2017 Scientific Ballooning Technologies Workshop

NASA Super Pressure Balloon

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Two Types of Balloons

Super Pressure Balloon maintains nearly constant volume – *under development*
- Allows Ultra Long Duration Balloon (ULDB) Flights
- Provides stable altitude Long Duration Balloon (LDB) flights at mid-latitudes

Zero-Pressure (ZP) Balloon changes volume due to radiative input
- Used for Conventional Flights and Polar LDB Flights
Altitude Stability Comparison

Flights from Antarctica

GPS Altitude Variation from Average Float Altitude (m)

Days at Float

-2,000 -1,500 -1,000 -500 0 500 1,000 1,500

Super Pressure

Zero Pressure

615N BLAST, +1,429 m -1,910 m
616NT Super Pressure Balloon, +212 m -182 m
Several science groups are requesting a suspended weight of 5,500 pounds on the 18.8 MCF; therefore, some future test flights will have higher suspended weights when appropriate.
Mid-Latitude Location for SPB
Wanaka, New Zealand

- Far Enough North
- Far Enough South
- Airport Location
- Geography
- Low Populations
- Stratospheric Trajectories
- Infrastructure
- Accommodations
Environmental Considerations

- WFF Completed a Biological Evaluation and Environmental Assessment for SPB (ULDB) Program Southern Hemisphere Flight Operations covering Antarctica and New Zealand-launched SPBs.
- The Program received a Finding Of No Significant Impact and has received approval from NASA and concurrence from NOAA and NSF to proceed with Operations.
- The stratospheric anticyclone over Antarctica provides a stable balloon trajectory, once the anticyclone breaks down trajectories are highly variable.
- Increased operational area (more northern latitudes) for 2017 mission.
- In the event of ocean termination, the entire balloon system will be valve downed to the water surface and submerged.
Safety Considerations

- Trajectory Analysis Pre-Launch
- Airport Closed During Launch Operations
- Roadblocks
- Go-No Go prior to Land Mass
- Go-No Go ~ every 24 hour when over land
• Wanaka team will monitor and support flight from launch pre-ops to end of LOS
• Palestine Operations Control Center will be online at launch and take over after leaving LOS capabilities in Wanaka
• SPB team will monitor the entire flight remotely
• Palestine Operations Control Center will be manned 24 hours from launch until termination
• Science typically monitors from home institution
• Launch Site: Wanaka, New Zealand
• Volume: ~532,152 m$^3$ (~18,793,000 ft$^3$)
• Launch Date: May 16, 2016 @ 23:35 Z
• Suspended Load: 2,268 kg (5,000 lbs.)
• Flight Time – 46 Days, 20 hours, 19 minutes
Lowest Altitude During Flight ~ 22 km Due to Loss of Gas During Flight.

669 NT SPB-COSI
Launched: 16 May 2016 / 23:35:00Z
Impact: 2 July 2016 / 19:54:00Z
Total Flight Time: 46 days, 20 hours, 19 minutes
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The Balloon Performed as a Hybrid – SPB During Day – ZP at Night Later in the Mission.
• Launch Site: Wanaka, New Zealand
• Volume: \(~532,152 \text{ m}^3 \approx 18,793,000 \text{ ft}^3\)
• Launch Date: April 24, 2017 @ 22:50 Z
• Suspended Load: 2,495 kg (5,500 lbs.)
• Flight Time – 12 days, 4 hours, 34 mins
• Flying the Extreme Universe Space Observatory (EUSO) as a Mission of Opportunity
2017 - 18.8 MCF SPB
Note: Initially, 1200 pounds of ballast – dropped over 1100 pounds of it in drops on 4/29, 4/30, 5/1, 5/3, and 5/6.
• Inflated volume = 18.8 million cubic feet
• Number of Gores = 280
• Number of Gore Width Measurements = 6,440 (23 per gore)
• Amount of Load Tape Tendon in Balloon = 137,760 feet (26 miles)
• Amount of film visually inspected, re-rolled and dispensed for this balloon > 1.3 million square feet - over 30 acres of film
• Minimum amount of walking just to seal balloon = 55 miles
• Balloon shipping box 16 ft. x 6 ft. x 5.3 ft.
• Gross Weight of Balloon in Box = 8,832 pounds