WALLOPS FLIGHT FACILITY

Wallops Range User's Handbook

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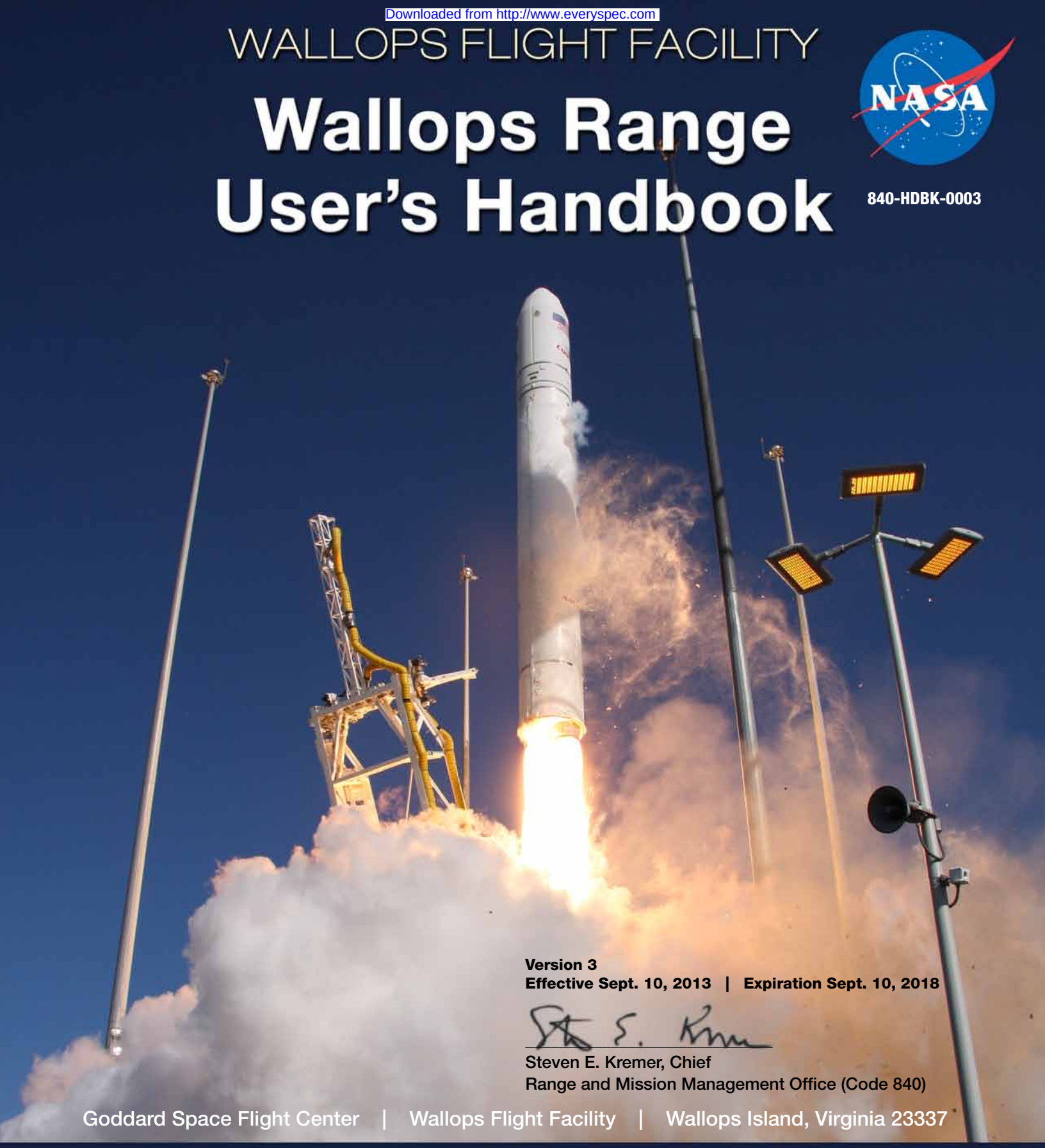

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Change History Log

Revision	Effective Date	Description of Changes
1	11/1996	Rewrite of all sections in handbook.
2	04/2000	Rewrite of all sections in handbook.
C	03/10/2003	Rewrite of all sections in handbook; added Appendix B. Replaces previous Range Users Handbook, 840-RUH-1996, Revision 2.
D	04/21/2003	Corrected beam widths in Table 3-3 for Radar 2, 8, 10, and 11
E	05/23/2003	Corrected beam widths in Table 3-3 for Radar for Radar 2 and 8
F	06/23/2003	Corrected paragraph 2.2.2
G	12/01/2003	Rewrite of all sections in handbook
H	10/01/2007	Revised all sections in handbook
I	03/17/2008	Revised all sections in handbook
3	9/10/2013	Rewrite of all sections in handbook

PREFACE

The NASA/Goddard Space Flight Center (GSFC) operates the Wallops Flight Facility (WFF) located on the Eastern Shore of Virginia. NASA supports space and Earth science technology and aeronautical research aircrafts. WFF operates a research range consisting of a rocket range and research airport. WFF also maintains capabilities to conduct mobile launch activities due to unique scientific requirements.

Wallops users represent NASA, other United States Government agencies, and foreign and commercial organizations. The *Wallops Range User's Handbook* summarizes Wallops' policies and procedures for facility use and provides a description of general capabilities.

The *Wallops Range User's Handbook* can be viewed online at **http://sites.wff.nasa.gov/multimedia/docs/wffruh.pdf**. The most recent versions of other documents referenced within this handbook can be found on the Goddard Directives Management System at http://gdms.gsfc.nasa.gov.

Abbreviations and acronyms in the handbook are listed in Appendix A. References are listed in Appendix B.

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This version of the Wallops Range User's Handbook replaces all previous versions of this document.

Check the Goddard Directives Management System at http://gdms.gsfc.nasa.gov to verify correct version prior to use.

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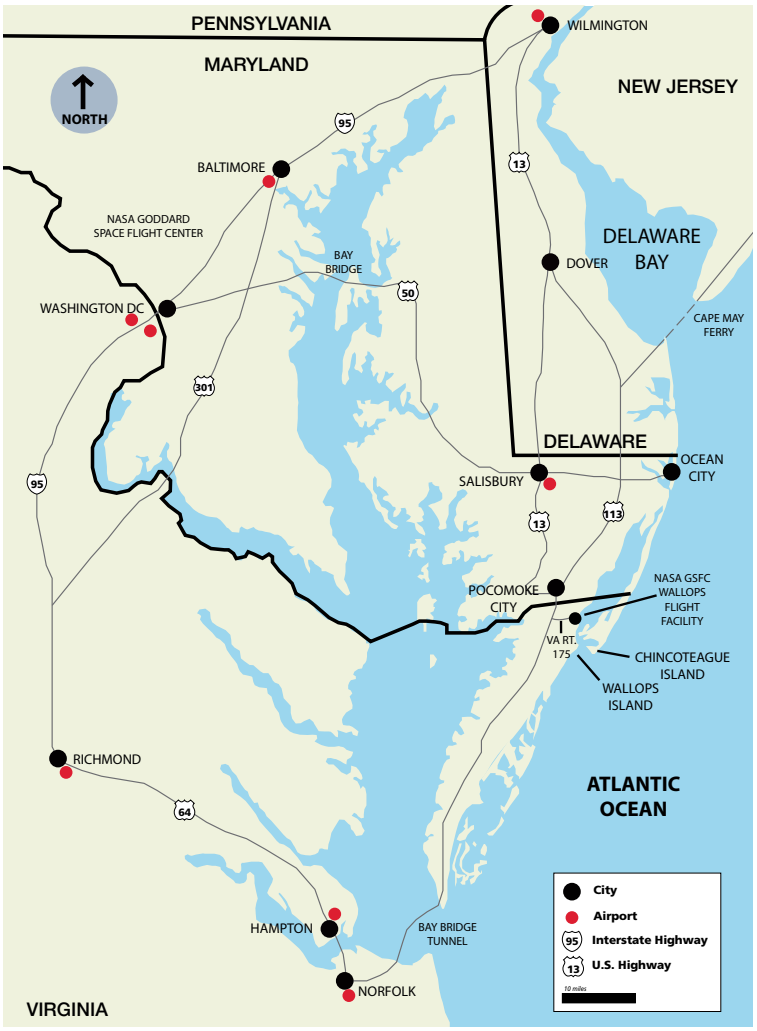

Road Map to NASA/GSFC/WFF

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1 INTRODUCTION

1.1 Purpose

The *Wallops Range User's Handbook* is a guide for planning operations at the Wallops Range. It provides a summary of the policies, procedures and capabilities of the range. Included are procedures for obtaining authorization for range use and for efficient project coordination between the range user and Wallops Flight Facility (WFF) personnel.

This handbook describes the information to be provided by the range user that will enable the Range to effectively plan for and support the range user's project. In addition, this handbook describes the facilities and systems available at WFF for supporting aeronautical research, balloons and suborbital and orbital research projects.

Visit the WFF homepage at **http://www.nasa.gov/centers/wallops/home** for more information.

1.2 Geography

The WFF Main Base is located on Virginia's Eastern Shore 5 miles west of Chincoteague, Va., approximately 90 miles north of Norfolk, Va., and 40 miles southeast of Salisbury, Md. See previous page for a road map to Wallops Flight Facility.

WFF consists of three separate parcels of real property: the Main Base, the Mainland and the Wallops Island Launch Site. The Mainland and the Wallops Island Launch Site are approximately 7 miles southeast of the Main Base. Figure 1-1 shows WFF and the relationship of the three properties.

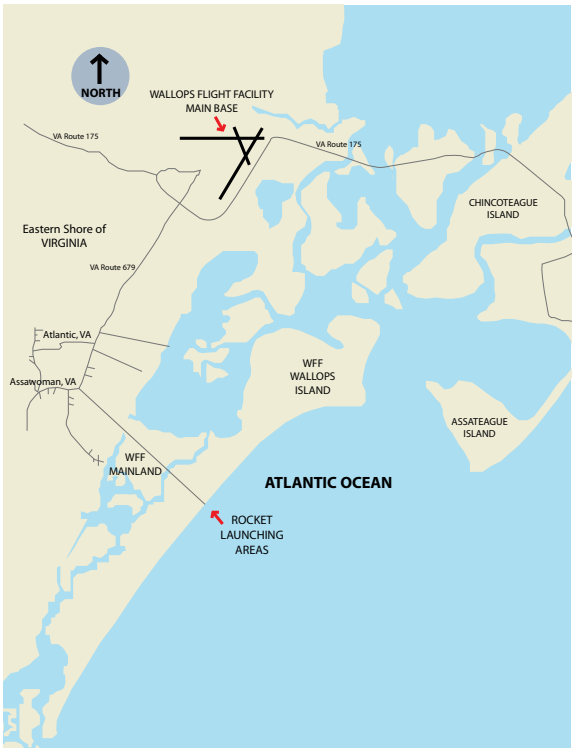


Figure 1-1. Wallops Flight Facility

1.3 Wallops Range

The Wallops Range is part of WFF and is managed by GSFC's Suborbital and Special Orbital Projects Directorate. The range consists of a launch range, an aeronautical research airport, and associated tracking, data acquisition, and control instrumentation systems. The range includes authorized operating space, primarily over the Atlantic Ocean, and authorized frequency spectrum. Scientists and engineers from NASA, other U.S. Government agencies, colleges and universities, commercial organizations, and the world-wide scientific community have conducted experiments at the range.

1.4 Operational History

A rocket launches from Wallops Island more than a half a century ago.

In 1945, NASA's predecessor agency, the National Advisory Committee for Aeronautics (NACA), established a launch site on Wallops Island under the direction of the Langley Research Center. This site was designated The Pilotless Aircraft Research Station and conducted high-speed aerodynamic research to supplement wind tunnel and laboratory investigations into the problems of flight.

In 1958, Congress established the National Aeronautics and Space Administration (NASA), which absorbed Langley Research Center and other NACA field centers and research facilities. At that time, the Pilotless Aircraft Research Station became a separate facility — Wallops Station — operating directly under NASA Headquarters in Washington, D.C.

In 1959, NASA acquired the former Chincoteague Naval Air Station, and engineering and administrative activities were moved to this location. In 1974, the Wallops Station was named Wallops Flight Center. The name was changed to Wallops Flight Facility in 1981, when it became part of Goddard Space Flight Center in Greenbelt, Md.

In the early years, research at Wallops was concentrated on obtaining aerodynamic data at transonic and low supersonic speeds. Between 1959 and 1961, Project Mercury capsules were tested at Wallops in support of NASA's manned space flight program before the astronauts were launched from Cape Canaveral, Fla. Some of these tests using the Little Joe Booster were designed to flight-qualify components of the Mercury spacecraft, including the escape and recovery systems and some of the life support systems. Two rhesus monkeys, Sam and Miss Sam, were sent aloft, acting as pioneers for the astronauts; both were recovered safely.

Since 1945, the Wallops Range has launched thousands of research vehicles in the quest for information on the flight characteristics of airplanes, launch vehicles and spacecraft, and to increase the knowledge of the Earth's upper atmosphere and the near space environment. The launch vehicles vary in size and power from small meteorological rockets to orbital class vehicles.

WFF continues to be a small, fast response, matrix organization that can accomplish rocket and balloon projects, spacecraft orbital tracking, airborne science support, instrument fabrication and aeronautical research.

1.5 GSFC/WFF Missions

Wallops' key mission elements support all NASA Centers with a science and technology focus.

- **Suborbital Flight Projects —**Wallops manages and implements NASA's sounding rocket, balloon, and airborne science programs. New technologies, such as the ultra-long duration balloons, are integrated into the programs.

• **Small and Medium Class Orbital Missions —** Wallops manages and provides technical support for small and medium class spacecraft carriers.

• **Mission Operations —** Wallops provides fixed and mobile launch ranges and a research airport. The range provides the services necessary for a wide variety of research, development and operational missions, including rocket, balloon and aerial vehicle flights. Wallops also manages and operates satellite tracking stations locally. The Range supports NASA, Department of Defense (DoD), commercial and academic organizations.

• **Science and Technology —**Wallops Earth scientists research global climate change. Wallops engineers develop new technologies that improve capabilities of flight projects or lower the cost of access to space.

• **Educational Outreach —** Partnerships formed with industry and academia foster educational outreach programs that support the development of future engineers and scientists.

This handbook addresses only those missions related to the Wallops Range.

1.6 GSFC at WFF

There are seven GSFC directorates located wholly or in part at WFF. These organizational elements combine to form the Wallops Flight Facility and perform all the functions for the operation of the facility.

• **Suborbital and Special Orbital Projects Directorate (Code 800) —** Code 800 elements supporting the range include:

Resources Management Office (Code 801), which plans and monitors execution of all budgets including research and development (R&D), institutional, reimbursable, manpower, and travel.

Advanced Projects Office (Code 802), which serves as the new project interface during feasibility and early formulation phases, and is responsible for establishing formal agreements with external customers.

Safety Office (Code 803), which develops and monitors ground and flight safety procedures for all launches managed by Code 800.

Other offices associated with Code 800 are the Sounding Rockets Program (Code 810), Balloon Program (Code 820), Airborne Sciences Program (Code 830), Range and Mission Management (Code 840) and Special Projects Office (Code 850).

• **Office of the Director (Code 100) —** Office of Human Capital Management (Code 110), Talent Cultivation Office (Code 114), Equal Opportunity Programs (Code 120), Wallops Office of Public Affairs (Code 130.4), and Wallops Fiscal Operations Section (Code 157) maintain facilities at Wallops.

• **Management Operations Directorate (Code 200)** — Code 200 elements that maintain offices at Wallops include Wallops Procurement Office (Code 210), Wallops Facilities Management Branch (Code 228), Wallops Logistics team (Code 231), Wallops Protective Services Division (Code 240), Wallops Environmental Office (Code 250), Technical Information and Management Services (Code 271).

• **Safety and Mission Assurance (Code 300) —** The Safety and Mission Assurance Directorate (SMA) main office is located at the GSFC in Greenbelt, Md. The Assistant Director of SMA at Wallops is co-located at WFF and serves as senior SMA advisor and a point of contact for mission assurance as it relates to WFF programs, projects and operations. The Assistant Director of SMA ensures the proper level of mission assurance for WFF programs, projects and operations is defined, appropriately documented, and implemented. This office also provides support for institutional safety at WFF to facilitate ongoing communication and collaboration with the institutional safety organization at Greenbelt.

• **Flight Programs and Projects Directorate (Code 400) —** Mission Services Program Office (Code 450) is located at GSFC in Greenbelt, Md. The Ground Network Project Office (Code 453), collocated at Greenbelt and Wallops Island, monitors the Ground Network services that are part of the Space Comunication and Navigation Division of NASA's Human Exploration and Operations Mission Directorate

• **Applied Engineering and Technology Directorate (Code 500) —** Code 500 maintains several branches at Wallops:

Mechanical Systems Branch (Code 548)

Wallops Electrical Engineering Branch (Code 569)

Wallops System Software Engineering Branch (Code 589)

Guidance, Navigation & Control and Mission Systems Engineering Branch (Code 598)

• **Sciences and Exploration Directorate (Code 600) —** Hydrospheric and Biospheric Sciences Laboratory (Code 614) maintains three branches at Wallops: Cryospheric Sciences (Code 614.1), Ocean Sciences (Code 614.2) and Instrumentation Sciences (Code 614.6)

• **Information Technology and Communications Directorate (Code 700) —** Wallops Information Technology and Communications is responsible for overseeing, planning and implementing IT and Communication services at WFF. (Code 763)

WFF supports the Poker Flat Research Range (PFRR) in Alaska and the Columbia Scientific Balloon Facility (CSBF) in Palestine, Texas, with contract management, instrumentation, and range support as required. PFRR is maintained and operated by the Geophysical Institute at the University of Alaska in Fairbanks under a contract managed by the Sounding Rockets Program. The CSBF is maintained and operated in Las Cruces under a contract managed by the Balloon Program.

1.7 Mid-Atlantic Regional Spaceport

An ELV takes flight from the Mars 0B pad on Wallops Island.

The Mid-Atlantic Regional Spaceport (MARS) is an enterprise of the Virginia Commercial Space Flight Authority (VCSFA) under joint governance by the States of Maryland and Virginia. MARS operates the commercial spaceport on Wallops Island and markets the Wallops Range to support their customer focus. MARS markets their services as a "one-stop shopping" place for low-cost, safe, reliable, user-friendly space launch facilities and services for commercial, government and scientific/academic users, both foreign and domestic, who want to purchase launch range services through a commercial spaceport. MARS, through the established agreements between the VCSFA and NASA, can serve as a broker for NASA-supplied range services through a Space Act Agreement or contractual relationship, thereby allowing multiple approaches to integrated WFF range services. The following link provides additional information on MARS facilities and services at **http://www.marsspaceport.com**.

1.8 Other Wallops Organizations

United States Navy (USN) Surface Combat Systems Center (SCSC) provides facilities that replicate USN fleet ships for purposes of training and technology validation. The Naval Air Warfare Center (NAWCAD) from Patuxent River, Md., also maintains systems at Wallops. NAWCAD makes regular use of the Wallops Range for aircraft development testing. Main Base facilities include housing for personnel and dependents and a Navy Exchange.

United States Coast Guard (USCG) is represented by Station Chincoteague on Chincoteague Island. USCG Search and Rescue helicopters and other USCG aircraft use the airport as a base of operations. USCG housing occupies several acres on the Wallops Main Base.

National Oceanic and Atmospheric Administration (NOAA) operates a field site of the National Environmental Satellite, Data, and Information Service (NESDIS), which produces multidimensional imagery from polar orbiting and geostationary satellites operated by NOAA.

Marine Science Consortium (MSC) is a nonprofit corporation dedicated to promoting teaching and research in the marine sciences. Founded in 1968, the MSC established operations at Wallops Flight Facility in 1971. The MSC is a cooperative educational venture, where 16 member institutions pool resources to offer courses and to provide residential and laboratory facilities to students from all member institutions. For more information, visit the MSC website at **http://www.msconsortium.org**.

2 WALLOPS RANGE SUPPORT POLICIES AND PROCEDURES

2.1 Introduction

The National Aeronautics and Space Act of 1958 (Space Act), as amended, charters NASA to plan, direct and conduct space activities. The Space Act authorizes NASA field installations to establish policies and operational interface procedures for users of NASA resources. Activities under the Space Act are to be conducted to optimize America's scientific and engineering resources. NASA is authorized to enter into contracts, leases, cooperative agreements, and other transactions on such terms as it may deem appropriate with any person, firm, association, or corporation. NASA is also authorized to cooperate with public and private agencies in the use of Government-provided launch support, services, equipment, and facilities.

For policies and procedures specific to Wallops, please see 802-HDBK-0001D, *Doing Business at Wallops Flight Facility: A Customer Guide*, available at **http://sites.wff.nasa.gov/multimedia/docs/CG2007.pdf**.

2.2 Key Range Personnel

All operations at the Wallops Range are conducted under NASA control. The following paragraphs define the functions, responsibilities and authority of key range personnel.

2.2.1 WFF Test Director

The WFF Test Director has authority over all operations conducted on the Wallops Range. The Test Director is responsible for ensuring that all range policy, criteria, and external agreements are satisfied during the operations. The Test Director is responsible for establishing and maintaining the schedule of range activities. This includes publishing schedules and summaries, resolving scheduling conflicts between project requirements and resources, and acquiring required clearances from external organizations for programs conducted at the range.

2.2.2 Project Manager

The Project Manager is the primary point of contact for the range customer. The designated WFF Project Manager has the authority to plan, coordinate, and direct operational support for assigned projects conducted at the Wallops Range.

2.2.3 Range Safety Officer (RSO)

The WFF RSO is responsible for ensuring the Wallops Range safety policy, criteria, and procedures are not violated during operations and to ensure that risks are understood and are within acceptable limits. The RSO has authority to stop work, hold a launch, or terminate a

mission in flight if necessary.

2.2.4 Operations Safety Supervisor (OSS)

The OSS is responsible for supervising all assigned hazardous operations. The OSS is also responsible for the implementation for ground safety plans, operation procedures, and ensuring all lifting devices and equipment are certified. In some instances, the OSS may delegate responsibilities to other qualified personnel for specific operations.

2.3 Policies

2.3.1 Safety, Reliability and Quality Assurance Policy

WFF safety personnel will review all activities conducted on the Wallops Range. All range activities will be conducted in accordance with safety policy and criteria established in NPR 8715.3C, *NASA General Safety Program Requirements,* NPR 8715.5A, *Range Flight Safety Program* and RSM-2002-RevC, Range Safety Manual for Goddard Space Flight Center (GSFC)/ Wallops Flight Facility (WFF). NASA's Online Directives Information Systems contains links to NPR 8715.3C and NPR 8715.5A (**http://nodis3.gsfc.nasa.gov/main_lib.cfm**), and RSM-2002-RevC, which can be found online at **http://sites.wff.nasa.gov/multimedia/docs/RangeSafetyManual.pdf**. Reliability and Quality Assurance reviews may be required on a case-by-case basis.

2.3.2 Frequency Utilization and Management

The WFF Test Director, along with the WFF Spectrum Manager, is responsible for the operational control of the radio frequency (RF) spectrum at Wallops. Frequency utilization and management policies and procedures applicable to all range user activities at Wallops are detailed in the *Wallops Flight Facility Frequency Utilization Management Handbook,* which is located at **http://sites.wff.nasa.gov/multimedia/docs/WFF_FUM04.pdf**.

2.3.3 Scheduling

The range customer submits project scheduling information to the Project Manager, who relays potential conflicts as they are identified. Every effort is made to resolve conflicts between programs in a manner that permits each program to be successfully completed on an acceptable schedule. Range scheduling meetings are held monthly. As new information becomes available, schedules are updated and maintained on a computer database, which is accessible through remote terminals.

The WFF Test Director acquires clearances required for airspace and oceanic impact areas from the Federal Aviation Administration (FAA), North American Aerospace Defense Command (NORAD), Fleet Area Control and Surveillance Facility (FACSFAC), and the U.S. Coast Guard.

A sounding rocket takes flight from Wallops Flight Facility in Virginia.

The range customer must submit launch/activity dates to the WFF Test Director at least 3 weeks in advance of the required time to facilitate approval and scheduling.

Range scheduling services include: tracking project start/stop dates for the range schedule, integrating Sounding Rocket, UAS, balloon, and other project schedules into the range schedule, scheduling individual Wallops Range assets/resources for specific project requirements so simultaneous operations planning can occur, assisting with frequency coordination by scheduling operational frequencies in use, and reporting potential conflicts. Other services include tracking and scheduling facilities maintenance schedules around mission operations, scheduling project reviews, and presentation of any above information at various meetings and reviews.

The daily schedule is announced on the WFF paging system at 0830 and 1600 local time. The current range operations scheduling system is simply a mission operations timeline and can be viewed at **http://sched.wff.nasa.gov/wffsched/**.

2.3.4 Environmental Requirements

The Wallops Environmental Office serves as the interface for National Environmental Policy Act (NEPA) compliance at Wallops. In most cases, Wallops has approved environmental documentation covering range users' activities at WFF. The Site-Wide Environmental Assessment, Wallops Flight Facility, dated January 2005, provides the required environmental documentation for all Wallops "in-house" activities and also provides the required documentation for many range users' activities. During project formulation, the Project Manager will discuss the project with the range user and the Wallops Environmental Office to identify potential environmental issues. Wallops Environmental Office personnel will make a determination of any formal analysis and documentation required. Funding for the preparation of additional analysis and documentation will be the responsibility of the customer and must be completed prior to the readiness reviews. The site-wide environmental assessment is available at **http://sites.wff.nasa.gov/code250**.

2.3.5 Unmanned Aircraft Systems (UAS)

The Aircraft Office at Wallops is part of NASA's Airborne Science Program, which utilizes different aircraft assets, including UASs, for various applications. The Range and Mission Management Office (RMMO) manages and conducts all UAS operations at Wallops.

Figure 2-1. UAS Runway on Wallops Island

The Wallops UAS runway is located on the south end of Wallops Island. The asphalt runway is 1,500 feet long and 50-feet wide. Commercial UAS manufacturers and other users conduct product trials, pilot training, and science missions from the runway. The runway provides immediate ocean access, and is completely within Wallops restricted airspace. Power, communications and data network access are available on the runway.

The UAS Control Center (CC), located in the Aeronautical Control Cab in Building E-106A is part of WFF's main Range Control Center (RCC). The primary role of this area is in supporting UAS design, testing and flight operations as the UAS CC. Project personnel in the UAS CC can access all the resources of the main RCC to ensure safe operations while conducting a UAS mission. Another UAS CC facility is located on Wallops Island in Building X-15.

A UAS Test and Integration Facility is located in hangar N-159. This facility provides an Electric Static Discharge (ESD) certified test and integration laboratory accessible directly from the main floor of the hangar. Lab test benches and access to a range of power and communications services are included. Adjacent office space and conference room facilities are also available to UAS project teams.

Table 2-1 UAS Size Category Defined

Category	I	II	III
Weight (lbs.)	<55	55 to 330	>300
Airspeed (kts)	<70	<200	>200
Type	Model or Small UAS	Small UAS	UAS

Prior to approval to conduct range operations, the range requestor/user must first submit UAS data for analysis and be granted a statement of airworthiness for flight by NASA.

Upon approval of airworthiness, the Range Safety Office will prepare a ground safety plan and a flight safety plan. These plans will be formulated from data collected in the UAS Access

Authorization Questionnaire (AAQ).

The Range Safety Office will also conduct a risk analysis and develop a plan to mitigate any discovered unnecessary risks. Risk mitigation is a joint venture between the range user and the Range Safety Office. Though a formal risk mitigation and analysis is conducted through the safety office prior to the onset of initial operations, it is the responsibility of the UAS Mission Commander to conduct an informal risk assessment prior to each day of flight and include this data in their daily pre-flight brief.

Range use and coordination is initiated through the NASA assigned Project Manager. Upon completion of the AAQ, the Project Manager forwards client data to the system safety analysis team. Upon favorable review the data is further forwarded to the WFF Frequency Utilization Management Working Group (WFUMWG) frequency de-confliction personnel. After the UAS is deemed safe for flight and frequency de-confliction is accomplished, the mission data is forwarded to Range safety and operations planning begins. The ground safety plan delineates procedures to follow to ensure safety prior to flight. The flight safety plan is formulated to reduce air risks and establish expectations while the range user is conducting the UAS flight.

An overview of the UAS Range Access process is depicted in Figure 2-2.

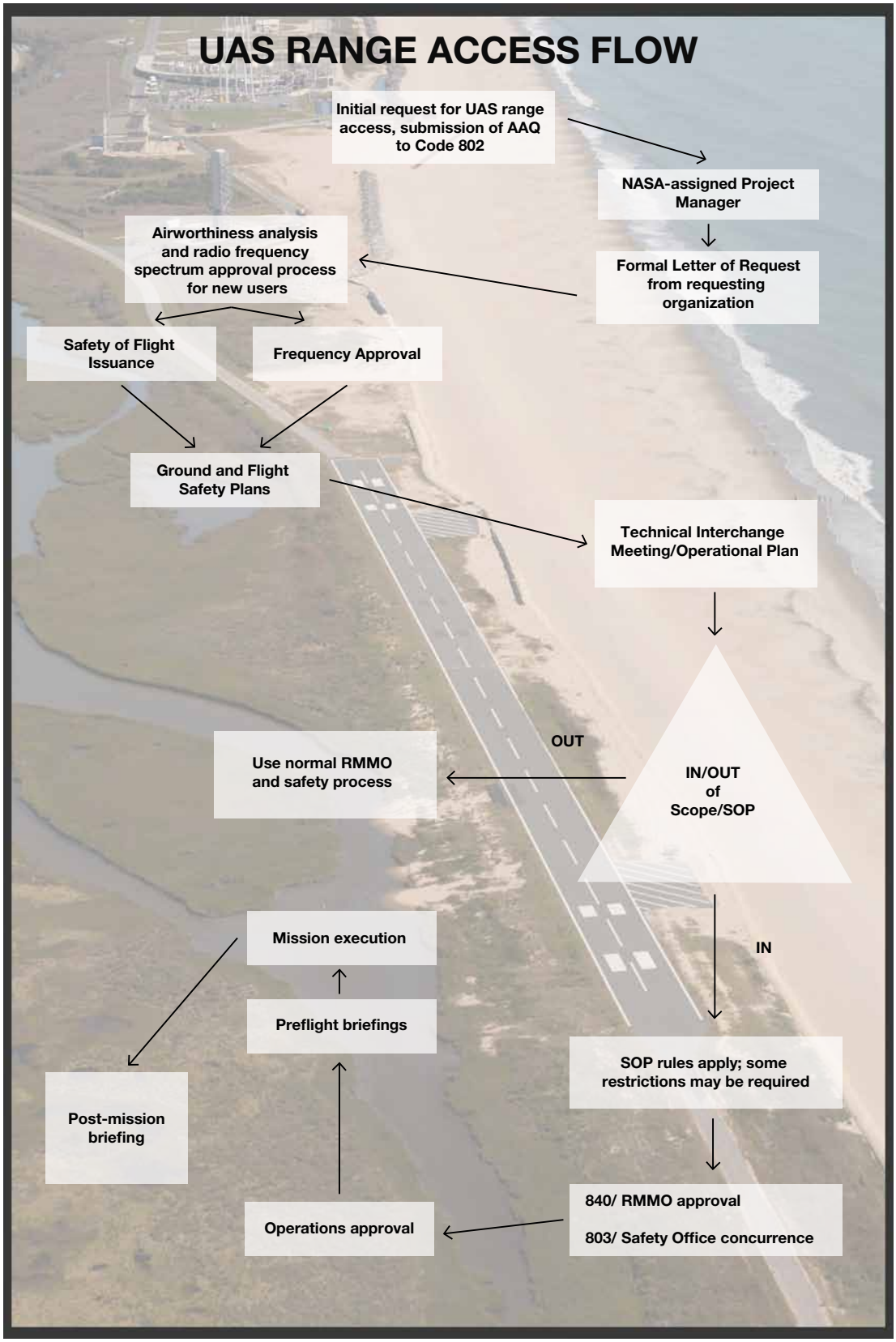


Figure 2-2. UAS Range Access Flow

Airspace control:

UAS flight in the National Airspace System (NAS) is only permitted through use of a Certificate of Authorization (COA) or permitted in Special Use Airspace (SUA).

Figure 2-3. The Global Hawk sits in front of the N-159 hangar, with the P-3 in the background

NASA WFF has restricted airspace extending from the main base airfield to Wallops Island. Bordering the eastern boundary of the restricted airspace is the Virginia Capes Operating Area (VACAPES) warning area. The correct and most up to date information about the lateral and vertical confines can be found on the Washington aeronautical sectional published by the FAA.

WFF has developed several procedures to facilitate airspace and ground operations. Some of these procedures include activating temporary airspace coordination areas, Class D airspace, restricted operations zones, or restricted operations areas for UAS takeoffs and landings and mission areas or flight routes. These are used in the development of air control points, assignment of block altitudes, and non-radar separation in order to facilitate UAS missions.

WFF range operations are conducted in a wraparound approach. Wallops personnel are concerned with mission accomplishment as much as their UAS range users and strive to be an integral part of each mission's success. From mission inception to fruition, support services are an integral part of every user's operation.

For more information on the UAS Program at Wallops, see 840-HDBK-0002, *Wallops Flight Facility Uninhabited Aerial Vehicle (UAV) User's Handbook* which can be found at **http://sites.wff.nasa.gov/multimedia/docs/UAV2005.pdf**.

2.4 Project Approval and Interface Procedures

The range user will confer with Wallops personnel prior to the submission of a formal request to determine the feasibility of conducting the proposed mission/project at the Wallops Range. The first point of contact is the Advanced Projects Office (APO), Code 802, by calling 757-824-1275 or by visiting **http://sites.wff.gov/code802** for more information. WFF and the range user typically hold preliminary discussions via teleconference and/or face-to-face meetings to assess the feasibility of prospective projects. These discussions primarily address the Range's ability to meet technical requirements, potential safety issues, schedule constraints, and estimated costs.

Once complete, assuming both the customer and WFF wish to proceed, formal agreements are established. The details and subsequent procedures of these agreements are dependent upon the range user's organization, as noted in the following subsections.

For all non-NASA customers, once funding is received by Wallops, several weeks of processing time is required before charge numbers are available which allow the Range to begin project support. The APO will facilitate the establishment of agreements with the customer and is available to address any questions.

2.4.1 NASA Organizations

Internal to NASA, WFF and the requesting organization can establish agreement through jointly-approved project plans that clearly define the roles and responsibilities of the respective organizations. This can also be accomplished via a Memorandum of Agreement/Understanding (MOA/MOU). The sponsoring organization is then responsible for providing WFF with a funded NASA Work Breakdown Structure.

2.4.2 Other Federal Organizations

Agreements with federal organizations most often occur through establishment of an Interagency Agreement (IA). IAs typically address roles and responsibilities, estimated cost, schedule milestones, and other key provisions. Once approved, the customer agency can then provide funding through an interagency fund transfer (including Military Purchase Request). For relatively simple efforts, the fund transfer can occur without an IA, but must be accompanied by an approved form provided by WFF that commits both the Range and the customer to certain key responsibilities extracted from the IA.

2.4.3 Non-Federal Organizations

Agreements with non-federal organizations require the establishment of a Space Act Agreement (SAA). SAAs identify roles and responsibilities of the parties, and address agreement details including the statement of work, estimated cost, schedule milestones, insurance and liability requirements, provisions for data rights, and public affairs. Further information is provided in the NASA Space Act Agreements Guide available at **http://www.nasa.gov/pdf/485043main_Space Act Agreements Guide 2008.pdf**. Once the SAA has been approved, the customer will then provide the agreed-to funding.

2.4.4 Commercial Space Launch Act (CSLA) Customers

Agreements with commercial launch service providers require the establishment of a CSLA Agreement with NASA Headquarters prior to negotiating project-specific agreements with WFF. This is due to the unique legal circumstances surrounding these types of missions. Alternatively, CSLA customers can bypass this requirement by entering into a commercial

contract with Wallops's spaceport partner, the Virginia Commercial Space Flight Authority (VCSFA). VCSFA has established agreements with NASA and WFF that can be leveraged to sponsor third-party projects.

2.5 Technical Data Requirements

2.5.1 Program Requirements Document (PRD)

The range user's project description and technical requirements are often conveyed to the Wallops Range through use of a Program Requirements Document (PRD) or equilvalent requirements document defined by the Project Manager.

WFF accepts many different PRD formats from the Universal Documentation System (UDS), which is the standardized documentation system accepted and used at ranges operated by the DoD, to any other format that describes the requirements of the project. The primary UDS reference is RCC 501-97, Universal Documentation System.

Projects at Wallops Range span a broad spectrum of complexity, and some flexibility in the application of PRD standards is necessary. However, the PRD provides an excellent checklist of information needed for projects conducted at the range. The PRD will normally contain all of the information needed.

2.5.2 Safety Data

The range user must provide a safety data package with ground and flight safety information, specifications, performance and procedures for safety related items. The detailed information that must be included in the safety data package is identified in RSM-2002-RevC, which can be found online at **http://sites.wff.nasa.gov/code803/docs/RSM2002RevC.pdf**.

2.5.3 Operations and Safety Directive (OSD)/Mission Operations Directive (MOD)

The OSD or MOD is prepared by the Project Manager and is NASA's response to the range user's requirements. Both documents provide a description of the project and the detailed support configuration for all Wallops equipment, instrumentation and facilities. A ground safety plan, flight safety plan, countdown, and special procedures, as appropriate, are included in the OSD. The flight safety plan and ground safety plan are attached to the MOD rather than included.

2.5.4 Documentation Schedule

WFF attempts to avoid excessive documentation wherever possible. Range users are required to provide a PRD or comparable document to aid WFF in defining support requirements. Only applicable sections need be provided. Required documentation with generalized publication dates for first-time projects are listed on the next page:

Program Requirements Document (PRD)	90 days prior to arrival at WFF
Preliminary Range Safety Data Package	L-120 days
Final Range Safety Data Package	L-90 days
Hazardous Procedures	L-60 days
Trajectory Simulation Data	L-60 days
OSD or MOD	L-21 days

Expendable Launch Vehicle (ELV) Missions:

PRD Draft	L - 1 year
Final PRD	90 days from arrival
Preliminary Range Safety Data Package	PDR + 60 days
Final Range Safety Data Package	L - 75 days
Hazardous Procedures	L - 75 days

Timelines may be compressed for small projects or expanded for ELV missions, depending on the Range schedule. Exact data requirements will be determined during the planning process based on schedule and project-unique details. Earlier dates may be required if the range user begins processing at WFF earlier than 30 days prior to launch.

Wallops Range encourages range users to provide documentation as early as possible to assure adequate time for review and approval. Failure to do so could require unnecessary redesigns or delays in schedule.

2.5.5 Operational Reviews

WFF conducts pre-mission reviews for all projects in order to ensure that personnel are briefed on requirements and responsibilities and to ensure that all necessary preparations have been satisfactorily completed. A synopsis of WFF reviews is included below:

• **Range Readiness Review (RRR)** – The RRR is mandatory for all projects managed by WFF whether on-site or at remote field locations where WFF functions as the lead range, such as Alaska's Poker Flat Research Range. The RRR assesses aspects of range support to include: review for completeness of prelaunch, launch, and post launch requirements, planned activities to meet requirements including range instrumentation services plan, safety products, security plans, contingency plans, environmental management plans, logistics plans (personnel and launch vehicle/payload), operation area clearances, Collision Avoidance (COLA), visitor management plan, surveillance plan, Office of Communications plan, mishap plan, special engineering development plans, staffing plans, sparing plans, housing plans, Radio Frequency (RF) management plan, communications plans, test plans, remediation (wrap-up) plan, and proposed schedule.

• **Launch Readiness Review (LRR)** – The LRR, a required deliverable for every orbital rocket mission conducted, is held to update the mission status, close out actions from the previously held RRR, authorize approval to proceed into launch countdown. The LRR is held at the launch site no later than 1 day before launch.

• **Operation Debriefing** – A post-operation meeting intended to evaluate the operation and identify items requiring action prior to future operations.

Additional reviews may be required for large projects. It is highly recommended that range operations and safety personnel be invited to participate in project design reviews and technical interchange meetings to ensure that concerns are addressed early in the planning process.

2.6 Funding Information

Wallops Range facilities and operational support are available to support NASA projects, other U.S. Government agencies, CSLA projects, commercial organizations, and, under certain circumstances, foreign governments. WFF staff will provide a project cost estimate for requested support. The user will be required to pay actual costs. Funding should be received by WFF at least 6 weeks prior to start of work on the project. Work cannot proceed until funding has been processed. Charges are established by means of the full recovery of direct costs incurred for items such as materials, personnel, equipment and facilities utilized. These charges can vary depending upon the work requested.

3 WALLOPS FLIGHT FACILITY AND WALLOPS RANGE

3.1 Introduction

Wallops Flight Facility includes three areas on the Eastern Shore of Virginia as shown in Figure 1-1. These are the Main Base, the Mainland, and the Wallops Island Launch Site. The Range is located across all three land parcels and is composed of the Wallops Island launch facilities, the Research Airport, supporting instrumentation, authorized space, authorized frequency spectrum and operations and support personnel.

Figure 3-1. Aerial View of the Wallops Main Base

3.1.1 Wallops Main Base

Figure 3-1 is an aerial view of Wallops Main Base, looking west. The Main Base is the location of many of the major functions and activities supporting the Range, including the Research Airport, Range Control Center, (RCC), Telecommunications Center, administrative offices, engineering support, technical service support shops, rocket inspection and storage area and telemetry facility.

Figure 3-2. Aerial View of the Wallops Mainland

3.1.2 Mainland

The Mainland site is a strip of land located west of Wallops Island and is the location for radar, optical, communications, and command transmitter facilities. The Wallops Geophysical Observatory (WGO), including the Atmospheric Sciences Research Facility (ASRF), is located on the Mainland. Figure 3-2 is an aerial view of the Wallops Mainland, looking west.

Figure 3-3. Northward view of Wallops Island with commercial launch facilities located to the right

3.1.3 Wallops Island

Wallops Island, named for John Wallops, a 17th Century surveyor, is an Atlantic Ocean barrier island off the coast of Virginia approximately 7 miles southeast of the Main Base. The island is roughly 6 miles long and about one-half mile at its widest point. It is separated from the mainland by 2 miles of marsh and water. A causeway and bridge connect the island with the Wallops Mainland. Facilities located on Wallops Island include launch sites, assembly shops, blockhouses, dynamic balance facilities, radar facilities, rocket storage buildings, payload processing facilities and the USN Surface Combat Systems Center.

3.1.4 Authorized Space

The authorized space includes the following restricted areas:

- **The GSFC/WFF Airport Control Zone:** Airspace vertically to 2,500 feet in a 5-statute mile radius of the airport. The Control Zone has an arrival and departure corridor.

- **Restricted Area R-6604:** Restricted airspace connecting WFF and offshore warning areas (Figure 3-4) is available 24 hours a day, 7 days a week (24/7) unconditionally to unlimited altitude.

- **VACAPES Warning Areas and International Waters:** Mission/project activity requiring surface area and restricted airspace extending outside of R-6604 into the Virginia Capes warning areas and international waters are available 24/7 unconditionally to unlimited altitude with clearance and approval by responsible agencies, e.g., the FAA and USN Fleet Area Control and Surveillance Facility (FACSFAC).

3.1.5 Trajectory Options

Wallops Range offers a wide array of launch vehicle trajectory options. The coastline of Wallops

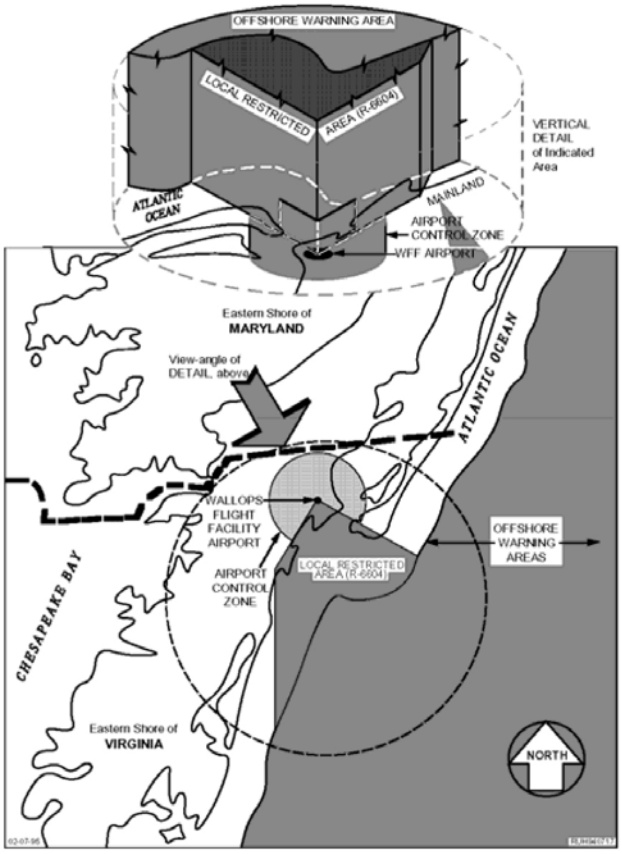


Figure 3-4. Wallops Range Authorized Airspace

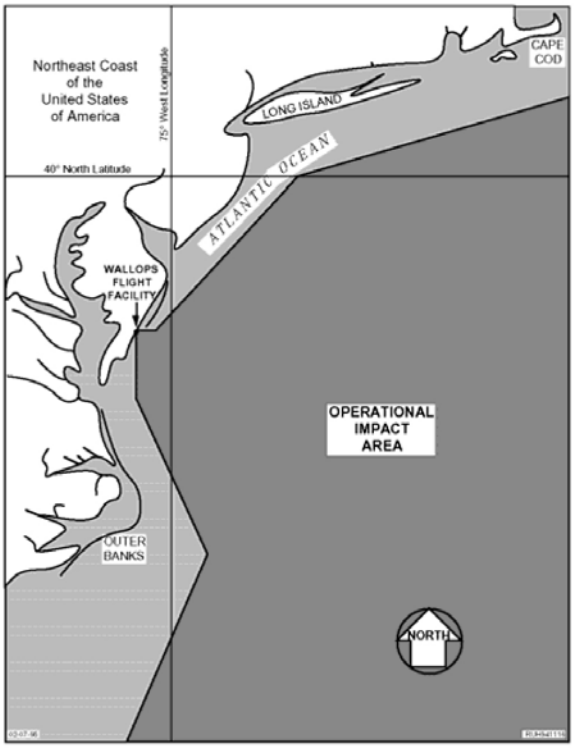


Figure 3-5. Operational Impact Area

Island is oriented such that a launch azimuth of 135 degrees is perpendicular to the shoreline. In general, launch azimuths between 90 degrees and 160 degrees can be accommodated depending on impact locations. For most orbital vehicles, this translates into orbital inclinations between 38 degrees and approximately 60 degrees.

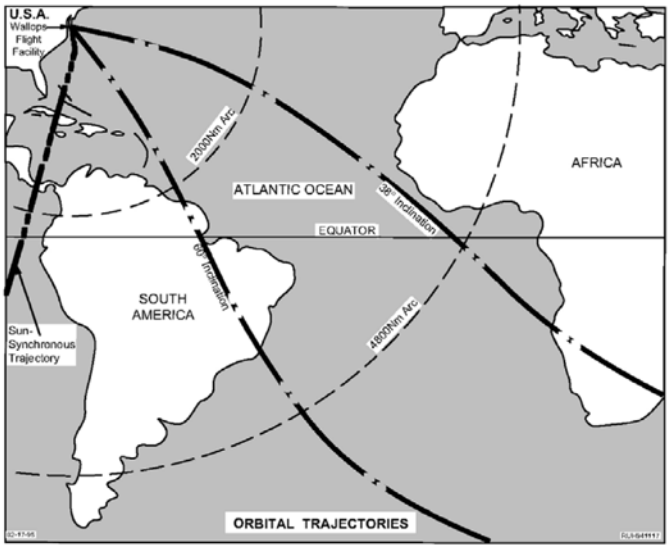


Figure 3-6. Orbital Trajectories

Trajectory options outside of these launch azimuths, including polar and sun-synchronous orbits, can be achieved by in-flight azimuth maneuvers. For example, wider northerly options are possible by maneuver around Assateague Island after passing 5 nautical miles (nmi) downrange. The North Carolina Outer Banks are generally the restricting landmass for southern launch azimuths. Specific trajectory options are determined through consultation with the Flight Safety Group. The operational impact area is shown in Figure 3-5, and trajectory options are illustrated in Figure 3-6.

3.1.6 Wallops Weather

Wallops enjoys a temperate climate and there are only a few months annually when cold weather can be a concern. In winter months, measures are taken to protect launch vehicles. As in most coastal regions, humidity can be relatively high; however, humidity is controlled in work areas and does not significantly affect operations at the Range.

Precip'n average	DAYS	9,8	9	9	10	9	8	10	8	7	7	8	9
	INCHES	3,2	2,93	3,59	2,62	3,23	3,26	3,61	3,92	3,24	2,81	2,74	3,2
Snow average	DAYS	1,8	2	0,5	0	0	0	0	0	0	0	< 1	1
	INCHES	3,2	3,5	0,8	0	0	0	0	0	0	0	0,1	1,3
MONTHS		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

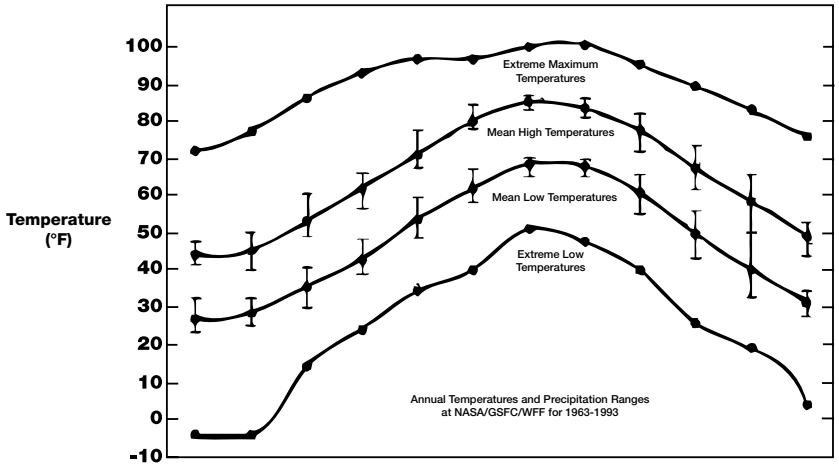


Figure 3-7. Annual Precipitation and Temperature Plot for Wallops Flight Facility

Figure 3-7 shows annual temperatures and precipitation at WFF on a month-to-month basis. There are plots for mean high and mean low temperatures and annual variation. Extreme high and extreme low temperatures are noted, as are average precipitation days and precipitation inches per month, including snow averages. The wettest three-month period is July through September, with showers and thunderstorms more frequently occurring; however, Wallops' vast array of lightning detection instrumentation minimizes their effect on range operations.

There are two figures depicting surface wind conditions at WFF. Figure 3-8 shows average surface wind speed by month and notes the predominately northwest winds between October and April and the predominately southerly winds between April and October. Appendix C shows monthly wind roses depicting the various directions of the surface winds within concentric circles indicating occurrences at 5 percent, 10 percent, and 15 percent of the time.

The Range is supported by meteorological and weather data, as well as forecasting capabilities from the Weather Forecast Office, Meteorological Facilities, and the Atmospheric Sciences Research Facility at the Wallops Geophysical Observatory.

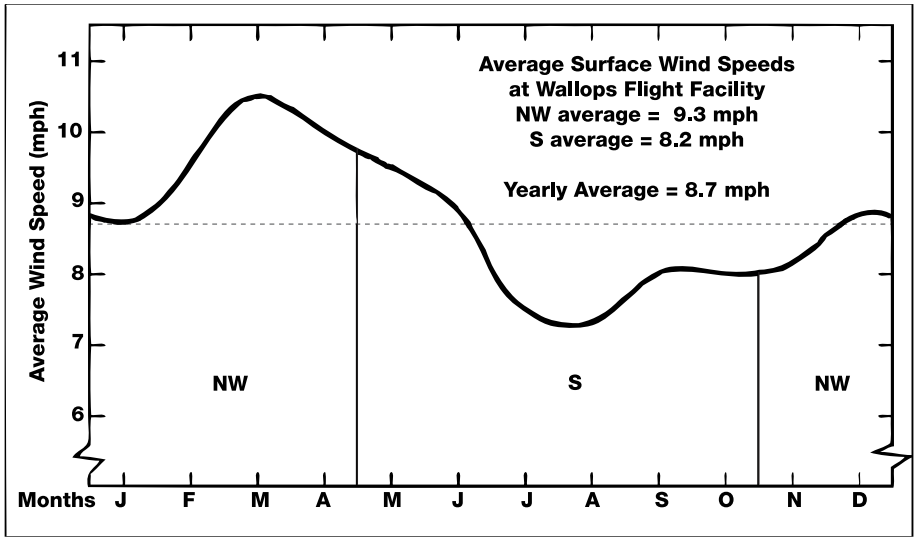


Figure 3-8. Average Surface Wind Speed at Wallops Flight Facility

3.2 Wallops Range Facilities

The Wallops Range has a variety of facilities supporting its operations. The major facilities are described in the following paragraphs.

3.2.1 Launch Facilities

Wallops Range has facilities for the receipt, inspection, assembly, checkout, and storage of rocket motors and other pyrotechnic devices. The Wallops Island Launch Site is comprised of six launch pads, three blockhouses for launch control, and assembly buildings to support the preparation and launching of suborbital and orbital launch systems. Figure 3-9 contains aerial maps of Wallops Mainland and the north and south ends of Wallops Island, which shows the location of support facilities and launch pads.

Table 3-1 shows vehicle and payload processing facilities and some of their major features.

Launcher capacities listed in Table 3-2 indicate the maximum design loads under ideal circumstances. User-provided launch systems can also be accommodated. Wallops Range also has the capability to support launch operations worldwide with mobile range instrumentation and equipment.

The Launch Pad Manager (LPM) maintains and operates the launch pads. The LPM is available to work directly with the range user. The LPM also serves as the point of contact for any shipments coming to the island and arrange for any GSE that might be required.

Figure 3-9. Wallops Mainland and Island Range Launch Facilities

Wallops Island

Table 3-1. Assembly and Payload Processing Facilities Wallops Island

Building	Function	Sq.Ft.	Special Features
V-45	Assembly	4,933	• 10-ton bridge crane – critical
V-55	Assembly	2495	• 20-ton bridge crane – critical
W-15	Assembly	5,165	• one 3,936 sq. ft. bay • door 13 ft high x 12 ft wide • 3-ton overhead crane with 10-ft hook height • approved for explosives • 6-ton bridge crane – non-critical
W-40	Assembly	5,255	• 6-ton bridge crane (dual 3-ton trolleys) – non-critical
W-65	Assembly	13,255	• 6 bays • pyrotechnic storage rooms • 6 assembly bays • approved for explosives Bay Doors / HxW / Crane(s) hook height (hh) Bay 1: 7 ft 10 in x 23 ft 11 in — 2x10 ton bridge/20 ft hh Bay 2: 18 ft x 23 ft 11 in 17 ft 10 in x 23 ft 11 in — 2x7.5 ton monorail/18 ft hh Bay 3: 17 ft 10 in x 18 ft 11 in — 2x3 ton monorail/19 ft hh Bay 4: 14 ft 11 in x 15 ft 11 in Bay 5: 14 ft 11 in x 15 ft 1 in — 2x3 ton monorail/16 ft 5 in hh Bay 6: 14 ft 11 in x 23 ft 11 in 14 ft 11 in x 23 ft 11 in — 2x3 ton monorail/16 ft hh
X-15	Payload processing	5,740	• co-located optical and crash/fire/rescue facilities • door 19 ft 10 in high and 18 ft 10 in wide • 3-ton overhead crane with 19-ft hook height • laboratory and office space • 1-ton stationary electric chain hoist – non-critical • 1-ton electric chain hoist – non-critical • 5-ton bridge crane – non-critical
Y-15	Assembly	8,240	• one high bay (Bay 8) • seven other bays • approved for explosives Bay Doors / HxW / Crane(s) hook height (hh) Bay 1: 9 ft 6 in x 17 ft 6 in Bay 2: 6 ft 10 in x 8 ft Bay 3: 6 ft 10 in x 8 ft Bay 4: 6 ft 10 in x 8 ft — 3-ton monorail/7 ft 10 in hh Bay 5: 6 ft 10 in x 8 ft Bay 6: 6 ft 10 in x 8 ft — 3-ton monorail/7 ft 10 in hh Bay 7: 6 ft 10 in x 8 ft Bay 8: 13 ft 7 in x 10 ft 10 in — 2-ton bridge/15 ft 10 in hh

Figure 3-10. H-100 Payload Processing Facility (PPF)

Figure 3-11. V-55 Spacecraft Fueling Facility (SFF)

Wallops Main Base

Table 3-1 Continued.

Building	Function	Sq.Ft.	Special Features
M-16	Payload Processing	19,290	• two bays 38 ft deep x 35 ft wide x 14 ft high • both are Class 100,000 clean rooms • each has Class 10,000 clean tent 23 ft x 19 ft x 12 ft high • door 12 ft high and 25 ft wide • 2x 1-ton electric chain hoists • manual trolley gantries
M-20	Assembly	11, 585	• single bay • end door 15 ft high and 25 ft wide • side door 13 ft high and 25 ft wide • approved for explosives • 1&1/2 ton manual chain hoist - critical
F-7	Payload Processing	17, 100	• high bay 60 ft long x 30 ft wide x 40 ft high • high bay 60 ft long x 40 ft wide x 30 ft high (100,000 Clean room and Truck Lock) • other lab and office space
H-100	Payload Processing	14, 400	• high bay 80 ft long x 40 ft wide x 62 ft high • intermediate bay 80 ft long x 40 ft wide x 40 ft high • end door into high bay 60 ft high x 20 ft wide • end door into intermediate bay 42 ft high x 40 ft wide • side door between the two bays 42 ft high x 45 ft wide • laboratory and office space • 20-ton bridge crane - critical

Select building floor plans located in Appendix C

Table 3-2 Launch Systems

Pad Number Launcher Name(s)	Description
Pad 0A MARS Launch Complex	Antares liquid fueled launch complex including Liquid Fueling Facility (LFF) for LOX/RP1 and 200,000-gallon elevated tank acoustic suppression system. 
Pad 0B MARS Launch Complex	Designed for small to medium class ELVs up to 200,000 pounds maximum load. Currently supporting Minotaur I, IV and V launches. 
Pad 1 50K Launcher	The 50K launcher is rated as a 50,000 pound maximum design load launcher. It has a movable environmental shelter and a 45-foot, 6-inch overall boom length. 
Pad 2 Atlantic Research Corporation (ARC) Launcher Missouri Research Laboratories (MRL)	The ARC launcher is rated as a 20,000 pound maximum design load launcher. It has a movable environmental shelter and a 38-foot overall boom length. Pad 2 also has a Missouri Research Laboratories (MRL) which has a 7,000-pound capacity with a 28-foot rail, as well as a removable environmental shelter. 

Table 3-2 Launch Systems Continued

Pad 3B	Currently supporting the USN Coyote Program.
Astro Met Launcher (AML) (In storage)	Rated as a 4,000-pound maximum design load launcher, the AML has a twin boom to accommodate single and multi-stage vehicles with an 18-foot, 8-inch overall boom length. Can be installed on Pad 2.
20K Launcher (AML) (In storage)	Rated as a 20,000 pound maximum design load launcher and has a 37-foot overall boom length.

3.2.2 Spacecraft Fueling Facility (SFF)

Figure 3-12. Inside Spacecraft Fueling Facility

Wallops Range is capable of supporting spacecraft processing operations including buildup, testing, hypergolic fueling and integration to the launch vehicle in the newly upgraded SFF, V-55, Figure 3-12. Self-Contained Atmospheric Protective Ensemble (SCAPE) suits, maintained and certified by Kennedy Space Center, are available for hydrazine fueling operations or the customer may provide their own suits subject to Range Safety approval. The SFF has trained valet and emergency support for SCAPE and a SCAPE van for transport to and from the fueling facility. Wallops will also provide all necessary facility support infrastructure to conduct SCAPE operations including breathing air panels and hoses, wired communications between the SCAPE suits and the fueling control room, nominal and emergency showers and hypergolic vapor sensors.

The SFF meets all existing NASA requirements for spacecraft fueling operations along with complying with relevant Federal, State and Industrial standards. The SFF 100,000 clean room, Figure 3-12, with fueling island has a trough sized to catch and dilute full 4BW spill and a Hydrazine and oxidizer compatible floor coating. The SFF has building and mobile vapor detectors with intrinsically safe pan tilt zoom and fixed cameras for safety and observation, as well as an infrared camera to allow operations to be observed and coordinated remotely from the fueling control room located nearby in building V-50. This control room can accommodate up to 12 people with eight concurrent video displays visible for the fueling support team and with full camera control by the fueling test conductor. All audio and video is recorded concurrently and redundantly in digital format to hard drives for easy access and playback.

Vapor and liquid collection systems for hypergolic fueling is accomplished via separate vacuum systems for hydrazine and nitrogen tetroxide to above ground tankers for neutralization, an aspirator to collect liquids and vapor as well as nominal and emergency high rate roof exhaust systems. The SFF has no wind direction restrictions on fueling operations and meets NASA and Virginia air emissions standards. The SFF includes a manually operated deluge system which is controlled remotely from the fueling control room in V50.

The SFF has an extensive flexible support capability by providing a critical lift certified bridge crane, scissor lifts, fork lifts, other typical GSE, pressurized commodity systems for clean nitrogen and nominal and shop air. There is also a small conference room and refreshment area to support the fueling teams of up to 24 people.

3.2.3 Horizontal Integration Facility (HIF)

Figure 3-13. Horizontal Integration Facility

The HIF launch vehicle processing facility, X-79, Figure 3-13 and 3-14, is a visibly clean high bay area and is sized to accommodate mid-sized launch vehicles. This facility is capable of dual vehicle processing in an open span high bay that is environmentally controlled by radiant floor heat, as well as temperature and humidity controls. The extensive flexible support capability of the HIF includes two critical lift bridge cranes (50 ton and 70 ton), and three mega doors for payload/vehicle ingress/egress, scissor lifts, and fork lifts. Pressurized commodity systems for clean nitrogen, helium, and air are available as well as secure access and 24-hour video surveillance. The processing team's support space has a loading dock for ground deliveries, lockable storage area, Electronic Ground Support Equipment (EGSE) lab space, battery charging room, and a kitchen and crew lounge.

3.2.4 Payload Processing Facility (PPF)

Figure 3-14. Inside Payload Processing Facility

The PPF, H-100, is shown in Figure 3-15 and is located outside Wallops Main Gate behind the Marine Science Consortium. There are two 100,000 Class clean rooms, one high bay and one low bay with adjoining work spaces supported by redundant chillers for high reliability. The spacecraft launch control center, located adjacent to the high bay, has pass-throughs for Ground Support Equipment (GSE) cabling and tools, as well as a display for visibility during spacecraft fueling integration and launch. The PPF

has an extensive flexible support capability that boasts bridge cranes, scissor and fork lifts, pressurized commodity systems for clean nitrogen, helium, and air, secure access and 24-hour video surveillance, visitor area, staging pad, and other support amenities. Office space for the payload team is available with 24 cubicles, kitchenette, and an adjacent conference room with observation windows overlooking the payload bays.

3.2.5 The Multi-Payload Processing Facility (MPPF)

The MPPF, F-7, Figure 3-15, houses multiple areas for scientific balloon and small spacecraft payload processing, as well as off-line subsystem and experimenter integration activities. Two high bays at the east and west ends of the building are available for payload processing. The West High Bay (60'L x 30'W x 40'H) has dual trolley cranes and is primarily used for balloon payload integration; a roof-top platform can be used for antenna testing. The East High Bay (60'L x 40'W x 30'H) is designed as a Class 100,000 clean room and is equipped with a bridge crane and ESD floor. The building also houses several specialized work areas: a thermal vacuum test area, a materials testing lab, a small prototyping machine shop, hardware storage, small ESD electronics labs, and a "battery lab" equipped with a fume hood and freezer.

Figure 3-15. Multi-Payload Processing Facility (MPPF)

3.2.6 Research Airport

The WFF Research Airport is located on the Main Base. See Figure 3-1 for an aerial view of the Wallops Main Base and Figure 3-17, which shows the Research Airport and associated facilities. There are three runways, two taxiways, three ramps, and one hazardous cargo loading area in active service. The runway dimensions are:

- 10-28 – 8,005 feet by 200 feet
- 04-22 – 8,750 feet by 150 feet
- 17-35 – 4,810 feet by 150 feet

The taxiways that service these runways are parallels of 04-22 and 10-28. Two ramps adjoin the two active hangars and the hazardous cargo loading area adjoins the approach end of runway 17.

All runways, with the exception of 35, are configured with FAA-approved circling and straight-in approaches. Runway 04-22, the primary research runway, has a test section with a variety of surface textures and materials for runway research projects. Runway features include the following:

- A grooved section for runway friction research
- A water test section for aircraft water ingestion tests
- A runway-to-taxiway high speed turnoff
- E-28 arresting gear
- GPS

Figure 3-16. Wallops Research Airport

Instrumentation and Facilities

To provide precision tracking for airborne research programs, an RIR-716C C-band radar (Radar 18) with an integrated laser tracking system (LTS) is located on the airport at the Aeronautical Research Radar Complex. This radar can provide an aircraft with Instrument Landing System (ILS) reference data to any WGS-84 point within 50 nautical miles of the Research Airport. Precision approach path indicators (PAPI) are installed on all runways. Control tower support is available. For more detailed descriptions, consult 830-AFOH-0001, Airport Facility and Operations Handbook at **http://wacop.wff.nasa.gov**.

Support and Services

The following support and services can be provided at the Research Airport with prior arrangement:

- Hangar space
- Minor and temporary repairs
- Fuel services for JP-5
- Ground power units
- Aircraft towing
- Rollaway stairs
- Oxygen service, liquid and gaseous
- Local and national meteorological information
- Flight planning support
- First aid and emergency treatment
- Hazardous cargo handling
- Night operations support
- Support for aircraft carrying combat ordnance

Hangar, office, and shop space are available for approved aircraft projects and vary in size and location. Since Wallops is equipped to affect only minor or limited repairs to transient aircraft, maintenance personnel should accompany project and R&D aircraft when engaged in flight operations at Wallops. Limited assistance may be provided for minor repairs.

Fuel services are available for U.S. Government program aircraft during normal working hours and at other times by prior arrangement. Fuel is dispensed from trucks equipped with single point refueling fittings.

Additional information regarding airport use is available on the Wallops website at **http://wacop.wff.nasa.gov**.

Figure 3-17. RCC Mission Control Room (MCR)

3.2.7 Range Control Center (RCC)

The focal point for all Range operations is the RCC located in building E-106 on the Main Base, as seen in Figure 3-17. Data from the range support instrumentation (e.g., closed circuit TV, optical, radar and TM data) are acquired, processed, and made available for video display throughout the facility. This data assimilation, in conjunction with communications and command links, facilitates the coordination, control, and safe conduct of WFF missions. The Range Data Acquisition and Computation (RADAC) System supports the RCC with redundant real-time data support, including impact prediction for range safety and other Range requirements. The RADAC System provides a quick and flexible selection of data sources and displays. The video switching network is the primary means of distributing data in the RCC. Critical instrumentation is supported by uninterruptible power supplies (UPS) and a backup power generator.

The RCC is composed of co-located rooms devoted to range control functions:

- Mission Control Room (MCR)
- MCR Observation Area
- Data Acquisition and Processing Room
- Aeronautical Projects Control Room
- Range Safety Room
- Surveillance Room
- Weather Forecast Office
- NASA Communications Room (NASCOM)

The Project Manager can provide information on the RCC communications, data systems, and

Figure 3-18. View of RCC MCR.

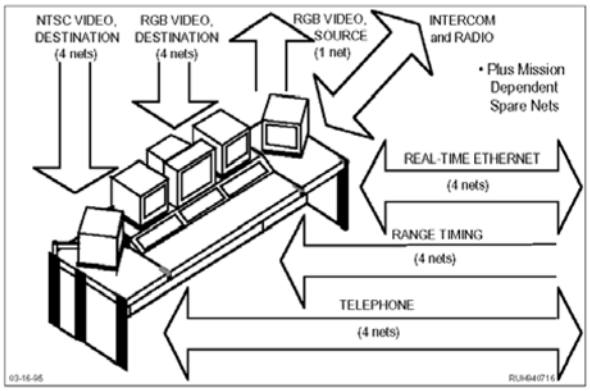


Figure 3-19. Data Interfaces

other capabilities available to support a project at the Range.

RCC Mission Control Room (MCR)

The MCR is two stories high and features large screen video displays, eight generic mission controller consoles, a raised Test Director area, and a VIP area. Figure 3-18 is a panoramic view of the MCR from the front of the room; Figure 3-20 is the layout of the MCR.

Typically, mission controller stations 1 through 4 and 6 through 8 are available to support range user functions. Additional console space can be made available for some missions in the rooms adjacent to the MCR.

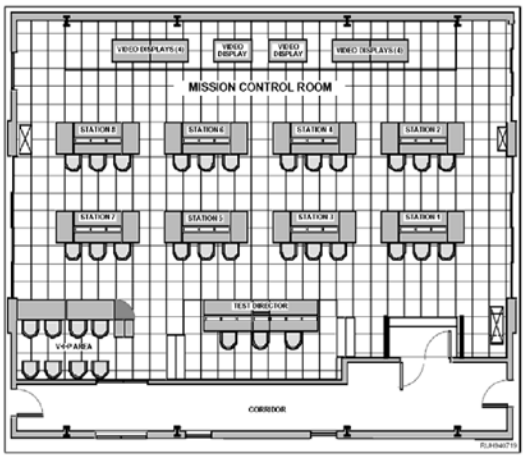


Figure 3-20. Layout of RCC MCR.

The eight mission controller stations have a standard configuration for video and data display; however, the selection of information and data displayed is very flexible. The configuration and selection of the displays and data sources can be pre-selected and changed during an operation, if required. Various consoles and workstations and/or PCs are available to provide additional real-time data displays.

Figure 3-19 illustrates the data and communications available at each station.

Data Acquisition and Processing Room

The Data Acquisition and Processing Room is adjacent to the MCR. Radar, TM, and other range data are checked for quality and selected for display from this room. The room is separated from the MCR by a glass wall with sliding glass doors.

Automatic Data Processing (ADP) Room

The room contains two Silicon Graphics Inc. Origin 300 computer systems: the Data Quality

Computer A (DQCA) and the Data Quality Computer B (DQCB). The DQCA and DQCB compose the RADAC, providing redundant real-time support to the RCC.

These computers provide post-mission data analysis, general data reduction, and range operations support, such as real-time processing, local and remote multi-batch processing, interactive communications, and time-sharing.

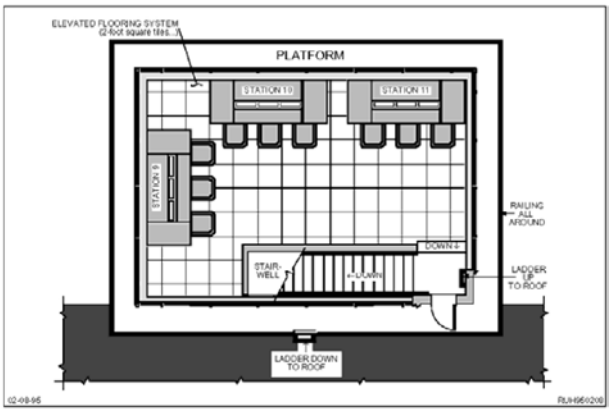


Figure 3-21. RCC 4th Floor Aeronautical Projects Control Room

The systems use the SGI IRIX Operating System and a SGI-provided C compiler. Wallops Range provides libraries and custom applications that process user data and provide real-time flight position data to Range Safety displays.

Range Safety Room

The Range Safety Room is adjacent to the MCR and is the focal point for ground and flight safety operations. The functions performed in the Range Safety Room are wind weighting, monitoring of preflight and flight parameters, and control of the Flight Termination System. The room is separated from the MCR by a glass wall with sliding glass doors.

Surveillance Room

This room is adjacent to the Data Acquisition and Processing Room. Surveillance consoles provide communications, computation and displays for range surveillance and clearance functions. In addition, there are three radar consoles: One for the ASR-8, and one each for the sea surface surveillance radars Furuno S-band and X-band, which provide radar control and range surveillance information. This room is separated from the MCR by a glass wall and sliding glass door.

MCR Observation Areas

There is a glass-enclosed balcony on the third floor between buildings E-106 and E-107, which overlooks the MCR. The balcony will accommodate approximately 30 visitors.

Aeronautical Projects Control Room (APCR)

The APCR on the fourth floor between buildings E-106 and E-107 provides visual observation of the Research Airport, including research runway 04-22 and aeronautical project activities in the surrounding area. The APCR has mission controller consoles identical to those in the MCR, which provide communications and data display for monitoring and control of aeronautical projects. Figure 3-21 shows the layout of the APCR.

NASA Communications Room (NASCOM)

The NASCOM Room provides the primary interface with internal and external RCC communications, as well as the control for data distribution within the RCC. The primary support instrumentation based in NASCOM is listed below:

- Frame for twisted pair interface to external points and distribution of RCC data and communications. These pairs support telephone, range intercom, remote radio circuits, command remote, tone keying, timing data, radar data and technical control
- Fiber optic cable system interface, which supports video, high-speed data, and access to the WFF LAN
- Video Switching Network, a two-level computer setup and control
- NTSC: 50-source input by 120 destination output
- RGB: 50-source input by 100 destination output
- Technical Control access, which provides real-time voice and data communications with other locations through the Technical Control network
- Programmable intercom for range communications, which provides patchable radio, telephone, SCAMA (Switching, Conferencing, and Monitoring Arrangement) and range operations channels

3.2.8 Wallops Geophysical Observatory (WGO)

The Wallops Geophysical Observatory (WGO) allows scientists, principal investigators and other experimenters to conduct measurements from ground-based test equipment. The WGO is intended to augment and enhance flight vehicle-based test equipment during scientific missions. Eventually, the facility will include a fully integrated network of devices accessible locally at the RCC and through connectivity to the NASA intranet and World Wide Web. Additional information on the WGO can be found in 802-HDBK-0002, *Wallops Flight Facility Geophysical Observatory Handbook*. See **http://sites.wff.nasa.gov/multimedia/docs/WGO2007.pdf** to download the handbook.

Atmospheric Sciences Research Facility (ASRF)

The ASRF houses the atmospheric radar installed on the Wallops Mainland. The facility possesses unique capabilities for atmospheric data acquisition, processing, display and recording. Past studies have contributed to the understanding of atmospheric turbulence, cloud and precipitation development and dynamics, lightning discharge characteristics and distribution patterns, as well as the effects of precipitation on the transmission of electromagnetic radiation. Permanent data acquisition systems available at the ASRF include two high-power radar systems (one S-band and one UHF-band) and an Environmental Data

Acquisition and Recording System (EDARS).

The following lightning characterization systems also support range operations:

- Total Lightning Solution (TLS) is a third-party lightning display system which integrates in-cloud and cloud-to-ground lightning detection network, serving as a back-up system.

Figure 3-22. ASRF and Research and Science Radar

- National Lightning Detection Network (NLDN) is a magnetic direction finder antenna network that displays cloud-to-ground lightning strike locations within the continental U.S.

- Extremely Low Frequency (ELF) Lightning Measurement System detects lightning activity at very long ranges

- Electric Field Measurement (EFM) System aids in determining the probability of and detection of local lightning activity

- Sferics System measures electromagnetic radiation from lightning discharges at different frequencies

The ASRF and Research and Science Radar (S-band space and range radar) are shown in Figure 3-22. Additional information on the ASRF is in *An Experimenter's Guide to the NASA Atmospheric Sciences Research Facility*, March 1994.

Table 3-3 ASRF Radars

WFF ID No.	Radar	Wave Length Band	Peak Power Output (Watts)	Pulse Rate Frequency (pps)	Beam-width (deg.)	Antenna Size (Meters)	Antenna Gain (dB)	Max-Range (KM)	1-m2 Skin Track (KM)	Range Precision (Meters) (rms)	Angle Precision (mils rms)	Tracking Velocity (deg/sec) AZ EL
UHF	ASRF	UHF	1M	320-960	2.9	18.29	36	n/a	1480	n/a	2.0	8 8
4	ASRF	S	1M	160, 320, 640	0.39	18.29	52.8	480 K	2,200	5	1.0	15 15

Wallops UHF Radar CubeSat Groundstation

The Wallops UHF Radar came online around 1959 and is a high power narrow beam system (2.9° Beamwidth; 18.3 m dish). The Wallops UHF Radar is one of only two dishes with similar capability at UHF Band (380 to 480 MHz) in the U.S. In the past the Radar has also been used for tracking and study of reentry wakes in the upper troposphere.

The UHF Radar answers a growing need for high data rate from CubeSats over a government licensed frequency. The National Science Foundation (NSF) had contributed to prove the Wallops UHF Radar as a CubeSat ground station. The two NSF Utah State University/ Space Dynamics Lab Dynamic Ionosphere CubeSat Experiment (DICE) 1.5 U spacecraft are successfully using an NTIA licensed government UHF band with the Wallops UHF Radar as its only ground station.

The natural gain provided by the 60' diameter UHF Radar enables high data rates (3.0 Mbit) 300 times the typical 9.6 Kbit for CubeSats. The UHF Radar, is currently being used for support of the DICE spacecraft, planned for the NSF/GSFC Firefly CubeSat, and for the NASA GSFC Compact Radiation BElt Explorer (CeREs), two MIT CubeSats, one University of Maryland, Baltimore County CubeSat and proposed on a number of follow-on missions.

The UHF Radar accommodates the addition of custom equipment for the reception of CubeSat data without jeopardizing reception of data from other highly expensive satellites, nor the use of the Radar systems for Earth Science. The use of the UHF Radar for CubeSats also fits into the responsive low-cost nature of Wallops for relatively high risk missions requiring minimal documentation, pre-mission testing, and cost per pass.

3.2.9 Fabrication Facilities

Wallops has a fully equipped machine shop that can provide electronic, electrical and mechanical support. The 26,000-square-foot machine shop includes a large selection of Computer Numerically Controlled (CNC) mills and lathes, manual machines, sheet metal fabrication, welding and heat-treating facilities. Capabilities include full CAD/CAM implementation in developing and fabricating mechanical systems, optical instrumentation, and payload components for flight research. The fabrication area performs functions such as sounding rocket launcher refurbishment, design and fabrication of mobile telemetry and mobile radar support vans and antenna systems. The machine shop includes mechanical technician laboratories for assembly of scientific sounding rocket payloads. While the facility primarily supports the Sounding Rocket Program, it regularly supports other NASA and reimbursable projects. The facilities are managed through the NASA Sounding Rocket Operations Contract (NSROC). A more comprehensive description of mechanical and electrical fabrication capabilities is available in 810-HB-SRP, *Sounding Rocket Program Handbook*, online at **http://sites.wff.nasa.gov/code810/files/SRHB.pdf**.

3.2.10 Environmental Testing Facilities

Specialized facilities for environmental testing of complete payloads, such as subassemblies and components in order to verify flight readiness when exposed to an intended flight environment are available at Wallops and include the following:

- Spin deployment bay
- Static and dynamic balance machines
- Vibration facility
- Thermal-vacuum chambers
- Anechoic chamber
- RFI/EMI chamber
- Bend test apparatus
- Magnetic calibration facility
- Vacuum chamber
- Mass properties apparatus
- Thin film testing facility
- Integration laboratories

For more information on environmental testing facilities, see *Doing Business at Wallops Flight Facility: A Customer Guide,* which can be found at **http://sites.wff.nasa.gov/multimedia/docs/CG2005_0510.pdf**. A detailed discussion of environmental testing policies and considerations is included in the *Sounding Rocket Program Handbook*.

3.3 Wallops Range Services

3.3.1 Mobile Range Services

Wallops has developed mobile radar, telemetry, command/control, and data systems that can be transported to offsite and remote locations. Campaigns have been conducted in the Arctic and Antarctic regions, South America, Africa, Europe, Australia and even at sea. WFF personnel have extensive experience in planning and conducting mobile campaigns and developing equipment and systems to support these operations. Mobile systems include the following:

Figure 3-23. Range Equipment in Bermuda

- C-band radar
- Launchers
- Range safety
- Meteorology
- Optical tracking
- Recovery
- Real-time data processing and display
- Data acquisition and recording
- Orbital tracking
- Flight termination system
- Power
- Command
- Wind weighting
- Payload processing
- Communications
- Telemetry
- Timing
- Control center
- Surveillance radar

Additional information on mobile capabilities can be found in the *Sounding Rocket Program Handbook*.

3.3.2 Mobile Power Services

Mobile Electric Power Services are available at the Wallops Flight Facility, the Poker Flat Range (PFRR), and at other ranges worldwide. Mobile electric power services are provided at Wallops Range and simultaneously for missions requiring support at remote locations.

Wallops Range maintains and sustains diesel generators and rotary frequency converters that are part of the electric power generating equipment as well as small diesel generators used for power systems. In addition to providing electric power to the tracking, data acquisition and communications systems at remote locations, utility electric power is provided for assembly buildings, rocket launchers and other remote site users as required. The electric power systems currently in use maintain single- and three-phase designs. The mobile electric power systems are installed in ISO portable containers and are able to be transported over the road on flat bed trailers. Figure 3-23 shows range equipment in Bermuda.

Figure 3-24. Fixed TM facilities

Figure 3-25. 8 Meter Transportable Orbital Tracking Station (TOTS)

3.3.3 Telemetry Services

Wallops Range provides telemetry services and maintains capabilities enabling telemeter of data in support of mission requirements.

Telemetry instrumentation and trailers are equipped with a trained and certified operations staff to provide services for operational support of a mission requiring both fixed and down range telemetry services, simultaneously with a remote mission utilizing deployed mobile telemetry services requiring no more than two complete mobile telemetry antennas and associated instrumentation systems.

Telemetry services include receiving, decoding, recording, relay and display of telemetered data from aircraft, uninhabited aerial systems, Sounding Rockets, Expendable Launch Vehicles (ELV's), balloon payloads, ground test articles, and satellites.

Each fixed or mobile telemetry system (single receiving aperture) is capable of supporting requirements of one to four downlinks. Ground systems are capable of supporting requirements that total up to 12 separate telemetry downlinks from a single receiving aperture. Wallops Range is able to provide telemetry services to enable receipt of data forwarded by remote downrange

Table 3-4. Range Telemetry Systems

Antenna Diameter/ Type	Frequency Range	Polarization	G/T* (Minimum)	Noise Temp. @ Degrees K	Gain	Tracking Modes	Pedestal Type
LGTAS 2.4M/8 ft 2 Parabolic4	1435-1540 MHz 1650-1710 MHz 2200-2300 MHz	RHC/LHC	5.18 dB/K @ 2.25 GHz	400 @ S-Band	L-Band: 28 dBi 1680 Band: 29 dBi -Band: 32 dBi	Auto Slave Manual Program	AZ/EL
MGTAS 7.3M/24 ft 2 Parabolic	1400-2400 MHz	RHC/LHC	13.5 dB/K @ 2.2 - 2.4 GHz 11 dB/K @ 1.4 – 1.75 GHz	200 @ 1.4-2.1 GHz 250 @ 2.2-2.3 GHz	39 dBi @ 2250 MHz	Auto Slave Manual Program	AZ/EL
9M Parabolic	2.2-2.3 GHz	RHC/LHC div	24 dB/K @ 2250 MHz	100 K	44 dBi @ 2250MHz	Auto Slave Manual Program	X-Y
8M (TOTS)	2200-2400 MHz	RHC/LHC div	Tracking >18db/K @ 2250 MHz Data				
>20.5db/K @ 2250 MHz	150 K	42.8 dBi @ 2250MHz	Auto Slave Manual Program	AZ/EL			
8M (TOTS) at Poker Flat, Alaska	2200-2400 MHz	RHC/LHC div	Tracking >18db/K @ 2250 MHz Data >21.5db/K @ 2250 MHz	140 K @ 2.25 GHz	42.9 dB & 2.25 GHz	Auto Slave Program	AZ/EL
9M Redstone at Poker Flat, Alaska	2200-2400 MHz	RHC/LHC div	19 dB/K	170 K @ 2.25 GHz	40.3 dBi & 2.25GHz	Auto Slave Manual	AZ/EL
* G/T - Gain/System Noise Temperature or Figure of Merit.							

telemetry receiving sites supporting missions launching from Wallops Island. Wallops Range provides data recording, telemetry best source selection, de-commutation, decoding and processing, and display of data products at the Telemetry Readout Facility.

Instrumentation components include signal amplifiers and conditioners, bit synchronizers, frame synchronizers and telemetry processors. Relay of data, processed/formatted data, and display video is provided by the Telemetry Readout Facility. Implementation and operation of customer provided data processing and display instrumentation systems, including data communications interfaces, is supported in the Telemetry Readout Facility.

Telemetry (TM) services at the Range include a variety of antennas, receivers, and display instrumentation systems. Command uplink and metric tracking capabilities are also available. Post-flight telemetry data can be distributed via magnetic tape, CD-ROM and magneto-optical disks.

Figure 3-26. Mobile Integrated Telemetry Systems (MITS) Van

Table 3-5. Transportable Telemetry Systems

Antenna Diameter/ Type	Frequency Range	G/T (Minimum)	Tracking Modes	Pedestal Type	Trailer	Van	Remarks
Antenna #1 3 M/10 ft 4 Section Parabolic	1435–1540 MHz 1650–1710 MHz 2200–2300 MHz	7.1 dB/K @ 2.25 GHz	Auto Slave Manual	AZ/EL	n/a	SVAN1 or 7M Van	Skid-mounted with 20-ft. Condex
Antenna #9 6.1M/20 ft 12 Section Mesh Parabolic; Wide band and Narrow band	1435–1540 MHz 2200–2300 MHz 2300-2400 MHz	>11.0 dB/K @1.49GHz >17.5dB/K @ 2.25 GHz	Auto Slave Manual	AZ/EL	12.8M/42 ft flatbed w/ enclosed shelter	n/a	Antenna #9 can be shipped in a C-141 aircraft.
Two 7-meter systems 7M/23 ft 12 Section Fiberglass Parabolic (rad-scan prime focus feed); 2 systems, Wide band and Narrow band	1435–1540 MHz 2200–2300 MHz 2300-2400 MHz	>11.0dB/K @1.49GHz >18.5dB/K @ 2.25 GHz	Auto Slave Manual	AZ/EL	40-ft flatbed	7M control van or SVAN	One 7M system can be deployed with 7M control van or two systems can be deployed simultaneous with the SVAN

Table 3-6. Transportable Van Summary

Van	Size	Function
Super Van SVAN1	14.8 meter (48 ft.)	Multipurpose telemetry van equipped to support 3 antenna systems individually and simultaneously.
ANT #9 Van	12.2 meter (40 ft.)	53-foot flatbed trailer with hydraulic erected 6.2-meter (20-ft.) tracker and 20-ft. long instrumentation shelter.
40-ft ISO Hauler and TOTS Control Van	12.2 meter (40 ft.)	Equipped to support pad-mounted 8-meter (26-ft.) TM antenna.
40-ft ISO Hauler and MITS Van	12.2 meter (40 ft.)	Equipped to support trailer mounted 7-meter (23-ft.) TM antenna.
40-ft ISO Hauler and 7 meter Control Van	12.2 meter (40 ft.)	Equipped to support pad-mounted 7-meter (23-ft.) TM antenna.

Fixed Telemetry Systems

Telemetry systems consist of fixed range TM facilities located on Wallops Main Base. Figure 3-25 is a view of the fixed TM facilities.

Transportable Telemetry Systems

Wallops Range has transportable TM capabilities for use at other locations. Tables 3-4 through 3-6 list the technical characteristics of transportable TM systems available at Wallops (see following pages).

The Transportable Orbital Tracking Station (TOTS) was developed to provide a multi-mission transportable low-Earth orbit spacecraft tracking capability. The TOTS can also support vehicle and payload telemetry. The TOTS is S-band but could be upgraded to support X-band. The Range owns two TOTS; one system is located at WFF and the other is located at Poker Flat Research Range near Fairbanks, Alaska.

3.3.4 Range Timing

The Master Timing Station (MTS) provides time synchronization and coordination of range activities. The system provides for the distribution of time codes, reference signals and program time (countdown) information to all required locations. The Time-of-Year (TOY) system is synchronized to the GPS constellation of satellites. The GPS time transfer unit is used to synchronize the Master Timing System and its remote sites. The codes are received and amplified at the various remote user sites for a variety of functions, including use with recorders, oscillographs, camera events, and for driving remote timing displays. Program time provides a visual count status and programmable function control (sequencer) for pre-determined events. Synchronous generators and translators at remote sites provide for fail-safe operations, propagation delay correction and translation of received time codes to other codes (e.g., IRIG-A, IRIG-G) and reference signals.

The following time codes are available: NASA 28-bit, NASA 36-bit, I RIG-B, IRIG-E, IRIG-H, IRIG-A, IRIG-G, Multiplexed Time Code (ASCII).

3.3.5 RF Monitoring and RF Communications

Range communications and monitoring services are available for the multi-channel intercom system distributed throughout the Wallops Range for use by both fixed and mobile instrumentation and range data processing and control facilities. WFF provides the voice communications in support of mission operations.

Various radio bands including High Frequency (HF), Very High Frequency (VHF), and Ultra High Frequency (UHF) are utilized by radio equipment at the range transmitting, receiving and airport tower facilities. These radio bands support ground-to-ground, air-to-ground

and ship-to-shore voice communications. Various instrumentation elements support voice communications, including digital voice switches, analog patch panels, analog and digital voice recorders, analog line drivers and bridging amplifiers, keysets, headsets and handsets, antennas and associated cabling.

WFF provides services and capabilities enabling inter and intrasite interface to communications end equipment in all instrumentation operations sites at the Wallops Range. Services are also available to mobile instrumentation systems and off-site locations as needed.

The Land Mobile Radio (LMR) system provides trunked analog and narrow-band VHF voice communications between mobile users and base stations.

WFF provides frequency monitoring and control services defined by mission requirements documents or requested by the WFF Spectrum manager and/or the WFF Test Director.

Wallops Range will monitor spectrum during times of controlled emissions for protection of sensitive and critical systems, such as experiment payloads and Flight Termination Systems.

Communications are supported by frequency monitoring equipment and frequency spectrum allocation management and coordination capabilities. The Frequency Monitoring System is used to monitor the frequency spectrum and for the detection and location of radio-frequency interference (RFI) sources. The Range is capable of monitoring frequencies up to 22 gigahertz (GHz).

3.3.6 Command Operations

Wallops Range is able to provide command instrumentation and trailers, as well as trained and certified operations staff to provide services for operational support of a local mission requiring both fixed and down range command services, simultaneously with a remote mission utilizing deployed mobile command services. Wallops Range provides services enabling mission controller uplink of control signals to flight targets, as well as a UHF uplink system with the capability to control or terminate flight experiments and vehicles. Flight Termination System (FTS) communications instrumentation shall support the Wallops Range Safety function. Command systems generate 20 discrete tones as defined in IRIG standard. Antennas from Omni-directional to directional helix and quad helix configurations are at fixed locations. Remote control communications systems serve to relay Range Safety Command Panel actions to a remotely located command transmitter and to return status information.

UHF command systems provide control of airborne vehicle (rocket, balloon or aircraft) functions for on-board experimental devices. The systems also provide flight termination for range safety purposes. There are fixed and mobile system capabilities. Omni- and quad-helix antennas are available at the fixed site. The mobile systems utilize single helix antennas. Command systems feature failover redundant transmitters and antennas. A typical configuration has 20 IRIG tones available for modulation.

The fixed command system at the Range can be controlled by the Range Safety Officer in the RCC or from building U-55, Table 3-7, on the Mainland. The Mobile Command System provides the same functionality as U-55 for downrange or off-axis support. The Mobile Range Control System contains all computer systems necessary to act as a stand-alone RCC. Additionally, it houses a command destruct system identical to that found in the Mobile and Fixed command systems. The Mobile Command System and the Mobile Range Control System (Table 3-8) also serve as communications hubs for co-located assets such as Radar and Telemetry systems.

Table 3-7. Fixed Command Systems

Fixed Command System (Building U-55)

Transmitters			Antennas		
Type	Frequency	Power	Type/Control	Gain	Polarization
(2) Ophir RF XRF-232 1kW	406-450 MHz FM IRIG Tones	• Commercial AC • 2 generators and UPS for redundant system	(2) Canoga quad helix; radar slaved or manual control	16 dB	LHC
			(2) Orbit quad-helix; radar slaved or manual control	18 dB	LHC
			(2) Omni	0 dB	Vertical

Table 3-8. Mobile Command Systems

Transmitters			Antennas		
Type	Frequency	Power	Type/Control	Gain	Polarization
Mobile Command System #1A					
(2) Ophir RF XRF-232 1 kW	406-450 MHz FM IRIG Tones	UPS	(2) Single-helix, pneumatic mast to 45 feet, radar slaved or manual control	15 dB	LHC
Mobile Range Control System #2					
(2) Ophir RF XRF-232 1 kW	406-450 MHz FM IRIG Tones	UPS	(2) Single-helix, pneumatic mast to 45 feet, radar slaved or manual control	15 dB	LHC

The communications systems at the Range consist of the following components:

- HF/VHF/UHF radios
- Local area network (LAN), Internet and email
- Telephone

- Frequency shift tone keying
- Technical Control
- 5 network terminal
- Cable plant
- High-speed data circuits
- Data transmission systems
- Closed-circuit television systems
- Administrative Message Service (AMS)

Frequency/Band	Modes	Transmitter	Receiver Location	Numbers of Radios	Power output
Range Radios					
2-30 MHZ HF	AM/LSB/USB	U-55	N-162	1	1KW
2-30 MHZ HF	AM/LSB/USB	U-55	N-162	2	100W
118-136.975 MHZ VHF	AM	U-55	N-162	8	50W
225-399.975 MHZ UHF	AM	U-55	N-162	8	50W
Project Aeronautical Control Cab Radios					
118-136.975 MHZ VHF	AM	RCC CAB	RCC CAB	3	20W
225-399.975 MHZ UHF	AM	RCC CAB	RCC CAB	2	20

NASA MOVE

The purpose of the Mission Operations Voice Enhancement (MOVE) units is to meet the mission voice conferencing and voice recording requirements at Wallops Range. The system has a robust architecture managing voice conferences to provide improved mission support. Each voice system is controlled and configured locally via a real-time control subsystem.

HF/VHF/UHF Radio System

The Wallops Range Air to Ground Radio system is comprised of transmitter systems located at U-55 and receiver systems located at N-162. The radio system is integrated into the RCC MOVE intercom panels allowing users to use the radio system from the any assigned intercom panel. Twelve audio and radio keyline circuits connect the RCC with U-55 Transmitter Site to provide uplink audio for RF transmission to range users such as Aircraft or Ships. RF transmissions from range users is received at N-162 Receiver Site, demodulated and the audio is routed to the RCC intercom panels. The system is typically used to support surveillance operations or any voice communications requirements needed in the bands. A bank of low-power VHF/UHF transceivers located at the RCC is primarily for use by the Aeronautical Cab. This system is typically used for air field operations requiring low-power close communications. These radios are also interfaced to the MOVE Intercom system and can be used from any intercom terminal

on the range. This radio system also serves as a backup to the range radio system. The following table lists the assets available for control from the RCC and Project Aeronautical Control Cab.

The cable plant supporting communications systems includes extensive telephone, coaxial cable and fiber optic cables interconnecting Wallops facilities. Varied combinations of multimode and single-mode fiber optic cable connect launch pads and blockhouses. Copper twisted pair cable is available for telephone, intercom, timing, and data transfer. All major buildings contain coaxial TV cable for the RF distribution system.

The frequency shift tone keying system provides remote control of events and devices, such as cameras and command transmitters.

The communications systems are flexible and can be configured to fit user requirements. These systems provide the means for managing operations at the Range and communicating and coordinating with related operations in other geographic areas.

Data Systems

Data is acquired during mission operations from radar, telemetry, optical, meteorological, and timing systems. A variety of data systems acquire, record, and display information in real time for science, control, and monitoring flight performance. Wallops has the capability to provide data in processed parameters and formats specified by the user. Data can be recorded on disk files in various formats and delivered on CD or by email to the customer/experimenter. Optically derived data is available on optical discs or large file transfer.

Tracking data can be transmitted to remote locations in two formats: Minimum Delay Data Format (MDDF) and Launch Trajectory Acquisition System (LTAS) format. MDDF data is raw radar data (range azimuth/elevation versus time of day relative to radar pedestal). LTAS data is smooth radar data relative to the center of the Earth.

Inertial Navigation System (INS) and Global Positioning System (GPS) on-board flight system data can be received at Wallops by telemetry and can be converted to LTAS format.

3.3.7 Precision Tracking Radar Services

Wallops Range is capable of providing radar operations services for local missions requiring both fixed and down range mobile radar services, simultaneously with a remote mission utilizing deployed mobile radar services requiring no more than two complete mobile radar antennas and associated instrumentation systems.

Tracking radar systems provide accurate velocity and positional data of launch vehicles, balloons, satellites, and aircraft. The Range has three fixed and four mobile tracking radar systems. The fixed radar systems are the RIR-716C (Research Airport), RIR-706 (Mainland) and RIR-716C (Wallops Island), see Table 3-9.

Table 3-9 Precision Tracking Radars

WFF ID No.	Radar	Wave Length Band	Peak Power Output (Watts)	Pulse Rate Frequency (pps)	Beam width (deg.)	Antenna Size (Meters)	Antenna Gain (dB)	Max Range (KM)	1-m2 Skin Track (KM)	Range Precision (Meters) (rms)	Angle Precision (mils rms)	Tracking Velocity (deg/sec) AZ EL
2	RIR-778C (mobile)	C	1M	160, 320, 640	1.5	2.38	39	60K	251	5	0.24	34 34
3	RIR-716C (Wallops Island)	C	1M	160, 320, 640	1.23	3.66	43	60K	630	3	0.15	45 28
5	RIR-706 (Mainland)	C	3M	160, 320, 640, 1280	0.39	8.84	51	60K	1496	3	0.05	20 20
8	RIR-778C (mobile)	C	1M	160, 320, 640	1.5	2.38	38	60K	251	5	0.24	34 34
10	RIR-778C (transportable)	C	1M	160, 320, 640	1.0	3.66	43	60K	473	3	0.15	34 34
11	RIR-778C (transportable)	C	1M	160, 320, 640	1.0	3.66	43	60K	473	3	0.15	34 34
18	RIR-716C (Airport)	C	1M	160, 320, 640	0.71	4.88	46	60K	630	3	0.1	31 28

Transponder Test Facilities

The Transponder Test Facility is located in the Engineering Support Building, Radar Engineering Lab, in building E-109, room 275. This is an automated test set designed to measure the tolerances to which flight transponders have been set. This is a mobile test setup that allows the equipment to be used at assembly buildings on the island, as well as at E-109 TTF. There are several test procedures which can be run to assure the reliability of the flight transponder. The test equipment meets NASA ESD requirements as per NASA Standard 8739.7 and all equipment calibration is kept current. Approximately 232 man hours per year is spent on flight transponder certification, recertification and equipment calibration dependent upon the number of projects.

Wallops maintains a calibration laboratory equipped to perform repair and calibration of test instruments. Customer-furnished equipment is calibrated and certified at this facility. The equipment in the standards laboratory is traceable to the National Institute of Standards and Testing (NIST). These standards are part of a mandatory recall program for recalibration and certification.

Electrical Performance Test is designed to step the flight transponder through various combinations of performance, such as varying and measuring the interrogate frequency, and at the same time looking at tuning tolerances and the point at which the reply pulse ceases. Other measurements include: transmit frequency, code spacing, delay pulse, power, current, PRF, Receiver Sensitivity and pulse jitter, as well as others.

Electrical Stress Test is identical to the Performance Test with the exception that more data points are stepped through which results in a longer testing period, thus testing the stress (Electrical and Thermal) the flight transponder might experience in flight.

Table 3-10 Wallops Range Surveillance Radars

Radar	Wave Length	Peak Power Output	Pulse Rate Freq.	Beam Width	Antenna Size	Antenna Gain	Max Range	11-m2 Skin Track	Range Precision
ASR-8	S-band	1 MW	1040 Hz	1.4° x 30°	9'x16'	33.54 dB	80 NM	75 NM	1%
APS-143 BV3	X-band	8 kW	395-2491 Hz	1.5 X 17	36" X 12"	31 dB	200 NM	28 NM	0.25 - 1.5%
RDR-1700B	X-band	1 kW	680-2491 Hz	1.5 X 17	36" X 12"	31 dB	120 NM	25 NM	0.4 - 1.5%
Furuno	S-band	30 kW	3000, 1500, 1000, 600 Hz	20°	12'	n/a	96 NM	n/a	n/a
Furuno	X-band	25 kW	3000, 1500, 1000, 600 Hz	20°	8'	n/a	96 NM	n/a	n/a

NOTES: Locally, the Furunos are referred to as WISSRDS-S & WISSRDS-X (Wallops Island Sea Surface Radar Detection System). PRF's change with range settings. The skin track values are estimated based on flight tests and assume relatively low sea states (< 3)

Transponder Set-up is also performed at this facility. Some launches require multiple vehicles to be launched at close intervals. Thus, different codes are used to differentiate between vehicles and sometimes the different stages of vehicles. Generally, we set Interrogate and Reply frequencies, Delay, and Codes. These criteria are set to specifications set by the Range Commander Council. For example the Interrogate frequency is set to 5690 MHz, plus or minus 2 MHz.

Transponder Test Set is a bank of equipment set up to perform the various test criteria. Currently, it is made up of the following:

- HP 5359A Time Synthesizer
- HP 5370B Time Interval Counter
- HP 437B Power Meter
- HP 5361B Microwave Frequency Counter
- HP 54200 Digital Storage Scope
- HP 8673E Synthesized Signal Generator
- HP 8481A Power Sensor
- Wavetek 859 Programmable Signal Generator
- Assorted attenuators, circulators and directional couplers

3.3.8 Surveillance Radar Services

In support of launches at WFF, fixed surveillance radar and Target Display Systems, including air and surface surveillance systems, are operated, maintained, and sustained by Wallops Range. Surveillance radars are able to accurately identify confidence targets as defined by NASA Range Safety and mission specific requirements documents.

Surveillance radars support the detection and tracking of surface and air targets operating on the Wallops Range. These radar systems provide critical data required to assure the safety of public

and non-participating aircraft and surface vessels operating in the vicinity of the Wallops Range. In addition, these radars are necessary to perform safe and efficient control of range aircraft and surface vessels that support Wallops Range operations. Two Furuno surface surveillance radars (one S-band, one X-band) and the ASR-8, an FAA-certified air surveillance radar owned by the U.S.; Navy, and operated in partnership with NASA-Wallops) are located on Wallops Island to support these operations. The ASR-8 radar system provides a shared air surveillance dataset to the Navy's Chesapeake Test Range at Patuxent River, and the Wallops' RCC, as well as other users on the FAA National Air Space network. The AN/APS-143 is a state-of-the-art NASA owned airborne surface surveillance radar system that operates on an aircraft contracted by the Wallops Range.

3.3.9 Range Data Processing and Display Services (RADAC)

Wallops existing RADAC ingests positional data and processes it in real time. Custom software applications provide parameters necessary to determine present position, predicted impact prediction, state vectors and orbital elements. Radar slaving data is also provided. In certain circumstances, plug-in type modules are used to enable special functions, such as vehicle guidance, vectoring payload recovery vehicles, or tracking balloons. Processed data is archived on the system's hard drive and may be further reduced per customer specifications.

The RADAC system hardware consists of two nearly identical workstations — DQCA and DQCB — are operated redundantly unless otherwise defined in mission specific requirements documents. These systems perform data ingestion, conversion, display and reduction of various types of positional data.

3.3.10 Range Surveillance and Recovery Services

Wallops Range provides planning, management, oversight, implementation and reporting on all range air and sea surveillance and recovery activities. Wallops Range arranges and coordinates range surveillance/recovery services, to include fixed wing aircraft equipped with an APS-143 surveillance radar as well as an UH-1 Huey helicopter for visual clearance, surface radar equipped surveillance and recovery vessels, crew and operational services, except in cases where other Government agencies, such as the U.S. Coast Guard, are providing services.

Wallops Range will interface with other ranges, organizations and corporations in identifying and assessing options and range surveillance and tools. The Ship Surveillance System (S3) is able to interface with video data communication interfaces for distribution of displays throughout the control center. Operations shall include pre-mission setup, to include entering launch trajectory and impact points into the system, which will be used to perform impact probability calculations.

U.S. Government and contractors provide recovery services for ocean surface, subsurface, and land operations. Visual and electronic search techniques are employed to locate objects impacting on the ocean surface and land areas. Electronic search employs aircraft- or ship-

Figure 3-27. Bell UH-1H Iroquois "Huey" Helicopter

mounted beacon receiving (homing) equipment, in conjunction with homing transmitters attached to the objects to be recovered.

Subsurface recovery utilizes sonar pinger locating equipment in conjunction with sonar pingers (transmitters) attached to the object to be recovered. Side-scan sonar, underwater TV, and dragline equipment are also employed to locate subsurface objects for recovery. Retrieval of subsurface objects can employ scuba and hardhat divers and underwater remote control retrieval units.

The range employs a King Air 200 equipped with belly mounted 360 degree azimuth APS-143 maritime surveillance radar with iridium linked ground station; Automatic Identification System (AIS) with a selectable range between 8-200 nautical miles for range surveillance and clearing.

The WFF Aircraft Office maintains and operates a Bell UH-1H Iroquois "Huey" (N535NA) helicopter (Figure 3-28). This helicopter is available for range surveillance, UAS chase, photographic support, and a variety of other aerial needs. The UH-1 has a maximum endurance of two hours, maximum range of 315 nautical miles, and can carry payloads up to 3,880 pounds. The helicopter is equipped with a marine band radio and search light for range surveillance purposes. The UH-1 has also been modified to support scientific and technology demonstrations and can be further modified to support future customer needs. The UH-1 asset

is scheduled through the WFF Aircraft Office Operations Manager.

3.3.11 Mission Webcasting Services

WFF can provide public and private (password protected) unclassified near real-time video and audio streaming over the internet in response to needs of customers using appropriate services, technologies and tools. If additional security measures are required, this requirement will be defined in additional task orders or in detailed mission requirements. Streaming video compatible with RealMedia™ and Windows Media™ is supported.

3.3.12 Air Traffic Management Services

The WFF Airport Control Tower controls the movement of air and ground traffic. The tower is staffed Monday through Friday with Control Tower Operators (CTOs) between 0700-1700 local (excluding Federal holidays and weekends) and as required, to support special projects.

The WFF Airport Control Tower complies with FAA regulations at 14 CFR Part 65, Subpart B pertaining to Air Traffic Control Tower Operations; FAA Air Traffic Control Procedures FAA Order 7110.65; and NASA Procedural Requirements (NPR) 7900.3 — Aircraft Operations Management. The CTO's possess an FAA Air Traffic Control Tower Operator's Certificate.

The Airport Manager's office works with NASA Project Managers in the conduct of WFF projects which may require a temporary or partial closure of the airport to accommodate research project requirements. The airport manager or his designee will attend all range reviews requiring WFF Airport services and provide air traffic management subject matter expert services for all mission planning needs that support WFF operations. Air Traffic Management support services include analysis of project requirements, goals, and objectives and are presented in appropriate mission reviews/meetings.

Visiting aircraft on official U.S. Government business are required to obtain a Prior Permission Request (PPR) number from Wallops Airport Operations/ Wallops Tower at 757-824-1688/2049 prior to flying into WFF. The PPR should be obtained at least 24 hours before the scheduled arrival. Upon arrival in Wallops airspace, the visiting aircraft should contact the Control Tower operator, call sign "Wallops Tower." The pilot must provide the assigned PPR to the Control Tower operator before permission is given to land.

During non-tower hours, the visiting aviator must contact "Wallops UNICOM" and provide the assigned PPR. Wallops UNICOM is a service that operates on the Control Tower frequencies to provide information, services and airport lighting to visiting aircraft. Non-FAA-ATC certified contract personnel provide this service from a remote location. Traffic Advisory Practices at Airports without Operating Control Towers (FAA AC No. 90-42) is in effect during non-tower operating hours because of safety and security considerations.

During tower and non-tower hours, the visiting aviator must contact "Wallops Tower"

or "Wallops UNICOM" prior to engine start. All movement on the airfield must be pre-coordinated over the Control Tower frequencies 126.5/306.975 MHz.

3.3.13 Weather Forecasting Office

The Weather Forecast Office provides daily forecasts and other meteorological information in support of all WFF activities, including targeted forecasts upon request. National, regional, and local weather data is available. Data sources include the Leading Environmental Analysis and Display System (LEADS), several lightning detection systems, field mills, which measure lightning potential, and a full complement of local surface instruments to measure wind, temperature, pressure, dew point, and cloud height.

A daily forecast briefing covering the upcoming 12 hours is broadcast at 10 a.m. over the WFF closed circuit television. A forecast of the upcoming 36 hours is prepared in the afternoon and is available from the Weather Forecast Office. Weather briefings are available by telephone upon request, and the daily 12- and 36-hour forecasts are placed on a telephone recording (extension 2291) at 10 a.m. and 2 p.m.

Other weather and video switching network information is available on the WFF closed circuit television network:

- Weather radar display originating from the National Weather Service (NWS) radar
- Local weather conditions, including upper winds, based on sensors at WFF
- National Lightning Detection Network displays

3.3.14 Meteorological Operations

WFF provides Meteorological Services at the WFF, PFRR and other ranges and mobile deployments worldwide. Meteorological services are provided at the Wallops Range and simultaneously for missions requiring support at remote locations. Meteorological services include weather forecasting, collection of upper air and surface weather data, collection of ozone data and pre-launch collection of data for blast and toxic dispersion required for orbital launches. Local weather forecasts include daily (Monday through Friday) forecasts presented via the local WFF closed circuit television system. Local weather forecasts are generated using local weather data systems and other resources as needed. Special weather forecasts are provided as required for various project requirements and/or special weather events.

Twice daily balloon soundings of the upper atmosphere and associated surface observations are provided at midnight and noon GMT, seven days per week, in compliance with the NWS LOA for Routine Upper-Air and Associated Surface Observations at Wallops Island and the Department of Commerce. Special balloon soundings are provided as required for various projects and weather events.

Various meteorological facilities support launch operations. Fixed, balloon-borne, and optical sensors are available for obtaining atmospheric data. Current weather data from weather sensors on the Main Base and Wallops Island are continuously displayed on the local WFF closed circuit TV system, and the data can be made available remotely via modem interfaces. An Ionosphere Sounding Station provides detailed data on the ionosphere characteristics. Lightning detection systems discussed in 3.2.8 display lightning conditions locally and over the United States.

Wallops Range provides input data into the Automated Surface Observation System (ASOS) as needed for proper weather data analysis and collection as well as providing data collection of ozonesonde data at Wallops Range and remote project locations worldwide.

3.3.15 Optical Systems Services

Optical Systems Group

The Wallops Range Optical Systems Group has two functional areas providing video technical support and photographic services to the Wallops community.

Technical Support

The Video Technical Team is responsible for the operations and maintenance of five fixed video tracking stations and four mobile tracking stations. The fixed assets are situated around Wallops Island providing coverage of Pad 0A, Pad 0B and all sounding rocket launch facilities. These stations are a mix of Intermediate Focal Optical Length Trackers (IFLOTs) and open site trackers each utilizing two cameras providing short- and intermediate-length optics. See Figure 3-9 for location of camera stations and Table 3-11 for instrumentation provided at each station.

The Technical Team also operates and maintains three manned IFLOTs and one unmanned Mobile Optical Tracking System (MOTS), which can be relocated to hazardous areas.

All video tracking stations are capable of ingesting and distributing standard-definition and

Table 3-11. Photo Optical Systems

Camera Station	Fixed/ Mobile	System Type	Tracking Rate	Video Format	Focal Length
2	Fixed	Open Site	Manual	SD/HD	20-inch Lens
4	Fixed	IFLOT	30˚/sec	SD/HD	20- & 40-inch lens
5	Fixed	Open Site	Manual	SD/HD	20-inch lens
8	Fixed	Open Site	Manual	SD/HD	10- & 20-inch lens
15	Fixed	IFLOT	32˚/sec	SD/HD	20- & 40-inch lens
9	Mobile	IFLOT	32˚/sec	SD/HD	20 inch & 500 mm lens
11	Mobile	IFLOT	22˚/sec	SD/HD	20 inch & 500 mm lens
13	Mobile	IFLOT	22˚/sec	SD/HD	20 inch & 500 mm lens
MOTS	Mobile	Slaved Pedestal	25˚/sec	HD	500, 600 and 800 mm lens

high-definition video formats via fiber while providing the customer range timing on all video sources.

Along with the video tracking stations, the Technical Team is responsible for operations and maintenance of the RCC, satellite receiving, cable television support to Code 763, and multiple video surveillance systems.

Figure 3-28. Optical Tracking Site

Production Support

The Optical Systems Group also provides photographic and graphic services to the Wallops community. Photographers are outfitted with the latest digital lens reflex cameras for operations support, portraiture photography, and are on stand-by for any Wallops employee request supporting official NASA activities. The Production Team routinely accepts request to create and print awards, certificates, and other documentation to communicate the Wallops mission. The Production Team is also responsible for audio and visual support for E-100.

The Production Team maintains the Wallops Archive, which consists of hundreds of thousands of images dating back to 1945, when Wallops launched its first rocket.

4 WALLOPS RANGE ADMINISTRATION & LOGISTICS

4.1 General

This section describes applicable administrative and logistics policy and procedures.

4.1.1 Access

Wallops Flight Facility maintains 24-hour security for all facilities. Personnel without current security badges will not be allowed access to the Main Base, Wallops Island, or the Mainland complex. All visits to WFF should be coordinated with the Project Manager.

4.1.2 Working Hours

The normal workday for WFF is 0800-1630 Eastern Standard Time (EST) Monday through Friday. There are work limitations established for safety purposes. Coordination of the work schedule with the Project Manager is necessary to ensure access to required facilities and the availability of necessary technical personnel.

4.1.3 Cafeteria, Dormitories and Gym

The Wallops Exchange and Morale Association (WEMA) manages the cafeteria and dormitories. The cafeteria serves breakfast and lunch Monday through Friday, except on holidays. Dormitory rooms are rented on a space-available basis. Morale activities can be viewed on base at http://sites.wff.nasa.gov/wemamac. Wallops Flight Facility Fitness Club memberships, for personnel with base security identification, can be purchased from the NASA Exchange Store located adjacent to the NASA Cafeteria. Rules, regulations and equipment information can all be found at http://sites.wff.nasa.gov/wfc/index.html

4.1.4 Communication Services

NASA Integrated Communications Services (NICS) provides all networking services. Several networks are available on premises including:

NASA Center Network Environment (CNE)

Both inbound and outbound connections are permitted on the NASA Center Network Environment (CNE) by following the complete IT security plan and processes with the sponsor vouching for any individuals requiring full access to CNE resources. Both wired and/or wireless connections to the CNE are available upon request.

NASA GUEST Center Network Environment (Guest-CNE)

For visiting projects, NICS provides internet access at no cost through a Guest network service which can be used for short-term, outbound-only access. Both wired and/or wireless connections to the Guest-CNE are available upon request and after successful registration.

Range Mission Network (RMN)

The Range Mission Network (RMN) is an operational closed network that supports mainland and island projects and inter-system communications. It supports mission-specific data through its fixed and mobile launch assets. The RMN enables communication of Ethernet-based Mission Voice (MOVE), ITAR video, E-LTAS/EMDDF, radar and telemetry tracking/slaving data, RADAC, Stratum 1 NTP time servers, command and control of GPS Radio Sonde receivers, remote control over RADAR assets, Wind Weighting sensing and data processing, and secure data gateway.

The NASA Communications Service Office (CSO) is the Internet Service Provider (ISP) for WFF. The CSO also provides direct dedicated data connections between NASA centers over the CSO WAN backbone. The CSO provides Video and multi-media conference room solutions. CSO also supports the WFF DTV system. The CSO is responsible for the enterprise-wide delivery of communication services. Examples include Agency Wide Area Network, Local Area Network, Collaboration Services, and Center Services as requested. CSO utilizes the I3P contract, NASA Integrated Communication Services (NICS), as the main support for provision of these services.

Additional closed, private networks can also be installed if there is a customer need and if connections to the existing networks prove insufficient or are prohibited due to security concerns or risks.

The cable plant supporting communications systems includes extensive telephone, coaxial cable, and fiber optic cables interconnecting facilities. Varied combinations of multimode and single mode fiber optic cable connect the various buildings, launch pads, and control centers. Copper twisted pair cable is available for telephone, intercom, timing, and data transfer. All major buildings contain coaxial TV cable for the RF distribution system. New communications infrastructure installations and changes or upgrades to existing cable plant infrastructure also are possible if necessary to satisfy project requirements. The communications systems are flexible and can be configured to fit user requirements. These systems provide the means for managing operations at the Wallops Range and communicating and coordinating with related operations in other geographic areas.

Telephone, Teleconferencing, and video teleconferencing services are available through the customer's sponsor. Unlimited local and long distance services are included with standard phone service. International dialing is available upon request. Analog telephone services are also available upon request for modem and fax applications.

A new corporate digital CATV head end and distribution system provides the capability for a multi-channel cable television system to distribute video from many diverse sources to WFF facilities, including the NASA Visitor Center, Management Education Center (MEC), U.S. Navy facilities, and the NOAA Weather Data Acquisition Center. Video sources from satellite, real-time range, or computer displays can be directly linked to the cable system and therefore are instantly available for wide distribution on campus.

Surveillance cameras are positioned in many areas of the main base and island. These cameras are capable of Pan, Tilt, and Zoom (PTZ) functions and can be remotely controlled. Many cameras are used by the Test Director, security personnel, and range customers to safely monitor range activities.

A Communications Security (COMSEC) account manager (CAM) is available on premises for aiding in the transfer of materials and the initialization and configuration of COMSEC devices. The CAM handles highly sensitive and classified information which pertains to national security and is responsible for ensuring all COMSEC material issued to, generated by, or held by the account is safeguarded as required by all applicable federal and NASA regulations.

Agency Consolidated End-User Services (ACES) is a consolidated solution for delivering end-user services across NASA to achieve increased efficiencies and reduced costs through standardization. The ACES contractor can provide IT services and resources such as: purchasing, management and support of computers, printers, multifunction devices, cellular devices, office software, NOMAD email and calendar, and other related IT accessories.

Application development services are also available including: design, development, implementation, maintenance, server hosting, technical support, consulting, and coordination for gathering and analysis of user requirements to help customers achieve their system goals. The application development team incorporates new technologies, system design methodologies, and service delivery strategies to ensure that applications and support remain aligned with industry best practices.

4.1.5 Smoking

Smoking is prohibited in all WFF buildings, launch pads, aircraft and aircraft support areas.

4.1.6 Industrial Safety

Industrial safety procedures are typical of those enforced at other U.S. Government facilities. In addition, personnel are expected to obey all control signals and roadblocks on the airfield and launch range.

4.1.7 Fire Protection

There are two fire stations at Wallops — one on the Main Base and one on Wallops Island.

Fully trained firefighters and emergency medical technicians man the stations 24 hours a day. Each station is equipped to meet Wallops emergency response requirements.

Figure 4-1. Wallops Fire Department

4.1.8 Medical Facilities

The Health Unit located on the Main Base is available for limited medical services in the event of an emergency during working hours. Emergency medical technicians from the fire station are available 24 hours a day, as well as ambulance services. The Riverside Shore Memorial Hospital is approximately 40 miles south in Nassawadox, Va., and the other local hospital is the Peninsula Regional Medical Center, located approximately 40 miles north in Salisbury, Md.

4.1.9 Shipping

Various shipping services are available, including United Parcel Service, Federal Express and the U.S. Postal Service. The range user should use the following information when mailing correspondence or shipping equipment for official project business:

Mail Address:	Name/GSFC Code Number
	NASA Goddard Space Flight Center
	Wallops Flight Facility
	Wallops Island, VA 23337 USA
Freight Destination Address:	Name/GSFC Code Number
	C/O Receiving Officer
	NASA Goddard Space Flight Center
	Wallops Flight Facility
	Wallops Island, VA 23337 USA

4.1.10 Motor Freight Truck Service

Most cargo and freight are received at WFF Main Base, building F-19; however, construction

material is delivered to the site, and commercial shipments may be received directly by commercial users.

Inbound shipments of Class "A" and "B" explosives and other designated hazardous materials require advance notice prior to arrival. The delivering carrier's representative should provide advance notice by telephone to the explosives handling personnel in building M-15 (757-824-1433). The explosives handling personnel will furnish onsite escort, unloading, inspection, and shipment acceptance.

Normal receiving hours are 0800-1430 (for truckloads) and 0800-1600 (for partial loads), Monday through Friday, excluding holidays.

4.1.11 Air Cargo

Air cargo deliveries require special consideration and must be discussed with the assigned Project Manager and/or the Airport Manager.

GSFC/WFF Airport Manager

Phone 757-824-1240

Fax 757-824-1250

4.1.12 Airfreight Services

The nearest commercial airfreight service is at the Salisbury-Ocean City Wicomico Regional Airport in Salisbury, Md.

4.1.13 Hazardous Material

All hazardous material must be packaged to conform to applicable Department of Transportation regulations. A Safety Data Sheet (SDS) must accompany all hazardous materials shipped to WFF.

All hazardous materials shall be disposed of in accordance with the Virginia Department of Environmental Quality Regulations. The range user must provide a "Hazardous Waste Disposal Inventory," NASA Form WI-1550, to the Wallops Environmental Office for disposal of all hazardous material.

Radioactive sources require approval from the Wallops Environmental Office prior to arrival. The range user must provide the proper forms requesting the use of a radioactive material at WFF, including license information, to the Project Manager at least 90 days prior to the shipment/arrival of the source. GPR 1860.1A, *Ionizing Radiation Protection*, defines procedures and provides the needed forms.

4.1.14 Hazardous Material Storage

There are facilities located on Wallops Island for the temporary storage of hazardous liquids, such as propellants and purging gasses. There are also two rocket motor storage facilities on the Island, one for Class 1.1 rocket motor storage and an above ground facility for storage of all classes of rocket motors.

Wallops Main Base has above ground and earthen-covered storage magazines for storage of Class 1.3 and Class 1.4 explosives. There are also facilities for the non-destructive testing of ordnance and rocket motors.

Wallops airfield maintains a Hot Pad at the approach end of runway 17 which is approved for the loading and unloading of hazardous and pyrotechnic materials.

4.1.15 Material Handling Equipment

A variety of material handling equipment is available. These include forklifts, overhead hoists, and material moving equipment. The range user should provide required information regarding the testing and certification of slings, fixtures, and other user-furnished lifting devices. Table 4-1 lists the primary material handling equipment available at WFF.

Table 4-1. Material Handling Equipment

Quantity	Material Handling Equipment
1	60-ton hydraulic truck crane with 118-foot main boom
1	28-ton hydraulic truck crane with 70-foot main boom
1	95-foot basket truck
1	65-foot basket truck
Several	Electric fork lifts
Several	Forklifts under 8,000 pounds
6	8,000-pound forklifts
1	10,000-pound forklift
2	18,000-pound forklift
2	Stakeside truck with 2,000-pound hydraulic lift gate
1	Lowboy trailer with hydraulic tail deck
1	Van Truck
3	Truck tractors
Several	Handtrucks
Several	Pallet jacks

4.1.16 Customs

International shipments should clear U.S. Customs before arrival at WFF. Arrangements for shipments directly from overseas into WFF must be coordinated and approved by U.S. Customs prior to shipment.

4.1.17 Post Office

A United States Post Office is located in building E-7 on the Main Base. The address is Wallops Island, VA 23337 USA.

4.2 Foreign Nationals

Foreign nationals must obtain prior approval from NASA before a visit. The individual must provide a visit request to the Project Manager at least one calendar month in advance for a visit of 30 days or less and two calendar months in advance for an assignment more than 30 days. A list of required information to be provided for the visit can be obtained from the Project Manager.

4.3 Office of Public Affairs

The Wallops Office of Public Affairs (PAO) is available to support range users with media and guest relations operations. The PAO can set up web casts of missions and can accommodate groups that want to transmit broadcasts from Wallops using a small local radio station that provides launch commentary for local listeners. Initial requests for PAO support can be made through the Project Manager.

4.4 NASA Visitors Center

Figure 4-2. The newly updated auditorium at the Visitors Center.

Wallops Flight Facility Visitor Center and Gift Shop are located on Virginia Route 175 about 1 mile east of the Wallops Main Gate. The Visitor Center, Gift Shop and Teacher Resource Lab are part of the Robert L. Kreiger Education Center. A collection of spacecraft and flight articles, as well as exhibits about the U.S. space flight program are on display. Special movies and video presentations can be viewed, and special events, such as model rocket launches, are scheduled. There is no admission charge. The NASA Visitors Center Auditorium has a 12-foot wide, 8-foot tall video wall that is capable of showing NASA's digital cable television, range video tracking locations, surveillance video, NASA Select Television and a full battery of other video sources to help the NASA community and surrounding public keep abreast of the latest happening at Wallops Flight Facility. The Auditorium can seat up to 126 people and is the location of media events and community outreach programs governed by the Wallops Office of Communications, as seen in Figure 4-2.

5 RANGE SAFETY POLICIES

5.1 Range Safety Organization

The Suborbital and Special Orbital Projects Directorate is responsible for implementing safety policies and criteria for the Wallops Range as defined in RSM-2002. More information regarding the WFF Range Safety Organization can be found at the following website: http://sites.wff.nasa.gov/code803.

5.2 Data Delivery Schedules

Schedules appropriate for delivery of range users' inputs to the Range Safety Office are as follows (*):

- Routine Un-Guided (Sounding Type) Rockets which are designated to be inherently safe by WFF Range Safety Personnel
    - o Hazardous Ground Operations: Step-by-Step Procedures along with supporting data – provided 30 days prior to operation
    - o Preliminary Range Safety Data Package – Provided 4-6 months prior to launch
    - o Final Range Safety Data Package – Provided 1-4 months prior to launch
- Unmanned Aerial Systems (UAS) Launched from the UAS Runway
    - o Flight Termination System Certification – Six weeks to 15+ months prior to launch
    - o Hazardous Ground Operations: Step-by-Step Procedures along with supporting data – Provided 30 days prior to operation
    - o Preliminary Range Safety Data Package – Provided 2-6 months prior to launch.
    - o Final Range Safety Data Package – Provided 2-6 weeks prior to flight.
- Guided Rockets and larger UAS's launched from the main base
    - o Flight Termination System Certification – Six weeks to 15+ months prior to launch
    - o Hazardous Ground Operations: Step-by-Step Procedures along with supporting data – Provided 30 days prior to operation

o Preliminary Range Safety Data Package – Provided 5-12 months prior to launch

o Final Range Safety Data Package – Provided 1-5 months prior to launch

(*) Note: Programs with unique flight characteristics require earlier delivery dates for the Range Safety Data Package as determined by the Safety Office.

5.3 Ranger User's Pre-arrival Requirements

Range users should design vehicle and payload systems to fully implement and conform to the safety policies and criteria established by Wallops Flight Facility.

Range users must identify vehicle or payload systems and/or operational requirements that cannot meet the NASA/GSFC/WFF safety policies and criteria.

Range users must provide a safety data package containing the data defined in RSM-2002, and according to the documentation schedule listed in 2.5.4 of this document.

5.4 Ground Safety

Specific policies and criteria, such as radiation exposure limits, power switching, multiple operations, electro-explosive circuit requirements, electrical storm criteria, RF restrictions, personnel requirements, radioactive sources, lifting operations, and pressure vessels, are provided in RSM-2002. Radiation protection requirements are detailed in GPG 1860.1. All hazardous procedures must certify personnel or approve the certification of range user personnel.

The Ground Safety group will prepare a ground safety plan and publish it as part of the Operations and Safety Directive (OSD) before any range user operations are conducted at the Wallops Range.

5.5 Flight Safety

Specific flight safety policies and criteria for impacts, land over-flights, and ship and aircraft hazard areas are also defined in RSM-2002. All flights will be planned to minimize the risks involved while enhancing the probability for attaining mission objectives.

The Flight Safety Group will prepare a flight safety plan and publish it prior to launch operations. The flight safety plan will include the specific flight limits, impact limits, ship and aircraft hazard areas, and mission-unique requirements.

APPENDIX A

Abbreviations and Acronyms

ADP	Automatic Data Processing
AML	Astro Meteorological Launcher
AMS	Administrative Message Service
APCR	Aeronautical Projects Control Room
ARC	Atlantic Research Corporation
ASRF	Atmospheric Sciences Research Facility
AWIPS	Automated Weather Interactive Processing System
AZ	Azimuth
CAD/CAM	Computer Aided Design/Computer Aided Manufacture
CD-ROM	Compact Disk – Read Only Memory
CNC	Computer Numerically Controlled
csc2	cosecant2
CSLA	Commercial Space Launch Act, Public Law 98-575
dB	decibel
dBmi	decibels milli-isotropic
D.C.	District of Columbia
DC	Direct current
DoD	Department of Defense
DQCA	Data Quality Computer A
DQCB	Data Quality Computer B
DRCS	Data Reduction Computer System
DVD	Digital Video Disc
EDARS	Environmental Data Acquisition and Recording System
EFM	Electric Field Measurement
EIRP	Effective isotropic radiated power
EL	Elevation
ELC	Emerging launch company
ELF	Extremely Low Frequency
ELV	Expendable launch vehicle
ER	Eastern Range
ERD	Environmental Resources Document
ESD	Electro-Static Discharge
FAA	Federal Aviation Administration
FACSFAC	Fleet Area Control and Surveillance Facility
Fax	Facsimile transmission
FM	Frequency modulation
ft	Foot or feet

FTS	Federal Telecommunication System
G/T	Gain/System Noise Temperature or Figure of Merit
GHz	Gigahertz
GMI	Goddard Space Flight Center Management Instruction
GPG	Goddard Procedures and Guidelines
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
H	Height
HAD	High Altitude Diagnostic (Launcher)
HF	High frequency
HH	Hook height
IFLOT	Intermediate Focal Length Optical Tracker
IIP/CD	Instantaneous Impact Prediction/Command Destruct
ILS	Instrument Landing System
in	Inch(es)
INS	Inertial Navigation System
IRIG	Inter-Range Instrumentation Group (U.S. Government Agency)
ISA	Individual Support Annex
ISO	In support of
kg	Kilogram
kW	Kilowatt
LAN	Local area network
lb	Pound or pounds
LDAR	Lightning Detection and Ranging System
LFF	Liquid Fueling Facility
LGTAS	Low Gain Telemetry Antenna System
LHC	Left Hand Circular
LTAS	Launch Trajectory Acquisition System
LTS	Laser tracking system
M	Meter
mm	Millimeter
MCR	Mission Control Room
MDDF	Minimum Delay Data Format
MEC	Management Education Center
MHz	Megahertz
MOA	Memorandum of Agreement
MPPS	Multi-Payload Processing Facility
MSC	Marine Science Consortium
MSDS	Material Safety Data Sheet
MTS	Master Timing System
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications Room

NEPA	National Environmental Policy Act
NIST	National Institute of Standards and Testing
NLDN	National Lightning Detection Network
nmi	Nautical mile
NOAA	National Oceanic and Atmospheric Administration
NORAD	North American Aerospace Defense Command
NPG	NASA Procedures and Guidelines
NPOL	NASA Polarimetric Radar
NSBF	National Scientific Balloon Facility
NSROC	NASA Sounding Rocket Operations Contract
NWS	National Weather Service
ODIN	Outsourcing Desktop Initiative for NASA
OSD	Operations and Safety Directive
OSS	Operations Safety Supervisor
P&BRO	Policy and Business Relations Office
PAO	Public Affairs Office
PAPI	Precision approach path indicators
PBX	Private Branch Exchange
PCM	Pulse code modulation
PFRR	Poker Flat Research Range
PPF	Payload Processing Facility
PPR	Prior Permission Request
PRD	Program Requirements Document
R&D	Research and development
RADAC	Range Data Acquisition and Computation
RCC	Range Control Center
RCC-DG	Range Commanders Council-Documentation Group
RF	Radio frequency
RFI	Radio-frequency interference
RHC	Right Hand Circular
ROCC	Range Operations Control Center
RSM	Range Safety Manual
RSO	Range Safety Officer
RTBS	Real-Time Backup System
RTCS	Real-Time Computer System
SCAMA	Switching, Conferencing and Monitoring Arrangement
sec	Second
SECOM	Secure Command
sq	Square
T.O.Y.	Time-of-Year
TM	Telemetry
TOGA	Tropical Ocean-Global Atmospheric Radar
TOTS	Transportable Orbital Tracking System

TRADAT	Trajectory Data System
TRMM	Tropical Rainfall Measuring Mission
TRMM-LBA	Tropical Rainfall Measuring Mission-Large Scale Biosphere Atmosphere
TV	Television
UAS	Unmanned Aerial System
UDS	Universal Documentation System
UHF	Ultra high frequency
UPS	Uninterruptible Power System
U.S.	United States
USA	United States of America
USCG	United States Coast Guard
USN	United States Navy
VA	Virginia
VCSFA	Virginia Commercial Space Flight Authority
VFR	Visual Flight Rules
VHF	Very high frequency
VIP	Very important person or people
VSFC	Virginia Space Flight Center
W	Wide
WEMA	Wallops Employee and Morale Association
WFF	Wallops Flight Facility
WGO	Wallops Geophysical Observatory
WGS	World Geodetic System
WI	Work Instruction

APPENDIX B

References

(Listed in order of appearance.)

1. National Aeronautics and Space Act of 1958 (Space Act)

2 NPR 8715.3, NASA General Safety Program Requirements

3. NPR 8115.5, Range Safety Program

4. RSM-2002-RevC, Range Safety Manual for Goddard Space Flight Center (GSFC)/Wallops Flight Facility (WFF)

5 800-HDBK-0001B, Wallops Flight Facility Frequency Utilization Management Handbook

6. 802-HDBK-0001D, Doing Business at Wallops Flight Facility: A Customer Guide

7. 840-HDBK-0002, Wallops Flight Facility Uninhabited Aerial Vehicle (UAS) User's Hand book

8. NAII 1050-1A, NASA Space Act Agreements Guide

9. 830-AFOH-0001, Airport Facility and Operations Handbook

10. 802-HDBK-0002, Wallops Flight Facility Geophysical Observatory Handbook

11. An Experimenter's Guide to the NASA Atmospheric Sciences Research Facility, March 1994

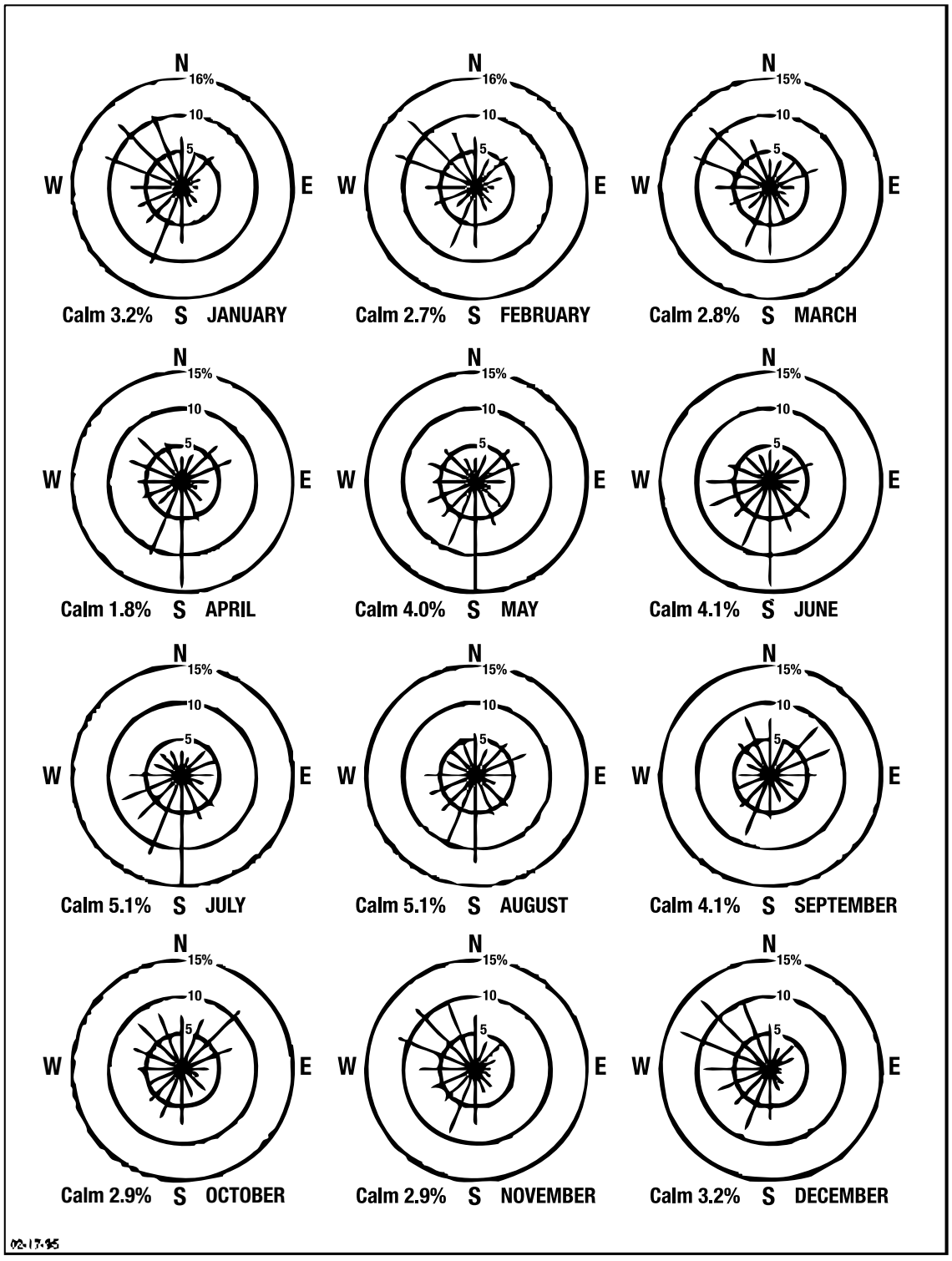
12. 810-HB-SRP, Sounding Rocket Program Handbook

13. Traffic Advisory Practices at Airports without Operating Control Towers (FAA AC No. 90-42)

14. GPR 1860.1A, Ionizing Radiation Protection

APPENDIX C

Surface Winds Chart



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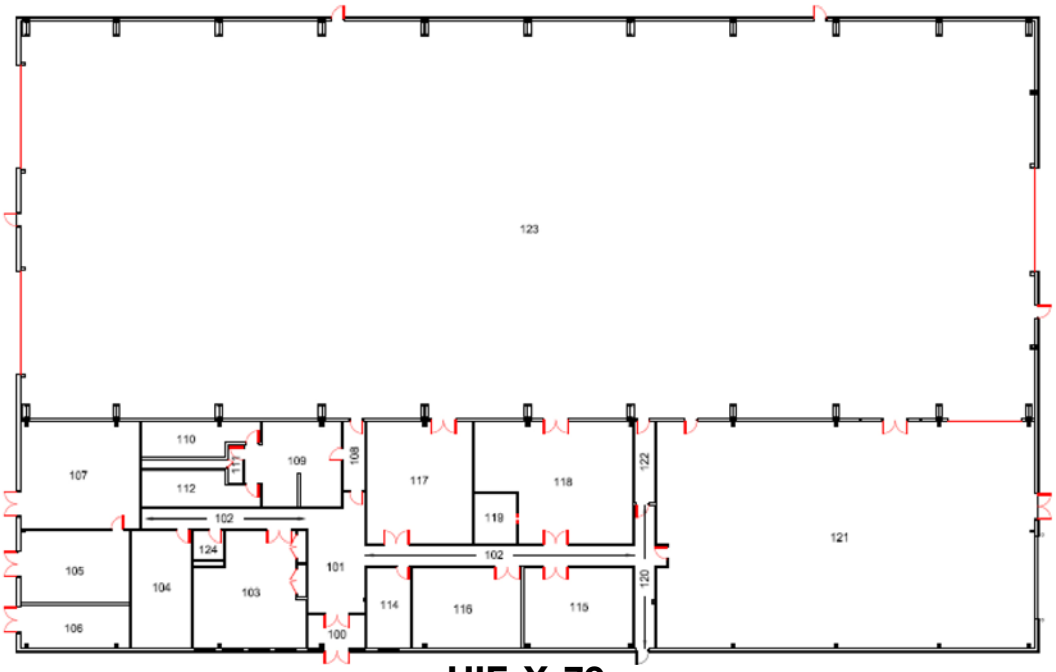
APPENDIX D

Building floor plans



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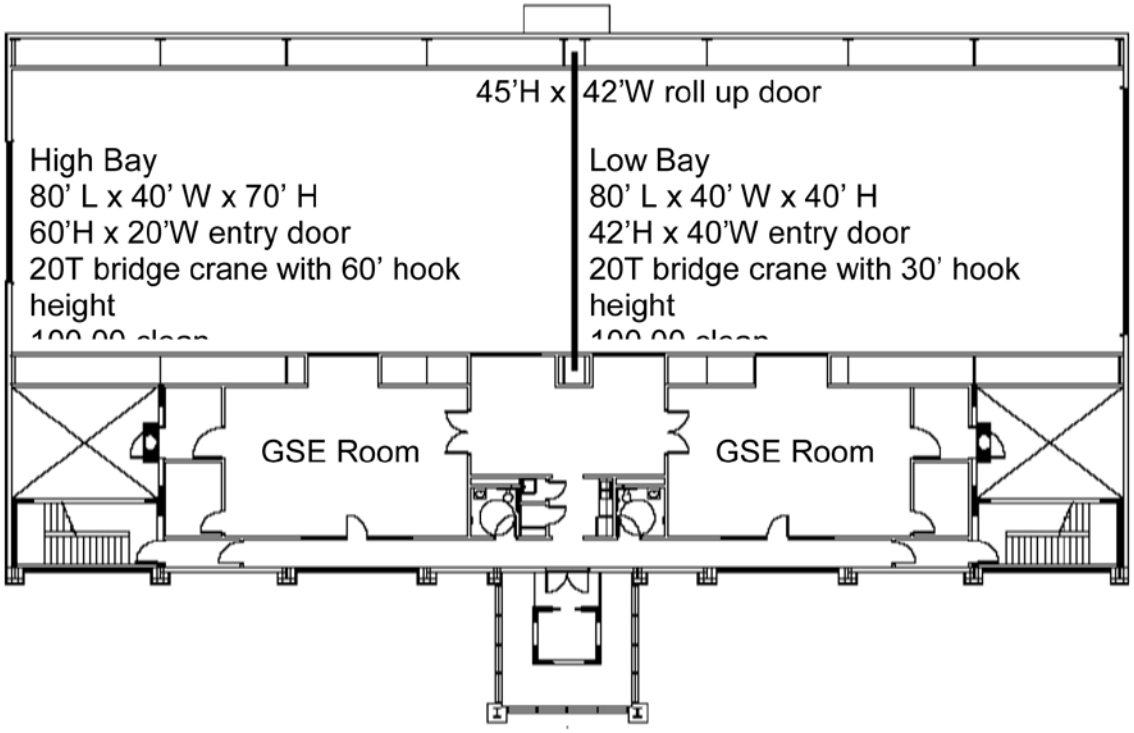

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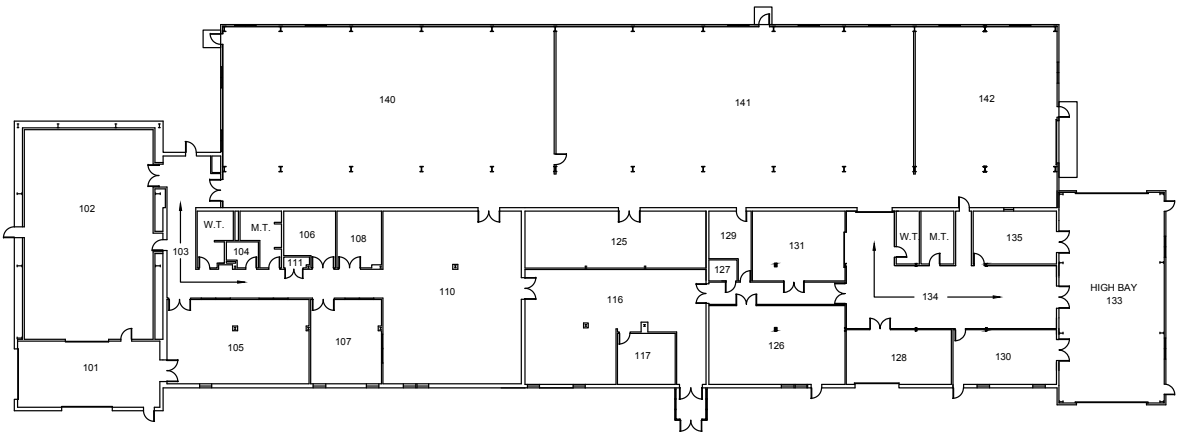

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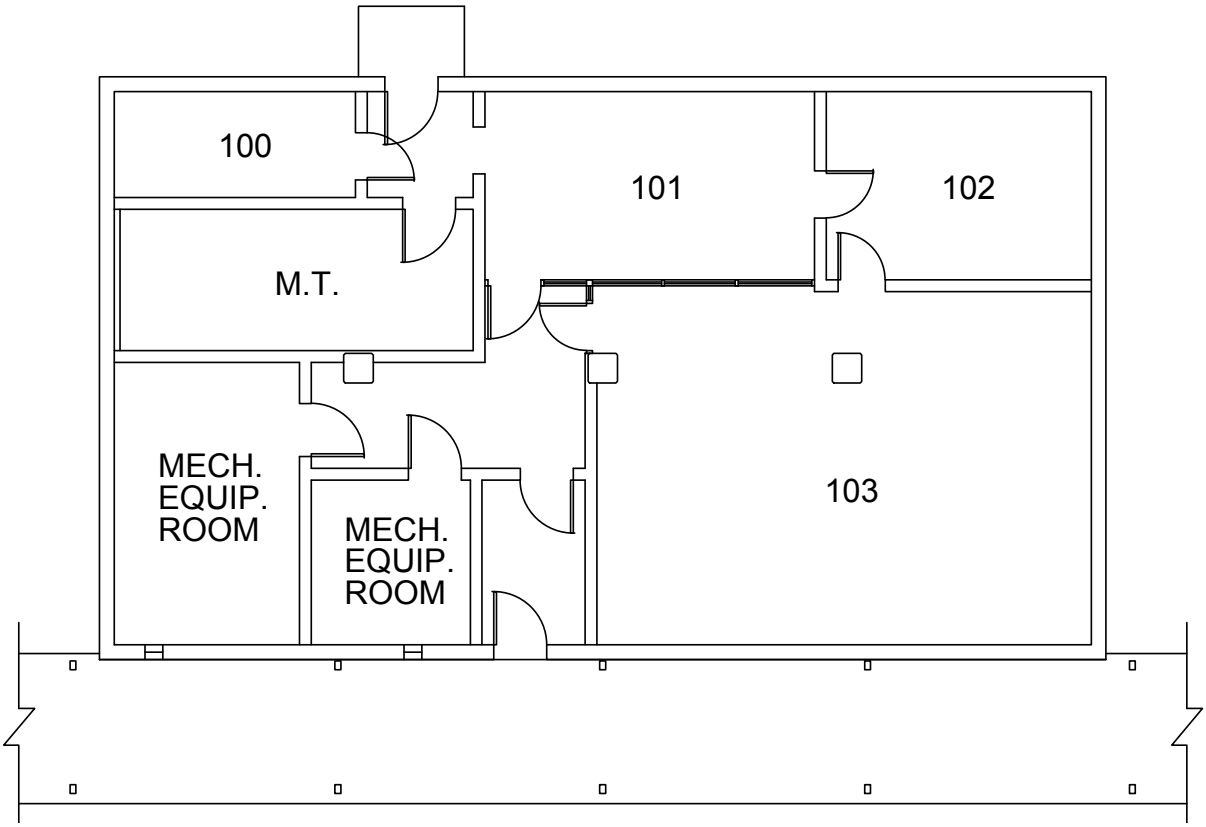

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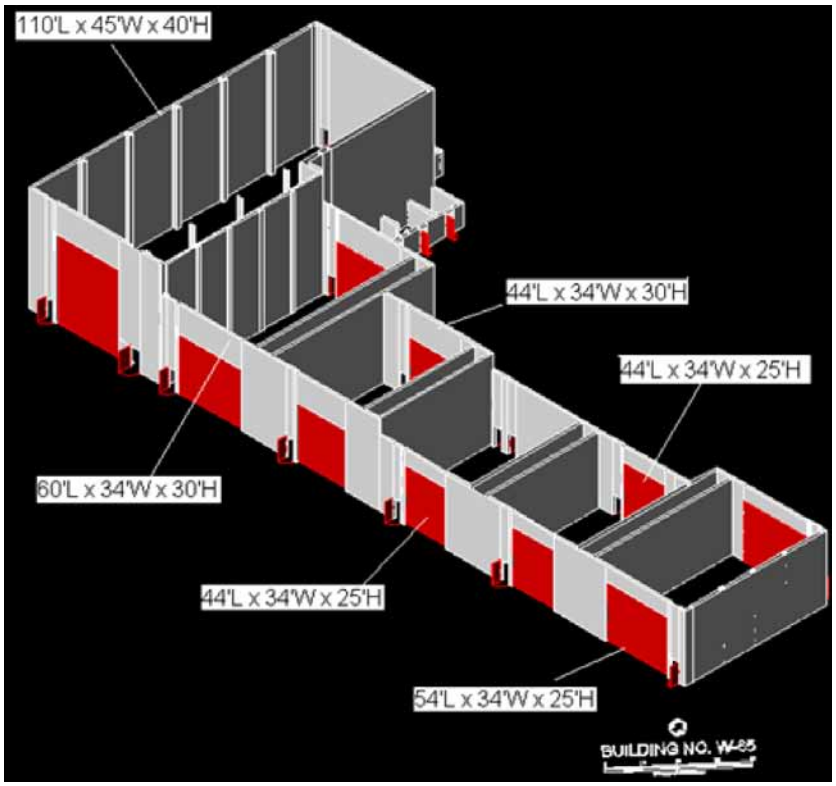
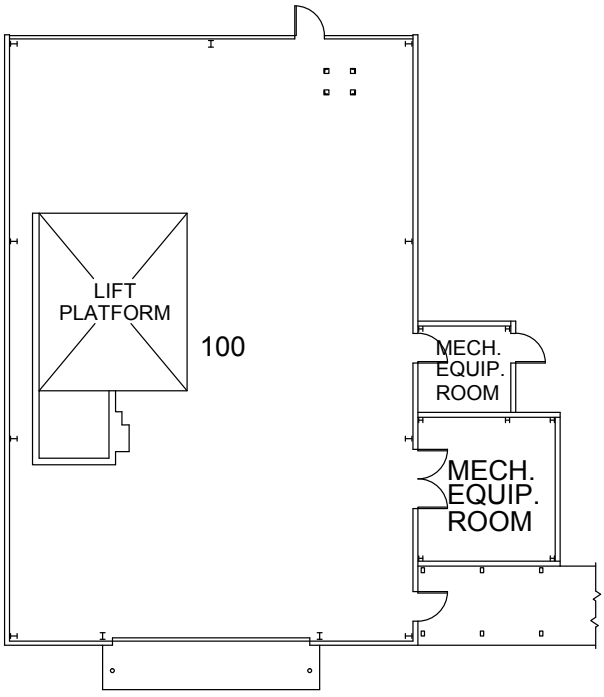


W-65



V-55

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