

NASA Goddard Space Flight Center, Wallops Flight Facility Suborbital Carriers to Support Science and Technology

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Abstract

NASA, through the Goddard Space Flight Center's (GSFC) Wallops Flight Facility (WFF), conducts a robust program using suborbital carriers to conduct science investigations and advance technology readiness. Sounding rockets, balloons and manned/unmanned aircraft are deployed worldwide to "go where the science is" and fly *in situ* experiments to collect requisite data as part of an overarching science mission. The low-cost of these platforms and the ability to deploy them quickly, allows principal investigators to set up at a location and wait for the proper science conditions to come to them. The platforms also provide flight opportunities to space and near-space conditions enabling technology advancement of new instruments and spacecraft components. The utility of the carriers will provide a key test bed for such components as NASA executes its flagship Artemis initiative in the coming decade.

The NASA/GSFC/WFF Suborbital Program

WFF began in 1945 as a post-WWII naval base to test supersonic aircraft design. By the time NASA took over in the 1950s, WFF became the preeminent location for testing elements of spacecraft to be used for human space flight leading up to the Apollo program and the 1969 Moon landing. After Apollo, programs using suborbital carriers to conduct science and technology missions ensued and continue to this day. Over its 75-year history, WFF has completed tens of thousands of missions from every corner of the Earth, providing critical data for the advancement of science & technology in the disciplines of astrophysics, heliophysics, Earth and planetary science, as well as human space flight. The suborbital program at NASA also provides many other tangible benefits, not the least of which includes providing fertile ground to develop the skills of young engineers and scientists on smaller, hands-on suborbital missions in preparation for the

larger multi-year flagship missions they will lead as their careers develop.

Suborbital Platforms in Use Today

NASA uses sounding rockets, balloons and aircraft as part of its suborbital arsenal. Sounding rockets come in an array of sizes and can support smaller experiments in space for short duration missions with apogees up to 1,500 km. Balloons range from very small to very large and can support suspended payloads up to 8,000 lbs. in near-space environments for up to 100 days. Aircraft – both manned and unmanned – can support small to large payloads in atmospheric environments from the surface to ~70,000 ft. Other flight opportunities exist to use a platform as a dedicated mission or fly as a "piggyback" tagalong on an approved mission.

Conclusions

The NASA suborbital suite of carriers (sounding rockets, balloons and manned/unmanned aircraft) provide a low-cost, rapid response capability to conduct world-class science and the ability to advance technology readiness in a rapid prototype environment. The robust nature of these carriers and the broadness of their application can play a key role in advancing science and technology as part of NASA's Artemis program to go to the Moon and onward to Mars over the next decade.



Figure Inset: A composite photo of two BlackBrant IX sounding rockets launching from Kwajalein on June 19, 2019, for the Waves and Instabilities from a Neutral Dynamo 2 (TooWINDY) mission (PI: Hysell)