National Aeronautics and Space Administration

Wallops Range Annual Report

2020 Wallops Flight Facility Range Report

Dedication

Barbara Justis

Barbara Justis retired from NASA in 2020, after 41 dedicated years of military and government service. Barbara's final assignment was as a project manager for the Wallops Range and Mission Management Office (RMMO). Her last customers were the Navy Field Carrier Landing Practice (FCLP) and the Small Sat customers that utilize the Wallops UHF Ground Station for tracking, which she managed since 2013.

Barbara's career began in 1979 when she enlisted in the United States Army as an electronic technician, where she gained the rank of Sargent. She served in the mobile command unit and communications command center, performing depot level maintenance on the fixed station cryptographic equipment. After serving her country in an active duty role, she transitioned to government service in Washington D.C., where she worked as a depot level maintenance electronic technician.

In 1986, she made the move to Wallops to support the Test and Evaluation Facility/Lab in N-159 prior to her move to F-10. She worked as a test primary operator for spin balance, MOI, component vibration, and thermal vacuum testing for the Sounding Rocket Program Office (SRPO).

The Shuttle Small Payloads Project Office (SSPPO), Code 870, was the next group to utilize Barbara's project management talents. She served as the technical liaison between NASA and the Get-Away-Special (GAS) users. In 1999, she transitioned into the NASA Technical Manager (NTM) position managing GAS payloads through review and approval to fly on Shuttle Missions. In 2002, Barbara was promoted to the GAS Mission Manager, serving in a great capacity to manage the overall GAS program. She also participated in the new student project SEM to select and manage K-12 student experiments that integrated into a GAS can to fly on the shuttle. In 2002, she led the planning to host a 20th Anniversary for the GAS program.

After the Columbia accident in 2003, the SSPPO was redefined as the Education Flight Projects Office (EFPO), which competed opportunities for K-12 students to fly experiments on different platforms, including the International Space Station as well as sounding rockets, weather balloons, UAS, and aircraft. Barbara continued in the project management role until EFPO was dissolved in 2004.

In 2005, Barbara was reassigned from Code 870 to the RMMO (Code 840). Her first project was to dispose of the shuttle small payloads hardware, estimated at 10,000 plus pieces. She was also assigned as the Deputy Project Manager for the Aerosonde UAS program and managed several other small reimbursable projects. She was the Principal Investigator (PI) for the NASA Student Involvement Program (NSIP) Sounding Rocket mission which bore her name – Justis.

2011 saw an uptick in UAS missions, and Barbara was assigned the Viking 300 UAS project. This led to a matrixed assignment to the Aircraft Office (Code 830). In the upcoming years until 2018, she spent half of her time as the Commercial Aircraft Services (CAS) project manager along with her normal projects supported. Barbara managed the Gulf Stream Water Ingestion Project, Deputy Project Manager for the Global Hawk HS3 missions, then NOAA's Sensing Hazards with Operational Unmanned Technology (SHOUT) mission in 2015.

In 2016, Barbara's experience led to her taking over as the Lead Project Manager for SHOUT. She also managed special aircraft missions for the ER-2 and Proteus, as well as managing the C-23 Sherpa Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE), Carbon Airborne Flux Experiment (CARAFE), and Student Airborne Research Program (SARP) missions. Missions were conducted in Alaska, Canada, California, Wyoming, and the Eastern Seaboard. CARVE was the second largest single airborne campaign supported by Wallops with 1627 flight hours completed over a four-year period.

Barbara left Code 830 once her matrixed position ended, returned to the RMMO, and was assigned as the NASA Project Manager for the UHF Ground Station CubeSat program. She facilitated the development and implementation of the weekly tracking schedule for a small fleet of NASA on-orbit small satellites (i.e. CubeSats) utilizing the NASA Wallops Flight Facility Ultra High Frequency (UHF) Ground Station, transmitting science data from space to the ground. Managing the CubeSat communications included de-conflicting priorities, responding to maintenance issues or urgent customer requests, weather events, and managing the contract task order. Managing the Ground Station 24/7 operations included coordinating new CubeSat, implementing the Service Level Agreements, communications plans, pre-launch testing, coordinating the commissioning schedule, and inserting the new spacecraft into the Wallops-tracked fleet. Under her management, the tracking schedule grew from five on October 2018 to twelve in September 2020, with an estimated 10,000 passes tracked.

Over her career, Barbara has worked tirelessly to form strong professional partnerships with her customers, along with providing them with the most flexibility, cost savings, and technical success. Barbara has worked diligently to truly understand her customer, what their overall objectives are, and how they must operate to meet these objectives. She masterfully managed the facilities and infrastructure at Wallops Flight Facility to further enhance their ability to perform to their highest level. Through her sustained customer service she has been able to understand even the smallest nuance that could detrimentally affect her customer.

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Introduction

Ever Forward

As I reflect upon this past year for the Wallops' Range and Mission Management Office (RMMO), two words immediately come to mind— appreciation and perseverance. This year every one of us have experienced unquestionable and unprecedented challenges as we navigate obstacles with the COVID-19 pandemic in our midst, yet these two words rise above. Appreciation is what I think of when I reflect this year on all the RMMO supporters across our nation, within NASA, Department of Defense (DoD), commercial, and other partnering organizations. You, our supporters, have believed in us and what we do at Wallops— provide unrivaled response, safe, low-cost range operations, and unparalleled partnering. So, for you, our supporters, I extend my utmost appreciation that in this climate you have allowed us a means to continue to do what drives us in a safe, healthy, and responsible manner. Perseverance is what I think of in regards to the RMMO team and what they have risen above and accomplished against this year. This professional and driven team has allowed safe and successful operations to continue throughout 2020 despite a fairly drastic shift in the way we operate. The members of the Range Team conducted Restart reviews, analyzing every logistical aspect of the mission to ensure that all involved were safe to conduct our essential and critical operations. We pivoted to working nearly fully virtually except for critical operations that required in-person presence, which is no easy feat with the fast-paced tempo of mission planning and operations. All the while, the team followed strict protocols and policies to ensure the safety of all involved and the successful execution of this year's missions. I have no doubt that as we embark upon 2021, our team and our supporters will continue to come together to allow that operational excellence that we have seen each year from the RMMO.

COVID-19 did not deter NASA's only range from launching multiple expendable launch vehicles (ELVs). The NG-13 Antares/Cygnus mission launched to the International Space Station on Feb. 15, 2020, just before restrictions began. The Wallops' team launched the L-129 Minotaur IV, the first Minotaur IV to be launched from Wallops, for the US Space Force on July 15th, at the height of NASA Stage 4 restrictions. To round out the year, the NG-14 Antares/Cygnus mission also launched to the International Space Station during Stage 3 restrictions. These safe and successful ELV launches under COVID-19 restrictions are a testament to Wallops' capabilities and strategic importance to Goddard Space Flight Center, NASA, and the nation.

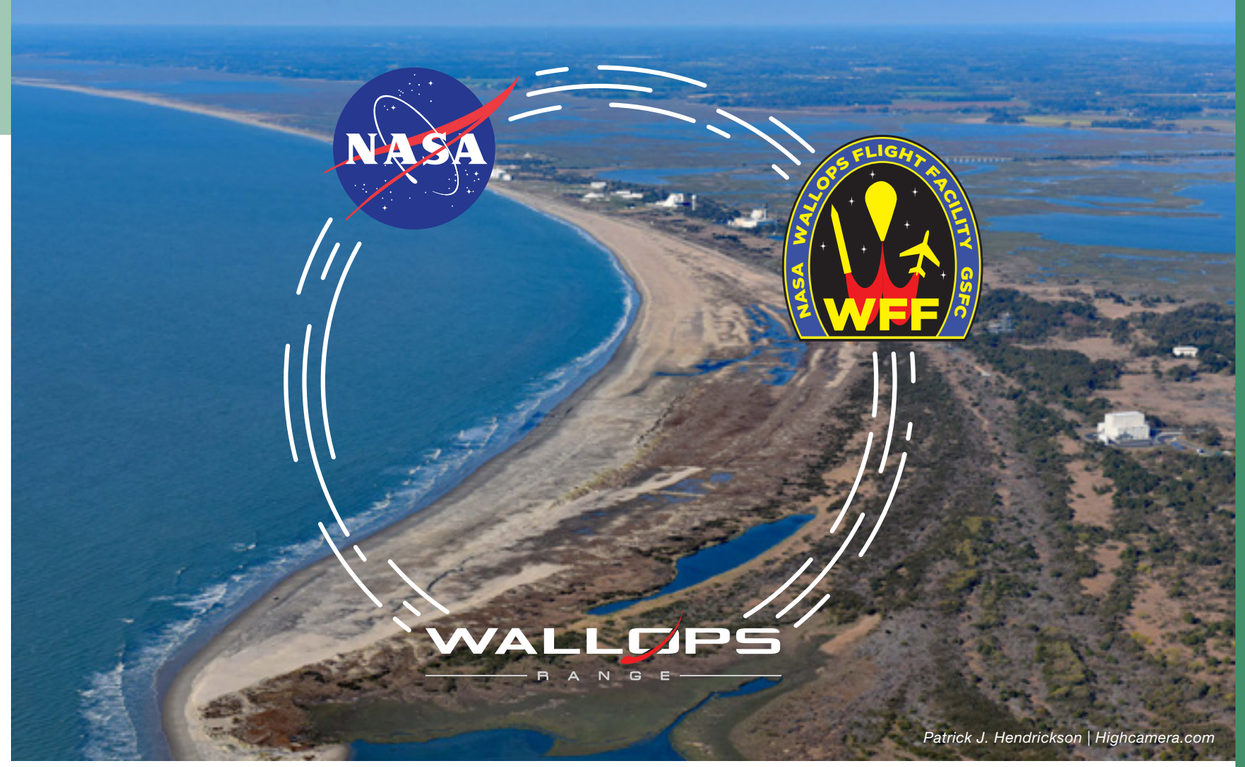
Wallops continues to support the launch community by ushering in low-cost access to Low Earth Orbit for small payloads. With the newly added launch capability of Launch Complex 2 (LC-2), Wallops is preparing to deliver as many as 12 Rocket Lab missions per year. In preparation for the first launch expected in FY2021, the Range completed a Rocket Lab Electron Rollout and Fueling test on Sept. 16 to fully check out LC-2 and evaluate launch vehicle systems. Goddard Space Flight Center personnel are hard at work completing the development, verification, validation, and safety certification of the NASA Autonomous Flight Termination Unit (NAFTU) that will enable future Rocket Lab missions, as well as a new tide of commercial venture-class launch providers. Additionally, Wallops has completed new "flat pads" at Wallops Island, Pads 1A and 1B, for use by other small-launch-vehicle providers.

In addition to rocket launches, the Range provided continuous support in 2020 to the DoD for their Unmanned Aircraft Systems (UAS) operations. The Navy Fire Scout UAS Airborne Use of Force (AUF) training flights were conducted six times throughout the year at the Mid Atlantic Regional Spaceport (MARS) UAS Airfield. The Fire Scout missions that flew from Wallops this year accomplished over 100 hours of flight, training, and experimentation. In addition to Fire Scout, the U.S. Navy also successfully gathered radar data on small UAS to test and calibrate the AN/SPQ-9B Radar, an X-band, pulse doppler, frequency agile radar.

As in past years, the Wallops Range hosted the U.S. Navy Fleet Forces for their Field Carrier Landing Practice (FCLP), which provides land-based practice to qualifications at sea of the Navy's E-2/C-2 aircraft. This year the Navy completed 13,908 passes. Wallops provided a safe and secure location once COVID-19

restrictions began to ensure the health and safety of the Navy personnel prior to boarding the carriers at sea. In other aircraft support activities, the Wallops Range hosted the Ocean City Airshow by positioning the USAF Thunderbirds, F22 Raptors, F-35 Lightning II, A-10 Warthogs demo-teams, and C-17 out of Wallops from Aug. 12 through Aug. 19. This event is always a lot of fun for the community and Wallops personnel, and although this year we could not support our local tail gate party for the air show, the local community was still able to see the birds take to the sky. Later in the summer RMMO also supported the USAF exercise GUARDIAN SHIELD from Sept. 21 through Sept. 25 using the Wallops airfield and infrastructure, and the greater Wallops area as a simulated National Capital Region. This multi-agency exercise was the largest live-fly cruise missile defense exercise of its type and showcased new technology designed to counter the most modern threats.

The Wallops Range continued its aggressive push in 2020 to modernize aging systems while improving range capabilities to meet a diverse array of customer flight program requirements. During COVID-19, our development teams have worked through a thorough project re-start process to enable teams to continue work on-site at Wallops where telework was not effective. Progress on these important projects has continued despite COVID-19.



Patrick J. Hendrickson | Highcamera.com

The Advanced Command Destruct System (ACDS) project is the Range's highest priority development, and will replace the legacy Flight Termination Command-Destruct systems (CDS) at Wallops and for our mobile and Bermuda down-range systems. The legacy CDS systems have been in operation for over 20 years and are plagued with supportability issues. ACDS will provide greater capability such as full Ethernet connectivity, autonomous failover, support of IRIG and Enhanced FTS formats, cyclic commanding, and simultaneous multi-launch vehicle operations. The Range is executing several enhancements to our Air Surveillance capability to enhance Safety and launch-day efficiency. In conjunction with our Navy Range partner, Naval Air Warfare Center Aircraft Division Patuxent River Atlantic Test Range, the Range is executing multiple upgrades to the prime air surveillance sensor, the ASR-8, including the replacement of the existing Secondary Surveillance Radar with a modern UPX-44. Another critical enhancement to the Range's surveillance capability is the Advanced Surveillance Display System— an acquisition and integration of a Commercial Off-The-Shelf (COTS) surveillance display and decision-support system that will include state-of-the-art data fusion capability. In addition, the acquisition of a COTS Electro-Optical/Infra-Red (EO/IR) surveillance camera system will complement the Range's air surveillance radar sensors while also aiding in close-in maritime surveillance. A new long-range high-performance Coastal Surveillance Radar is being procured and will augment existing short-range Surface Surveillance Radars, dramatically enhancing performance in the detection of maritime surface craft near mission hazard areas. Finally, the Range is acquiring a C-Band Range/Aeronautical Telemetry receiving system to replace an obsolete 9 meter antenna and system. The new dual-band system will operate at the traditional S-band and the newly allocated C-Band. The project represents a capability enhancement that will support the changes driven by national spectrum re-allocation, as well as provide opportunity for increased downlink data rates that accompany the shift to a higher radiofrequency.

The accomplishments in which I have just highlighted would not be possible without the expertise, drive, and dedication of the members of the Range and the entire Wallops community. This year's challenges have been met with an equal amount of hope and enthusiasm for the future, and the innovation and dedication to the missions we support rings true. This team will certainly prevail and persevere as we embark upon a new year of hopes, visions, and challenges in the days to come, and I'm excited to see what the future holds. Best wishes in 2021!

- Shannon L. Fitzpatrick

Chief, Range and Mission Management Office

Mission Accomplishments

NG-13

Wallops Range, February 15, 2020

After three attempts, an Antares vehicle carrying the CYGNUS spacecraft, launched skyward destined for the International Space Station on Saturday, Feb. 15, 2020, at 15:21 EST. The afternoon sky was beautiful, and the weather was perfect as the Commercial Resupply Services (CRS) Northrop Grumman (NG-13) mission lifted off from the Mid-Atlantic Regional Spaceport's (MARS) Pad OA located at Wallops. Originally scheduled for February 9, the launch slipped twice due to ground support equipment failure and weather. Since the first abort was within five minutes of launch, the NG launch team was able to perform, for the first time, the late load cargo refresh abort procedure afterwards.

NG-13 is the second of six CRS-II missions scheduled to launch out of Wallops, and the eleventh successful launch of the Antares vehicle. Antares placed the Cygnus spacecraft, named the S.S. Robert Lawrence, Jr. after the first African American astronaut, in a perfect orbit. It successfully rendezvoused with the International Space Station on Feb. 18 and delivered over 7,500 lbs. of cargo. The arrival of NG-13 Cygnus came just 18 days after NG-12 Cygnus departed the International Space Station, marking the shortest time between Cygnus missions at the station. Having two Cygnus payloads in orbit at the same time proved the capability and flexibility for Cygnus on orbit use. As of April 17, 2020, Cygnus has marked one year of continuous on orbit operations including NG-11, NG-12, and NG-13.

NASA, NG, and MARS prepared for the successful NG-13 launch in only a few months after the launch of NG-12. Wallops is responsible for providing Range services to include facilities for cargo and vehicle preparation, assists in spacecraft fueling, and provides tracking, telemetry, and command services. MARS is responsible for the launch pad preparation, and NG owns and provides the launch vehicle and spacecraft under the NASA CRS-II contract.

Prior to departure on May 11, 2020, an external payload was attached to NG-13 Cygnus using the International Space Station CanadaArm. Cygnus spent approximately three weeks in orbit completing its second mission that included CubeSat deployment and other NASA experiments. On May 29, 2020, CYGNUS reentered the Earth's atmosphere and safely burned up on reentry, culminating in a very successful mission.

NG-14

Wallops Range, October 2, 2020

"Successful launch of NG14!!!" was the call after the Antares rocket lifted off from Wallops Flight Facility on October 2, 2020, at 2116 EST. The relief was felt from the entire launch team after the original launch window on the previous day was scrubbed for minor equipment issues and unfavorable weather. This was the third mission to the International Space Station (ISS) under Northrop Grumman's Commercial Resupply Services-2 (CRS-2) contract with NASA.

The Cygnus, S.S. Kalpana Chawla, is named after former astronaut Kalpana Chawla who was the first woman of Indian decent to go to space. For the NG-14 mission, the S.S. Kalpana Chawla delivered nearly 8,000 pounds of science and research, crew supplies, and vehicle hardware to the orbital laboratory and its space station crew. Among the nearly 8,000 pounds of supplies, research, technology demonstrations, and other payloads are a new toilet, seeds to study how radishes grow in space to prepare for feeding future crews on deep-space missions, and investigation that leverages microgravity to identify targeted cancer therapies, a potential innovative water recovery system, a new camera to film a spacewalk and Earth views in cinematic 360-degree virtual reality, and a commercial product that will be photographed in the space station's iconic cupola window as part of NASA's efforts to enable business activities at the space station and develop a robust low-Earth orbit economy.

On October 5, the Cygnus spacecraft was successfully captured using the International Space Station's robotic Canadarm2.

After completing its primary mission, the Cygnus spacecraft was released from the ISS on January 6, 2021 carrying 4,000 pounds of disposable cargo and will remain in orbit for approximately two weeks to perform its secondary mission. Cygnus' secondary mission includes conducting NASA's Spacecraft Fire Safety Experiment V (Saffire-V) experiment, which helps researchers understand how fire behaves in microgravity, and hosting the SharkSat payload.

Field Carrier Landing Practice

Wallops Range

Wallops proudly supports Field Carrier Landing Practice (FCLP) aboard the Wallops Airfield through an Inter-Agency Agreement (IAA) with the United States Navy (USN) Fleet Forces. This support entails Project Management and schedule deconfliction provided by the Range and Mission Management Office (RMMO), airfield support including hangar space, fueling, and Air Traffic Control (ATC) services provided by the Aircraft Office (Code 830), Wildlife Management (BASH) provided by the USDA Wildlife Biologists, lodging and food services provided by Wallops Exchange and Morale Association (WEMA), as well as Security and Aircraft Rescue & Fire Fighting (ARFF) provided by Code 200.

Since FCLP's inception in 2013, Wallops has supported 19 detachments (DETs). In 2020, Wallops was able to support two DETs. DET 18 was able to complete its training objectives prior to the COVID-19 pandemic forcing a facility shutdown in March. In June, DET 19 relocated to NAS Jacksonville in accordance with (IAW) USN sequestration protocols. In September, an unfortunate mishap caused DET 20 to cancel its deployment. In 2020, the Navy performed 11,436 passes on WFF's simulated carrier decks and Improved Fresnel Lens Optical System (IFOLS) located on Runways 10 and 28.

Wallops also supported post-detachment In/Out operations with the Fleet Replacement Squadron (FRS), Carrier Airborne Early Warning Squadron 120 (VAW-120), as well as other fleet squadrons. The primary mission of VAW-120 is to fly and train Naval Aviators, Naval Flight Officers, and Naval Aircrew to safely and effectively operate E-2C/D Hawkeye Airborne Early Warning and C-2 Greyhound carrier based aircraft, preparing them to join the fleet. This aviation training is essential for national security interests and wartime readiness around the world.

The mission of the highly valued E-2C/D Hawkeye, the linchpin of naval aviation operations, is to provide command and control leadership to aircraft carrier strike groups. A highly flexible aircraft flown in addition to the FRS VAW-120 by 11 fleet squadrons, the carrier-based Hawkeye has a trio of detection systems capable of detecting ships and aircraft in excess of 300 nautical miles. When this "over-the-horizon" detection capability is combined with a suite of communications equipment and a highly trained aircrew, the Hawkeye is a potent airborne weapon for any mission in which the carrier air wing takes part, from strike and air-intercept-control to close-air-support for ground forces as well as search and rescue missions. Regardless of its assigned mission, the Hawkeye is a priceless player in the airborne command and control of the United States Armed Forces.

The mission of the C-2A Greyhound is to provide high priority logistics support to aircraft carrier strike groups throughout every region of the world. A highly flexible aircraft, the Greyhound, also commonly referred to as the Carrier On-Board Delivery (COD), lands aboard aircraft carriers principally to deliver cargo, mail, and passengers. Additionally, the Greyhound is an approved special warfare asset, capable of airdropping the United States Navy's Sea, Air, and Land (SEAL) Team's inflatable combat rubber raiding craft out of its ramp and then deploying personnel after its release. This enables the SEALs to be deployed closer to enemy shores. A similar capability allows the Greyhound to be used as a viable Search and Rescue (SAR) platform, capable of airdropping life rafts and provisions to people who are in peril on the sea.

FireScout

Wallops Range

NASA and MARS continued their support of the United States Navy Helicopter Sea Combat Wing Atlantic (HSCWL) MQ-8 flight operations this year by providing a multitude of elements necessary for the safe and effective execution of unit-level training, a critical piece in the readiness of the squadrons prior to deploying overseas.

Detachments started in Feb. with the return of HSC-22 to the MARS UAS Airfield located on Wallops Island. The Navy resumed similar flight operations to those that had been conducted during successful campaigns the previous year with the execution of autonomous flight profiles and maneuvers in R-6604. Operations were also conducted in W-386 with airspace surveillance and monitoring provided by NASA.

Detachments in July and Aug. included MH-60s out of Norfolk Naval Station, Virginia, which offered an excellent opportunity for sailors to achieve additional training by conducting concurrent manned and unmanned operations in a safe and secure environment. Additionally, the July detachment involved personnel from the Naval Aviation Warfighting Development Center, who were able to exercise a simulated ground operation with HSC-22 providing intelligence, surveillance, and reconnaissance (ISR) for the Special Operations Forces on the ground.

In total for 2020, NASA supported five separate detachments: four detachments for HSC-22 spanning from Feb. through Nov., and the first stand-alone detachment of HSC-28 to Wallops in Dec. Nearly 100 sorties were conducted with the MQ-8B, culminating to approximately 240 flight hours completed, further building on the foundation set forth in 2019 between NASA and the United States Navy with the long-term goal of offering an excellent training space through the one-of-a-kind environment that is Wallops Island.

Minotaur

Wallops Range, July 15, 2020

L-129 Minotaur

The Wallops Range once again was at the forefront to support National Security by successfully launching a Northrop Grumman Minotaur IV space vehicle with a National Reconnaissance Office (NRO) spacecraft into orbit. The launch occurred on July 15, 2020, at 09:46 a.m. EDT from the Mid-Atlantic Regional Spaceport (MARS) Pad 0B on Wallops Island. This was the seventh Minotaur IV flight and the twenty-seventh consecutive launch in the Minotaur product line.

L-129 was the first launch from Wallops since the COVID-19 pandemic began. The Range led the charge by coordinating with Goddard management and NASA medical professionals to ensure the entire team was in a safe environment while conducting the planning and execution of the launch. Guidance from the CDC and state of Virginia were taken into consideration and molded into the plan of action.

The Range Surveillance team used local surveillance assets to identify vessels in the hazard area and coordinated with contracted boats and the US Coast Guard to ask them to move. This caused the launch to delay at T-16 minutes to allow time for range foulers to clear the hazard area. The Range team also sent personnel to the tracking stations in Bermuda and Coquina, NC. This was accomplished during NASA's COVID Stage 4 phase, which involved coordination with multi-state and international officials to allow travel into those areas.

The U.S. Space Force (USSF) Space and Missile Systems Center's Launch Enterprise Program provided the launch services for this mission. It was the first USSF mission from Wallops Flight Facility and the NRO's first dedicated launch from Wallops. L-129 was the first Minotaur mission from Wallops since 2013 and the second orbital launch from the MARS launch pads in 2020. Minotaur rockets have launched from Wallops for nearly 14 years. The Range looks forward to supporting future Minotaur launches.

Range Meteorology Support

Wallops Range

Meteorology Operations (METOPS)

For nearly 60 years, weather balloons have been flying at Wallops in support of rocket launches, the National Weather Service upper-air network, and the Upper Air Instrumentation Research Project. What began as a focused effort to provide detailed upper-air weather data has evolved into a vast collection of meteorological data to help support missions at Wallops and other campaigns throughout the world.

The first mission support in 2020 occurred in the very frigid climate of Poker Flat Research Range in Fairbanks, Alaska. MetOps personnel provided weather balloon support and wind data from instrumentation mounted on a 265' meteorological tower for this mission, which successfully launched during the early morning hours of Jan. 27. Other missions that have been supported throughout 2020 include the successful launches of NG-13, NG-14, and L-129. Each of these missions provided a unique set of requirements, with as many as 15 weather balloon releases required for each ELV mission.

In addition to mission support, MetOps has been busy during the past year with maintenance, testing, and software development of new meteorological instrumentation. One of the newest pieces of equipment is the Mobile Met Tower. Throughout the last year, rigorous testing and software development has been conducted to set the stage for this asset to provide the range with another source of meteorological data. The Range is taking full advantage of the mobile capability of this 150' tower, which is scheduled to be used during the upcoming Australia Campaign in 2021 and will likely be used in multiple campaigns throughout the world for years to come.

The Wallops Weather Office is one of the biggest beneficiaries of the meteorological instrumentation. The MetOPS technicians maintain the equipment so the meteorologists utilize it to gather and present data to the safety group to evaluate and make critical decisions for each launch. The instrumentation also provides the Weather Office meteorologists with a vast toolkit of data for real-time analysis and weather forecasting. With mission support increasing both at Wallops and at downrange locations, meteorological data will continue to be crucial in providing protection for personnel and infrastructure that are needed to safely achieve the objectives for each mission.

Weather Office

The Weather Office had to adjust to a new way of life in 2020, with most of the weather forecasting support being conducted at home. Fortunately, due to modern advances in technology and the ability to quickly adapt to the changes that Covid-19 brought to the entire Wallops workforce, accurate weather forecasting and weather monitoring support continued without any interruptions in service.

This year brought a busy Expendable Launch Vehicle (ELV) schedule, it also brought some very active weather, including a record-breaking Atlantic Hurricane Season. With a total of 30 named storms, it was not surprising to see the Wallops Weather Office getting in on the action. In early August, Hurricane Isaias made landfall along the southern coast of North Carolina and tracked almost directly over Wallops. Although Isaias had weakened to a strong tropical storm by the time it made its closest approach, it brought some of the highest winds from a tropical system since records began at Wallops during the early 1960s. During the morning of Tuesday, Aug. 4, Isaias quickly moved through the Wallops region, providing a quick burst of heavy rain and gusty winds. A brief gust of 68 mph was recorded, tying it for the second highest wind recorded by a tropical system since records began, trailing only Hurricane Gloria in 1985.

The National Weather Service and other forecasting agencies across the region identified the threat to be focused mainly to the south of the Wallops Region. The Wallops Weather Office was able to forecast a high threat of tornadoes well in advance of the storm. This knowledge allowed preparations to be made to minimize the potential damage. This forecast was verified during the early morning hours of Aug. 4, as five tornadoes occurred throughout the Delmarva Peninsula.

In addition to the daily forecasts produced for operations at Wallops , the Wallops Weather Office also provided advance notice of impending hurricanes to the downrange locations supporting ELV missions. With forecasts for Isaias focused on Wallops and the tracking station at Coquina, North Carolina, forecasts were also provided to the Bermuda team as they prepared for the NG-14 mission that would ultimately launch in October. The busy 2020 Atlantic Hurricane Season did not spare Bermuda, as hurricanes Paulette and Teddy disrupted buildup operations in the weeks leading up to launch. Fortunately, the accurate forecasts and daily updates from the Wallops Weather Office provided the Bermuda Team with the information necessary to remain safe, protect property, and remain on schedule to support the successful launch of NG-14.

Mission Accomplishments

Mobile Deployments

Norway Grand Challenge

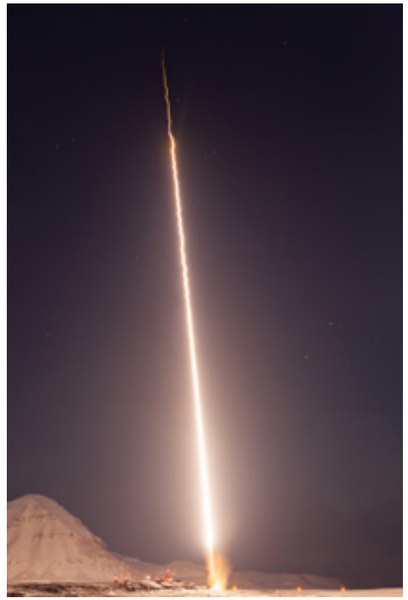
The Norway Grand Challenge Initiative (GCI) is a multiyear effort involving the launch of several different missions from organizations around the world. Despite the logistical and environmental challenges of deploying support equipment to such a remote environment, the Research Range Services (RRS) team was able to successfully complete all required missions and hopes to support more in the future.

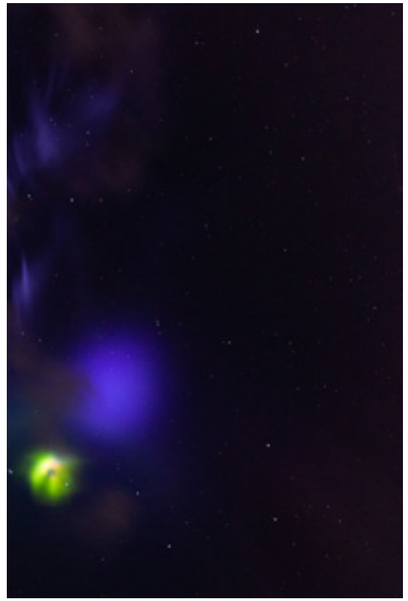
ICI-5, CHI, & C-REX-2

Norway

After completing a summer maintenance trip which saw the pack up and return of the SuperVan, 7M-2, and Rollaway Readout Station, the launch team closed out the year by once again traveling to both Ny-Ålesund and Andenes in support of the next round of vehicles in the Grand Challenge. In November, the mission engineer and a photographer traveled to Andenes, while a telemetry team, a photographer, and the project manager traveled back to Ny-Ålesund. This campaign saw the team in Ny-Ålesund supporting two rockets: Investigation of Cusp Irregularities-5 (ICI-5), which was managed by the Norwegian team from Andøya Space, and the Cusp Heating Investigation (CHI) mission, which was managed by personnel from Wallops. After completing all required pre-mission testing, the Research Range Services (RRS) team was team was ready to support the mission. On just the second day of the launch window, Nov. 26, the Principal Investigator (PI) spotted the science conditions he was looking for and called to pick up the count. A few minutes later, the telemetry technicians successfully tracked the vehicle, and the photographer was able to get some great pictures as the rocket soared into the sky. The CHI mission, however, was not so lucky. Day after day of the launch window passed without the required science conditions showing themselves. The official science window closed on Dec. 9, but there were a few less-than-perfect launch days that were requested, just in case. On Dec. 10, the skies were mostly clear, the wind was mostly calm, and the PI seemed excited about developing science conditions. Later that morning, the PI called for a count pick up, and this time it progressed all the way down to zero and a launch. The RRS team once again successfully tracked the vehicle and captured long-exposure photos of the flyout. After providing the required data and securing the site, the team in Ny-Ålesund headed south, back to sunlight and warmer temperatures. The team in Andenes was not quite so lucky, as their PI never found the required science and weather conditions that would have allowed for a launch. They were able to return in November to achieve their objectives.

Despite the logistical and environmental challenges of deploying support equipment to such a remote environment, the RRS team was able to successfully complete all required missions that could lead to future opportunities.





Mobile Deployments

PolarNOx

Fairbanks, Alaska

After a year off in order to support the first Norway Grand Challenge mission, the Research Range Services (RRS) team once again traveled to Fairbanks, Alaska, to support a launch from Poker Flat Research Range (PFRR). This year's campaign was to support a second flight of the PolarNox mission that flew in 2017. During the 2017 launch, the team successfully tracked the rocket, but unfortunately, the Principal Investigator (PI) did not get the expected science results. Fast forward three years, and the PI was ready to give it another shot.

The team traveled to Fairbanks in early January where they were met with the traditional Fairbanks winter greeting: a frigid -36-degree blast upon walking out of the airport. The cold weather held on for several days with temperatures frequently dipping into the -30s or below, but the team persevered and continued to set up and check out their systems to prepare for mission support. Prior to this point, a separate team traveled up in early December to re-populate the main telemetry support area with new equipment to replace the previously removed equipment in support of the Norway mission.

An additional challenge for this mission was the installation of the updated Rollaway Command System (RACS). This mission is referred to as an "uplink" mission, where the PI can use ground-based systems to send commands to the scientific payload and make small payload adjustments as needed during the flight. The system originally installed at PFRR used to support this capability had reached "end of life" and needed to be replaced. In the year prior to this mission, that system was removed from PFRR and the RACS system underwent an upgrade, making the PolarNOx mission its first operational support after the upgrades were complete. After successfully installing the system, the team completed all required testing and declared the system operational.

After ensuring that the payload could "communicate" with the ground support equipment, the countdown was ready to commence. Science missions at PFRR typically have a long support duration because the PI is looking for clear skies or a specific kind of aurora to appear in a specific location. The PI for this mission did not have any stringent requirements, and there were high hopes that the mission would launch on the first day. A Poker mission, however, would not be a Poker mission if the launch occurred on the first day, and this year was no exception. The night of the first count progressed smoothly from count pick-up through all the required pre-mission tests. As the clock counted down into the final minutes, everyone mentally prepared for the launch. The final seconds ticked by, and then nothing.

Each team member began a self-evaluation of steps accomplished to verify nothing was missed. The countdown lead announced a "hang fire", which meant the launch command was sent but the vehicle did not launch. After following all required safety procedures, the probable cause of the hang fire was determined and the team was able to return the next day to support another attempt. With high hopes, the countdown commenced once again, and this time, when the clock hit zero, the rocket roared off into the sky. After successful completion of the mission, the team packed up the RACS system for its return to Wallops and subsequent integration into the Australia mission support infrastructure.

Thanks to the hard work and dedication of the team, the PI was able to successfully gather the data he had not been able to retrieve during the previous attempt. Despite the cold weather and other challenges, the team was able to work with its partners to successfully support the science community, and RRS will welcome opportunities to support future missions at PFRR.

Education & Public Outreach

RCC Tours

Wallops Range

Throughout the year, the Wallops Range hosts a multitude of tours to educate the public on the ins-and-outs of launching a rocket from Wallops Flight Facility. Tours are given to a wide range of participant types and professional levels from middle school students and senior citizens to other government agencies and councils. Visitors are taken right to the main stage of the Range Control Center (RCC) where the magic happens and the biggest decisions are made on whether a rocket will take flight. From the safety room to test director's console, a range official escorts visitors on a ride of launching rockets into sub-orbital and orbital space. The video wall gets fired up and the visitors get to experience what it would be like to watch a rocket launch for themselves in the seats of NASA's brightest who work up until the very last minute to make every mission successful. The tour not only focuses on the successful launches but the failures as well.

Participating Organizations

- MIT AeroAstro Student Tour
- Wor-Wic Veterans Upward Bound
- Delaware Technical Community College Encore-Seniors
- Broadwater Academy STEM Engagement
- NASA Community College & Aerospace Scholars (NCAS)
- SCSC Senior Leadership (RCC/MOCC)

Range Capability Advancements

Range System Development

Wallops Range

The Wallops Range continued this year to modernize our aging systems while improving range capabilities to meet the diverse array of customer flight program requirements. During COVID-19, the various development teams have worked through a thorough Center project re-start process to enable certain team members to continue work on-site at Wallops where required. Progress on these important projects, while hampered, has continued.

Advanced Command Destruct System (ACDS)

The ACDS project will replace the legacy Flight Termination Command-Destruct systems (CDS) at Wallops, in addition to our mobile and Bermuda Down-range systems. The legacy CDS systems have been in operation for over 20 years and are plagued with supportability issues. ACDS will provide greater capability such as full Ethernet connectivity, autonomous failover, and support of IRIG and Enhanced FTS (EFTS) formats, cyclic commanding, and simultaneous multi-launch vehicle operations. The project passed Critical Design Review (CDR) in June 2020. Mock-up systems have been built up to assist with discovery testing, requirement verification, and installation planning. The project is working toward its next major milestone of the System Test Readiness Review which will mark the beginning of official testing culminating in Operational Readiness and formal Safety Certification. Project completion is planned in early 2023.

Air Surveillance RADAR Enhancements

Wallops Range, in conjunction with Navy Range partner Naval Air Warfare Center Aircraft Division (NAWCAD) Patuxent River Atlantic Test Range, is executing multiple upgrades to the Range's prime air surveillance sensor – the ASR-8, including the replacement of the existing Secondary Surveillance Radar (SSR) with the UPX-44. The UPX-44 SSR upgrade will replace the obsolete interrogators and switching unit with modern, maintainable systems which will preserve the current capability and expand the modes supported to include Mode 5, Mode S and Automatic Dependent Surveillance – Broadcast (ADS-B). This upgrade is being pursued in conjunction with an upgrade of the analog target data extractor to the Common Terminal Digitizer (CTD) which will improve radar performance and extend the service life of the ASR-8. Wallops is in the final procurement phase of the contract with the vendor, Telephonics.

Air Surveillance Display System (ASDS)

Another critical enhancement to Range surveillance capability is the acquisition and integration of a Commercial Off-The-Shelf (COTS) surveillance display and decision-support system that will include state-of-the-art data fusion capability. This system will optimize the effectiveness of numerous organic and remote sensors and data link sources, while enhancing overall ability to detect aircraft operating in the hazard areas offshore. Improved capability will improve Safety analysis and mission success as well as enhance launch availability for customer missions. Raytheon Solipsys's Multi Source Correlator Tracker (MSCT), was selected. Operational Acceptance studies and documentation for MSCT at other DoD Facilities are being leveraged to streamline the Safety certification process for this advanced capability. The project is in the procurement phase with installation beginning approximately three months after the post award conference.

EO/IR Camera

The Range's effectiveness and Safety are being enhanced by the acquisition of a COTS Electro-Optical/Infra-Red (EO/IR) surveillance camera system to complement the Range's air surveillance RADAR capability while also aiding in maritime surveillance. This EO/IR system will provide low-light, nighttime surveillance with "slew to cue" functionality with data taken from local surveillance radars. The project is nearing completion of bench testing the camera system and are engineering installation of a remote operating console in the Range Control Center (RCC).

Coastal Surveillance RADAR (CSR)

The Range is augmenting existing short range Surface Surveillance RADARs with a long range high performance radar that will dramatically enhance performance in the detection of maritime surface craft operating in and near mission hazard areas. This increased capability will improve safety and mission success by improving the reliability of information delivered to Range and Safety Decision-Makers. The CSR is in the procurement phase with installation scheduled no earlier than June 2021. Detailed system installation design on an existing Wallops tower is in-progress.

C-Band Telemetry / 9 Meter System Replacement

This year, the Range is acquiring its first C-Band Range/Aeronautical Telemetry receiving system in the process of replacing the obsolete "9 meter" system. The new system will operate at the traditional S-band and the newly allocated C-Band. The project represents a capability enhancement that will support the changes driven by national spectrum re-allocation as well as provide opportunity for increased downlink data rates that accompany the shift to a higher radio-frequency. The Wallops Sounding Rocket Program is concurrently implementing a corresponding flight vehicle C-Band TM transmitter project which will support the NASA Science and Flight Test community in addition to the non-NASA range customers seeking to operate in the new frequency band. A vendor has been selected and the project's Preliminary Design Review (PDR) was conducted in December. Critical Design Review (CDR) is currently scheduled for March 2021.

Upcoming Missions & Highlights

Upcoming Missions

ELV Campaigns

The Research Range Services (RRS) team continues to support Northrop Grumman's Commercial Resupply Services-2 (CRS-2) contract with NASA by providing communications, data processing, radar, telemetry, timing, optical tracking, surveillance, and weather services.

ANTARES NG-15 & NG-16

In 2021, two more launches of the Antares rocket with the Cygnus spacecraft are scheduled. NG-15 & NG-16 are scheduled to launch in February and July.

NG-15 is scheduled to launch no earlier than February 20, 2021. It is tradition to name each Cygnus spacecraft after an individual who has played a pivotal role in human spaceflight. The NG-15 Cygnus spacecraft is named after NASA mathematician Katherine Johnson, a Black woman who time and again broke through barriers of gender and race. Her hand-written calculations were critical to America's success during our first human spaceflight missions. For the NG-15 mission, the S.S. Katherine Johnson will deliver approximately 3,719 kg. (8,200 lb) of cargo to the space station.

NG-16 is scheduled to launch no earlier than July 2021.

L-111 MINOTAUR

Wallops will be launching another NRO payload in June of 2021. This launch will utilize a Minotaur 1 launch vehicle to propel the payload into orbit. The multiple stage rocket will launch from the MARS Pad 0B. The Wallops Range will provide Project Management, safety oversight, and range surveillance of the hazard area.

Upcoming Missions

Sounding Rocket Campaigns

The Research Range Services (RRS) team continues to support the Sounding Rocket Program Office (SRPO) by providing launcher operations, communications, data processing, radar, telemetry, timing, optical tracking, payload recovery, surveillance, and weather services.

VIPER

In April 2021, the VIPER mission is an observational and modeling effort to understand Very Long Frequency (VLF) wave penetration through and propagation above the Earth's ionosphere. The two-stage Terrier-Improved Malemute sounding rocket will support this payload.

KiNET-X

KiNET-X is scheduled to launch in May 2021. This experiment studies how momentum transport is affected by kinetic-scale physics, i.e. formation of parallel electric fields and dissipation, how electromagnetic energy is converted into plasma kinetic and thermal energy, and what the interplay is between fluid- and kinetic-scale processes. This launch will be on a four stage Black Brant XII-A vehicle.

RockOn

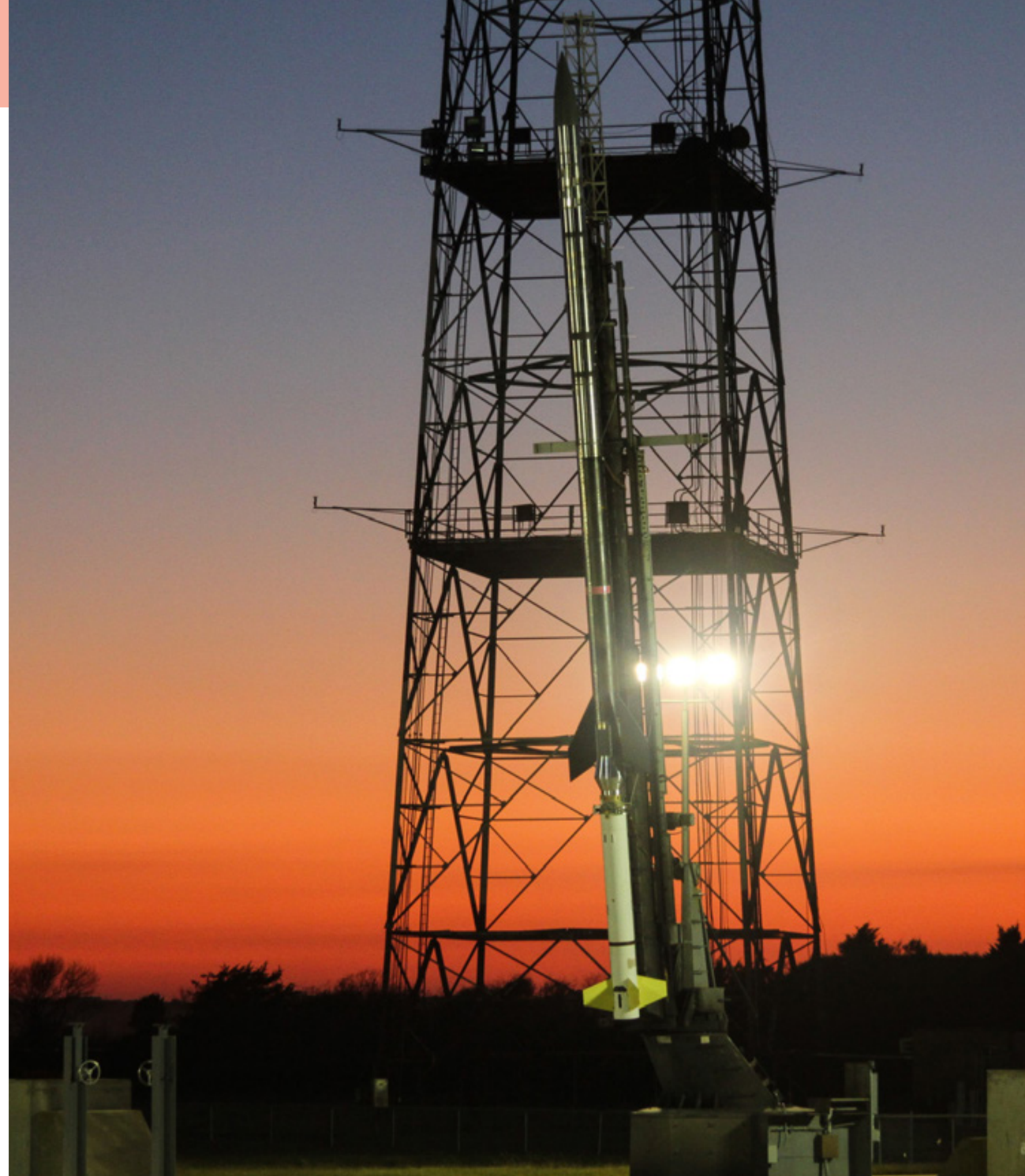
The RockOn workshop continues its support of the next generation in June 2021. This workshop is an opportunity to provided exposure to, and spark interest in, space-based science missions to universities. This is accomplished by flying two classes of experiments. First time participants generally fly the simpler kit built experiment. As educational institutions gain more experience, it is expected they will progress towards developing their own unique RockSat-C class experiments. This particular launch will be on a two-stage Terrier-Improved Orion.

Dynamo-2

In July 2021, SRPO is planning two launches of Dynamo-2 on a Black Brant 9 two-stage sounding rocket. The Blank Brant 9 has a Terrier first stage and a Black Brant second stage. The overall objective of this suite of instruments on the Dynamo-2 payloads is to measure DC electric fields, plasma density, currents, neutral winds, neutral density and temperature, and ion mass distributions.

RockSat-X

In August 2021, the RockSat-X which will carry student developed experiments. This mission is a follow-on mission of the RockOn and RockSat-C programs. RockSat-X experiments are more advanced and include full-featured sounding rocket support systems, including telemetry, attitude control and recovery. RockSat-X experiments are exposed to the space environment enabling measurement of variables outside the payload. The payloads will be launched using a two-stage Terrier-Improved Malemute.



National Aeronautics and Space Administration

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