Wallops Flight Facility
Range User's Handbook

Revision 2

April 2000

National Aeronautics and Space Administration

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia 23337

CHECK THE CODE 840 RANGE AND MISSION MANAGEMENT OFFICE WEBSITE,
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Change History

Major Change	Major Section Affected	Date	Version
Revision	All sections	11/1996	Revision 1
Revision	All sections	04/2000	Revision 2

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 aircraft. In support of these activities, WFF operates a test range consisting of a rocket range and research airport. Because of unique scientific requirements, WFF also maintains capabilities to conduct mobile launch activities. Wallops users represent NASA, other United States Government agencies, and foreign and commercial organizations. The *Wallops Flight Facility Range User's Handbook* summarizes Wallops' policies and procedures for facility use and provides a description of general capabilities.

The *Wallops Flight Facility Range User's Handbook* can be viewed online at http://www.wff.nasa.gov/.

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

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This is revision 2 of the *Wallops Flight Facility Range User's Handbook*, dated April 2000.

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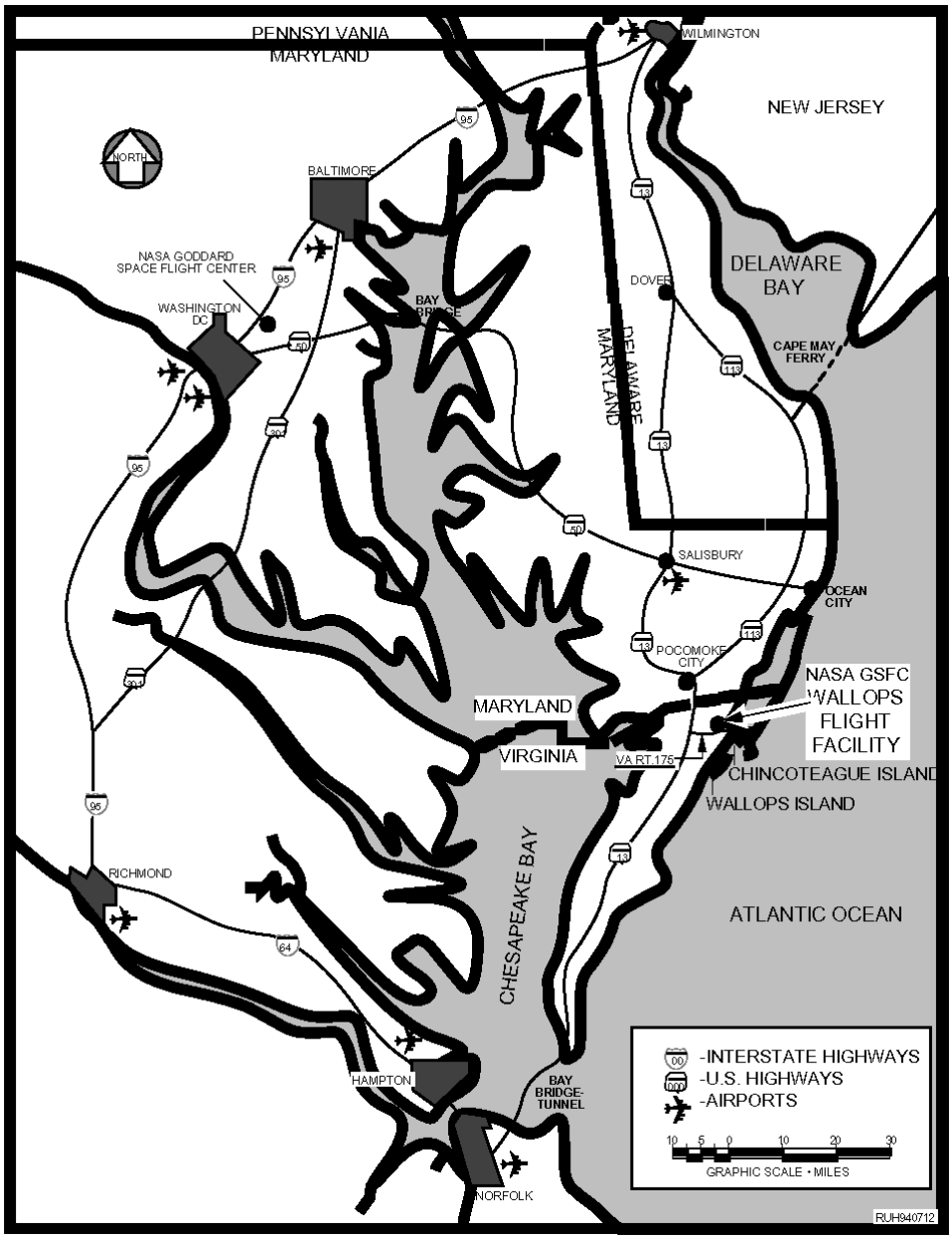


Road Map to NASA/GSFC/Wallops Flight Facility

Section One: Introduction

1.1 Purpose

The *Wallops Flight Facility Range User's Handbook* is a guide for planning operations at the Wallops Test 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 personnel.

This handbook prescribes the information to be provided by the range user that will enable the Test 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 home page at http://www.wff.nasa.gov/ for additional information.

1.2 Geography

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

1.3 Wallops Test Range

The Wallops Test Range is part of the WFF and is managed by GSFC 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 United States Government agencies, colleges and universities, commercial organizations, and the worldwide scientific community have conducted experiments at the range.

1.4 GSFC/WFF Missions

Wallops' key mission elements include the following:

- **Suborbital Flight Projects**—Wallops manages and implements NASA's sounding rocket, balloon, and scientific aircraft programs in support of the Earth Sciences and Space Science enterprises. New technologies, such as the ultra-long duration balloons, are integrated into the program.

- **Low-Cost Orbital Missions**—Wallops manages and provides technical support for University Class missions and Space Shuttle-based carrier systems.

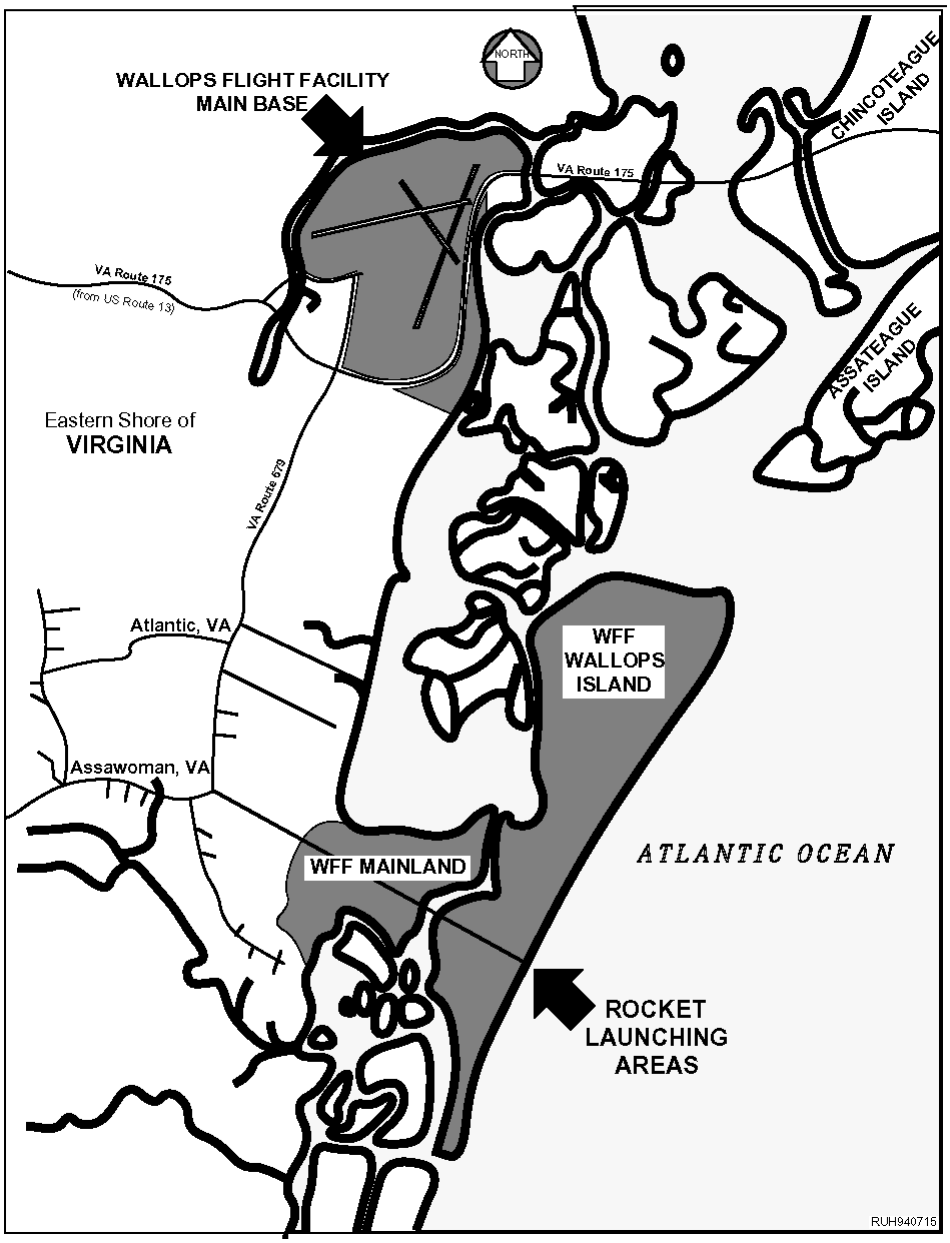


Figure 1-1. Major Areas: Wallops Flight Facility

- **Mission Operations**—Wallops provides fixed and mobile launch ranges integrated with 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 and at other worldwide locations. The Test Range supports NASA, 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 costs of access to space.

- **Educational Outreach**— Partnerships formed with industry and academia foster educational outreach programs. Wallops also carries out a wide array of education and outreach programs that support the development of future engineers and scientists.

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

1.5 GSFC at WFF

There are six GSFC directorates located wholly or in part at WFF. These organization 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.
  - Policy and Business Relations Office (Code 802), which plans and manages space launch commercialization activities.
  - 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), Aircraft (Code 830), Range and Mission Management (Code 840), and University Class Projects (Code 850). The Spartan Projects Office (Code 860) and Shuttle Small Payloads Project Office (Code 870) are located at GSFC/Greenbelt. The GSFC/WFF Suborbital and Special Orbital Projects Directorate organization chart is displayed in Figure 1-3.

- Office of the Director (Code 100). The Office of Human Resources (Code 110), Office of Public Affairs (Code 130), and Financial Management Division (Code 151.2) maintain facilities at Wallops.

- Management Operations Directorate (Code 200). Code 200 elements that maintain offices at Wallops include Safety, Environmental and Security Office (Code 205.W); Institutional Procurement Division (Code 218); Facilities Management Division (Code 228); Logistics Management Division (Code 233); and Information Services and Advanced Technology Division (Code 290), which includes the Information Technology Center and the Wallops Technical Library.

- Flight Programs and Projects Directorate (Code 400). Networks and Mission Services Projects (Code 450) and the Ground Network Project (Code 452) are based at Wallops. Code 452 monitors the Consolidated Space Operations Contract at Wallops.

- Applied Engineering and Technology Directorate (Code 500). Code 500 maintains several branches and centers at Wallops:

  - Carrier Systems Branch (Code 546)
  - Electrical Systems Center (Code 560)
  - Electrical Systems Branch (Code 565)
  - Microwave Systems Branch (Code 567)
  - Guidance, Navigation and Control Center (Code 570)
  - Guidance, Navigation and Control Systems Engineering Branch (Code 571)
  - Information Systems Center (Code 580)
  - Real-Time Software Engineering Branch (Code 584)

- Earth Sciences Directorate (Code 900). The Laboratory for Hydrospheric Process (Code 970) and the Observational Science Branch (Code 972) are located at Wallops.

WFF supports the Poker Flat Research Range (PFRR) in Alaska and the National Scientific Balloon Facility (NSBF) in Palestine, Texas, with contract management, instrumentation, and other range support as required. PFRR is maintained and operated by The Geophysical Institute at the University of Alaska in Fairbanks. The NSBF is maintained and operated by the Physical Science Laboratory at New Mexico State University in Las Cruces.

Several tenant organizations also maintain facilities at Wallops:

United States Navy (USN) has several organizations located at Wallops. The Surface Combat Systems Center (SCSC) provides several facilities that replicate USN fleet ships for purposes of training and technology validation. The Naval Air Warfare Center (NAWCAD) from Patuxent River, Maryland, also maintains facilities and personnel at Wallops. NAWCAD makes regular use of the Test Range for missile launches and aircraft development testing. Main Base facilities include housing for personnel and dependents, food services, medical clinic, and Base Exchange.

United States Coast Guard (USCG) is represented by Station Chincoteague and Group Eastern Shore, both quartered on Chincoteague Island. Dependent housing occupies several acres on the Wallops Main Base. The search and rescue helicopters and other aircraft use the airport as a base of operations.

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.

Virginia Commercial Space Flight Authority (VCSFA) operates the Virginia Space Flight Center (VSFC) on Wallops Island in partnership with NASA. The VSFC offers 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. VSFC has established commercial launch facilities and often serves to broker NASA-supplied range services.

Marine Science Consortium (MSC) is a non-profit 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.

A more detailed discussion of Wallops organizational elements can be found on the WFF web site at http://www.wff.nasa.gov/.

1.6 Operational History

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, Greenbelt, Maryland.

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 spaceflight program before the astronauts were launched from Cape Canaveral, Florida. 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 Test 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 the small Super Loki meteorological rockets to orbital class vehicles.

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

1.7 Key Range Personnel

All operations at the Wallops Test Range are conducted under NASA control. The terminology in the following paragraphs defines the functions, responsibilities, and authority of key range personnel. Appendix A lists commonly used abbreviations and acronyms.

1.7.1 WFF Test Director

The WFF Test Director has authority over all operations conducted on the Wallops Test Range. The Test Director is responsible for assuring that all range policy, criteria, and external agreements are satisfied during the operations.

1.7.2 Range Support Manager (RSM)

The RSM is the primary point of contact for the range user. The designated WFF RSM is responsible for planning, coordinating, and directing operational support for assigned projects conducted at the Wallops Test Range. The RSM also serves as Assistant Test Director. The RSM is usually identified during the mission/project acceptance process by WFF management and is given authority to plan and implement required support during the lifetime of the program.

1.7.3 Range Safety Officer (RSO)

The WFF RSO is responsible for assuring the Wallops Test 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.

1.7.4 Operations Safety Supervisor (OSS)

The OSS is responsible for supervising all assigned potentially hazardous operations. The OSS is also responsible for implementation of ground safety plans and operating procedures. In some instances, the OSS may delegate responsibilities to other qualified personnel for specific operations.

1.8 Virginia Space Flight Center

NASA has formed a partnership with the Virginia Commercial Space Flight Authority to cooperatively support many Wallops launch customers. VCSFA, through its agreement with NASA, has augmented existing Wallops launch infrastructure to provide increased capabilities. VCSFA markets the Wallops Test Range. For VCSFA customers, NASA and VCSFA cooperatively supply services to meet the customer’s needs.

Section Two: Wallops Test Range Support Policies and Procedures

2.1 Introduction

This section outlines the policies and procedures for conducting a project at Wallops Test Range. The NASA Goddard Space Flight Center Management Instruction GMI 1300.2, *Policies and Procedures for the Use of the Goddard Space Flight Center/Wallops Flight Facility (GSFC/WFF) Test Range*, primarily guides use of the range and its associated support facilities.

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.

2.2 Policies

2.2.1 Safety, Reliability and Quality Assurance Policy

WFF safety personnel will review all activities conducted on the Wallops Test Range. All range activities will be conducted in accordance with safety policy and criteria established in GMI 1700.2, *Goddard Space Flight Center Health and Safety Program*; NPG 8715.3, *NASA Safety Manual*; and RSM-2002, *Range Safety Manual for Goddard Space Flight Center/Wallops Flight Facility*. Reliability and Quality Assurance reviews may be required on a case-by-case basis.

2.2.2 Frequency Utilization and Management

The WFF Test Director is responsible for the operational control of the RF spectrum at Wallops. Frequency utilization and management policies and procedures applicable to all range user activities at Wallops are detailed in the *Goddard Space Flight Center/Wallops Flight Facility Host/Tenant Frequency Utilization Management Manual*.

2.2.3 Scheduling

The Office of 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.

The range user submits program scheduling information to the RSM. Potential conflicts are relayed by the RSM to the range user 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.

Scheduling meetings are held monthly and the updated schedule is published and distributed. As new information becomes available, activity schedules are updated and maintained on a computer database, which is accessible through remote terminals. A calendar format schedule, covering the upcoming four weeks, is published weekly. The daily schedule is announced on the WFF paging system at 0830 and 1600 local time.

The 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. The range user must submit information for the clearances to the RSM at least 2 weeks in advance of the required time to facilitate approval and scheduling.

2.2.4 Environmental Requirements

The Wallops Environmental Office serves as the clearinghouse for National Environmental Policy Act (NEPA) compliance at Wallops. In most cases, Wallops has approved environmental documentation covering range users' activities at WFF. The *Wallops Flight Facility Environmental Resources Document (ERD)* provides the required environmental documentation for all Wallops "in-house" activities and also provides the required documentation for many range users' activities. Early in the project, the RSM will discuss environmental requirements with the range user to identify potential environmental issues. Wallops Environmental Branch personnel will make a determination of any formal documentation required.

2.3 Project Approval and Interface Procedures

The range user should 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 Test Range. The first point of contact can be the Policy and Business Relations Office (P&BRO) (Code 802) or any of the Suborbital and Special Orbital Projects Directorate offices, including the Range and Mission Management Office (Code 840).

The initial contact will normally lead to a meeting between the range user and WFF technical personnel to exchange preliminary information and to reach a tentative position on the feasibility of conducting the mission or project at the range. The procedures to be followed subsequent to establishing feasibility depend on the range user's organizational affiliation as noted in the following paragraphs.

2.3.1 United States Government Agencies

After agreement on the feasibility of a project, the range user should send a letter requesting support to the Director, Suborbital and Special Orbital Projects Directorate (Code 800). The formal request should provide a brief overview of the support required, the safety aspects of the project, and the operation requirements.

WFF acceptance will normally take the form of a letter from the Director, Code 800, to the range user. The letter of approval will identify the RSM, project support conditions, and the estimated project support cost. Other documentation requirements are listed in 2.4 below.

Projects that require long-term user presence at WFF, multiple support efforts, or user-constructed facilities at WFF may require more formal documentation such as a Memorandum of Agreement (MOA) or a Host-Tenant Agreement (HTA).

2.3.2 Commercial Organizations and Foreign Governments

Procedures are similar to U.S. Government users, except that a MOA is always required.

2.3.3 Commercial Space Launch Act (CSLA) Organizations

NASA can agree to support commercial launch service providers through a series of CSLA documents. The first is an agreement established with NASA Headquarters. This is followed by a subagreement with the Goddard Space Flight Center. Once these general agreements are in place, project-specific Individual Support Annexes (ISAs) can be established with WFF. The multi-tiered agreements are required because the CSLA requires federal agencies to set aside some expenses that would otherwise be passed along to the customer.

The first contact for potential CSLA range users desiring access to the Wallops Test Range is the P&BRO.

2.3.4 Operational Interface

After the necessary agreements are established, the primary interface between the range user and the Wallops Test Range will be the assigned RSM.

2.4 Technical Data Requirements

2.4.1 Program Requirements Document (PRD)

The range user's project description and technical requirements are often conveyed to the Wallops Test Range through use of a PRD.

WFF has adopted a modified PRD format from the Universal Documentation System (UDS), which is the standardized documentation system accepted and used at ranges operated by the Department of Defense (DoD). The primary UDS reference is the *Range Commanders Council-Documentation Group (RCC-DG) Document 501-97*, which can be found online at http://tecnet0.jcte.jcs.mil/RCC/UDS/index.htm.

Projects at the Test 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.

A PRD is not the only acceptable format, however. A customer can provide data in any manner that provides for a detailed understanding of the project and customer requirements.

2.4.2 Safety Data

The range users 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, *Range Safety Manual for Goddard Space Flight Center/Wallops Flight Facility*.

2.4.3 Operations and Safety Directive (OSD)

The OSD is prepared by the RSM and is NASA's response to the range user's requirements. The OSD provides a description of the project, 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.

2.4.4 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 below:

- Program Requirements Document (PRD) — 90 days prior to arrival at WFF
- Preliminary Range Safety Data Package — T-120 days
- Final Range Safety Data Package — T-90 days
- Hazardous Procedures — T-60 days
- Trajectory Simulation Data — T-60 days
- Operations and Safety Directive (OSD) — T-21 days

Timelines can be compressed for small projects or expanded for orbital launch vehicles. 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 that 30 days prior to launch.

WFF 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.

2.4.5 Operational Reviews

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

- Range Readiness Review – Conducted for all major operations. A panel is established to review the WFF support preparations.
- Premission Briefing – A mandatory briefing that serves to assure all key personnel are prepared to support the operation and that participants understand roles, responsibilities, and operational details.
- 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. In addition, it is highly recommended that range operations and safety personnel be invited to participate in project design reviews and technical interchange meetings to assure concerns are addressed early in the planning process.

2.5 Funding Information

Test 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 the following guidelines:

- NASA organizations – Charged for project-unique services.
- Other U.S. Government agencies – Full recovery of costs.
- CSLA projects – Charged for additive cost.
- Commercial organizations and foreign governments – Full recovery of costs.

Section Three: Wallops Flight Facility and Test Range

3.1 Wallops Flight Facility and Test Range

The Wallops Flight Facility includes three areas on the Eastern Shore of Virginia as shown in Figure 1-2. These are the Main Base, the Mainland, and the Wallops Island Launch Site. The Test 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.

3.1.1 Wallops Main Base

Figure 3-1 is an aerial view of Wallops Main Base, looking east. The Main Base is the location of many of the major functions and activities supporting the Test Range, including

- administrative offices
- engineering support
- technical service support shops
- rocket inspection and storage area
- telemetry facility
- Research Airport
- Range Control Center
- Telecommunications Center
- Wallops Orbital Tracking Station (WOTS)

The Main Base also supports several tenants (see 2.6).

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

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 Atmospheric Sciences Research Facility (ASRF) is located on the Mainland. Figure 3-2 is an aerial view of the Wallops Mainland, looking north.

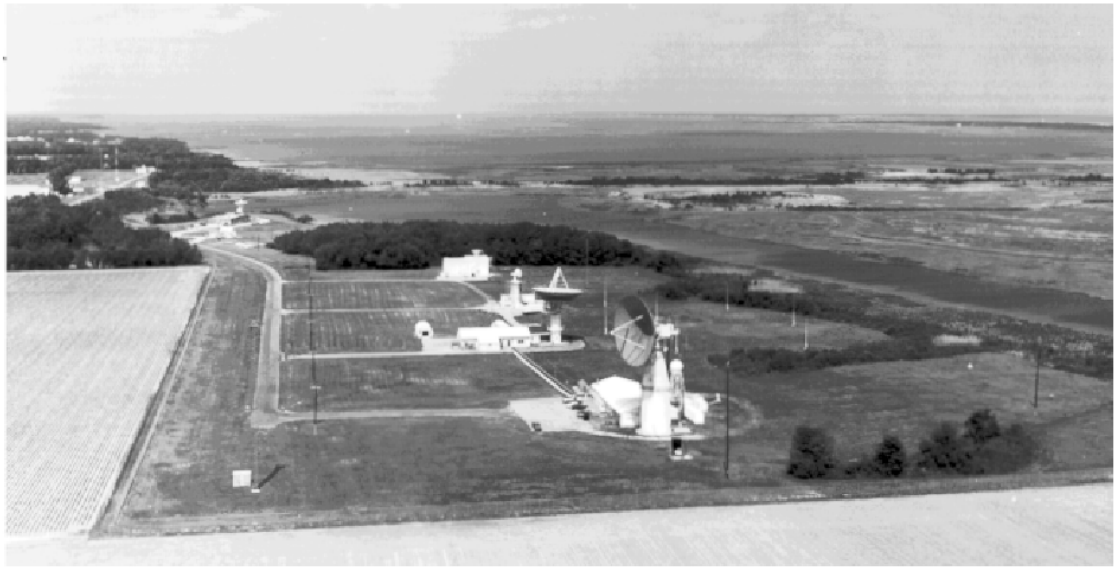


Figure 3-2. Aerial View of the Wallops Mainland

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. The following facilities are located on Wallops Island:

- launch sites
- blockhouses
- radar facilities
- payload processing facilities
- assembly shops
- dynamic balance facilities
- rocket storage buildings
- USN Surface Combat Systems Center

Figure 3-3 is a northward view of Wallops Island with an overview of the launch facilities.

Figure 3-3. Aerial View of Wallops Island

3.1.4 Authorized Space

The authorized space includes the following restricted areas:

a. 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.
b. Restricted Area R-6604: Restricted airspace connecting WFF and offshore warning areas as shown in Figure 3-4.

c. Surface area and airspace extending from Restricted Area R-6604 into the offshore warning areas: The extended area varies with the particular mission/project activity and is limited to that area for which specific use has been cleared with the responsible agencies, e.g., the FAA and USN FACSFAC.

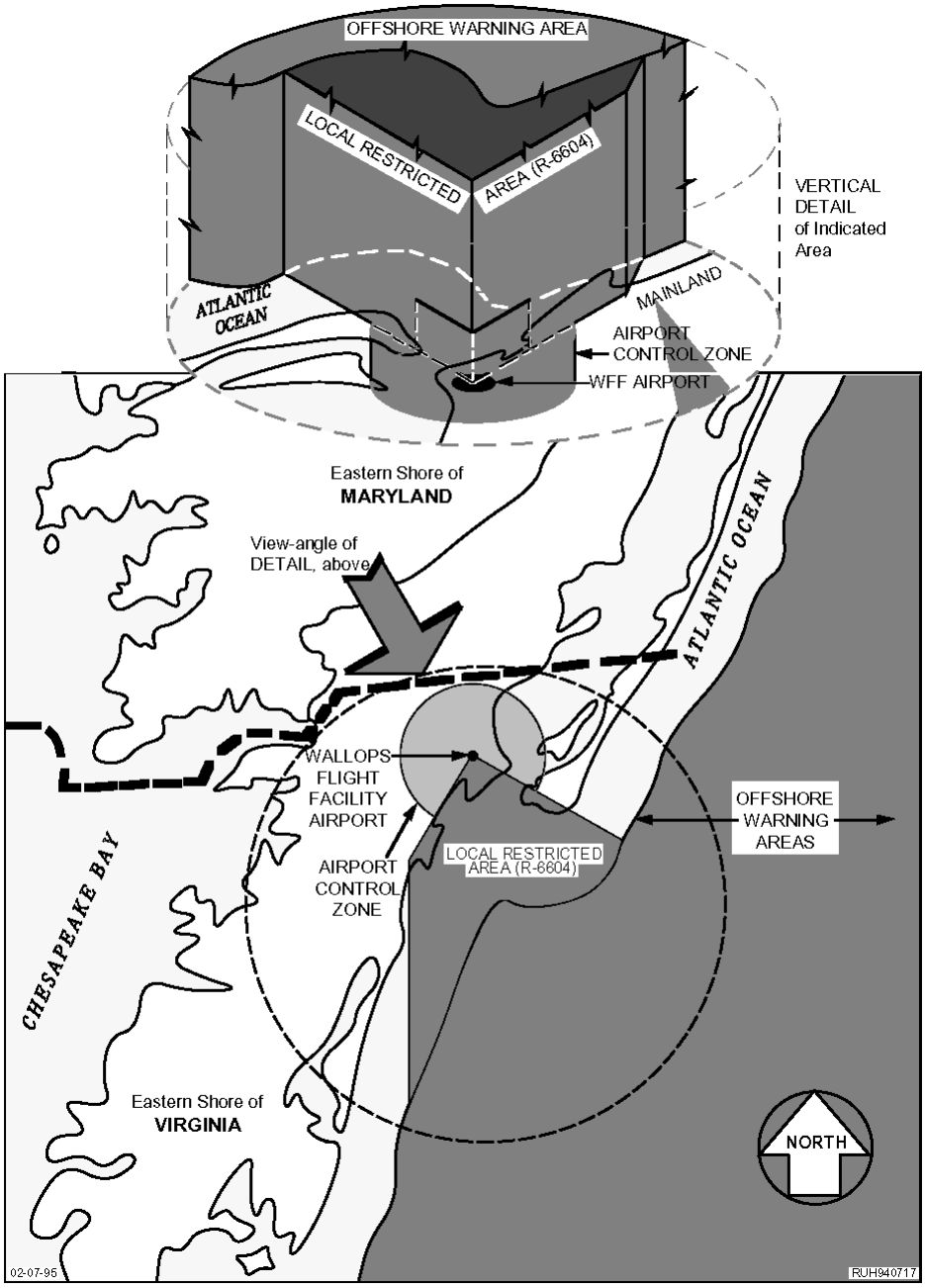


Figure 3-4. Wallops Test Range Authorized Space

3.1.5 Trajectory Options

WFF offers a wide array of launch vehicle trajectory options. The coastline of Wallops Island is oriented such that a launch azimuth of 135˚ is perpendicular to the shoreline. In general, launch azimuths between 90˚ and 160˚ can be accommodated depending on impact ranges. For most orbital vehicles, this translates into orbital inclinations between 38˚ and approximately 60˚.

Trajectory options outside of these launch azimuths, including polar and sun-synchronous orbits, can be achieved by inflight 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.

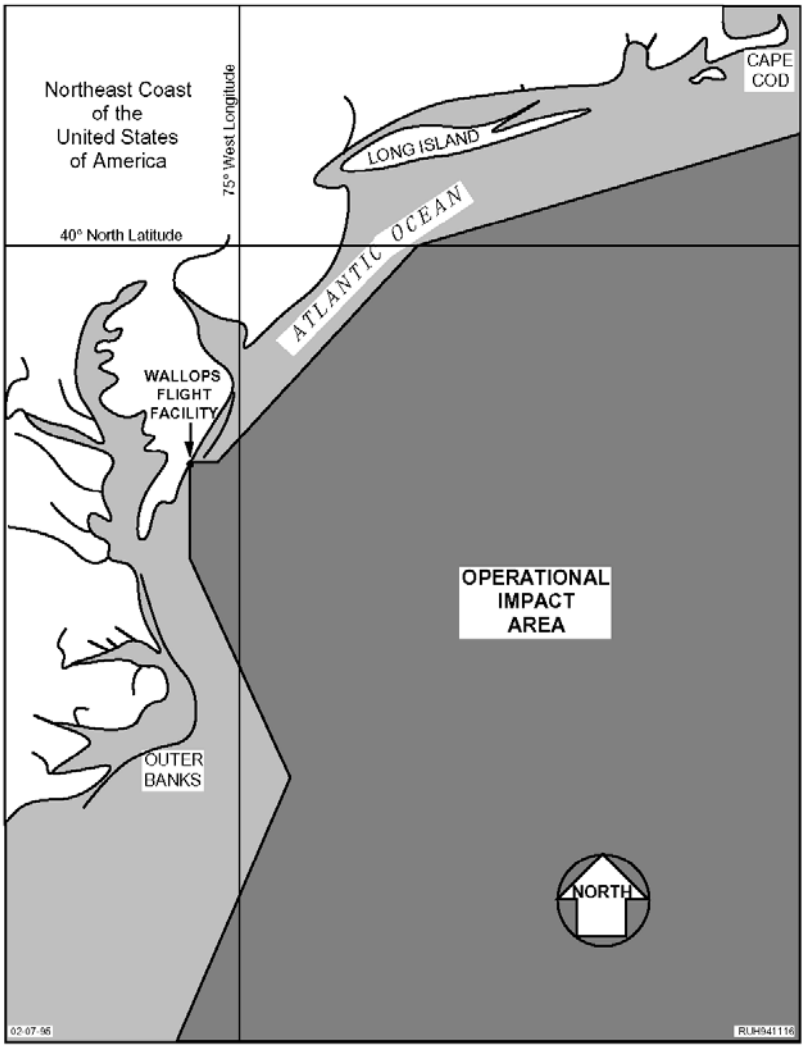


Figure 3-5. Operational Impact Area

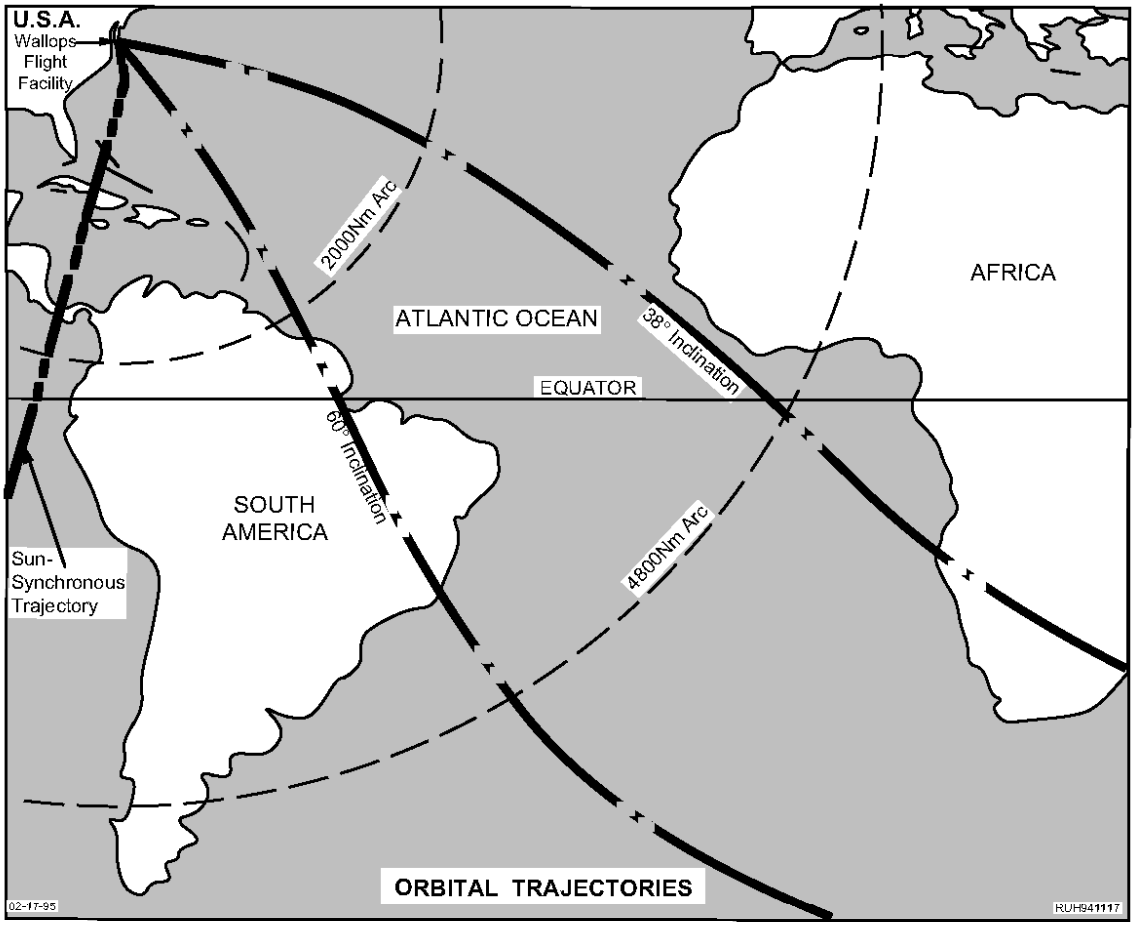


Figure 3-6. Orbital Trajectories

3.1.6 Wallops Weather

Wallops enjoys a temperate climate and weather seldom interferes with launch and aeronautical operations. 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 Test Range.

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 maximum and extreme low temperatures that have been experienced at WFF are noted. Also shown are average precipitation days and precipitation inches per month, including snow averages.

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. Figure 3-9 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.

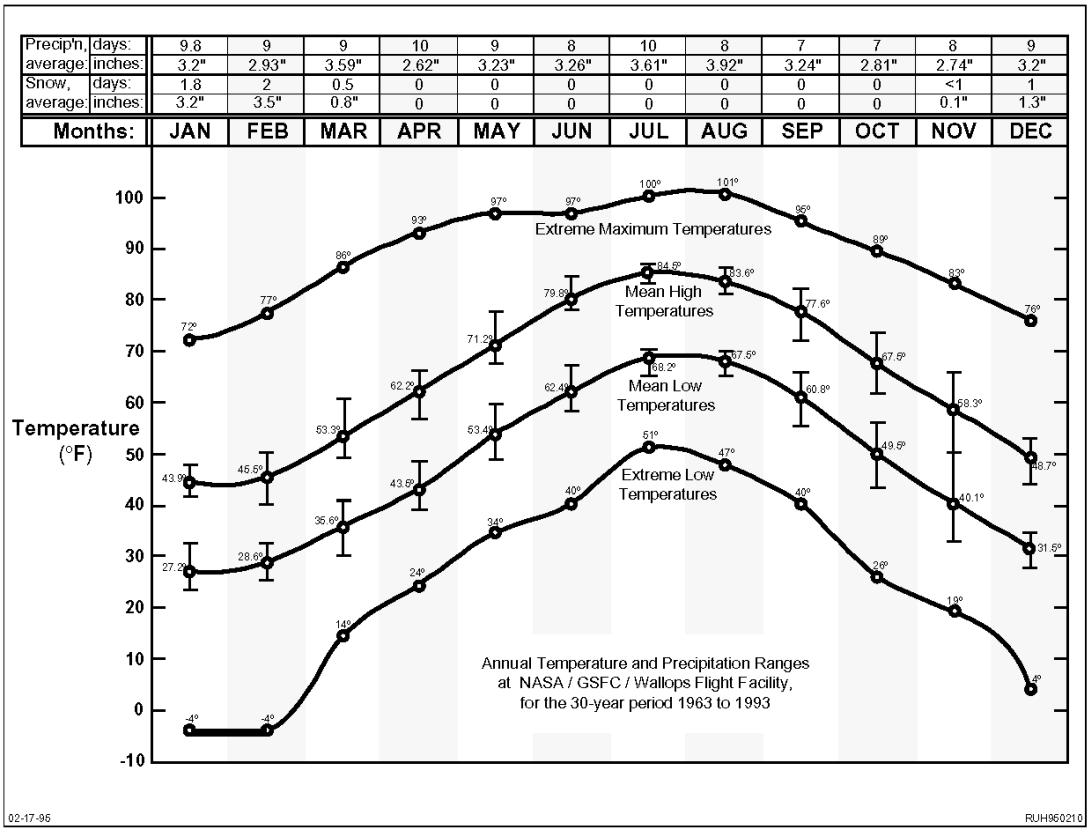


Figure 3-7. Annual Precipitation and Temperature Plot for Wallops Flight Facility

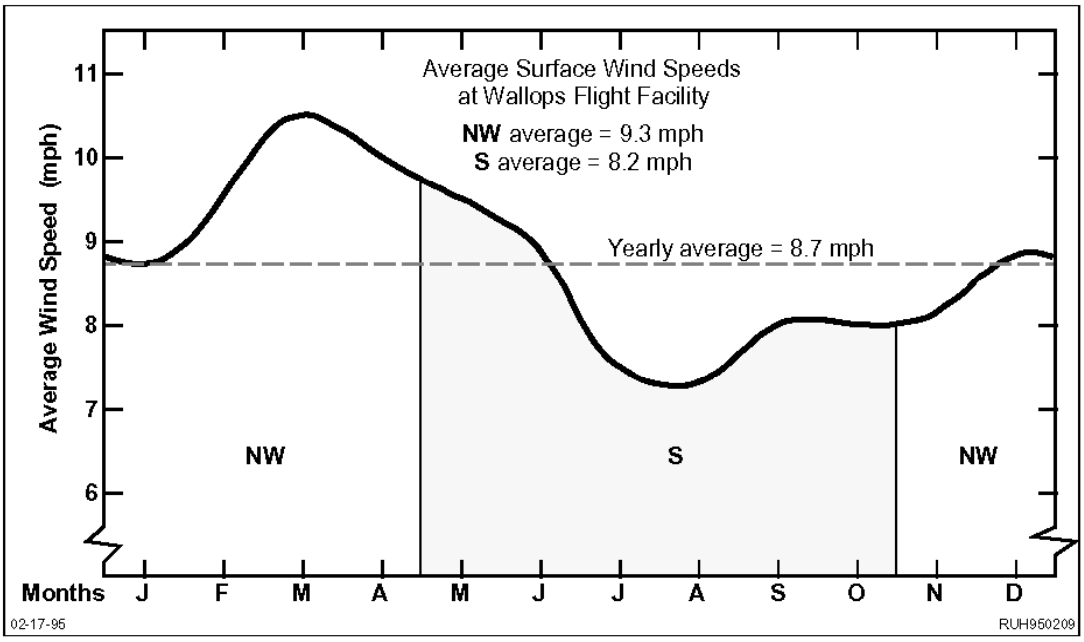


Figure 3-8. Average Surface Wind Speed at Wallops Flight Facility

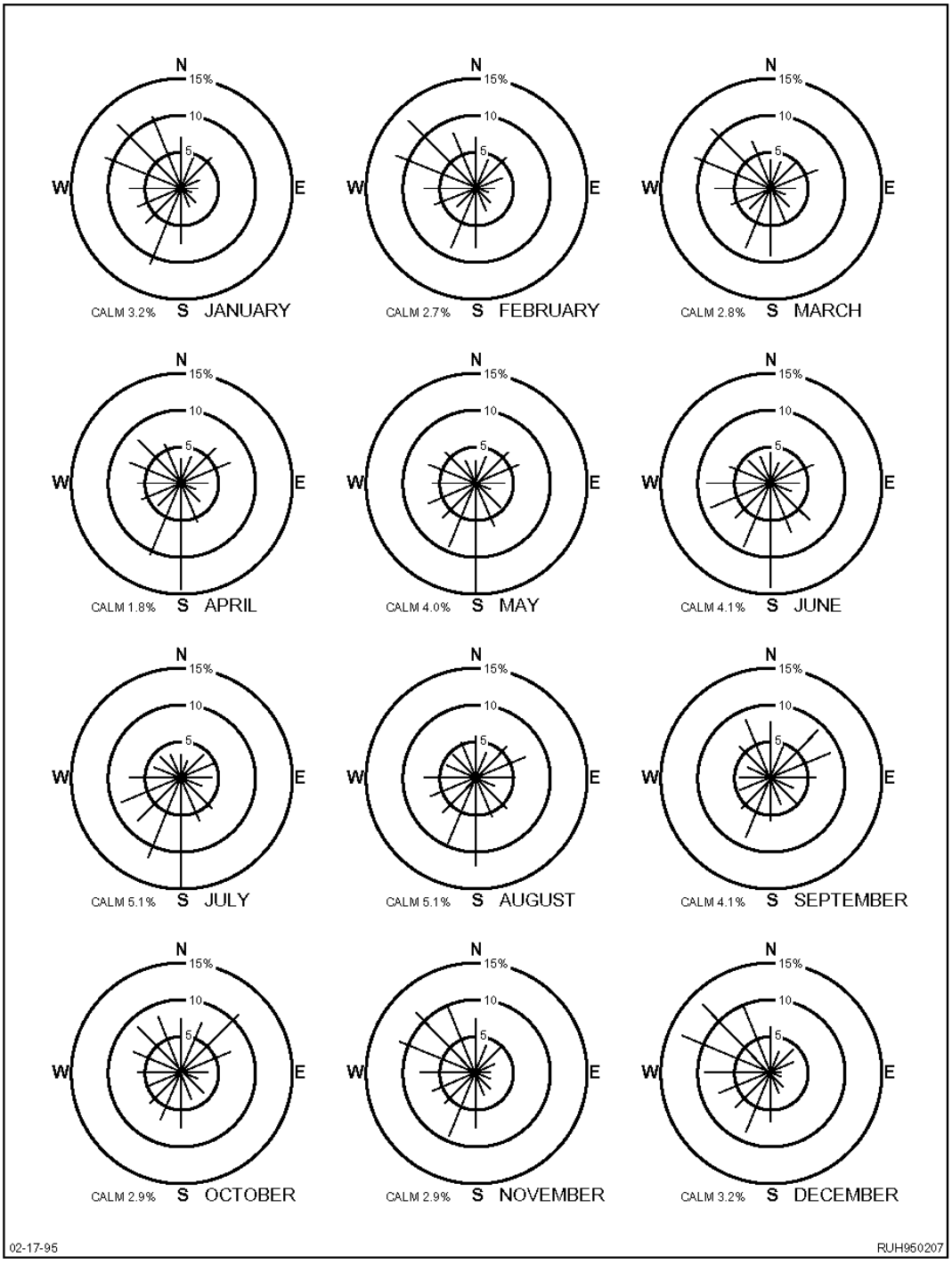


Figure 3-9. Wind Roses for Wallops Flight Facility by Month, All Speeds Inclusive

The Test Range is supported by meteorological and weather data and forecasting capabilities from the Weather Forecast Office, Meteorological Facilities, and the ASRF (see 3.2.10, 3.2.11, 3.2.12).

3.2 Test Range Facilities

The Wallops Test Range has a variety of facilities supporting its operations. The major facilities are described in the following paragraphs. More detailed descriptions of many of the facilities and their capabilities are available in a series of instrumentation handbooks and related documentation. Contact Code 840 for a list of available publications.

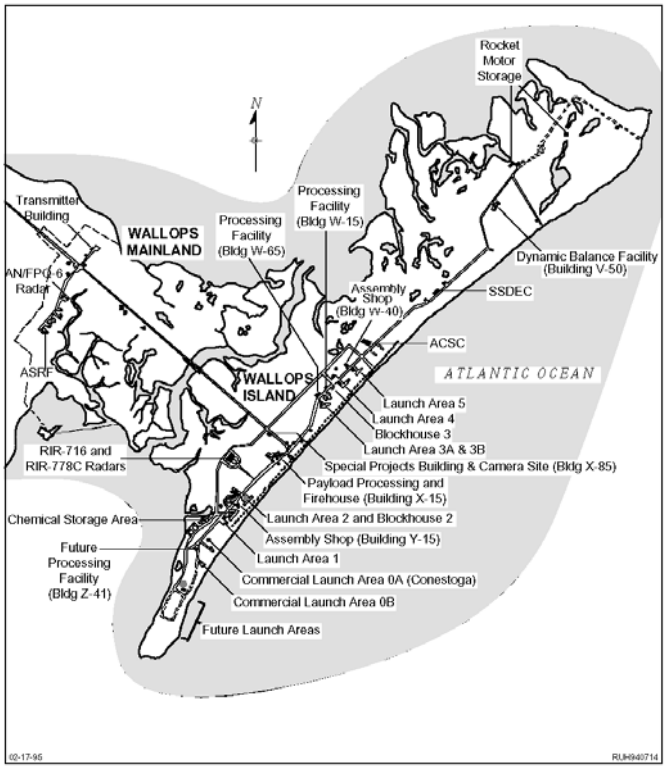


Figure 3-10. Wallops Mainland and Island Test Range Launch Facilities

3.2.1 Launch Facilities

WFF 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 3-10 is an annotated drawing of the Wallops Mainland and Wallops Island showing the location of support facilities and launch pads.

Table 3-1 shows vehicle and payload processing facilities and some of their major features. Table 3-2 lists some of the capabilities and characteristics of launchers on Wallops Island (Figures 3-11 through 3-21).

Launcher capacities are determined by a variety of factors including total vehicle weight and the relative distribution of that weight at launcher interface points. Capacities listed in Table 3-2 indicate the maximum design loads under ideal circumstances. User-provided launch systems can be accommodated. WFF also has the capability to support launch operations worldwide with mobile range instrumentation and equipment (see 3.2.20).

Table 3-1. Assembly and Payload Processing Facilities

Wallops Island

Building	Function	Sq.Ft.	Special Features
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
W-40	assembly	5,255	• Currently supports Vandal Program
W-65	assembly	13,255	• 6 bays •• 5 assembly bays •• 1 clean room in Bay 6 20 ft x 20 ft x 8 feet door 95 in high x 94 in wide • pyrotechnic storage rooms • approved for explosives Bay / Doors HxW / Crane(s) hook height (hh) Bay 1: 17 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 — none 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	• collocated 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
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

Wallops Main Base

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
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

Table 3-2. Launch Systems

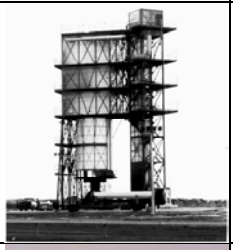
Pad Number Launcher Name	Description
Figure 3-11. Pad 0A Commercial 	The multilevel Conestoga launch complex for a commercial ELV can also support other launch vehicles up to 200,000 pounds maximum load.
Figure 3-12. Pad 0B VCSFA Launch Complex 	Designed for small to medium class ELVs up to 500,000 pounds maximum load.
Figure 3-13. 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. It is shown with a base ring for the ARIES sounding rocket mounted under the rail.
Figure 3-14. Pad 2 Atlantic Research Corporation (ARC) Launcher 	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.
Figure 3-15. Pad 2 South Astro Met Launcher (AML) 	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. The AML is shown with a rail mounted for the single stage ozone sonde rocket.
Figure 3-16. Pad 2 North Astro Met Launcher (AML) 	Same as above. Figure 3-16 shows the AML twin boom launcher with two rails for a Super Loki rocket mounted on the left boom.
Figure 3-17. Pad 2 Improved High Altitude Diagnostic (HAD) Launcher 	Rated as a 7,500-pound maximum design load launcher, the HAD has a 31-foot overall boom length.

Table 3-2. Launch Systems (cont.)

Figure 3-18 Pad 3B 20K Launcher (AML)		Rated as a 20,000-pound maximum design load launcher, it has a movable environmental shelter and a 37-foot overall boom length. Figure 3-19 shows the 20K launcher with the rail mounted environmental shelter pulled away. A launcher ring for the ARIES sounding rocket is mounted on the launcher.
Figure 3-19. Pad 4 Tubular Launcher		Rated as a 20,000-pound maximum design load launcher, the tubular launcher has a 40-foot overall boom length (currently inactive).
Figure 3-20. Pad 5		Currently supporting the USN Vandal Program. Figure 3-21 shows the Vandal launcher with two Vandal missiles.

3.2.2 Telemetry Facilities

Telemetry (TM) facilities at the Test Range include a variety of antennas, receivers, and display instrumentation systems. Command uplink and metric tracking capabilities are also available.

Postflight telemetry data can be distributed via magnetic tape, CD-ROM, and magneto-optical disks.

Detailed descriptions of systems and capabilities can be found in *Telemetry Facilities and Systems* and *Tracking and Data Acquisition Systems Capabilities*.

Fixed Telemetry Systems

Telemetry systems consist of fixed range TM facilities and the WOTS (Wallops Orbital Tracking Station) collocated in building N-162 on Wallops Main Base. Figure 3-21 is a view of the fixed TM facilities, including the WOTS.

The WOTS primarily supports low earth orbit spacecraft; however, the WOTS facilities are flexible and can be used for range TM and share resources with the range TM systems. The WOTS has metric tracking and command uplink. The 6-meter and 9-meter parabolic antennas were replaced during a major WOTS automation upgrade in 1997.

Tables 3-3 and 3-4 list the technical characteristics of the fixed TM systems.

Figure 3-21. Range TM Facility and WOTS

Table 3-3. Range Telemetry Systems

Receiving Characteristics

Antenna Diameter/Type	Frequency Range	Polarization	G/T (Minimum)	Noise Temp. @ Degrees K	Receiver Type	Gain	Tracking Modes	Pedestal Type
LGTAS 2.4M/8ft 2 Parabolic Note 1	1435-1540 MHz 1650-1710 MHz 2200-2300 MHz	RHC/LHC	5.18 dB/K @ 2.25 GHz	400 @ S-Band	Microdyne 1100-AR	L-Band: 28 dB 1680 Band: 29 dB S-Band: 32 dB	Autotrack Slave Manual Computer	EL/AZ
MGTAS 7.3M/24ft 2 Parabolic/ Note 2	1400-2400 MHz	RHC/LHC	16 dB/K @ 2.2 - 2.4 GHz 13 dB/K @ 1.4 - 2.2 GHz	200 @ 1.4-2.1 GHz 250 @ 2.2-2.3 GHz	MFR S/A 410 DEI 74 Microdyne 1100-AR	39 dB @ 2250 MHz	Autotrack Slave Manual Programmed	EL/AZ

G/T - Gain/System Noise Temperature or Figure of Merit.

Notes:
1. The LGTAS (Low Gain Telemetry Antenna System) antennas reside atop building N-162.
2. MGTAS (Medium Gain Telemetry Antenna System) is located in antenna field near building N-162. The MGTAS antennas are listed here with range telemetry systems and on Table 3-4, Wallops Orbital Tracking Station.
3. The WOTS 18M antenna system *can* be used for Test Range support.

Table 3-4. Wallops Orbital Tracking Station

Receiving Characteristics

Antenna Diameter/Type	Frequency Range	Polarizations	G/T (Minimum)	Receiver Type	Up/Down Con. Freq.	Tracking Modes	Pedestal Type
18M/60ft Parabolic	1.4.-2.4 GHz	LHC & RHC div	28.5 dB/K @ 2.2-2.4 GHz 28 dB/K @ 1.4-2.4 GHz	MFR	400-500 MHz P- Band	Manual, auto, STAR, and STPS (future)	EL/AZ
9M/30ft Parabolic	2.2-2.3 GHz	RHC & LHC div	23 dB/K@ 2250 MHz	MFR	400-500 MHz	Auto, slave, TDPS, manual, and STPS (future)	X-Y
7.3M/24ft (STDN) 2 Parabolic Note 1	1.4-2.3 GHz	H/V or LHC & RHC div	16 dB/K@ 2.2-2.4 GHz, 13 dB/K @ 1.4-2.2 GHz,	MFR, S/A 410 DEI 74, 1100-AR	400-500 MHz P-Band	Auto, slave, manual, programmed	EL/AZ
Array 1 SATAN	136-138 MHz	Linear Diversity	-8 dB/K @ 137 MHz	MFR	400-500 MHz	Manual, slave	X-Y
Array 2 SATAN	136-138 MHz	Linear Diversity	-8 dB/K @ 137 MHz	MFR	400-500 MHz	Manual, slave	X-Y
7.3M/24ft METEOSAT Parabolic (dedicated)	1690-1700 MHz	Linear Diversity	19.6 dB/K @ 1690 MHz	1100-AR	400-500 MHz	Manual	EL/AZ Kingpost
7.3M/24ft UHF (MET-3/ TOMS) Parabolic	464–469 MHz	RHC & LHC div	4.0 dB/K @ 466 MHz	MFR	none	Manual, slave	X-Y

Note: 1. Also listed as MGTAS antennas on Table 3-3, Range Telemetry Systems.

Transmitting Characteristics

Antenna Diameter/Type	Frequency Range	Polarizations	Transmitter Type	Power	EIRP	Tracking Modes	Pedestal Type
9M/30ft Parabolic	2025-2120 MHz	RHC/LHC	TWTA/exciter Solid State Amp	200 W/16 W	96 dBmi	Auto, slave TDPS, manual, and STPS (future)	X-Y
6M/20ft Command Parabolic	2025-2120 MHZ	RHC/LHC	TWTA/exciter Solid State Amp	200 W/16 W	92 dBmi	Manual, slave	X-Y
Array SATAN	147-152 MHz	RHC/LHC Linear	Linear	10 KW	92 dBmi	Manual, slave	X-Y
Array SCAMP	147-152 MHz	RHC/LHC Linear	Linear	10 KW	87 dBmi	Manual, slave	X-Y

Transportable Telemetry Facilities

WFF has transportable TM capabilities for use at other locations. Transportable TM systems have metric tracking (Doppler and angles) and command uplink. Tables 3-5 through 3-8 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 and can be upgraded to X-band. The Test Range owns two TOTS. Figure 3-22 shows a TOTS installation at Poker Flat Research Range, which has since been replaced with a 9-meter fixed Redstone antenna.

Figure 3-22. TOTS

3.2.3 Radar Systems Facilities

Radar systems perform tracking and surveillance functions. Table 3-9 lists the significant characteristics of tracking radar systems and ground-based and airborne surveillance radar systems.

Tracking Radar Systems

Tracking radar systems provide accurate velocity and positional data of launch vehicles, balloons, satellites, and aircraft. The Test Range has four fixed (permanently installed) and four mobile (transportable) tracking radar systems. The fixed radar systems are the RIR-716C (Research Airport), AN/FPQ-6 (Mainland), and RIR-716C and AN/MPS-19 (Wallops Island). The airport radar also has a Laser Tracking System (LTS) to perform automatic, short-range, high-precision tracking. Figure 3-23 shows the AN/FPQ-6 radar system installed on the Mainland.

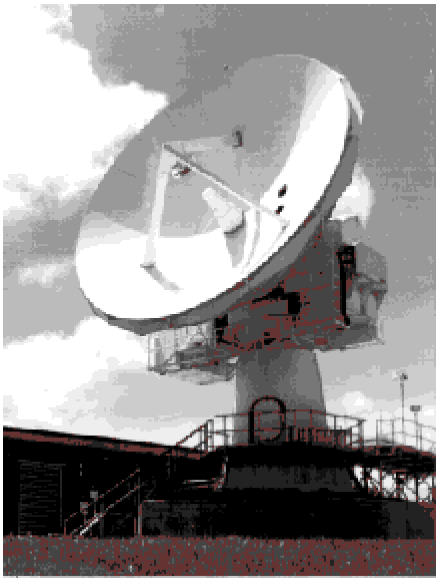


Figure 3-23. AN/FPQ-6 Radar

Table 3-5. Transportable Telemetry Systems Summary

Antenna Diameter/Type	Frequency Range	G/T (Minimum)	Tracking Modes	Pedestal Type	Trailer	Van	Remarks
Antenna #1 3 M/10ft 4 Section Parabolic	1435–1540 MHz 1650–1710 MHz 2200–2300 MHz	7.1 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	8.5M/28ft Lowboy	Van #1 (RV) or Van #2	Shipping container available
Antenna #2 3 M/10ft Solid Parabolic	1435–1540 MHz 1650–1710 MHz 2200–2300 MHz	7.1 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	8.5M/28ft Lowboy	Van #1 (RV) or Van #2	Shipping container available
Antenna #3 2.4M/8ft Solid Parabolic	1435–1540 MHz 2200–2300 MHz	5.18 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	5.5M/18ft Lowboy	Van #1 (RV) or Van #2	Shipping container available
Antenna #4 2.4M/8ft Solid Parabolic	1435–1540 MHz 2220–2300 MHz	5.18 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	5.5M/18ft Lowboy	Van #1 (RV) or Van #2	Shipping container available
Antenna #5 2.4M/8ft Parabolic Reflector	1435-2300 MHz (includes 1680)	5.18 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a	n/a	Installed at Poker Flat Research Range
Antenna #6 4.8M/16ft Parabolic Reflector	1435-2300 MHz (includes 1680)	11.0 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a	n/a	Installed at Poker Flat Research Range
Antenna #7 2.1M/6ft "Minitracker" 2 Section Parabolic	2200–2300 MHz	2.9 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a; compact pedestal	n/a	Minitracker TM Systems Total Weight 1000 lbs.
Antenna #8 2.1M/6ft "Minitracker" 2 Section Parabolic	2200–2300 MHz	2.9 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a; compact pedestal	n/a	Minitracker TM Systems Total Weight 1000 lbs.
Antenna #9 6.1M/20ft 8 Section Mesh Parabolic	1435–1540 MHz 2200–2300 MHz	17.2 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	12.8M /42ft Flatbed w/ enclosed shelter	#4	Antenna #9 can be shipped in a C-141 aircraft.
Antenna #10 5.5M/18ft 16 Section Mesh Parabolic	1435–1540 MHz 2200–2300 MHz	14.5 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a	Self-equipped container	Antenna #10 is configured for shipborne transport.

Table 3-6. Transportable Van Summary

Van	Size	Function
#1	7.9 meter (26 ft.)	• A self-propelled recreational research vehicle equipped to support various balloon programs. It is a modified GMC Transmode Van, gross weight of 4,450 kg (10,000 lb.) • Interfaces with Scientific Atlanta 2.4 -meter (8 -ft.) and 3-meter (10-ft.) tracking antennas
#2	12.2 meter (40 ft.)	• Expandable instrumentation van (trailer) that features automatically regulated air suspension system for leveling and shock protection. • Antenna control for 2.4-meter and 3-meter dishes can be installed in this trailer
#3	12.2 meter (40 ft.)	Standard 40-foot trailer used on various mobile campaigns with similar capabilities as Van #2
Super Van	14.8 meter (48 ft.)	Multipurpose telemetry van, equipped to support 2.4-meter, 3-meter, or 5.5-meter (18-ft.) antenna systems individually and simultaneously
20’ Tracker	12.2 meter (40 ft.)	40-foot flatbed trailer with hydraulic erected 6.2-meter (20-ft.) tracker and 20-ft. long instrumentation shelter
Self-equipped	3 meter (10 ft.)	Support mini-tracker system
Pad-mounted	Various	Equipped to support pad-mounted 8-meter (26-ft.) TM antenna
C-130 container for air, sea, land transport	12.2 meter (40 ft.)	Mobile Range Control System with redundant command transmitters for command and flight termination, UPS, Range Safety Display System, real-time computer processors, communications

Table 3-7. TRADAT V Telemetry System

Antenna Type	Frequency	Remarks
TRADAT V Trajectory Data System One single 10-turn helix antenna for command	FM/FM	• PCM ranging system provides trajectory data for vehicles such as sounding rockets or balloons • The command antenna is normally attached to the telemetry antenna and interfaced with the host’s autotrack controller system; it transmits to an airborne PCM receiver/transmitter

Table 3-8. Transportable Orbital Tracking Station (TOTS) Systems

Antenna #11, Antenna #12, and Antenna #13

Receiving Characteristics

Antenna Diameter/Type	Frequency Range	Polarization	G/T (Minimum)	Receiver Type	Up/Down Con. Freq.	Tracking Modes	Pedestal Type
Transportable system 8 meter/26 foot Parabolic	2200-2400 MHz Upper L-Band	RHC & LHC Diversity Combined Pre/Post Detection	150 °K; 21 dB/°K G/T	S/A 930; Microdyne 1400; Microdyne 1100; MFR, DEI 7400	Raw; 215-315 MHz 400-500 MHz	Auto Manual Slave Computer	S/A 3315M; EL/AZ; 20°/ Sec AZ/EL Velocity; 20°/sec AZ/EL Acceleration

Transmitting Characteristics

Antenna Diameter/Type	Frequency Range	Polarization	Transmitter Type	EIRP	Tracking Modes	Pedestal Type
Helix 10 Turn	547, 550, 553 MHz	RHC	Various Types	200W RMS for 63 dBmi	Auto Manual Slave Computer	S/A 3315M; EL/AZ: 20°/ Sec AZ/EL Velocity; 20°/Sec AZ/EL Acceleration
Transportable system 8 meter/26 foot Parabolic	2025-2120 MHz	RHC or LHC	AYDIN Solid State	200W RMS for 93 dBm EIRP @ 2025 MHz	Auto Manual Slave Computer	S/A 3315M; EL/AZ: 20°/ Sec AZ/EL Velocity; 20°/Sec AZ/EL Acceleration

Notes: 1. TOTS requires pre-positioned concrete pad for precision angular accuracy.
2. Housed in a 40-foot expanding-side ISO container.
3. Set-up time is estimated to be 3 days after arrival on site.

Table 3-9. Synopsis - Wallops Flight Facility and Airborne Radar Systems

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-m^2 Skin Track (KM)	Range Precision (Meters) (rms)	Angle Precision (mils rms)	Tracking Velocity (deg/sec) AZ EL
UHF	ASRF	UHF	8 M	320-960	2.9	18.29	36	n/a	1480	n/a	2.0	8 8
4	ASRF (SPANDAR)	S	5 M	160, 320, 640, 960	0.39	18.29	52.8	480 K	2200	5	1.0	15 15
6	AN/MPS-19	S	325 K	160, 320, 640, 1280	3.0	2.44	33	925	100	10 KMS	1.0	60 60
n/a	AN/ASR-7	S	425 K	713, 1200, others available	1.5 (AZ) csc^2 (EL)	5.33 x 2.74	34	110	75 (Aircraft)	1%	n/a	n/a
5	AN/FPQ-6	C	3 M	160, 640, others available	0.39	8.84	51	60 K	1300	3	0.05	20 20
3	RIR-716 (Island)	C	1 M	160, 640	1.23	3.66	43	60 K	350	3	0.15	45 28
18	RIR-716 Airport Radar	C	1 M	160, 320, 640, 1024	0.71	4.88	46	60 K	435	3	0.1	31 28
	Airport Laser	Infrared	125	40	0.11	0.18	n/a	40	n/a	0.5	0.1	n/a
2	RIR-778C (mobile)	C	1 M	160, 320, 640	3.0	2.44	38	3745	220	5	0.24	34 34
8	RIR-778C (mobile)	C	1 M	160, 320, 640	3.0	2.44	38	3745	220	5	0.24	34 34
9	RIR-778C (mobile)	C	1 M	160, 320, 640	3.0	2.44	38	3745	220	5	0.24	34 34
10	RIR-778C (transportable)	C	1 M	160, 320, 640	1.1	3.66	43	60 K	425	3	0.15	34 34
n/a	Mariner's #2 Pathfinder	X	20 K	900, 1800, 3600	0.9@ 3 dB (H)	3.67 x 0.15	32	125	n/a	n/a	n/a	n/a
n/a	AN/APS-80B (V)	X	200 K	200	2.4 (H)	1.18x 0.81	35	155	n/a	n/a	n/a	n/a
n/a	AN/APS-128E (airborne)	X	100 K	267, 400 1200, 1600	2.4 (H) 9.0 (V)	1.06x 0.305	31	125	n/a	1% max. range	n/a	n/a

Surveillance Radars

Surveillance radars provide range surveillance to detect water surface and airborne targets. There are two fixed surveillance radar systems that support operation on the Test Range: the AN/ASR-8 at the Research Airport and the Marine Pathfinder radar system on Wallops Island. Two airborne surveillance radar systems can be installed on WFF aircraft: the AN/APS-80B(V) and the AN/APS-128E.

Additional information regarding range radars can be found in *Radar Facilities and Systems* and *Tracking and Data Acquisition Systems Capabilities*.

3.2.4 Command, Control, and Communications Facilities

The communications systems at the Test Range are composed of the following components:

- HF/VHF/UHF radios
- Local area network (LAN), Internet, E-mail
- telephone
- frequency shift tone keying
- NASCOM 2000 network terminal
- cable plant
- high-speed data circuits
- data transmission systems
- 12-channel intercom
- 40-channel intercom in Range Control Center (RCC)
- closed-circuit television systems
- Administrative Message Service (AMS)

The cable plant supporting communications systems includes extensive telephone, coaxial cable, and fiber optic cables interconnecting WFF facilities. Launch pads and blockhouses are connected by varied combinations of multimode and single mode fiber optic cable. 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 recorders.

The communications systems emphasize flexibility to configure to user requirements. These systems provide the means for managing operations at the Test Range and communicating and coordinating with related operations in other geographic areas.

For additional information, see *Communications Facilities and Systems*.

3.2.5 Data Systems

Data are 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 and magnetic tape in various formats. Optically derived data are available on videotape and film. Videotapes of real-time displays in the RCC can be provided.

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 are raw radar data (range azimuth/elevation versus time of day relative to radar pedestal). LTAS data are 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.

For additional information, see *Data Systems and Facilities*.

3.2.6 Command Systems

UHF command systems provide control of airborne vehicle (rocket, balloon, or aircraft) functions for on-board experimental devices. The systems also provide flight termination capabilities for range safety purposes. There are fixed and mobile system capabilities. Omni, single helix, and quad helix antennas are used, and antennas are selected based on mission requirements. Table 3-10 shows characteristics of the command transmitters and antennas available. Command systems feature failover redundant transmitters and antennas. A typical configuration has 20 IRIG (Inter-Range Instrumentation Group) tones available for modulation.

The fixed command system at the Test Range can be controlled by the Range Safety Officer in the RCC or from building U-55 on the Mainland. Control of the mobile system is from the 6-meter (20-foot) shelter housing the transmitters. An Instantaneous Impact Prediction/Command Destruct (IIP/CD) System is deployed with the Mobile Range Control Center. Additionally, the mobile systems and a command system in the Bermuda Islands can be controlled from the RCC.

The Digital Range Safety Set (DRSS) command system supports Space Transportation System (STS) missions (Shuttle). While the DRSS does not use IRIG tones, it does use the two transmitters and two quad-helix antennas (listed in Table 3-10) and communications links with the U.S. Air Force Eastern Range.

Table 3-10. Command Systems

Fixed Command System

Transmitters			Antennas		
Type	**Frequency**	**Power**	**Type/Control**	**Gain**	**Polarization**
(2) ALEPH CTS-100 1,000 Watts	4-6-549 Mz FM IRIG Tones	• Commercial AC • Generator for redundant system	(2) Orbit quad-helix; radar slaved or manual control	18 dB	LHC
			(2) Omni	0 dB	Vertical

Mobile Command Systems

Transmitters			Antennas		
Type	**Frequency**	**Power**	**Type/Control**	**Gain**	**Polarization**
(2) Henry Radio Company 1,000 Watts	406-450 MHz	Built-in UPS	Antlab quad-helix, trailer mounted, radar slaved or manually controlled	18 dB	LHC
			(2) Automatically controlled single-helix	15.3 dB	LHC
IIP/CD (2) PSC Solid State	400-450 MHz	2 UPS	(2) Omni	0 dB	LHC
			(2) Automatically controlled single-helix	15.3 dB	LHC

3.2.7 Frequency Monitoring

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 Test Range is capable of monitoring frequencies to 22 GHz.

3.2.8 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 (T.O.Y.) system is synchronized to the GPS. The GPS time transfer unit is used to synchronize the MTS and the 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 sites, and for driving remote timing displays. Program Time provides a visual count status and programmable function control for events. Synchronous generators and translators at sites provide for fail-safe operations, propagation delay correction, and translation of received time codes to other codes (e.g., IRIG-A) and reference signals.

The following time codes are available:

NASA 28-bit	IRIG-B
NASA 36-bit	IRIG-E
	IRIG-H

For additional information, see the NASA/GSFC/WFF *Timing Synchronization Procedures Manual*.

3.2.9 Research Airport

The WFF Research Airport is located on the Main Base 5 miles west of the town of Chincoteague on the Eastern Shore of Virginia, at geographical coordinates 37˚57′ North latitude, and 75˚28′ West longitude. Field elevation is 41 feet above sea level. See Figure 3-2 for an aerial view of the Wallops Main Base, including the Research Airport. Figure 3-24 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

- 04/22 – 8,750 feet by 150 feet
- 10/28 – 8,000 feet by 200 feet
- 17/35 – 4,820 feet by 150 feet

The taxiways that service these runways are parallels of 04/22 and 10/28 and are the same length as their respective runways. Two ramps adjoin the two active hangars, and a third ramp adjoins the Crash Fire and Rescue building. The hazardous cargo loading area adjoins the approach end of runway 17.

Runways 10 and 17 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

- 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
- Global Positioning System (GPS)

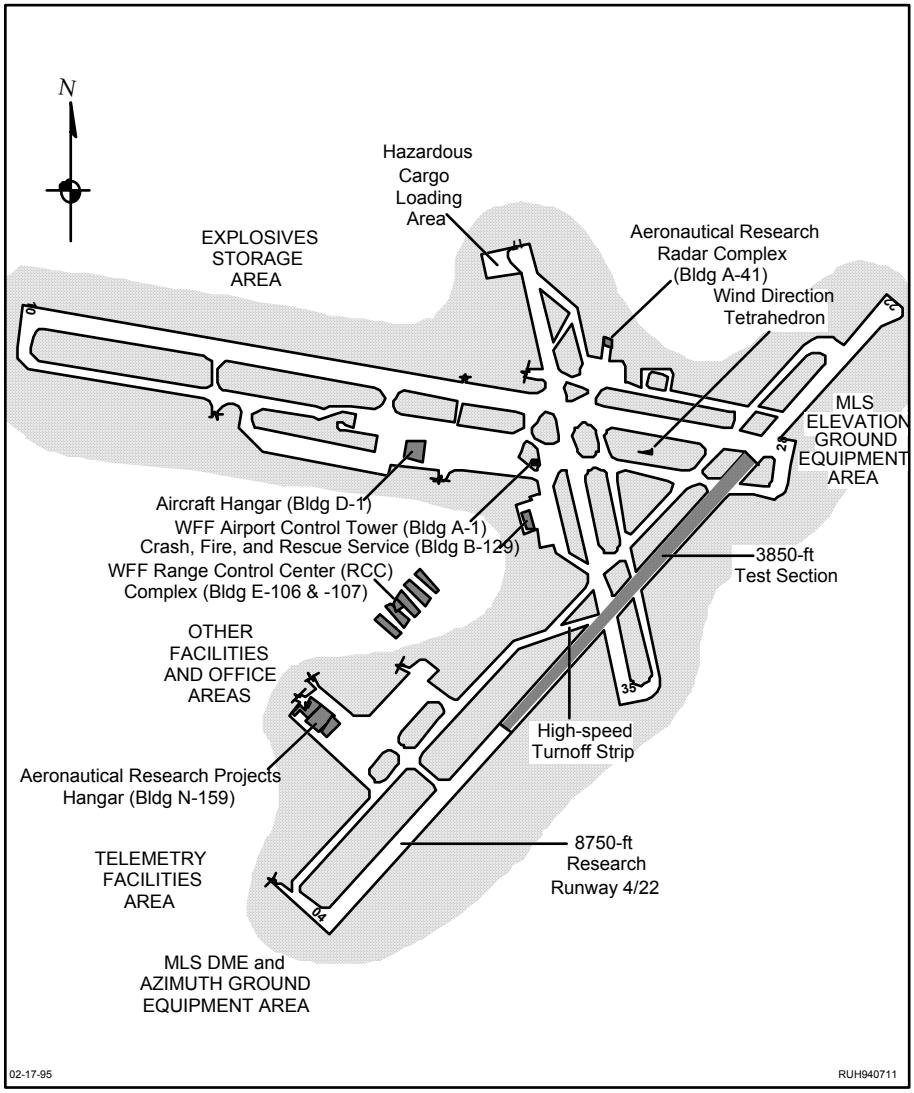


Figure 3-24. WFF Research Airport with Associated Facilities

Instrumentation and Facilities

To provide precision tracking for airborne research programs, a RIR-716C C-band radar (Radar 18) with an integrated LTS is located on the airport at the Aeronautical Research Radar Complex (building A-41). 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. Annotations on Figure 3-24 indicate the locations of facilities at the Research Airport. For more detailed descriptions, consult the *Goddard Space Flight Center/Wallops Flight Facility Airport Operations Manual*.

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, both 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 is available for approved aircraft projects and varies in size and location. Since Wallops is equipped to effect only minor or limited repairs to transient aircraft, project and R&D aircraft should be accompanied by maintenance personnel 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 in the *GSFC/WFF Airport Operations Manual* and on the Wallops web site at http://www.wff.nasa.gov.

3.2.10 Range Control Center (RCC)

The focal point for all Test Range operations is the RCC located in building E-106 on the Main Base. Data from the range support instrumentation (e.g., closed circuit TV, 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 Test 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 collocated rooms devoted to range control functions:

- Mission Control Room (MCR)
- Data Acquisition and Processing Room
- Range Safety Room
- Secure Room
- Surveillance and Downrange Communications Room
- MCR Observation Areas
- Aeronautical Projects Control Room
- Automatic Data Processing Room
- Instrumentation Room
- Weather Forecast Office

The WFF RCC *Guide to Range Control Center Communications* provides information on the RCC communications, data systems, and other capabilities available to support a project at the Test Range.

RCC Mission Control Room

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 3-25 is a panoramic view of the MCR from the Test Director's console; Figure 3-26 is the layout of the MCR.

Typically, mission controller stations 1 through 4, 6 and 8 are available to support range user functions. Additional console space can be made available for some missions in the adjacent Surveillance and Downrange Communications Room and/or the RCC Secure Room.

Figure 3-25. RCC Mission Control Room

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 have Silicon Graphics workstations and/or PCs to provide additional real-time data displays.

Figure 3-27 is a typical mission controller station with video display and communications and control devices. The video displays are shown in the background.

Figure 3-28 illustrates the data and communications available at each station.

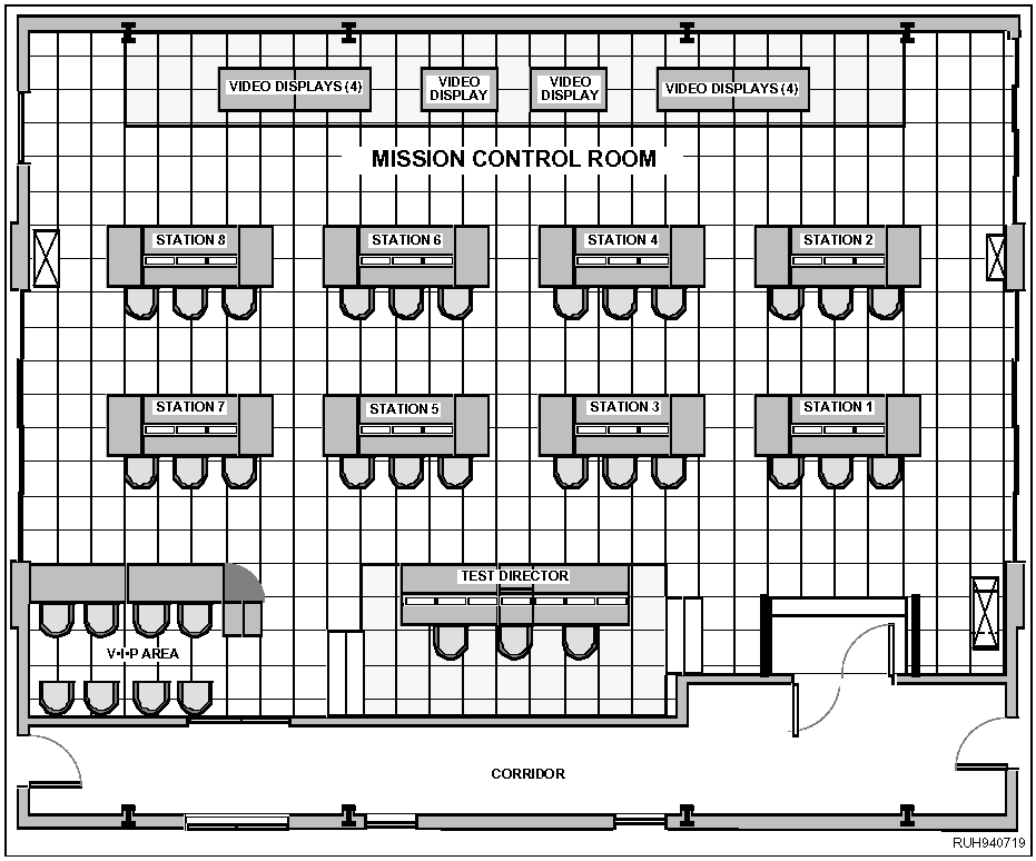


Figure 3-26. Layout of RCC Mission Control Room

Figure 3-27. Mission Controller Station

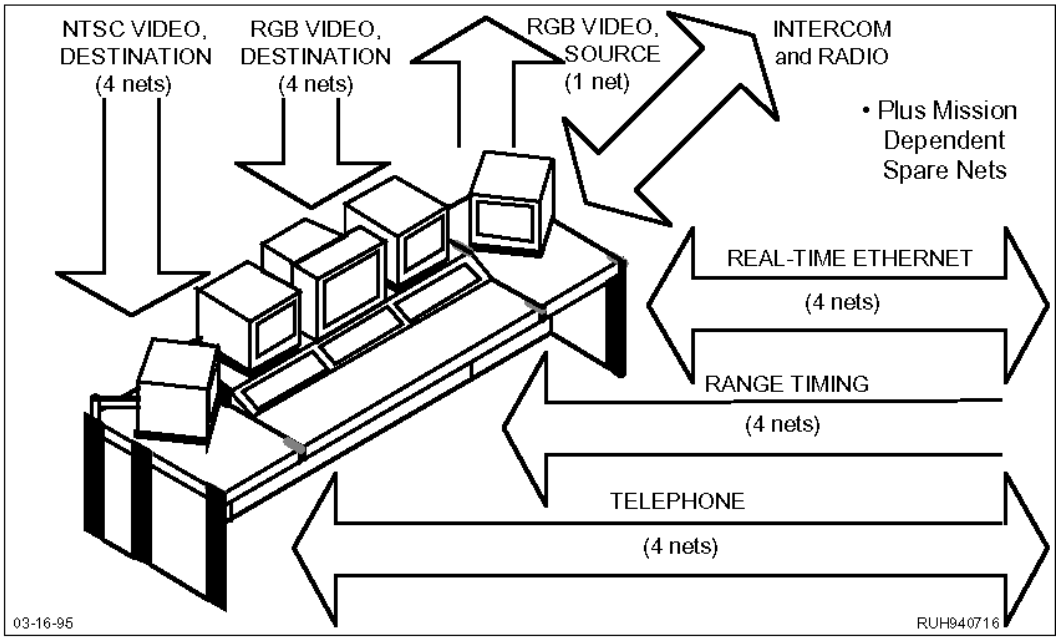


Figure 3-28. Mission Controller Station Data Interfaces

Data Acquisition and Processing Room

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

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.

Secure Room

The Secure Room is adjacent to the Range Safety Room and the MCR. A secure environment can be established for encrypted communications systems, if required. User-provided equipment can be accommodated.

Surveillance and Downrange Communications 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, two remote radar consoles, one for the ASR-7 and one for the Marine Pathfinder radar, 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 glassed-in balcony on the third floor between buildings E-106 and E-107, which overlooks the MCR. The balcony will accommodate approximately 30 visitors.

There is a second observation area in building E-107, third floor, which overlooks the MCR and is used primarily for press and VIPs.

Aeronautical Projects Control Room (APCR)

The APCR on the fourth story 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 3-29 shows the layout of the APCR.

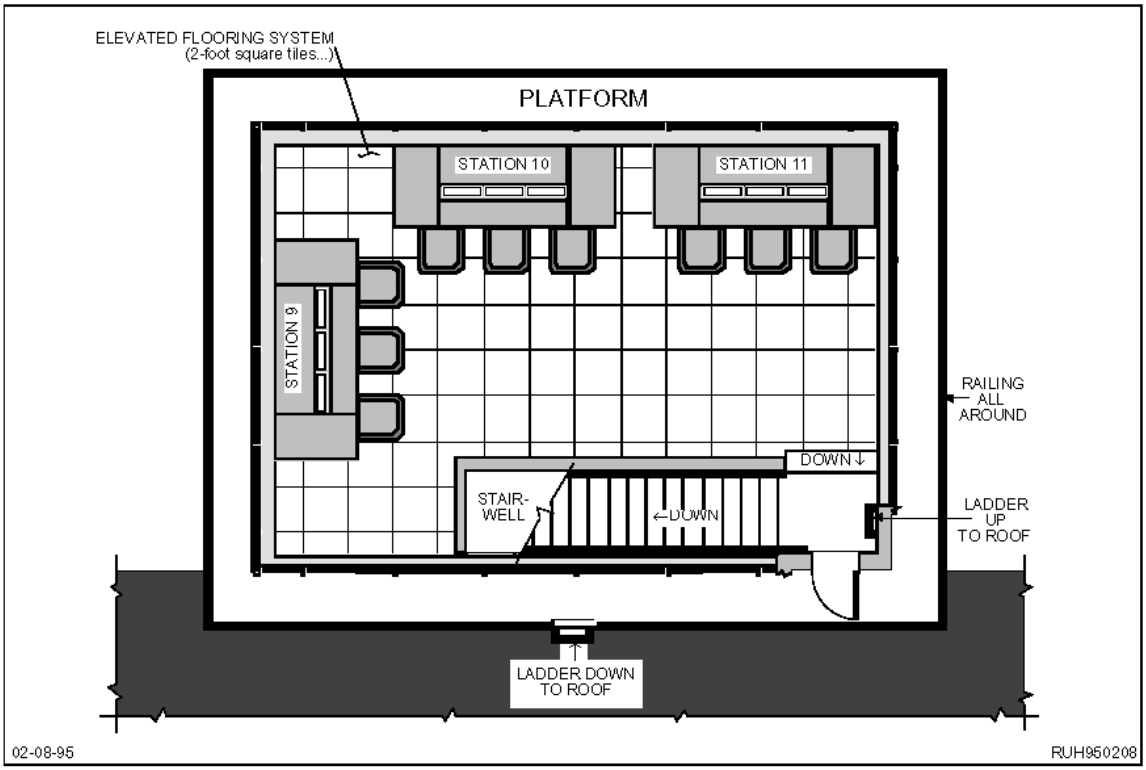


Figure 3-29. RCC 4th Floor Aeronautical Projects Control Room

Automatic Data Processing (ADP) Room

The ADP Room contains three Encore/Concept 32 super-mini computer systems: The Real-Time Computer System (RTCS), the Real-Time Backup System (RTBS), and the Data Reduction Computer System (DRCS). The RTCS and RTBS compose the RADAC, providing redundant real-time support to the RCC. The DRCS provides general ADP support, primarily data reduction.

The systems use the MPX-32 operating system, and there are C and FORTRAN 77+ compilers. WFF maintains libraries of applications to process user data. The super-mini computers are networked to share data and can provide access via RS-232 ports and modems.

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

More detailed information concerning computer resources and capabilities is contained in the WFF *Information Processing Laboratory's Data Processing Handbook*.

RCC Instrumentation Room

The Instrumentation 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 the Instrumentation Room 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 NASCOM.
- 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:
  - NRSC: 50-source input by 120 destination output
  - RGB: 50-source input by 100 destination output.
- NASCOM access, which provides real-time voice and data communications through the NASCOM 2000 network with other locations.
- Programmable intercom for range communications, which provides patchable radio, telephone, SCAMA (Switching, Conferencing, and Monitoring Arrangement), and range operations channels.

Weather Forecast Office

The Weather Forecast Office provides meteorological information in support of all WFF activities, and provides daily and special forecast support as required. National, regional, and local weather data are available. Data sources include the Automated Weather Interactive Processing System (AWIPS); several lightning detection systems; field mills, which measure lightning potential; Digital Facsimile (DiFax) for charts and graphs; 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 8 hours is broadcast 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 recorded and accessible by telephone.

The following additional weather information is also 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.

3.2.11 Meteorological Facilities

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 3.2.12 display lightning conditions locally and over the United States.

For more detailed descriptions of meteorological systems at Wallops, see *Meteorological Facilities and Systems*.

3.2.12 Atmospheric Sciences Research Facility (ASRF)

The ASRF houses the atmospheric radar installed on 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:

- Lightning Detection and Ranging (LDAR) System is a time-of-arrival system that measures, locates, and displays intercloud, intracloud, and cloud-to-ground lightning discharges.
- National Lightning Detection Network (NLDN) is a magnetic direction finder antenna network that displays cloud-to-ground lightning strike locations within the continental United States.
- Extremely Low Frequency (ELF) Lightning Measurement System detects lightning activity at very long ranges.
- Electric Field Measurement 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 is shown in Figure 3-30. Additional information on the ASRF is in *An Experimenter's Guide to the NASA Atmospheric Sciences Research Facility*, March 1994.

Figure 3-30. Atmospheric Sciences Research Facility

3.2.13 Optical and Television Facilities

The WFF Optical and Television Facilities provide operations and maintenance of photographic and television services for Wallops and other locations around the world.

Optical Section

The Optical Section performs three distinct functions:

- Process and Printing Laboratory, which processes and reproduces black and white and color still photographs and sensitizes paper records exposed for various test requirements.
- Aerial photography, which uses different film and filter combinations, either at ground stations or from aircraft, to produce a variety of images from motion picture, still, or video cameras.
- Tracking and instrumentation operations, which are based primarily at Wallops Island to support sounding rocket and balloon launches. WFF camera domes enclose fixed and tracking cameras used to photograph launches and operations from Wallops Island. Mobile equipment, cameras, and lenses are transported to remote sites to track, photograph, and transmit coverage of projects. Table 3-11 lists camera capabilities, and Figure 3-31 shows camera locations on Wallops Island and Mainland.

An electronic data management system and digital still camera system are in operation. Digital timing can provide precision timing on 16-mm film data for range users at Wallops and remote locations.

Table 3-11. GSFC/WFF Photo Optical Systems

I.D. No.	Station	System Type	Track Modes	Tracking Rates	Camera Type	Film Type	Lens Focal Length	Environmental Control
#1	Tracking	IFLOT MK1	EL/AZ Manual	22°/sec	MP Film	16-mm	40-inch 80-inch	12-foot Astrodome shelter
#2	Tracking	SOT MK 51	EL/AZ Manual	Manual	MP Film TV	16-mm Video	15-inch 12-inch	10-foot Astrodome shelter
#4	Tracking	IFLOT Mk 3A	EL/AZ Manual	30°/sec	MP Film TV	16-mm video	80-inch 40-inch	12-foot Astrodome shelter
#5	Tracking	SOT Mk 51	EL/AZ Manual	Manual	MP Film TV	16-mm video	10 - 20 inch ZOOM	10-foot shelter
#8	Tracking	IFLOT Mk 1	EL/AZ Manual	22°/sec	MP Film	16-mm	40-inch 40-inch	12-foot Astrodome shelter
#9	Tracking	IFLOT Mk 3 (Mobile)	EL/AZ Manual	32°/sec	MP Film	16-mm	40-inch 80-inch	N/A
#11	Tracking	IFLOT Mk1 (Mobile)	EL/AZ Manual	22°/sec	MP Film	16-mm	No camera or lens assigned	N/A
#12	Tracking	IFLOT Mk 1 (Mobile)	EL/AZ Manual	22°/sec	MP Film	16-mm	No camera or lens assigned	N/A
#15	Tracking	IFLOT MK 3	El/AZ Manual	32°/sec	MP Film TV	16-mm video	80-inch 80-inch	12-foot Fixed Shelter
W-60	Fixed	Stationary Mount	Fixed	N/A	MP Film Sequence Film	16-mm 70-mm	12-mm to 12-in 6- to 12-inch	10-foot Fixed Shelter
W-115	Fixed	Stationary Mount	Fixed	N/A	MP Film Sequence Film	16-mm 70-mm	12-mm to 12-in 6- to 12-inch	10-foot Fixed Shelter
Y-110	Fixed	Stationary Mount	Fixed	N/A	MP Film Sequence Film	16-mm 70-mm	12-mm to 12-in 6- to 12-inch	10-foot Fixed Shelter

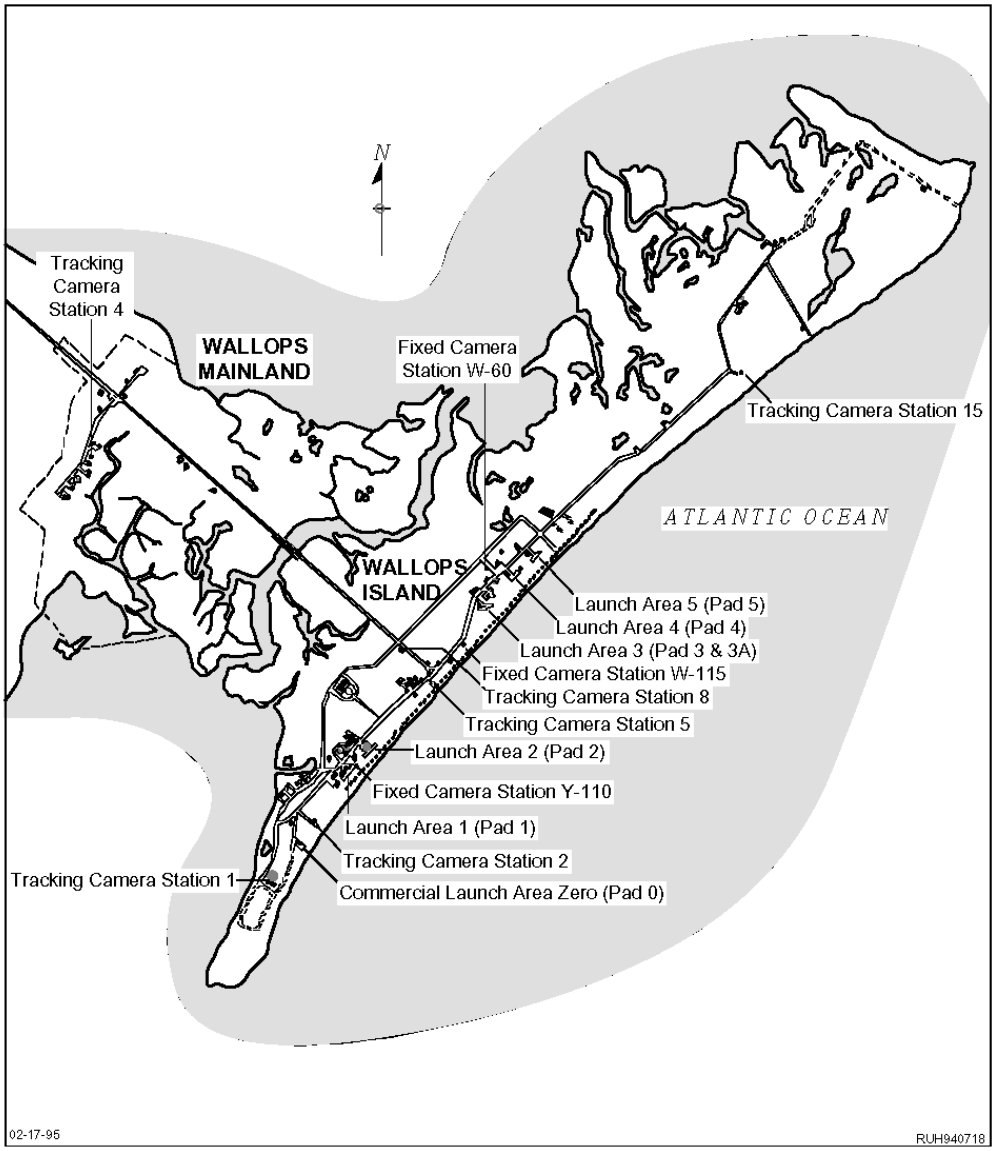


Figure 3-31. Optical Tracking Stations at Wallops Island and Mainland

Television Section

The Television Section provides two distinct functions:

- Video editing and reproduction, which produces videotapes in support of WFF activities and special projects. The Television Section provides videotaping in three main formats for data capture. A television studio is available for later editing and reproduction with high quality, prompt data processing.

- Video distribution, which uses the multichannel cable television system to distribute video from many diverse sources to Wallops facilities, including the Visitor Center and the NOAA Weather Data Acquisition Center. Video sources, whether real-time or computer-generated, are directly linked to the cable system and, therefore, instantly available to the network.

Additional information is available in *Optical and Photographic Systems*.

3.2.14 Recovery Facilities

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-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.

3.2.15 WFF Aircraft

Wallops uses Lockheed P-3B Orions for aeronautical research (Figure 3-32). The P-3B is capable of worldwide missions. It has a range of 3,800 nautical miles, 12 hours airtime, and a maximum altitude of 30,000 feet. The aircraft has multiple instrumentation ports, airborne radar, and special features to support remote sensing and instrumentation development. Additional information on research aircraft can be found in 830-PG-8072.1.1, *Aircraft Operations Manual*.

Figure 3-32. Lockheed P-3B Orion

3.2.16 Mechanical and Electrical Fabrication and Testing

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, and 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 the *Sounding Rocket Users Handbook*.

3.2.17 Dynamic Balance Facility

The Dynamic Balance Facility is located in three different buildings on Wallops Island (V-45, V-50, V-55). The facility is used in support of sounding rockets, probes, re-entries, and orbital missions.

Building V-45 contains one 10-ton bridge crane, with a 23-foot hoist height.

Building V-55 houses the Trebel FVD-3000 Aerospace Balancing Machine, which is the largest of its kind in the world. The building contains one 20-ton bridge crane with a 32-foot hoist height.

The FVD-3000 is operated remotely from the Blockhouse Control Building, V-50. Table 3-12 lists the capacities of the FVD-3000:

Table 3-12. Trebel FVD-3000 Balancer

Test specimen weight	50 to 6,000 lb; 35,000 lb maximum at reduced speeds
Balancing velocities	50 to 1,000 rpm
Maximum test specimen size	10-ft diameter (15 ft with modifications); maximum height 27 ft

A selection of turntable-workpiece standard adapters is available to fit the 48-inch diameter table.

Three vertical Gisholt balancers are located in building V-45 and are remotely operated and monitored from V-50. The balancers are used primarily for small or medium test setups with restricted diameters. These displacement type machines are the soft bearing amplitude kind. Table 3-13 lists their capacities.

Table 3-13. Vertical Gisholt Balancers

Test specimen weight	10 to 300 lb, 40 to 2,000 lb, 50 to 3,300 lb
Balancing velocities	80 to 1,000 rpm
Maximum test specimen size	46-inch diameter by 20-ft long

A variety of electronic scales are available to measure weight from 0.1 gram to 22,676 kilograms. The Toledo Scale Corporation Portable System determines weight and center of gravity (CG) of the various rocket motor components. The system specifications are listed in Table 3-14.

Table 3-14. Toledo Scale System

Maximum weight capacity	900 lb
Weight accuracy	0.1% or 1 lb, whichever is greater
CG accuracy	±3 in. over 250 lb, ±2 in. over 500 lb

3.2.18 Metrology

Wallops Flight Facility maintains a Metrology 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.

3.2.19 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.

3.2.20 Mobile Range Systems

Wallops has developed mobile radar, telemetry, and data systems that can be transported to offsite and remote locations. Campaigns have been conducted in Arctic and Antarctic regions, South America, Africa, Europe, Australia (Figure 3-33), 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:

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

Figure 3-33. Range Equipment at Woomera, Australia

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

Section Four: Wallops Test Range Administration and 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 RSM.

4.1.2 Working Hours

The normal workday for WFF is 0800 to 1630 Monday through Friday. There are work limitations established for safety purposes. Coordination of the work schedule with the RSM is necessary to ensure access to required facilities and the availability of necessary technical personnel.

4.1.3 Visiting Aircraft

A FAA-certified VFR control tower operates on 126.5/394.3 MHz. The Control Tower is manned from 0700 to 1730 Monday through Friday, excluding holidays, and at other times to support specific missions. Visiting aviators on official U.S. Government business are required to obtain a Prior Permission Request (PPR) number from the Wallops Airport Manager (or in his absence, from an approved RSM) 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 firefighters and rescue 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 126.5/394.3 MHz.

4.1.4 Cafeteria and Dormitories

The Wallops Employee and Morale Association (WEMA) manages the cafeteria and dormitories. The cafeteria serves breakfast and lunch Monday through Friday, except holidays. Dormitory rooms are rented on a space-available basis.

4.1.5 Communication Services

Telephone service is provided through the Federal Telecommunications System (FTS-2000) for official U.S. Government business. Long-distance billing can be supported by telephone credit cards or prorated FTS accounts for non-Government projects. Fax service is available. Modem support for range user computers may be provided through the digital PBX system. Pay phones are located in front of the cafeteria and in the dormitories. The WFF operator is available during normal working hours at (757) 824-1000.

The Outsourcing Desktop Initiative for NASA (ODIN) contractor can provide Internet access on a month-to-month basis. There are no restrictions on pagers and cell phones. Teleconferencing and video teleconferencing services are available through the customer's sponsor. Portable audio conferencing equipment is also available.

4.1.6 Smoking

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

4.1.7 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.

4.1.8 Fire Protection

There are two fire stations at Wallops, one on the Main Base and one on Wallops Island. Both stations are manned by fully trained firefighters and emergency medical technicians 24 hours a day. Each station is equipped to meet the Wallops' emergency response requirements.

4.1.9 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. Ambulance services are also available. The Northampton-Accomack Memorial Hospital is approximately 40 miles south in Nassawadox, Virginia. The other local hospital is the Peninsula Regional Medical Center located approximately 40 miles north in Salisbury, Maryland.

4.1.10 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

4.1.11 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 tenant 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 from 0800 to 1430 (for truckloads) and 0800 to 1600 (for partial loads), Monday through Friday, excluding holidays.

4.1.12 Air Cargo

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

GSFC/WFF Airport Manager
Phone (757) 824-1654
Fax (757) 824-1373

4.1.13 Airfreight Services

The nearest commercial airfreight service is at the Salisbury-Wicomico County Regional Airport, Salisbury, Maryland.

4.1.14 Hazardous Material

All hazardous material must be packaged to conform to applicable Department of Transportation regulations. A Material Safety Data Sheet (MSDS) 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 WFF Environmental Office for disposal of all hazardous material.

Radioactive sources require approval from the Safety, Environmental and Security 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 RSM at least 90 days prior to the shipment/arrival of the source. GHB 1860.1, *Radiation Protection–Ionizing Radiation*, defines procedures and provides the needed forms.

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 forklifts
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 individuals must provide a visit request to the RSM. A list of required information to be provided for the visit can be obtained from the RSM and should be provided a minimum of 3 weeks before the visit.

4.3 Public Affairs Support

The Wallops Public Affairs Office (PAO) is available to support range users with media and guest relations operations. Initial requests for PAO support can be made through the RSM.

4.4 NASA Visitors Center

A Wallops Flight Facility Visitor Center and Gift Shop is 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 (see Figure 4-1). A collection of spacecraft and flight articles as well as exhibits about the United States space flight program is 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 Visitor Center auditorium may be used for media and guest relations activities.

Figure 4-1. Wallops Visitor Center and Gift Shop

Section Five: Range Safety Policies

5.1 Range Safety Organization

The Suborbital and Special Orbital Projects Directorate (Code 800) is responsible for implementing safety policies and criteria for the Wallops Test Range as defined in RSM-2002, *Range Safety Manual for Goddard Space Flight Center/Wallops Flight Facility*.

5.2 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 2.4.5 of this document.

5.3 Ground Safety

Specific policies and criteria, such as radiation exposure limits, power switching, multiple operations, electroexplosive circuit requirements, electrical storm criteria, RF restrictions, personnel requirements, radioactive sources, and pressure vessels, are provided in RSM-2002. Radiation protection requirements are detailed in GHB 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 OSD before any range user operations are conducted at the Test Range.

5.4 Flight Safety

Specific flight safety policies and criteria for impacts, land overflights, 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 as part of the OSD 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 ControlRoom
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
CG	center of gravity
CNC	Computer Numerically Controlled
csc^2	$cosecant^2$
CSLA	Commercial Space Launch Act, Public Law 98-575
CSOC	Consolidated Space Operations Contract
dB	decibel
dBm	decibels above (or below) 1 milliwatt
dBmi	decibels milli-isotropic
DiFax	digital facsimile
DoD	Department of Defense
DRCS	Data Reduction Computer System
DRCS	Data Reduction Computer System
DRSS	Digital Range Safety Set
EDARS	Environmental Data Acquisition and Recording System
EIRP	effective isotropic radiated power
EL	elevation
ELF	Extremely Low Frequency
ELV	expendable launch vehicle
ERD	Environmental Resources Document
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
GHB	Goddard Space Flight Facility Handbook
GHz	gigahertz
GMC	General Motors Corporation
GMI	Goddard Space Flight Center Management Instruction

Abbreviations and Acronyms (cont.)

GPS	Global Positioning System
GSFC	Goddard Space Flight Center
HAD	High Altitude Diagnostic (Launcher)
HF	high frequency
HTA	Host-Tenant Agreement
IIP/CD	Instantaneous Impact Prediction/Command Destruct
ILS	Instrument Landing System
INS	Inertial Navigation System
IRIG	Inter-Range Instrumentation Group (U.S. Government Agency)
ISA	Individual Support Annex
kg	kilogram
LAN	local area network
lb	pound or pounds
LDAR	Lightning Detection and Ranging System
LGTAS	Low Gain Telemetry Antenna System
LHC	Left Hand Circular
M	meter
MCR	Mission Control Room
MDDF	Minimum Delay Data Format
MHz	megahertz
MOA	Memorandum of Agreement
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
NIST	National Institute of Standards and Testing
NLDN	National Lightning Detection Network
NOAA	National Oceanic and Atmospheric Administration
NORAD	North American Aerospace Defense Command
NPG	NASA Procedures and Guidelines
NSBF	National Scientific Balloon Facility
NSROC	NASA Sounding Rocket Operations Contract
NWS	National Weather Service
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

Abbreviations and Acronyms (cont.)

PCM	pulse code modulation
PFRR	Poker Flat Research Range
PPR	Prior Permission Permit
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
RFI	radio-frequency interference
RHC	Right Hand Circular
rpm	revolutions per minute
RSM	Range Safety Manager
RSO	Range Safety Officer
RTBS	Real-Time Backup System
RTCS	Real-Time Computer System
SCAMA	switching, conferencing and monitoring arrangement
SPANDAR	Space and Range Radar
STS	Space Transportation System
T.O.Y.	Time-of-Year
TM	telemetry
TOTS	Transportable Orbital Tracking System
TRADAT	Trajectory Data System
TV	television
U.S.	United States
UDS	Universal Documentation System
UHF	Ultra High Frequency
UPS	Uninterruptible Power System
USA	United States of America
USCG	United States Coast Guard
USN	United States navy
VCSFA	Virginia Commercial Space Flight Authority
VHF	Very High Frequency
VIP	very important person or people
VSFC	Virginia Space Flight Center
WEMA	Wallops Employee and Morale Association
WFF	Wallops Flight Facility
WI	Work Instruction
WOTS	Wallops Orbital Tracking Station