NASA Balloon Program Overview

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Abstract
The National Aeronautics and Space Administration (NASA) Balloon Program Office (BPO) offers low-cost access to near space for the science community. The science community's needs continue to broaden, and the BPO has evolved to support this by providing enhanced capabilities across a spectrum of disciplines. The Program supports heliophysics, gamma-ray/x-ray, planetary, particle astrophysics, infrared-submillimeter, upper atmosphere, test flights, and student flight projects. A broad overview of the NASA Balloon Program that touches on key highlights, including launch locations, standard systems, and development efforts, will be presented. In addition, the COVID-19 impacts on the Program, the return to the flight path, and the campaigns conducted since the coronavirus outbreak will be discussed.

Operations
The Program traditionally launches balloons from remote locations in the southwestern United States, southern New Zealand, Antarctica, and northern Sweden. The Program launches balloons that can carry a suspended load of 3600 kg, up to 48 km, for hours or months, depending on the specific location and launching configuration.

The worldwide outbreak of COVID-19 in early 2020 resulted in the cancellation of campaigns in Fort Sumner, NM (fall 2020), Wanaka, New Zealand (spring 2020), McMurdo, Antarctica (winter 2020-2021), and Palestine, TX (summer 2020). Impacts from COVID-19 occurred not only at the NASA Balloon Program level but also among science teams, resulting in at least thirteen postponed flights.

BPO did continue domestic launch operations again with spring and fall Fort Summer, NM campaigns, with ten successful balloon launches for twenty science missions in 2021. Calendar year 2022 saw its first international campaigns since COVID-19 at Wanaka, New Zealand and Esrange, Sweden (as well as Fort Sumner, NM and McMurdo, Antarctica) with a total of nine successful balloon launches for nineteen science missions. This year promises to be an even busier year with campaigns currently scheduled for Wanaka, New Zealand, Palestine, TX, Fort Sumner, NM and McMurdo, Antarctica with a manifest that projects twenty-one balloon launches for twenty-five science missions. The manifest this year is especially large, due to continued postponements from science teams, likely still held up by COVID-19 or supply chain impacts, as well as operations challenges with BPO and its partners.

Technology Development
The technology development portfolio for the Balloon Program is focused on supporting the needs of the scientific community. Given these flights' remote location and long-duration nature, over-the-horizon communications via satellite are critical. Several current projects are exploring the options of low power, low latency, and high bandwidth communications, including using state-of-the-art optical wavelengths. The primary goals for technology development over the next decade include:

- Completion of the qualification of the 18.8 MCF Super Pressure Balloon
- Study of the use of hydrogen as a lifting gas
- Increasing the available science mass through light-weighting, standardization, and modernization of support equipment
- Pushing the state-of-the-art for solar panels, battery chemistries, and high data-rate telemetry

Conclusions
NASA’s BPO provides low-cost, easy-access to the edge of space for a variety of science missions every year. Through various platforms like the Wallops Arc Second Pointer (WASP), the Super Pressure Balloon (SPB) vehicle, and the High-Altitude Student Payload (HASP) program, BPO fills a much-needed gap in capabilities for science groups around the world. The program continues to provide innovative solutions to meet the needs of the next generation of balloon scientists, with plans to expand and grow throughout the next decade.

Figure 1: Checking compatibility for a test flight in Fort Sumner, NM (left) and a zero-pressure balloon is inflated for flight from Esrange, Sweden (right).