NASA Facts

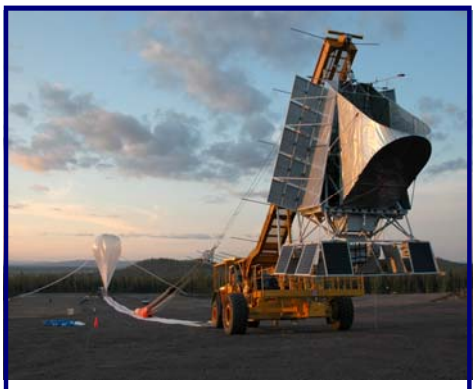
National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility, Wallops Island, Va.

NASA Balloon Program

The National Aeronautics and Space Administration (NASA) Balloon Program is managed by the Suborbital and Special Orbital Projects Directorate (SSOPD) at Goddard Space Flight Center, Wallops Flight Facility and it primarily supports space and Earth science research activities. Scientific ballooning has made important contributions to NASA's science program. It has contributed directly with important science results and indirectly by serving as a test platform for developing instruments that are subsequently used on NASA spacecraft.

What are NASA scientific balloons?

NASA scientific balloons are very large structures made of a thin, 0.8 mil thick, polyethylene film, about the same thickness as an ordinary sandwich wrap. The structure is assembled from gores shaped like "banana peels". For the commonly used 40 million cubic feet (1.13 x 10^6 m^3) balloon, each gore is approximately 660 feet (183 m) long and 9 feet (3 m) wide at the mid point. Heat is used to seal hundreds of gores together to make up the final structure. All of the seals also include load tapes for supporting the suspended payload. When fully inflated, scientific balloons range up to 460 feet (140 m) in diameter and 396 feet (121 m) in height.



Scientific Payload

The flight system at launch includes a balloon, a parachute and a payload that includes the scientific instrument for an experiment. Scientific balloons can carry a suspended load weighing as much as 8,000 pounds (3600 kg) to an altitude of 120,000 feet (37 km). Higher altitudes can be achieved with lighter payloads. Balloons have been used to conduct scientific studies for decades. Balloons have always offered great flexibility for payload design and weight, as well as reduced mission cost. While the basics of ballooning remain unchanged, balloons have increased in size, allowing for heavier lift capabilities, with greater reliability.

Why use a balloon for scientific investigations?

Balloons offer a low-cost, quick response method of performing scientific investigations in the near space environment above about 99.5% of the Earth's atmosphere. Balloons can typically be launched from where the scientist needs to conduct an experiment and they can be ready for flight in as little as six months.

NASA Scientific Balloon Prior to Launch

Experiments flown on balloons provide information about the atmosphere, the universe, the Sun, and the near-Earth space environment. Balloons also are used as a test platform to qualify and calibrate new instruments and subsystems prior to their use in more complex or expensive missions.

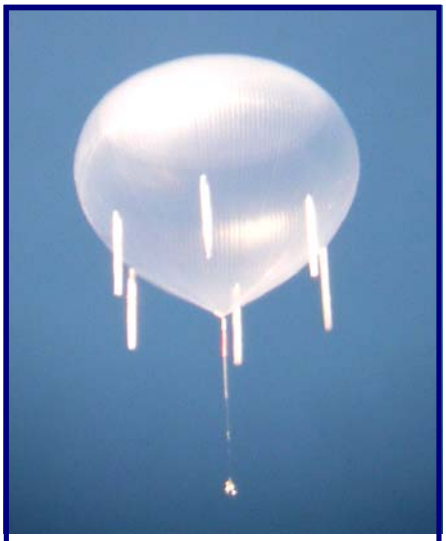
Balloons play a major role in education. Over the years, experiments flown on scientific balloons have helped develop future scientists. It is possible for undergraduate and graduate students to design and conduct a balloon based scientific study within the length of time it takes them to complete a two to five year graduate degree program. University professors are developing many of the current scientific balloon payloads with team members from the graduate and undergraduate student body.

Antarctica Launch

How are scientific balloons launched and operated?

The balloon flight mission is unique. The balloon is partially filled with helium and launched with the payload suspended beneath it. As the balloon rises, the helium expands and fills the balloon until it reaches full deployment. Two to three hours after launch, the balloon will reach peak altitude. As the balloon drifts across the sky, the experiment package in the payload gathers scientific data. When the experiment is complete, a radio command is sent from a ground station to separate the payload from the balloon. This creates a tear in the balloon material, destroying the balloon and causing it to begin falling back to Earth. A parachute then opens and floats the payload back to the ground. Recovering the payload allows the experiment package to be reused on another flight. NASA presently supports approximately 20 scientific balloon launches annually with a success rate in excess of 92 percent.

NASA currently flies conventional and long duration balloon missions (LDB) missions using so-called zero pressure balloons. Typically, a conventional balloon flight will last from 6 to 36 hours, while a LDB flight can last up to several weeks. These zero-pressure (vented) balloons are launched partly inflated, and they expand as they rise. Some of their gas is vented through vent ducts as daytime temperatures rise in the stratosphere, causing the balloon to expand up to its maximum design volume. As night approaches, the remaining gas shrinks, causing the balloon volume to decrease and the balloon to descend for thousands of feet. In order to stay aloft at the mission target altitude, the balloon system drops ballast. As a result, payload weight management is a major design driver, because the longer the flight, the more ballast is needed to maintain a desired altitude.



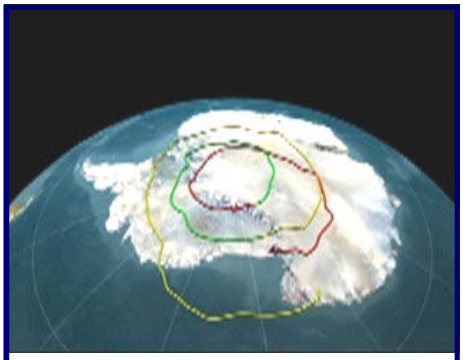
Balloon at Float

Balloons are presently launched from NASA sites in Palestine, Texas, and Ft. Sumner, New Mexico, as well as from remote sites in the United States, Canada, Australia, Sweden and Antarctica. Antarctica is a premier flight location because LDB flights have flown for up to 42 days during the Antarctic Austral Summer. During this time, the balloons experience less severe diurnal changes than those encountered at mid-latitudes. The constant sunlight allows observation of the Sun for a full solar rotation, and the orientation of Earth in space allows valuable celestial observations.

What science is done with balloons?

Balloon payloads are becoming more complex and more sophisticated, in many cases resembling spacecraft. However, balloon missions can be flown for a fraction of the cost of a satellite.

Balloon science instruments range from telescopes that cover a wide range of the electromagnetic (light) spectrum to spectrometers that detect and quantify cosmic particles, as well as, new and advanced subsystems for calibration, testing and validation purposes.



Record 42 Days Over Antarctica

Balloons support several science disciplines including IR/ Sub-mm Astrophysics, particle Astrophysics, Gamma Ray/X-Ray Astrophysics, Geospace Sciences, Solar & Heliospheric Physics, and Upper Atmosphere Research as well as Special Projects and Test Flights.

Balloons also provide an excellent platform for parachute and vehicle drop tests, aerodynamic performance research and many other applications in support of NASA's exploration vision.

The NASA Balloon Program Office (BPO) located at Goddard Space Flight Center's Wallops Flight Facility has managed the scientific balloon flight program since 1982.

The BPO manages the flight operations in support of scientific investigations sponsored by the NASA Science Mission Directorate, as well as other reimbursable government, commercial, and international agencies.

The BPO administers the operations support contract with the Physical Sciences Laboratory of New Mexico State University to operate the Columbia Scientific Balloon Facility (CSBF) located in Palestine, Texas. The CSBF conducts balloon launches worldwide and provides the operations needed to implement NASA's flight requirements.

For more information on NASA scientific balloons, contact David Pierce, Chief, Balloon Program Office at (757) 824-1453 or visit: www.wff.nasa.gov/balloons

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