



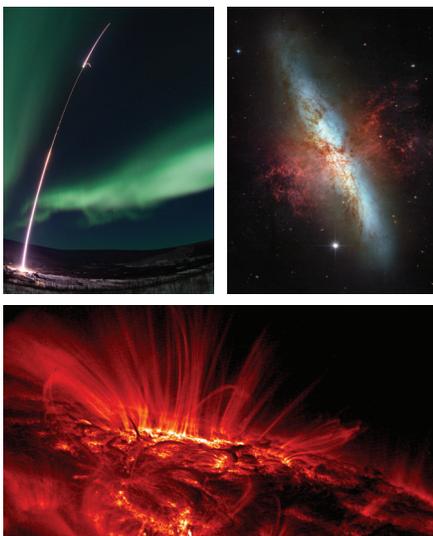
# Sounding Rockets

Sounding Rockets carry scientific instruments to altitudes of between 50 and 1,500 kilometers and fly in nearly parabolic trajectories, re-entering the atmosphere and impacting downrange from the launch site. NASA's Sounding Rockets Program (NSRP) is managed by the Sounding Rockets Program Office (SRPO), located at NASA Goddard Space Flight Center's Wallops Flight Facility. SRPO provides launch vehicles, payload development and field operations support to customers including NASA, academia and other government agencies.

Supported by NASA's Science Mission Directorate approximately 20 science missions are flown annually. Sounding rockets are used for all major science disciplines of interest to the agency, and include astrophysics, heliophysics, geospace physics, solar system exploration, and microgravity research. Additionally, sounding rockets are an optimum testbed for future space based instruments and are frequently used for technology development. With the fast mission turnaround time, as short as nine months, it is possible to fly a concept instrument on a sounding rocket to verify functionality before committing to the development of, more expensive, space based platforms.

## Science

Science missions focus on geospace research, solar physics, astrophysics and atmospheric studies. Auroral studies are often conducted with instruments that measure electron



Terrier-Black Brant sounding rocket takes-off.

densities and structures in plasma. These missions are flown from launch sites in the Arctic. Telescopes launched with sounding rockets are used for planetary, solar and astrophysics studies and are often flown from launch sites with land impact areas to facilitate recovery and reflight of the payload. New technologies for future satellite missions are tested with sounding rockets, allowing scientists to verify functionality of instruments prior to committing to a multiyear space mission. Sounding rockets are used for carrying and releasing re-entry test vehicles. The instrumented re-entry body transmits data on dynamic pressure, orientation, velocity and other characteristics of the flight. This research helps answer questions about landing probes on other celestial bodies, such as Mars or perhaps moons orbiting other planets in our solar system.

## Payloads

A sounding rocket payload consists of the instrument or experiment designed by the Principal Investigator, often a scientist from academia, NASA or other government organization. The science instruments require support systems for data transmission, alignment in space, and payload recovery among others.



Scientists preparing a telescope payload for pre-flight testing

The SRPO provides the support systems to complete the mission. The main support systems include telemetry systems for data transmission, Attitude Control Systems (ACS) to align the payload with a specific target in space and recovery systems to soften the impact on landing. Additionally a boost guidance system is sometimes used to control the path of the rocket during the initial 20 seconds of flight.

## Payload Manufacturing and Testing



Custom manufacturing capability.

Sounding rocket manufacturing is done by machinists and technicians at NASA Goddard Space Flight Center's Wallops Flight Facility. Extensive in-house manufacturing capability is necessary for a program with many customization requirements. The machine shop includes CNC milling machines, lathes, welders, sheet metal breaks/shears/rollers

National Aeronautics and Space Administration

Goddard Space Flight Center

Wallops Flight Facility

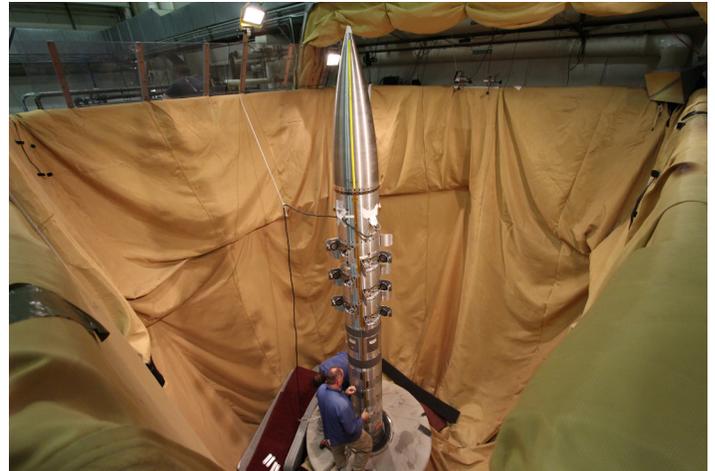
Wallops Island, VA 23337

<https://sites.wff.nasa.gov/code810/>

[www.nasa.gov](http://www.nasa.gov)

and additional tools/processes to support the mechanical needs of the program. Waterjet cutting machines enable fast manufacturing of small parts in large quantities.

The launch and flight phases of a sounding rocket impart high loads on the scientific payload. A rigorous test plan helps to ensure that a payload will survive the flight environment and continue working to successfully complete the mission. Testing includes vibration of the payload to flight levels, bend testing, deployment testing, and balancing. Thermal vacuum testing, optical alignments for telescopes, and magnetic calibration are additional tests and measurements performed according to mission requirements. Mass properties are measured for all payloads.



Deployment testing of sub-payloads.

## Worldwide Launch Sites

In order to accommodate science requirements sounding rockets are launched from several permanent, as well as, temporary sites worldwide.

Geospace science is often conducted in the Arctic region due to the high probability of Auroral activity. Several Arctic launch sites are available to the NASA Sounding Rockets Program, and include Andøya and Svalbard, Norway, Esrange, Sweden and Poker Flat Research Range, Alaska.

Telescopes, both for heliophysics and astrophysics, are most often flown from launch sites with land impact areas, such as New Mexico and Australia, to facilitate recovery of the payload. For astrophysics additional requirements must be met, i.e. the target for the study must be visible from the launch site. Southern hemisphere science targets are accommodated with launches from Australia.

