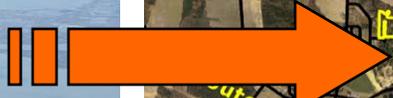




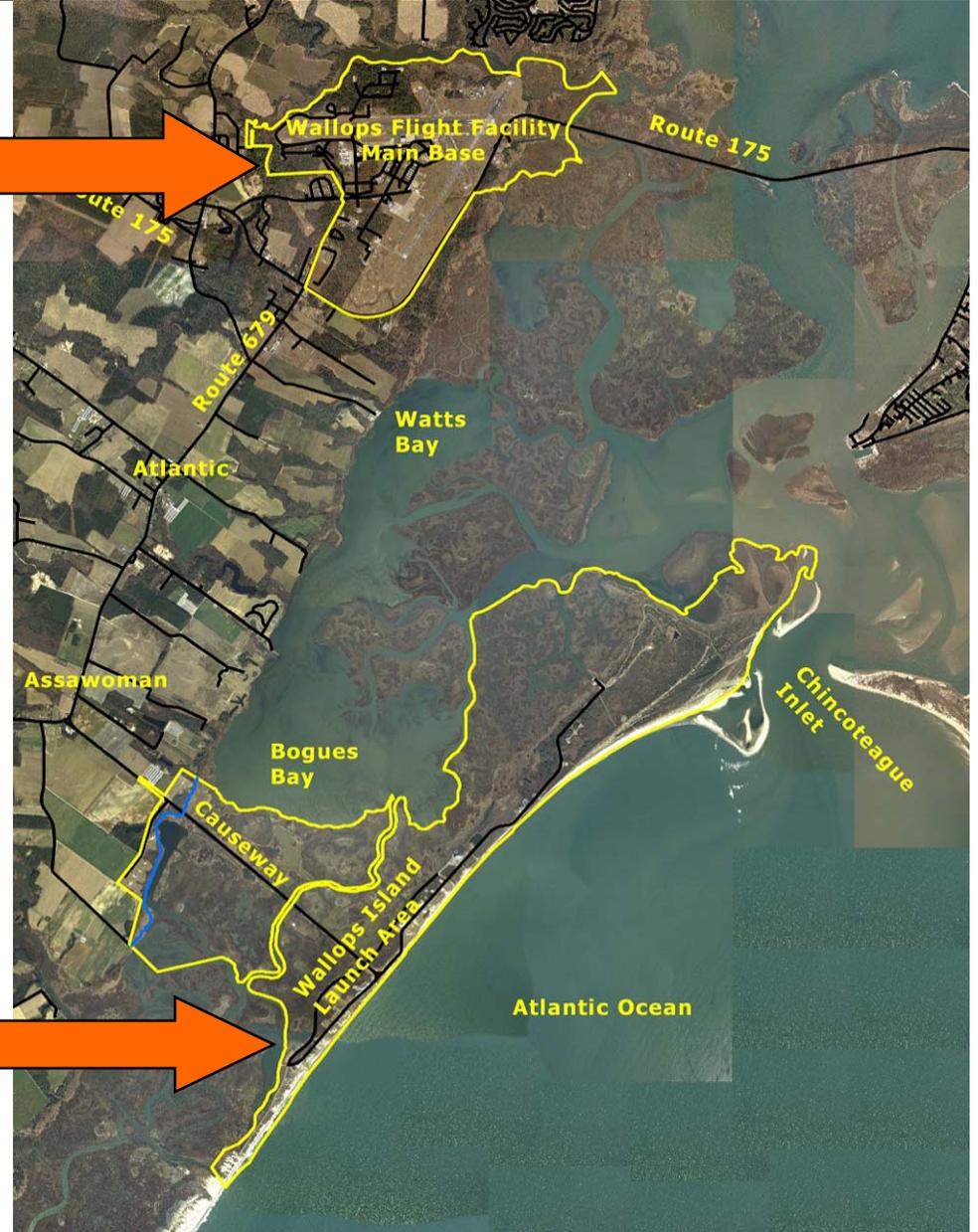
GSFC/Wallops  
Flight Facility

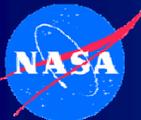
# Wallops 6000 Acre Campus

Main Base



Wallops Island





GSFC/Wallops  
Flight Facility

# Wallops Flight Facility



## Three Major Parcels      6000 Acres

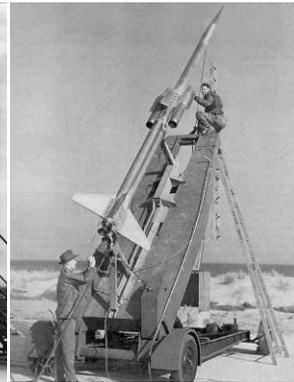
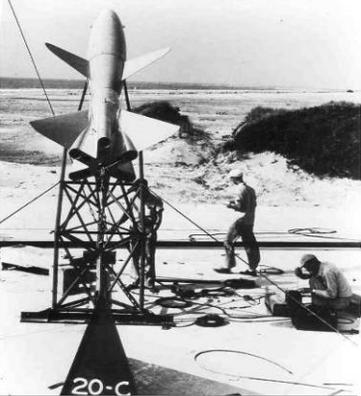
- **Wallops Main Base**      **1900 Acres**
  - Administrative & Technical Offices
  - Tracking & Data Acquisition
  - Range Control Center
  - Ordnance Storage/Processing
  - R&D, Processing Facilities
  - Research Airport
  - Navy Administration/Housing
  - Coast Guard Housing
- **Wallops Island**      **3000 Acres**
  - Launch Sites
  - Blockhouses
  - Radar
  - Processing Facilities
  - Dynamic Spin Balance
  - Navy Operational Facilities
- **Wallops Mainland**      **100 Acres**
  - Tracking & Data Acquisition
- **Marshland**      **1000 Acres**



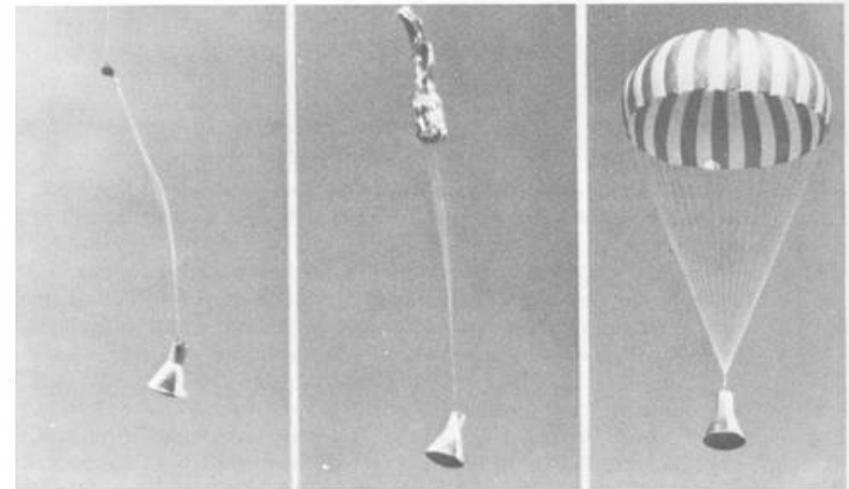
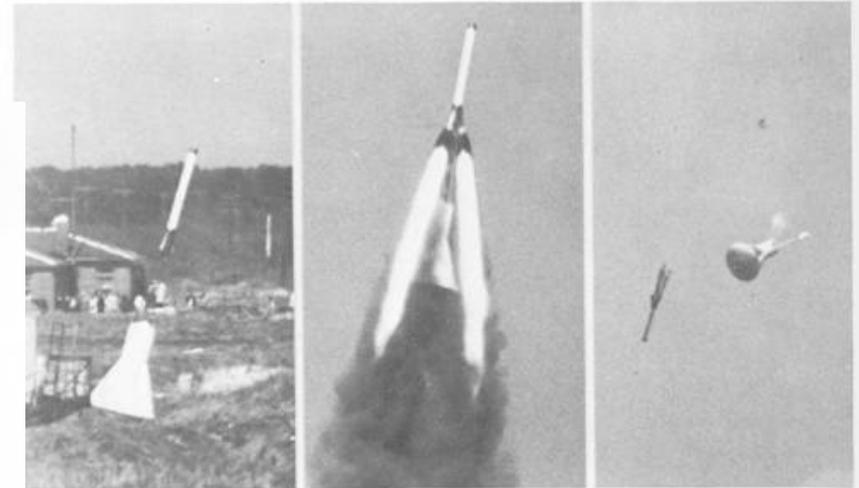
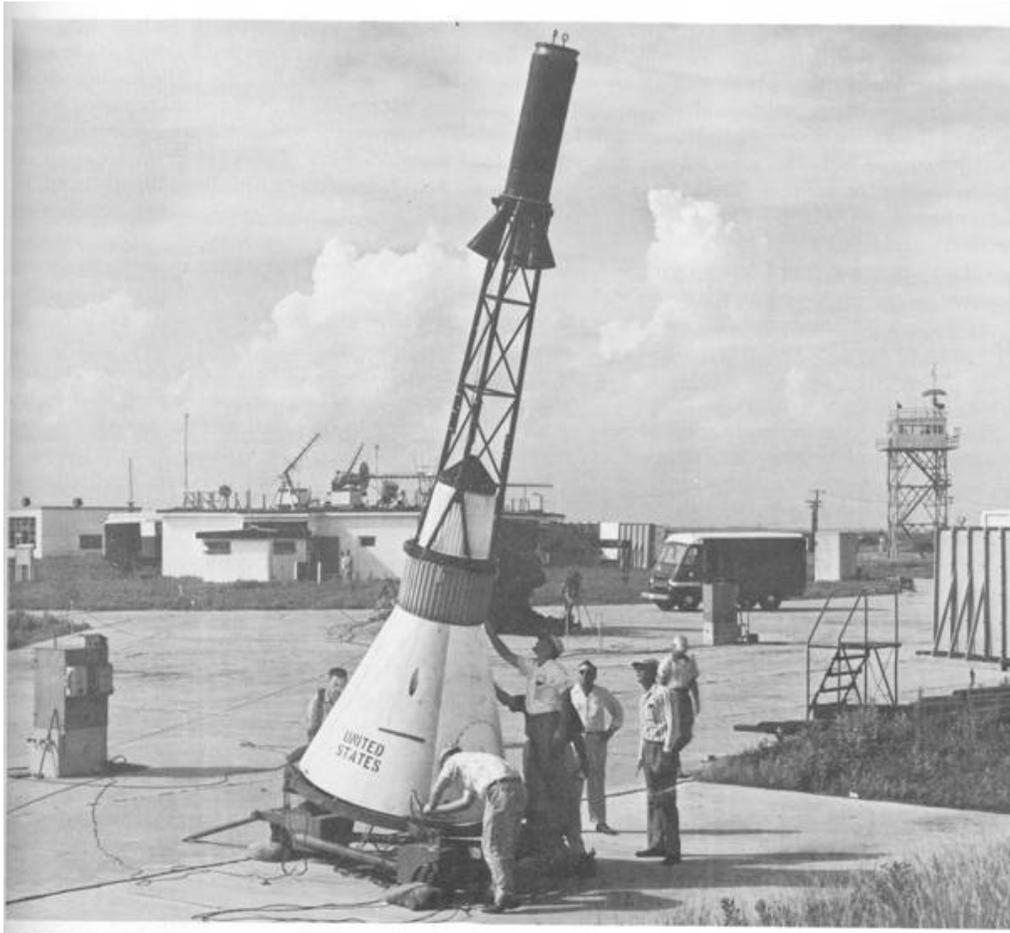
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Flight Facility

# Wallops History

- **Established by National Advisory Committee on Aeronautics in 1945 as test site for aerodynamic research**
- **Over 16,000 launches conducted during 62 year history**
- **Wallops mission has evolved to include:**
  - **Flight program management**
  - **Technology development**
  - **Scientific research**



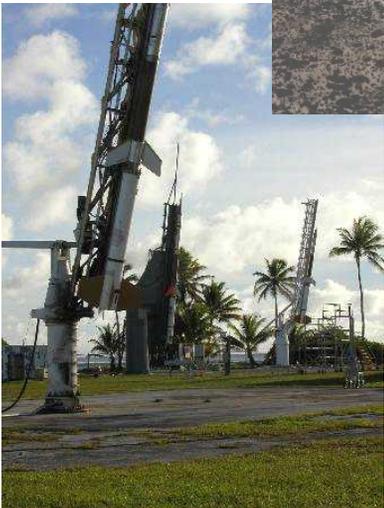
# Wallops Demonstration of Mercury Launch Abort System



# Sounding Rocket Launch Locations



- **Fixed Launch Sites**
  - **Wallops Research Range**
  - **White Sands Missile Range (NM)**
  - **Poker Flat Research Range (AK)**
  - **Andoya & Svalbard (Norway)**
  - **Esrange (Kiruna, Sweden)**
  - **Kauai**
- **Recent Mobile Campaign Sites**
  - **Kwajalein**
  - **Australia**
  - **Puerto Rico**
  - **Brazil**
  - **Greenland**



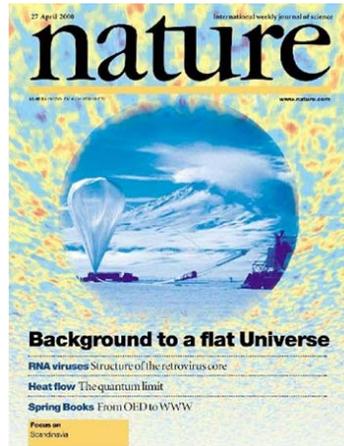


GSFC/Wallops  
Flight Facility

# Balloon Program



**Balloon  
Inflation**



- **Primary mission:**
  - **Space Science research**

- **15-20 missions/year**

- **Features**

- **Balloon volumes up to 60M cubic ft.**
- **Suspended loads up to 8000 lbs.**
- **Float altitudes of 100K-160K feet**
- **Mission durations of >1 month**

- **Worldwide mission sites**

- **Development efforts:**

- **Ultra-Long Duration Balloon**
- **Trajectory control**
- **Planetary balloons**



**Balloon  
at Float**

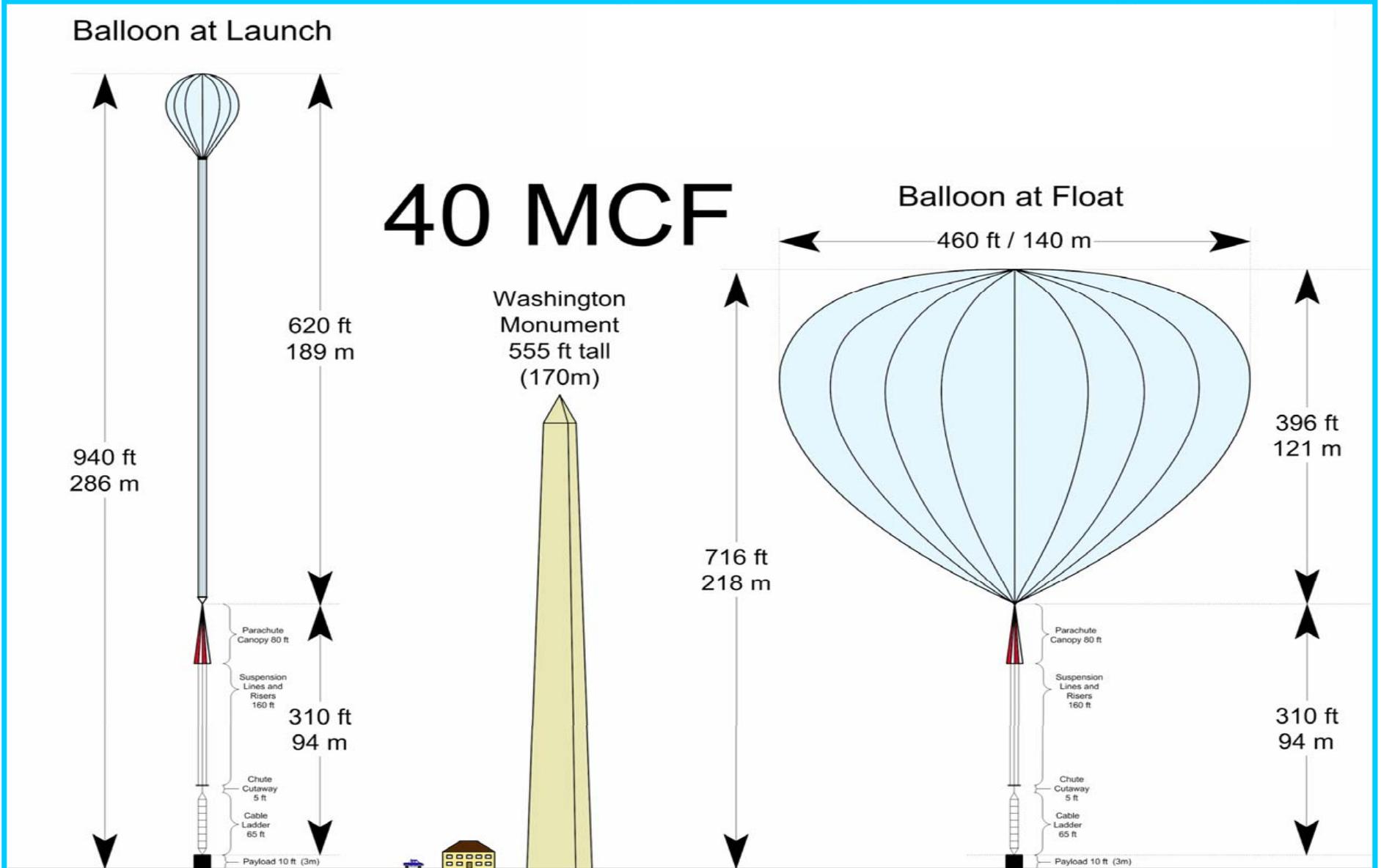


**Balloon  
Payload**



GSFC/Wallops  
Flight Facility

# Balloon Characteristics



# Airborne Science Program



*NASA P-3 (based at WFF)*



*NASA DC-8 (based at U of ND)*



*Twin Otter (contracted)*

- **Piloted aircraft & UAV “flying laboratories” supporting Earth Science research**
  - **Heavy Lift:**
    - *Wallops: P-3B*
    - *U of ND: DC-8*
    - *Pass throughs: WB57 (JSC), ER-2 (DFRC)*
  - **Contract Aircraft: Twin Otter (others pending)**
  - **UAVs: AAI/Aerosonde, Aurora**
- **Research examples:**
  - **Atmospheric Chemistry**
  - **Climate Change**
    - *Ice cap & beach mapping*
    - *Ocean current & biology studies*
    - *Coastal Zone Research*
  - **Natural Disasters**
    - *Hurricane studies & volcano eruptions*
- **Aircraft activities**
  - **Mission planning**
  - **Aircraft operations & maintenance**
  - **Aircraft modifications & certification**



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Flight Facility

# Uninhabited Aerial Systems



Aurora GE-80



Aerosonde



Wallops UAS Runway



- **WFF UAV Activities**
  - Science missions
  - Operations
  - Science-enabling technology development
- **NASA investigating UAV contribution to science. UAVs offer:**
  - More hazardous flight regimes
  - Longer duration missions
  - Potentially lower costs
- **AAI/Aerosonde partnership**
  - Demonstrate utility of small UAVs for science
  - Establish procedures for science projects
  - Execute science missions
- **Aurora Flight Sciences partnership**
  - UAV infrastructure upgrades
  - Development & demo. of UAV-independent & science-independent data systems

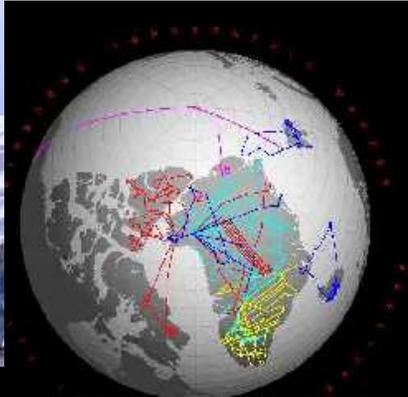


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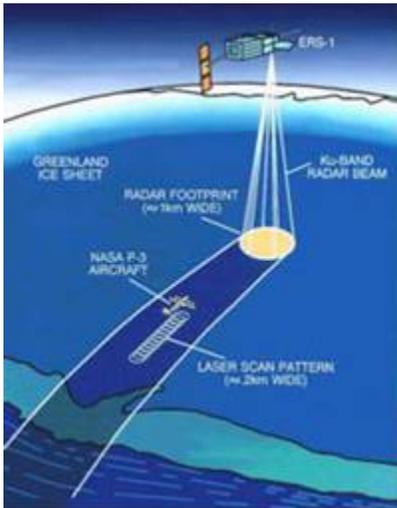
# Earth Science Research



**Antarctic & Greenland  
Ice Mapping**



**Coastal Zone  
Research**



**Laser & Radar  
Altimetry**



**Wallops  
"Wave Tank"**

## **Research activities include:**

- **Atmospheric chemistry**
- **Beach erosion**
- **Arctic ice mapping**
- **Hurricanes**
- **Satellite Altimetry**
- **Biological modeling**
- **Coastal Zone Research**

**Remote & in-situ instruments  
flown on aircraft, balloons, &  
rockets**

**Worldwide data measurements**

**Cal/Val instrument support**

## **Laboratories include:**

- **Air-Sea Interaction Facility**
- **Rain-Sea Interaction Facility**

# Wallops Mission Operations



***Launch Range***



***Mobile Range***



***Research Airport***



***Orbital Tracking***

# Launch Range



- **NASA's only launch range**
  - Over 16,000 launches conducted since 1945
- **Support:**
  - NASA science & technology (primary)
  - DoD & other gov't agencies
  - Commercial industry
- **Full suite of support services**
  - Launchers
  - Processing facilities & logistics
  - Range safety
  - Tracking & data services
- **Specialized focus:**
  - Suborbital & small orbital launch vehicles
  - Experimental vehicles & payloads
  - Responsive & low-cost missions



GSFC/Wallops  
Flight Facility

# Numerous & Diverse Launch Capabilities



**MARS Pad 0B**



**Orbital Sciences  
Pegasus**



**Pad 1 50K Launcher**



**20K ARC Rail Launcher**



**MARS Pad 0A**



**20K AML Launcher**

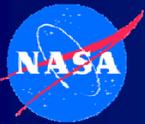


**Navy Target Launchers**

# Wallops Small Sat Launch History



- **Worldwide:**
  - **1 Minotaur mission (Wallops)**
  - **20 Scout missions (Wallops)**
  - **9 Pegasus (8 from Wallops)**
    - **1 mobile from Canary Islands**
  - **1 Conestoga (Wallops)**
  - **1 Athena (mobile from Kodiak, AK)**
- **Most recent orbital ground launch from Wallops Island:**
  - **December 16, 2006 TacSat-2**



GSFC/Wallops  
Flight Facility

# Minotaur at Wallops



# Wallops Tenants

## Land Owner



**Goddard Space Flight Center**

## Tenants



**Navy/Surface  
Combat Systems  
Center**



**Naval Air Warfare Center  
(Patuxent River)**



**NOAA**



**U. S. Coast Guard**



**Mid-Atlantic  
Regional Spaceport**

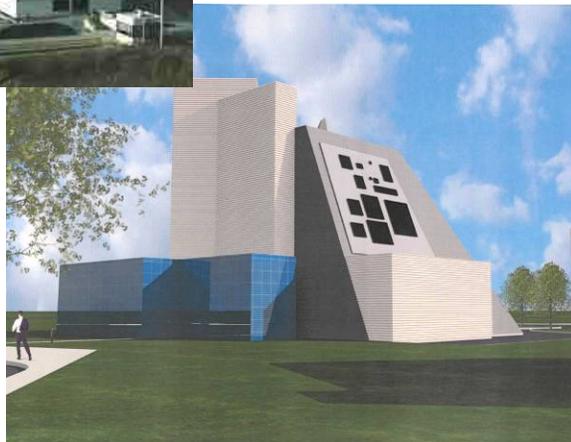
# U.S. Navy at Wallops

- Surface Combat Systems Center

- **Aegis Combat Training Center**
  - **Cruiser & destroyer simulators**
  - **Crew training**
  - **System development test bed**
- **Ship Self-Defense Facility**
- **DDG(1000) engineering facility**

- Naval Air Warfare Center (Patuxent River)

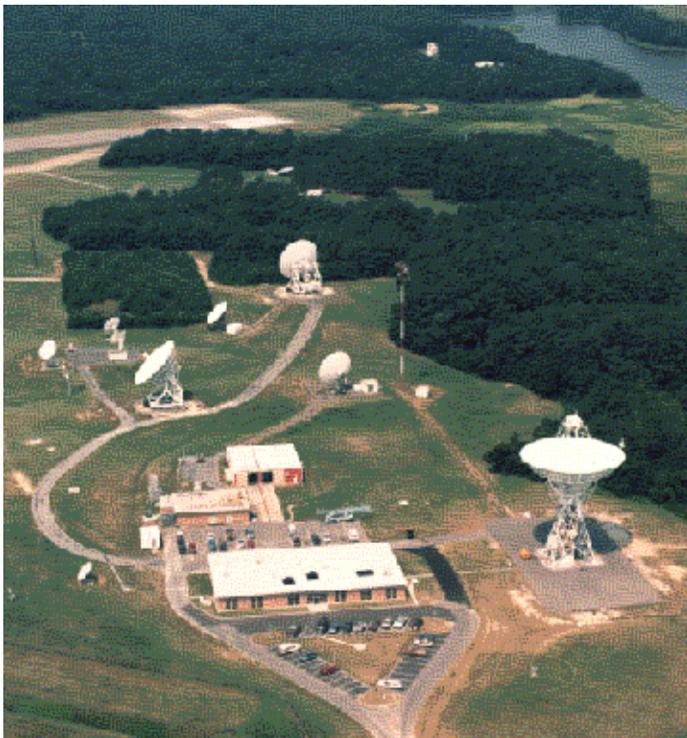
- **Target launch operations**
- **Aircraft development testing**



Wallops Partnership  
**NOAA at Wallops**



- **Home to NOAA's Command and Data Acquisition Station**
  - **Tenant of NASA/Wallops**
  - **Staff of ~100 personnel**



- **Primary mission:**
  - **Receive data from and transmit commands to NOAA meteorological satellites.**
- **Also provides testing and evaluation of new systems and techniques**

# Wallops RF Program

- *RF Hazards have been and continue to be a major concern for Personnel, the Public, and Ordinance Safety*
- *Our RF database was an evolution out of necessity with 30 – 40 evaluations performed annually*

*Hand Calculation*



*Spreadsheet*



*Database*

# Wallops RF Program

- ***Why move from a Spreadsheet to a Database***
  - ***Standardized form for inputting data***
  - ***Formulas reside in one location vs cells or fields***
    - ***Making global changes easier***
    - ***Less chance for errors***
  - ***Reports are flexible - they don't have to look like your entry form***
  - ***Query's have greater utility and complexity***
  - ***Data security***
  - ***Information can be transitioned from spreadsheet to database easier than from database to spreadsheet***
    - ***Spreadsheets can be used to test and validate formulas then imported into the database.***

# Wallops RF Program

*The Process for new or modified sources is initiated through the Frequency Manager*

***Frequency Manager:***

- ***Coordinate RF spectrum utilization planning for new and existing frequencies.***
- ***Evaluate requests for utilization of specific frequencies and make operational impact recommendations to the Director of SSOPD (this one includes collecting info from NOAA, SCSC, WFF TD and WFF Safety).***
- ***Investigate and attempt to resolve RF interference affecting operations at GSFC/WFF.***
- ***Coordinate frequency utilization activities with other spectrum users in the surrounding area.***
- ***Coordinate frequency utilization activities with other spectrum users in the US and territories.***
- ***Obtain/maintain radio frequency authorizations from NTIA when required.***

# Wallops RF Program

*User completes WFUMWG request form-*

**WALLOPS FREQUENCY UTILIZATION MANAGEMENT  
WORKING GROUP: FREQUENCY UTILIZATION REQUEST**





# Wallops RF Program (WFUMWG)

## WALLOPS FREQUENCY UTILIZATION MANAGEMENT WORKING GROUP

### FREQUENCY UTILIZATION REQUEST

IT IS REQUESTED THAT THE INDICATED FREQUENCY BE REVIEWED FOR USE AT THE GSFC/WFF.

1. FREQUENCY: **2790 - 2810 MHz**
2. ORGANIZATION:
3. PROJECT: **TRMM (Tropical Rain Measurement Mission)**
4. SPECIFY ALL COORDINATION REQUIREMENTS FOR AREAS OR ORGANIZATIONS OUTSIDE WALLOPS FLIGHT FACILITY:
5. SPECIFY ALL COORDINATION REQUIREMENTS FOR AREAS OR ORGANIZATIONS WITHIN WALLOPS FLIGHT FACILITY (NASA OR TENANTS): **Routine**
6. STATION CLASS: **SMD**
7. BANDWIDTH/EMISSION: **8M00P0N**

8. IF A FREQUENCY BAND IS REQUESTED, DOES SYSTEM OPERATE ON DISCRETE FREQUENCIES IN THE BAND, SPREAD SPECTRUM, FREQUENCY HOPPING, OR HOW? **Discrete**
9. ORGANIZATION/PROJECT CONTACT:
10. CONTACT PHONE NUMBER:
11. DESCRIPTION OF HOW FREQUENCY WILL BE USED, METHOD OF OPERATION, ETC.: **Pulsed radar, used for meteorological research.**
11. PERIOD OF USAGE, (INCLUDE OVERALL TIME FRAME, DAYS/WEEK, HOURS/DAY OF PROJECTED USAGE OR OTHER NARRATIVE DESCRIPTION): **Indefinite, primarily normal workdays and hours, but some usage on weekends and at night depending on project requirements.**

File No. 597A

## 10. TRANSMITTER DATA

- A. NOMENCLATURE: **Enterprise Electronics Corp. DWSR-8500S**
- B. LOCATION:
  - 1. **Bldg. U-20 tower**
  - 2. **Bldg E-134 tower**
  - 3. **On "Seatainer" near Bldg. E-134 Tower (Field Setup)**
- C. TRANSMITTER PEAK POWER OUTPUT: **850 Kw**
- D. TRANSMITTER AVERAGE POWER OUTPUT: **1020 watts**
- E. PULSE WIDTH: **0.8 us or 2.0 us (selectable)**
- F. MAXIMUM DUTY CYCLE: **0.0012 or 0.12%**
- G. PULSE REPETITION FREQUENCY: **250 pps - 1200 pps (duty cycle limited)**
- H. STABILITY: **3 parts in  $10^7$  (0.00003%)**
- I. ANTENNA TYPE: **Planar Array simulating parabolic reflector**
- J. ANTENNA HEIGHT ABOVE GROUND: **~47 ft. (on U-20 tower)  
~37 ft. (on E-134 tower)  
~30 ft. (on "seatainer")**

- K. ANTENNA POLARIZATION: **Dual Polarized (Simultaneous Horizontal and Vertical)**
- L. ANTENNA GAIN: **40 dB**
- M. ANTENNA, FIXED OR ROTATABLE: **Azimuth: 360°  
Elevation: -3° to 185°**
- N. ANTENNA, BEAM WIDTH - AZ: **1.5°**
- O. ANTENNA, BEAM WIDTH - EL: **1.5°**
- P. FIXED ANTENNA DIRECTION OF RADIATION: **NAP**
- Q. TRANSMISSION SYSTEM ATTENUATION LOSSES: **1 dB. approx.**
- R. ANTENNA LATITUDE AND LONGITUDE:
  - U-20 tower: 37°51'23"N; 75°30'41"W**
  - E-134 tower: 37°56'07"N; 75°28'23"W**
  - Seatiner near E-134 tower: ~37°56'07"N; ~75°28'23"W**

## 14. RECEIVER DATA

- A. NOMENCLATURE: **DWSR-8500S**

- B. LOCATION:
1. Bldg. U-20 tower
  2. Bldg E-134 tower
  3. On "Seatainer" near Bldg. E-134 Tower (Field Setup)
- C. STABILITY: 2.5 ppm (0.00025%)
- D. SENSITIVITY: -114 dBm
- E. ANTENNA TYPE: Planar Array simulating parabolic reflector
- F. ANTENNA POLARIZATION: Dual Polarized (Simultaneous Horizontal and Vertical)
- G. ANTENNA GAIN: 40 dB
- H. ANTENNA, FIXED OR ROTATABLE: Azimuth: 360°  
Elevation: -3° to 185°
- I. ANTENNA, BEAM WIDTH - AZ: 1.5°
- J. ANTENNA, BEAM WIDTH - EL: 1.5°
- K. FIXED ANTENNA DIRECTION OF PATTERN: NAP

L. ANTENNA LATITUDE AND LONGITUDE:

U-20 tower: 37°51'23"N; 75°30'41"W

E-134 tower: 37°56'07"N; 75°28'23"W

Seatainer near E-134 tower: ~37°56'07"N; ~75°28'23"W

15. HAS FREQUENCY ALREADY BEEN ASSIGNED TO ORGANIZATION BY NTIA OR FCC FOR AREA IN WHICH IT WILL BE USED? **Yes. Serial numbers NASA010002, NASA010003, NASA010006 and NASA010007.**

16. MISCELLANEOUS COMMENTS:

**This file is being reevaluated to add a third location (near the Bldg. E-134 tower). The radar will be setup on a "seatainer" as it is configured on the field.**

SIGNATURE

\_\_\_\_\_  
DATE

### **3. WFF Safety Office**

***Information received via Frequency Utilization Request is entered in the database to determine the following:***

***HERP (Hazards of Electromagnetic Radiation to Personnel)***

***HERO (Hazards of Electromagnetic Radiation to Ordinance)***

***Note: HERF (Fuels) are not performed***

***After Evaluation the following report is generated and becomes a part of the **WFUMWG*****

## RF RADIATION HAZARD EVALUATION

System/Equipment: **DWSR-85008**

FREQUENCY: 2790-2810 MHz

Comments, Restrictions, Etc.

### **HERP (Mainbase)**

The permissible exposure limit at the lowest proposed frequency is 1.9 mW/cm<sup>2</sup> for an uncontrolled environment like the Mainbase. The calculated hazard distance for a fixed antenna is 186 meters (611 feet) based on a 1020 watts max average power. If no controls are established to prevent continuous exposures, cut outs or limitations on minimum angle of depression shall be established to avoid potential over exposure to personnel interference problems within the buildings listed below.

Building	Range (ft)	Bearing Degrees true	Min Depression On Seatainer	Min Depression on E-134 Tower
E-107	552	351-11	2.5	1.75
E-108	475	345-8	2.7	1.9
E-134	27	265-15	-11.2	-24.5
E-144	414	276-280	0.1	-0.8
N-116	200	78-107	-1.5	-3.4
N-117	380	95-110	-.4	-1.5
Ground	611	Any	-1.1	-1.8

This calculation assumes a nominal 10-foot person on top of the building. A minimum depression angle of 2.7 (seatainer) and 1.9 (E-134 tower) protects personnel without regard to azimuth. Lower elevations, -1.1 (seatainer) and -1.8 (E-134 Tower), can be achieved with cutouts. Procedures to reduce potential exposure time could be used after approval by the Safety Office. These would require positive controls to be identified.

## **HERO (Mainbase)**

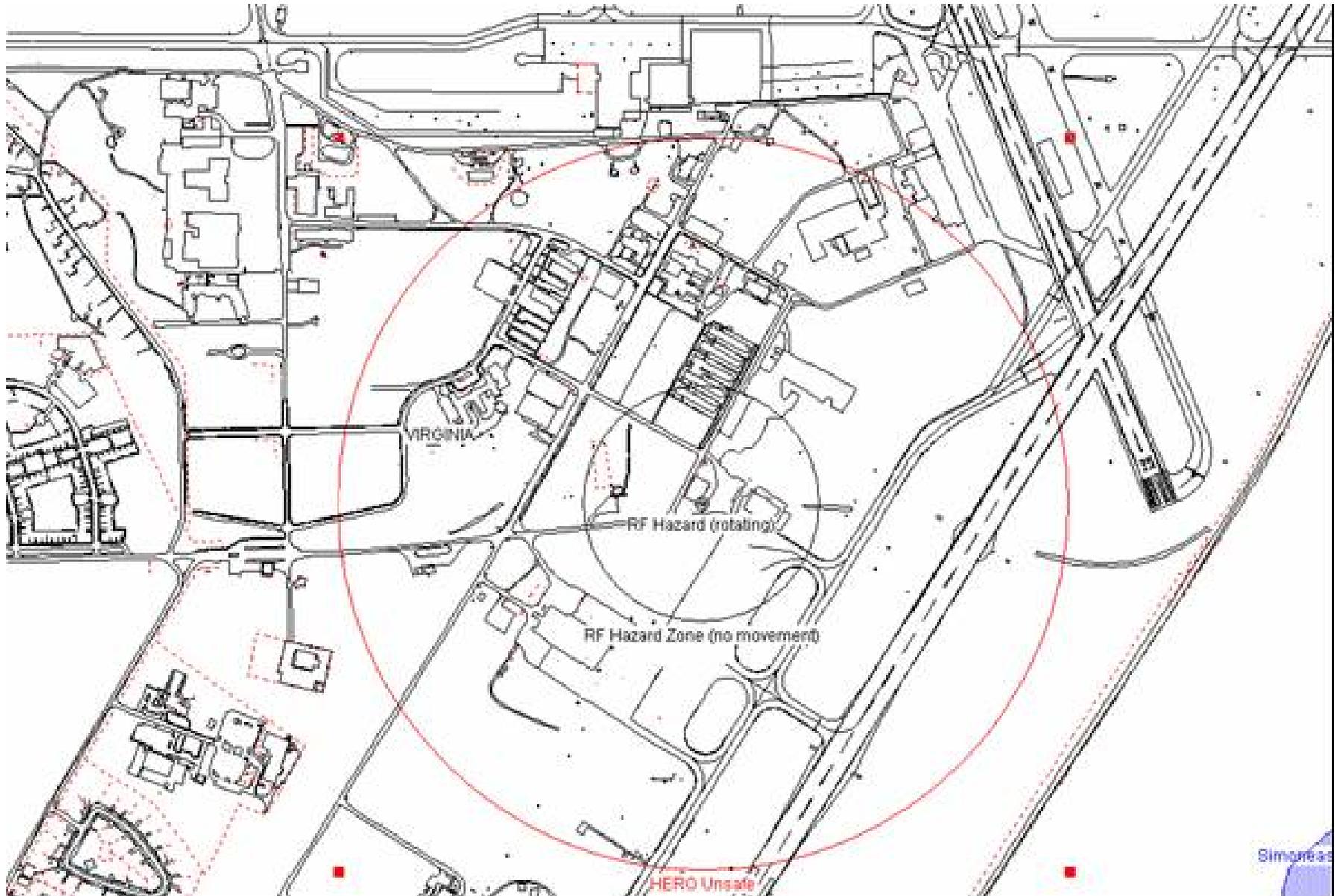
An RF hazard to ordnance exits out to about 575 meters (1888 feet) for HERO unsafe ordnance. The Ordnance hazard distance includes the ramp around N-159. Since aircraft carrying/installing ordnance devices may be in this area, the minimum depression angle must be to prevent more than  $0.19 \text{ mW/cm}^2$  in this area is 0.14 degrees elevation for bearing 126 thru 229.

No analysis has been done for interference with WOTS or NOAA.



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# WFUMWG (MARPLOT) Main Base



## HERP (ISAND)

The permissible exposure limit at the lowest proposed frequency is 9.3 mW/cm<sup>2</sup> for an controlled environment like the Mainbase. The calculated hazard distance for a fixed antenna is 83 meters (273.2 feet) based on a 1020 watts max average power. If no controls are established to prevent continuous exposures, cut outs or limitations on minimum angle of depression shall be established to avoid potential over exposure to personnel interference problems within the buildings listed below.

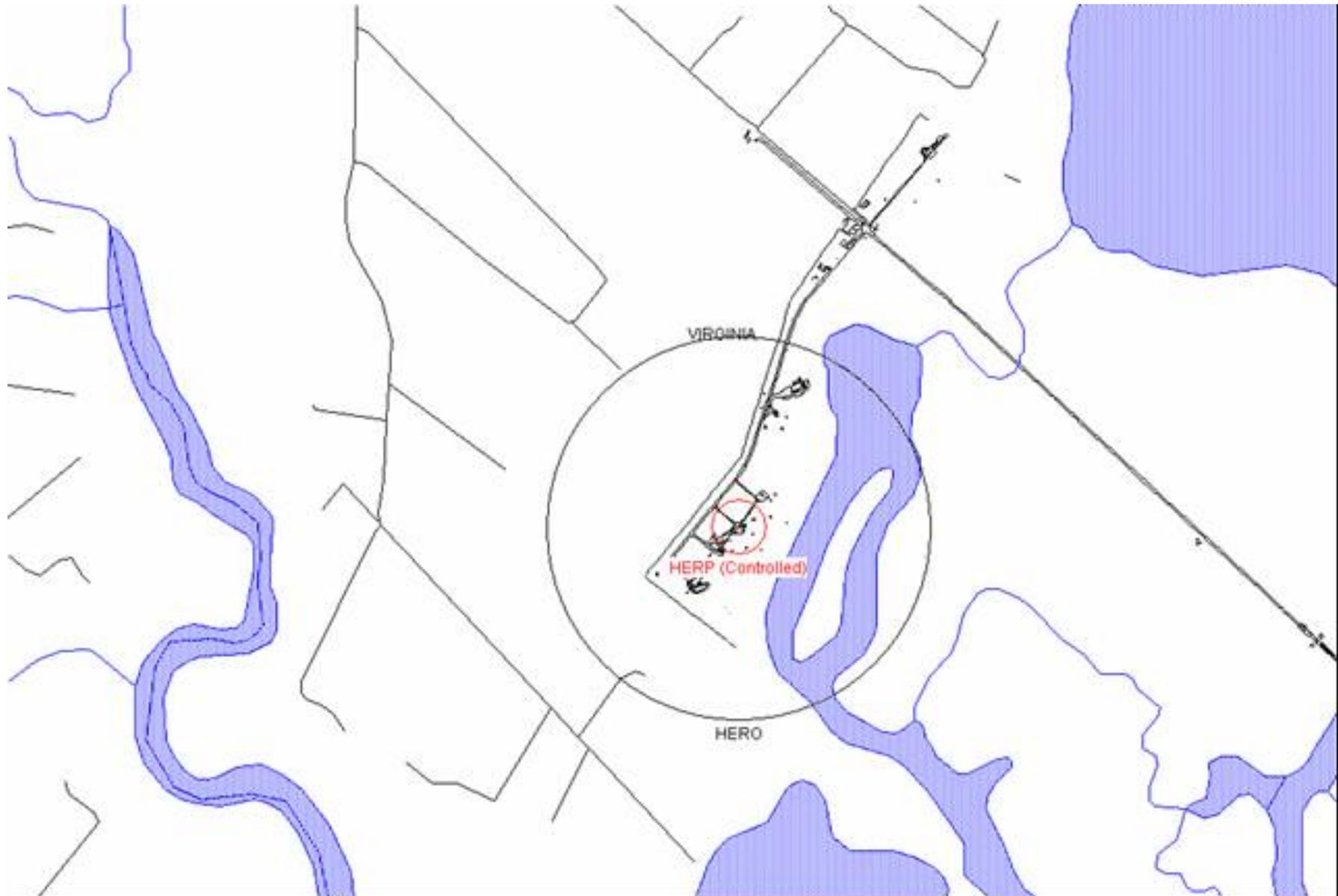
Building	Range (ft)	Bearing Degrees true	Min Depression On U-20 Tower
U-25	282	215-312	-3.4
U-26	247	287-292	-4.0
U-27	196	228-236	-5.3
U-30	598	216-222	-1.2
U-40	380	26-40	-2.3
Ground	273	Any	-7.0

This calculation assumes a nominal 10-foot person on top of the building. A minimum depression angle of -1.2 (U-40 tower) protects personnel without regard to azimuth.

## HERO (Island)

An RF hazard to ordnance exits out to about 575 meters (1888 feet) for HERO unsafe ordnance. This does not impact any normal explosives operations on the Island. See Drawing

# WFUMWG (MARPLOT) Mainland





# WFUMWG

No analysis has been done for interference with WOTS or NOAA.

This system/equipment and frequency are approved for use as requested without restrictions unless noted above.

RF Safety Officer  
NASA/GSFC/WFF

Date

File No. 597A  
Equipment Code NA282



# ***DATABASE***

## ***Wallops Flight Facility Radio Frequency Emitters and Safety Analysis***

### ***Database Formulas:***

- ***HERP is based on the IEEE STD***
- ***HERO is based on the OP 3565 modified (NAVSEA STD)***