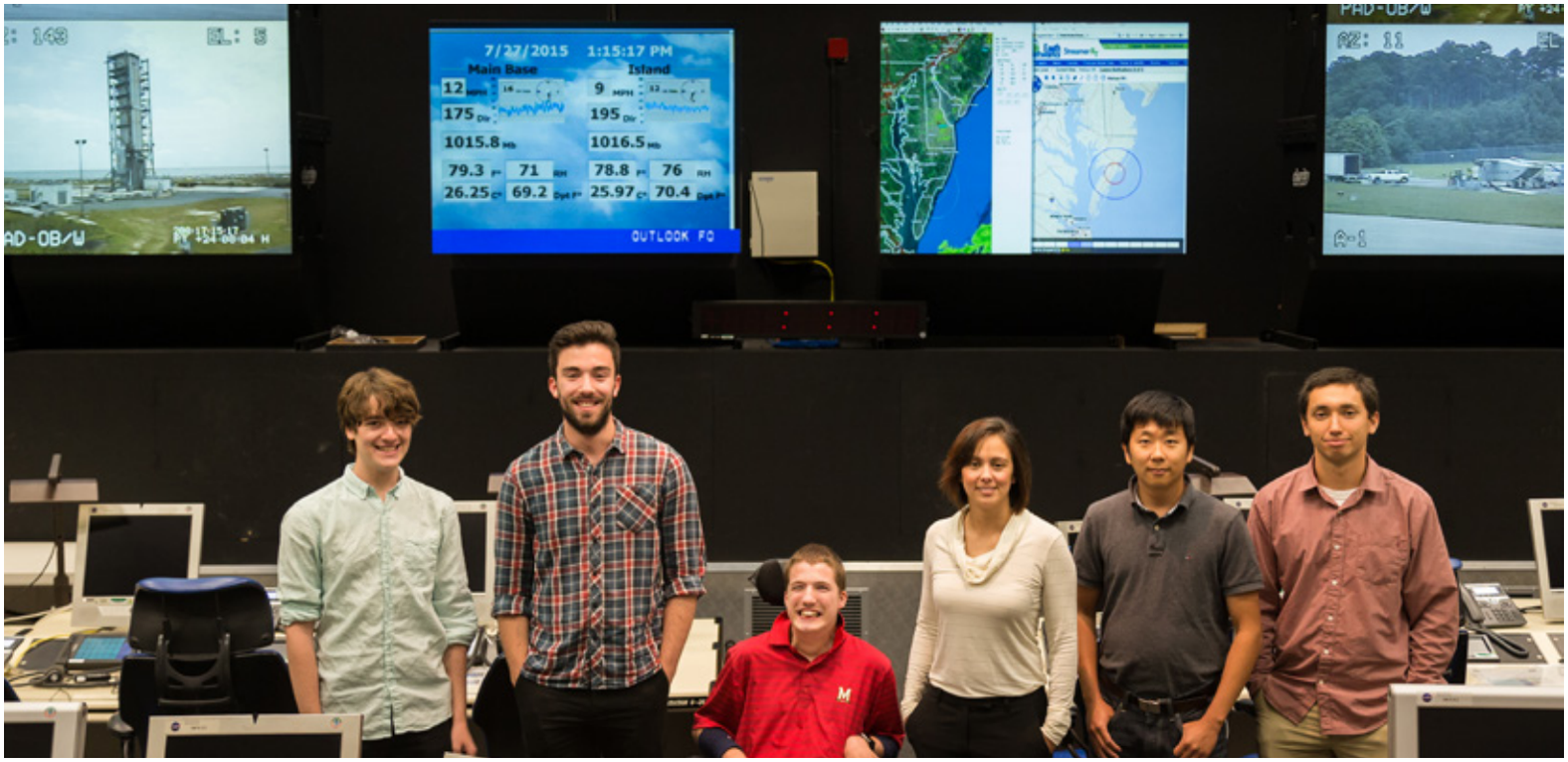
On August 12, an MK12 Terrier-Improved Malemute sounding rocket carrying student experiments launched from Pad 2 at the Wallops Range as part of the RockSat-X program. The RockSat-X 2015 mission was the fifth in the series of RockSat-X payloads, which provide expanded flight opportunities beyond the RockOn! experiment series.

This mission provided experimenters from seven universities the opportunity to fly a payload of their choosing into the space environment. The first launch attempt on Aug. 11 was scrubbed due to unsatisfactory weather conditions. On Aug. 12, a search and rescue initiated by the U.S. Coast Guard (USCG) threatened to derail the launch for the second day in a row. However, quick coordination with the NASA test director and USCG led to a successful launch just minutes after the nominal launch time. The launch trajectory was within the expected variance, with a maximum altitude of 156.3 kilometers. For the fifth year in a row, the students were thrilled to see their experiments launched into space.

The universities involved were:

- Capitol Technology University, Laurel, Maryland
- University of Colorado at Boulder, Boulder, Colorado
- Northwest Nazarene University, Nampa, Idaho
- University of Hawaii Community College, Hilo, Hawaii
- University of Nebraska – Lincoln, Lincoln, Nebraska
- University of Puerto Rico, San Juan, Puerto Rico
- Virginia Tech University, Blacksburg, Virginia

LAUNCH VEHICLE	MK12 Terrier-Improved Malamute
MISSION:	RockSat-X 2015
WALLOPS ID:	NRW-5624
LOCATION:	Pad 2 —ARC
LAUNCH DATE/TIME:	August 12, 2015, 6 a.m. EDT



NASA summer interns had a chance to tour the Range Control Center at NASA Wallops Flight Facility. Photo Credit: NASA/Allison Stancil

Range Control Center Tours

Along with student-driven launches, the RRS hosts many different schools and programs at Wallops Flight Facility. This includes tours, such as the popular Range Control Center tour, where students and community members are given a rare look into the launch control environment. This year's groups ranged from grade school students to retired citizens excited to experience a side of Wallops that many dream about.

The groups who visited RRS during 2015:

- Nanticoke Senior Center, Virginia
- The Salisbury School, Salisbury, Maryland
- First United Methodist Church, Hampton, Virginia
- Johnson Space Center, Houston Texas
- Ocean Pines Community Center, Ocean Pines, Maryland
- Museum of Chincoteague, Chincoteague, Virginia
- Virginia Space Coast Scholars
- Chincoteague Bay Field Station, Chincoteague, Virginia
- Salisbury University, Salisbury, Maryland
- University of Maryland Eastern Shore, Princess Anne, Maryland
- Eastern Shore Community College, Melfa, Virginia
- Parkside High School, Salisbury, Maryland
- Girl Scout Troop, Royersford, Pennsylvania
- Morehouse College, Atlanta, Georgia
- Greenbrier Enrichment Center, Chesapeake, Virginia
- Sons of Italy, Ocean City, Maryland
- Worcester Technical High School, Newark, Maryland
- American Association of Retired Persons, Ocean City, Maryland
- Moravian Academy Bethlehem, Pennsylvania
- Granby High School, Norfolk, Virginia
- Northhampton High School, Cape Charles, Virginia
- Southhampton Middle School, Courtland, Virginia
- The Key School, Annapolis, Maryland

Technicians perform maintenance on the Redstone 2 antenna at Poker Flat Research Range in Alaska.

Annual maintenance key to Mobile Range's continued success

COOPER'S ISLAND, Bermuda — To maintain the multi-million dollar Research Range Services (RRS) mobile assets, scores of RRS engineers and technicians are dispatched throughout the year to perform necessary maintenance and upgrades.

Utilizing the Maximo™ Computerized Maintenance Management System, RRS personnel completed 431 corrective maintenance work actions, 5,806 preventative maintenance actions, and calibrated 895 pieces of equipment.

These mobile assets are spread around the globe in far-away places such as Alaska, Bermuda, and Norway and are scheduled to be shipped to Australia. The planning and scheduling of trips coincides with upcoming missions to ensure system availability and mission requirements.

Bermuda

The Bermuda maintenance trip was performed just prior to the Antares Orb-3 Antares mission and included the 7-meter 1 antenna, the Mobile Integrated Telemetry System (MITS), the Mobile Command System 1A (MCS1A), the Radar 8 pedestal and instrumentation van, and the Mobile Power System 1 (MPS1). All work was completed, systems checked and the site was ready to support. Following the Orb-3 mishap, the RRS team deployed to Bermuda to package the equipment for return to Wallops.

Norway

The Norway maintenance trip was performed during July 2015. Part of the maintenance team had to deploy early to repair the motor generator on

Mobile Power System 4 (MPS4). The early deployment would allow the team uninterrupted time to complete the task and the ability to provide power to the mobile assets. The new generator was sent directly to the Norway site to facilitate schedule and reduce cost. The new generator performed as expected, which allowed the maintenance team to complete the maintenance activities on the 7-meter 2 antenna, the Super Van (SVAN), MPS4, and the mobile bore sight tower. The station was ready to support the CARE II mission flown in September 2015.

Alaska

The Alaska maintenance trip to Poker Flat Research Range was accomplished in early September 2015. To facilitate operations, the team moved the controls and equipment for the Transportable Orbital Tracking System (TOTS) into the telemetry annex (TMA). Additional equipment was moved from the 40-foot telemetry instrumentation van into the TMA for the 20-foot telemetry antenna, and the team successfully integrated the relocated equipment. Additional sensors were added onto the wind weighting tower to assist in verification of data during launch activities. All maintenance activities were completed on the Radar 10 pedestal and instrumentation van, meteorological operations tower, 20-foot antenna, 40-foot instrumentation van, 10-foot antenna, 9-meter 1 and 9-meter 2 antennas, 8-meter TOTS, 11-meter antenna, command system, Mission Operational Voice Enhancement (MOVE), and associated equipment.

Bermuda site gets major upgrades to assets, buildings

COOPER'S ISLAND, Bermuda — For more than 50 years, NASA has maintained a presence on Bermuda. Located on the north-eastern most tip of the island nation, Cooper's Island hosted a permanent tracking station from the 1960s through 2000, and beginning in 2012, radar, telemetry, and command destruct mobile assets were deployed there in support of launches from the Wallops Range and Cape Canaveral at Kennedy Space Center. This past summer, Research Range Services (RRS) personnel initiated a major project to relocate Wallops Range mobile assets into environmentally protected shelters and to consolidate the command and control for the telemetry, radar, and command into one Operations Center.

The complex planning for this project began with the identification of more than 600 line requirements for radar, telemetry, command, power, network, and communication along with designing the renovation of the old administration building to house the new Operations Center. The project calls for the renovation for one-third of the existing building to use as the Operations Center, local area network room, equipment room, break room, and two offices. The remaining portion of the building will be refurbished for use by the Bermuda government or house common areas, such as heating ventilation and air conditioning equipment. In anticipation of potential future expansion by the Bermudan government, current building plans call for a "viewing window" that will allow visitors a glimpse into the control center consoles and observe operations during future launches. Space has also been designated for a visitor center, small museum, and/or education center.

The telemetry and radar antennas will be sheltered in Radomes or similar structures that will be environmentally controlled to protect the equipment against heat, rain, and salt corrosion. In a novel approach, the command antennas will be housed in a renovated area of the building, where the command mast antennas will deploy through hatches in the roof.

The major hurdle for this massive project is schedule, with a requirement to be complete by Summer 2016, and the necessity to work around the deployment of additional mobile Range assets to support Antares OA-5 in Spring 2016.

The project is well into the design phase, and work on the building is scheduled to begin by the end of 2015. The multi-million dollar project is scheduled to be completed by Summer 2016 to support Antares launch OA-7.

Engineering sustains fixed and mobile Range assets

Radar 2 Repackaging

Due to obsolescence issues, RRS decided to repackage Radar 2 in a new expandable shipping container. By using excessed equipment from the U.S. Air Force and Kennedy Space Center, the project should be completed for under $100,000, including a $50,000 HVAC system.

This was an astonishing success since other quotes for this job exceeded $1 million. At the time of this publication, the project is nearing completion. This includes painting the shipping container; installing appropriate power, electrical and lighting; refurbishing and repackaging of the Radar electronics; and the relocation, setup and testing of the Radar 2 equipment with the original 8-foot NIKE pedestal, to include system testing and the Operational Readiness Review. This system is slated to go to Bermuda as a mobile asset in late 2015.

Interior view of Radar 2.

Poker Command Antenna Power Monitoring

In 2012, the Research Range Services (RRS) team installed a command system at Poker Flat Research Range (PFRR) to help alleviate resource constraints in the command service area. Although the project reached substantial completion, some capabilities were deferred when the commanding aspect of that year's mission was rescoped. During 2015, a capability to document power levels transmitted from the system was added.

The desire was to have a monitoring system that would simultaneously record the transmitted power level and the time power was transmitted. This would allow operators to prove the system was transmitting stable power levels in the event of a failure. The equipment needed for power-level monitoring had been purchased during the original project, but the software required to drive the equipment and the actual installation had been delayed. When it was confirmed that the PFRR Command System would be required, the RRS team mobilized and completed in-house development of the required software.

This software interfaces with the power monitoring hardware and provides the operator not only with a display that shows current power levels, but also with a time-stamped record of the system's power level performance. Once developed, the team tested and optimized the system here at Wallops prior to installing and testing it in its operational location at PFRR. Testing at PFRR proved successful, and the operators now have the capability to prove the system performs correctly during a mission.

Radio Frequency Direction Finding

RRS had a busy year enhancing the monitoring and surveillance activities on the Wallops Range. When operational, the Radio Frequency Direction Finding (RFDF) system will provide RF monitoring and surveillance with direction finding capability during all phases of launch preparations to include pre-mission testing through launch vehicle operations. Emission control (EMCON) monitoring and surveillance will be provided during all phases of launch preparations to include pre-mission testing through vehicle launch operations. RF monitoring and surveillance will follow a pre-determined schedule, as well as availability on an emergent, as needed basis. During prior reporting periods, the RFDF and EMCON systems were procured and installed. This year, functional testing was completed and demonstrated the usefulness of this system. A number of upgrades were achieved, including installing more capable spectrum analyzers, replacing obsolete servers, and implementing centralized control over the remote sensing locations. Currently, the team is relocating an antenna in a remote sensing location as the host structure is slated for demolition. This relocation includes building a new tower, relocating the antenna to the new tower, and re-establishing system connectivity. Completion of this project, anticipated in early 2016, will greatly improve capabilities for monitoring potential sources of interference.

Mobile Command Antenna Control Unit

This year, the engineering team continued their efforts to complete the Mobile Command Antenna Control Unit (ACU) project. The purpose of this project is to replace the controllers in the Mobile Range Control Systems, including replacing non-maintainable, legacy antenna pointing data translation capabilities. Both of these objectives will be accomplished by installing a robust, safety-certified ACU in the Mobile Command Systems. The RRS team continued working with specialty engineering partners to create a hazard analysis for this safety-critical capability. This report allows the team to develop tests and procedures to document the behavior of the system with respect to these potential failure modes.

This, in turn, allows the team to ensure that the system will operate correctly during the critical phases of launch and that a single failure of one component will not cause a failure of the entire system.

Command TDM Upgrade

After two-and-a-half years of hard work, the RRS team hit a major milestone with the safety certification and operational approval of the new Command Time Domain Multiplexers (TDM) system. The TDM system is responsible for transmitting command tones and receiving transmission verifications during safety critical flight termination and commanding events. The new system using modern fiber optic network technology replaced the legancy copper/analog system.

The RRS team was able to obtain this extraordinary goal even after facing what could have been more than a half-year set back. During engineering bench testing of commercial off-the-shelf hardware, the engineering team discovered an anomaly which identified a design flaw in the vendor hardware of which even the vendor was unaware. Utilizing engineering best practices, the team was able to narrow down the fault to a specific piece of hardware and located a second vendor to complete the solution. While the hardware was not identical, it allowed the team to salvage the majority of the system design and saved valuable time on the redesign.

The team then completed the necessary reviews and test procedures to ensure no procedural issues were discovered during the testing that would halt this effort. The hours put in proved to be worth it as the team (and system) made it through all phases of testing without issue. RRS estimates this new system is capable of providing 10-plus years of service.

Engineering Projects

Major Engineering Projects

Surveillance Radar Project (Poker L-STAR)

Technicians work on the Lightweight Surveillance Target Acquisition Radar (L-STAR).

During pre-mission preparations for the Alaska 2015 campaign, the upper levels of the Range in Fairbanks, Alaska, experienced a strong windstorm that ripped the aircraft surveillance system from its supports, damaging both the radar and its mounting base. The rocket launchers at PFRR are located on the floor of a long valley, so this radar is required to ensure no aircraft are flying through that valley when the vehicle lifts off.

The team was able to repair the radar in time to support the launch, but this event, coupled with other minor failures the team had observed, hinted that it may be time to replace the Portable Surveillance Target Acquisition Radar (P-STAR) radar. Luckily, the engineering group at Wallops Flight Facility (WFF) already had a solution lined up, in the form of an upgraded version of the P-STAR called the Lightweight Surveillance Target Acquisition Radar (L-STAR).

The RRS team began working with both the engineering group at WFF and with the L-STAR vendor to receive training on the new system, as well as perform a system checkout of the radars that had been provided by another Government agency.

RRS purchased a pedestal for the installation at Poker, as well as a rugged enclosure to protect the radar from the harsh Alaska environment. At the time of publication, the RRS team was at the L-STAR vendor participating in radar flight testing. From there the team will make plans for the operational installation at PFRR during the 2016 summer maintenance trip.

Medium Gain

RRS personnel were provided the funding required to purchase a new 6-meter antenna to replace an aging, unrepairable 7.3-meter antenna. The new system will provide the Wallops Range a higher gain and a newer, more reliable tracking antenna across the L-band and S-band frequency range. The RRS team had a new pad constructed near building N-162 while the antenna was being constructed by the vendor. This fall, the team accomplished factory acceptance of the new system. As of publication, the RRS team is planning the installation, testing, and operational acceptance of this aperture.

RRS purchased a new 6-meter antenna to replace the 7.3-meter antenna.

Andøya Space Center range is seen from the northeast side of Røyken. The Town of Andenes can be seen in the background. Photo Credit: NASA/Chris Perry

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Aerial view of the Wallops Range during the final stages of the 2014 beach restoration.

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