

# NASA Sounding Rockets

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, Virginia. SRPO provides suborbital launch vehicles, payload development, and field operations support to NASA and other government agencies.

To take a sounding means to take a measurement. Instruments on board sounding rockets take measurements in the atmosphere and in space. Sounding rockets carry experiments to altitudes between 50 and 1,500 km and fly in nearly parabolic trajectories re-entering the atmosphere downrange from the launch site.

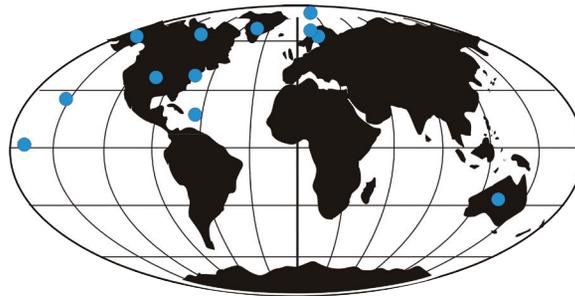
Science missions focus on geospace research, solar physics, astrophysics and atmospheric studies. Auroral studies are often conducted with instruments that measure electron densities and structures in plasma. These missions are flown from launch sites in the arctic. Telescopes launched with sounding rockets are used for planetary, solar and astrophysics studies.

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.

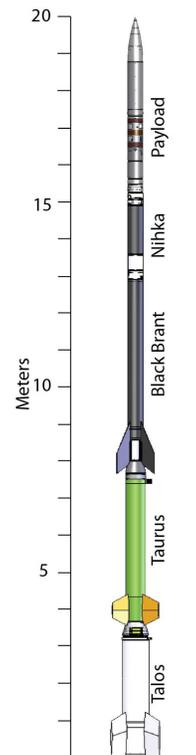
Sounding rockets are used for carrying and releasing re-entry test vehicles. The instrumented re-entry body transmits data on dynamic pressure, orientation, velocity and other characteristics of the flight. This research helps answer questions about landing probes on other celestial bodies, such as Mars or perhaps moons orbiting other planets in our solar system.

The hands-on approach to instrument design, integration and flight, as well as the short mission life-cycle, provides opportunities for the next generation of space scientists and engineers. Students are often involved through participation in the science missions or through dedicated education missions supported by NASA.

Approximately 20 missions from sites worldwide are launched annually. Mobile operations enable scientists to conduct research from strategic vantage points. Frequently used launch sites include Poker Flat, Alaska, White Sands Missile Range, New Mexico, Wallops Island, Virginia and Andoya, Norway.

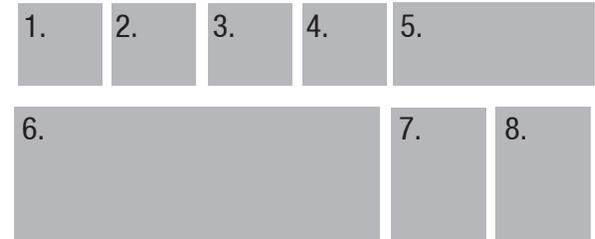


Sounding Rocket launch sites



NASA uses several different sounding rocket configurations, the smallest is a single stage, or single rocket motor Orion and the largest is a four stage Black Brant XII, shown here. After a motor burns out, it is dropped from the stack, reducing the mass that the next stage has to lift. The next stage then ignites and carries the payload higher. This sequence of events is repeated until all the motors are expended. The payload separates from the final stage and science operations are conducted. When the experiment is completed, the payload re-enters the atmosphere. When recovery of the experiment is required a parachute is deployed allowing a gentle landing. Floatation devices are used to keep experiments afloat when launches occur over water.

## ABOUT THE IMAGES



1 - 4 depict the types of missions supported by sounding rockets and include 1. Geospace Science, credit Lee Wingfield NASA/WFF 2. Heliophysics, credit SOHO 3. Astrophysics, credit: NASA, ESA, S. Beckwith (STScI), and The Hubble Heritage Team (STScI/AURA) 4. Technology, credit Sean Smith/NASA LaRC.

5. This is a graphic representation of a four stage Black Brant XII trajectory profile. Expended stages are dropped as they burn out and fall back to Earth. The payload deploys instruments to collect scientific data. The payload also re-enters the atmosphere and impacts downrange from the launch site.

6. The graphic shows the current fleet of sounding rockets in use by NASA's Sounding Rockets Program. New vehicles are developed when new rocket motors become available, either as surplus from other government agencies or developed by industry. Vehicle numbers indicate the order in which the vehicles were taken into use. NSROC Solid Works drawing.

7. Payloads are tested prior to flight to ensure that the scientific instruments and all support systems will survive the flight environment. The image shows scientists and engineers working on testing instrument deployments at NASA's Wallops Flight Facility. NASA Photo.

8. A four stage Talos-Terrier-Oriole-Nihka launched from Wallops Island, VA, September 22, 2012. NASA Photo.

## FOR THE CLASSROOM

Build and launch a model rocket. How does the flight profile compare to that of a sounding rocket?

Research Newton's three laws of motion. How do they apply to rocketry?

## FOR MORE INFORMATION

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