



Scientific Balloon Missions of Opportunity

Debra A. Fairbrother, Chief, NASA Balloon Program Office

Conventional Balloon Missions

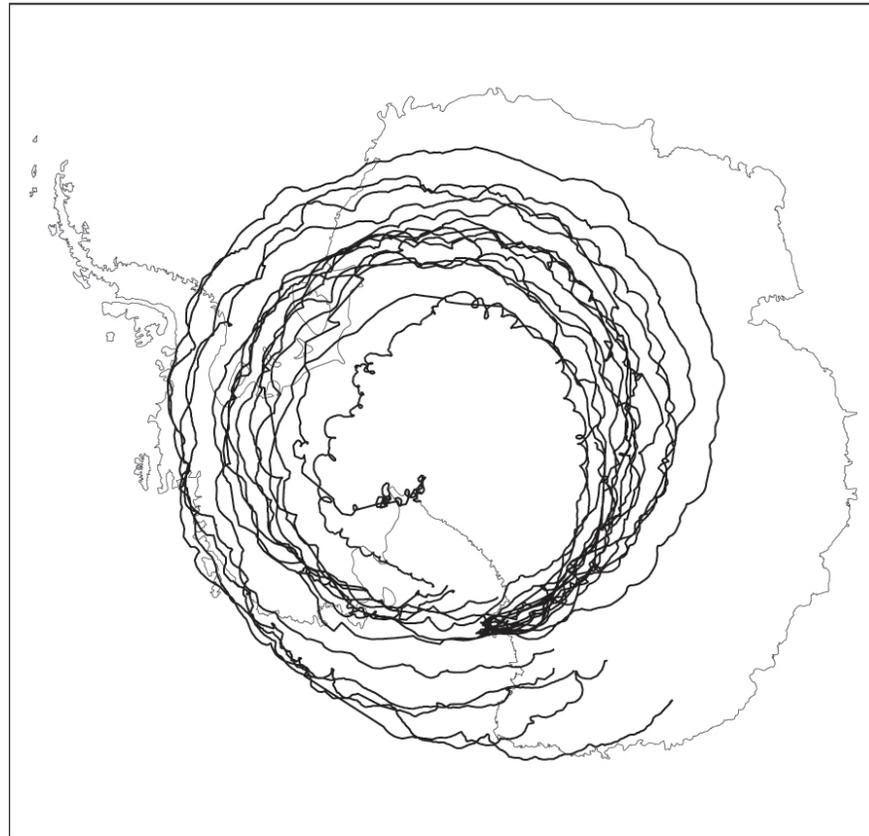
- NASA supports “conventional” missions launched from Fort Sumner, NM and other locations world-wide depending upon requirements.
- “Conventional” missions are those that are maintained within line of sight of the launch site or via downrange stations and typically last a few hours to typically less than forty eight hours duration.
- Conventional missions are supported with the Consolidated Instrument Package (~26 kg) or the Micro Instrument Package (~12 kg), both of which support up to about 500 mbps return data bandwidth.
- NASA supports conventional missions from Fort Sumner during spring and fall around the stratospheric wind turnaround periods. Other conventional mission launch sites supported on case by case basis (contact Balloon Program Office.)

LDB/ULDB Missions - Antarctica

- 2-3 LDB Missions Launched Annually From McMurdo, Antarctica.
- Durations upwards of 42 days, 21 days nominal. Determined by time of launch and NSF resources for support and recovery.
- Launch window first of December through January 10, each year.
- Arrive on site to perform pre-flight preparations October 25 – February 15.
- Proposers should plan two-three personnel to support recovery at end of flight.
- Payload and balloon recovery planned same year as flown but circumstances can preempt this where recovery can't be accomplished until the following year
- Additional detailed information for planning of LDB support is available on CSBF Web Site:

<http://www.csbf.nasa.gov/docs.html>

Antarctica LDB Trajectories - Composite



Antarctica Balloon Launch Facilities



ULDB New Zealand Balloon Launch Site

- The BPO is pursuing a new launch site location from Wanaka, on the south island of New Zealand.
Latitude 44.7S Longitude 169.1E
- Wanaka appears to be an excellent location from a Ground and Flight Safety standpoint
- A second Southern Hemisphere launch site for SPB missions.



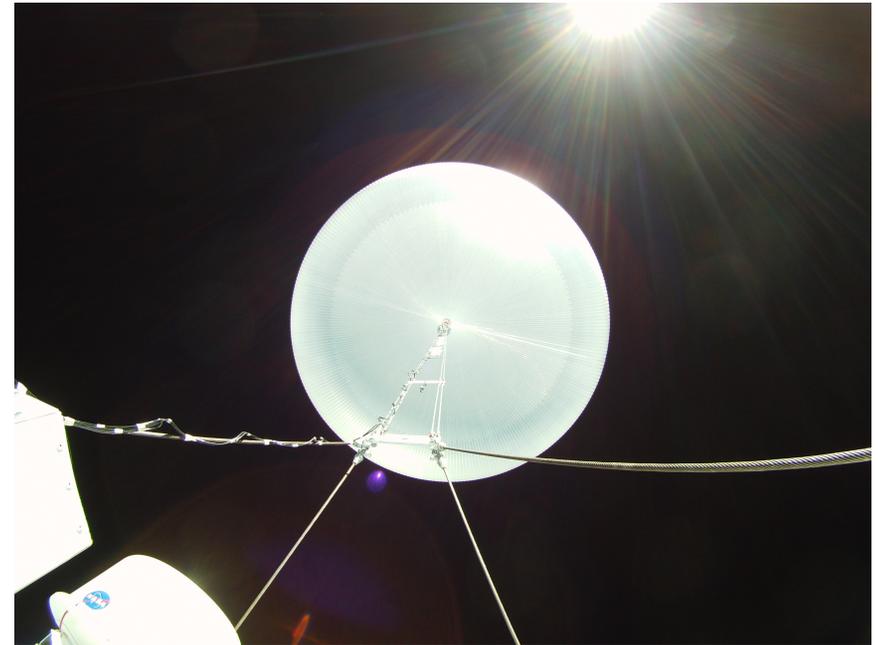
Typical ZP Balloon / Altitude Capabilities

- 28 MCF Balloon
 - Carry 4000 lb science (1814 kg) to 120,000 feet nominal altitude
- 34 MCF Heavy Lift Balloon
 - Carry 5000 lb science (2268 kg) to 117,000 feet nominal altitude
- 40 MCF Balloon
 - Carry 4000 lb science (1814 kg) to 126,000 feet nominal altitude



Super Pressure Balloon Capability

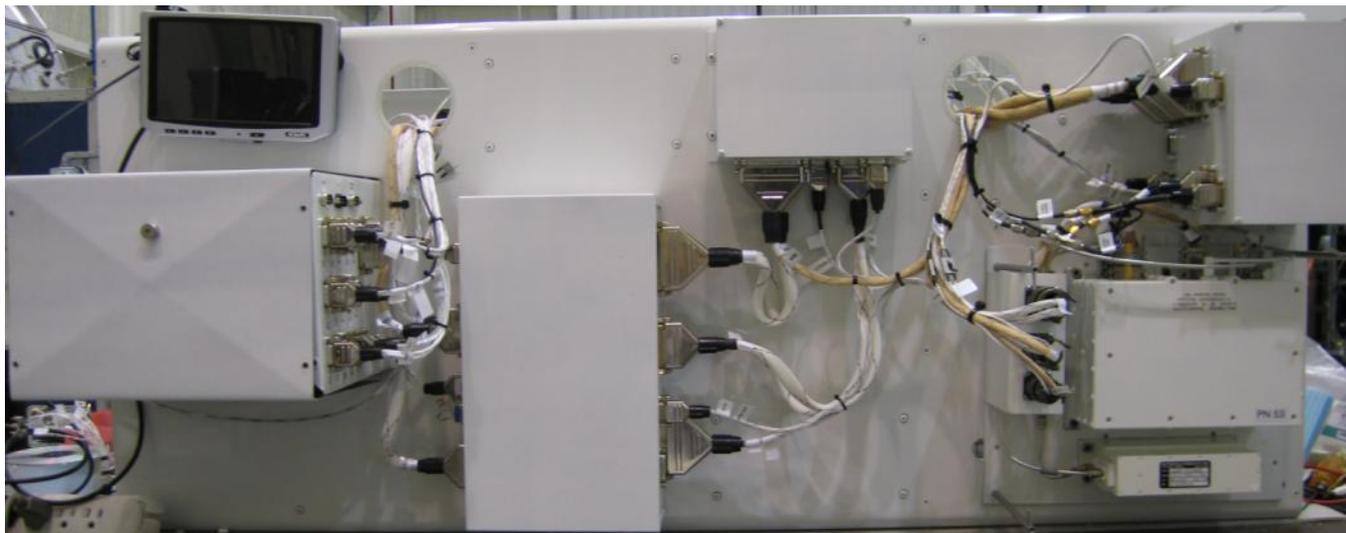
- The Super Pressure Balloon Development has been a stair step development . The 18.8 MCF is the mid-range Super Pressure Balloon for Science that is intended to be qualified for Explorer type missions.
- Science allocation mass dependent upon specific mission profile. (~3,000 to 3,500 pounds)



Volume	Flight Number	Launch Date	Suspended Weight	Altitude	Duration
7 MCF	591 NT	Dec 28, 2008	1,500 Lbs	110 KFT	54 days
14.9 MCF	616 NT	Jan 9, 2011	4,000 Lbs	110 KFT	22 days
18.8 MCF	631NT	Aug 14, 2012	5,000 Lbs	110 KFT	6.5 hours
26 MCF			4,000 Lbs	117 KFT	

LDB Flight Systems Support Instrument Package (SIP)

- Two Communication Links (COMM Links):
TDRSS and IRIDIUM
IRIDIUM Backup Navigation (MIP Based)



SIP TDRSS Support

- Commanding via TDRSS (OCC only), IRIDIUM (crossover from COMM2), and LOS.
- Return TM via TDRSS (COMM1) – while within view of satellite.
 - 255 “low rate science” bytes every 30 seconds.
 - 255 “science stack” bytes every 30 seconds.
 - 6 kbps “real-time high rate science” data.
 - Science data received by LDB flight system logged to LDB hard disk.
 - Receive TDRSS data at OCC in Palestine.
 - Possible for higher return rates (150 kbps) using high gain antenna.



LDB TDRSS Planning & Configuration

- Command from the OCC at Palestine.
- Command to TDRSS COM1 via LOS at the ROCC.
- Command to TDRSS COM1 via IRIDIUM crossover command.
- Availability

Analysis indicates at 90 degrees south latitude, link availability is at least 6 hours per day.

Flights as far as 85 degrees south, usually 3-4 hours loss per day.



SIP IRIDIUM Support

IRIDIUM (Science required to implement):

- Commanding via Iridium (OCC only), TDRSS (crossover from COMM1), and LOS.
- Return TM via IRIDIUM (COMM2).

255 “low rate science” bytes approximately every 15 minutes.

255 “science stack” bytes approximately every 15 minutes.

Science data received by LDB flight system logged to LDB hard disk.

Receive Iridium data at OCC in Palestine.



SIP Science Options

- Two Low Rate Science ports (one per COMM system):
 - Downlink telemetry, uplink commanding.
 - SIP data - GPS position and time, MKS pressure.
- One High Rate Science port (TDRSS COMMLINK).
- Science Stack (control and TM) providing:
 - Analog and Digital channels.
 - Command outputs.
 - Optically isolated and powered by Science.
- L/S-band return LOS TM link.
 - LDB: L-Band (1453.5 MHz) only used during Termination (SIP TM via TDRSS & Iridium)
 - Science: S-Band (2382.5 MHz), Science LOS Data.



LDB Ground Stations

- Two Science ports each to the LDB OCC and ROCC computers.
 - Data port at 19,200 baud.
 - Commanding port at 2400 baud.
- Analog recording of all L/S-band LOS data.
- Logging of the following:
 - TDRSS data at OCC.
 - Iridium data at OCC.
 - Commands received from Science and sent at ROCC and OCC.



Ultra Long Duration Balloon Missions

- NASA encourages experimenters to be able to show that they can achieve their science using existing zero pressure (ZP) NASA qualified balloons for LDB missions.
- NASA is still working to fully qualify the Super Pressure Balloon (SPB) for support of missions up to 100 days duration. Recently demonstrated successful deployment of 18.8 MCF SPB which supported 5,000 pounds suspended to 110,000 feet.
- Given that the SPB has the potential to become a qualified vehicle during the lifetime of this proposal initiative, experimenters wishing to fly extended durations using a SPB, should discuss how their science will be enhanced beyond that which can be achieved using only ZP balloons.

NASA Provides:

- Overall management of the balloon flight program
- Project planning support and management
- Conduct Project Initiation Conference, Mission Readiness Reviews
- Approve the mission for flight
- Authorize financial expenditures
- Maintain Inter-Agency Agreements
- Request BRA analysis and coordinate with the WFF Safety Office when required
- Request Nuclear Launch Safety Approval (NLSA) per NPG 8715.3
- Works with NASA Safety to coordinate Ground Safety and Flight Safety.
- Solicit customer feedback

NASA Provides via CSBF:

- Technical support for project formulation, planning, & preparation
- Flight and ground support systems, including integration, testing and safety
- Balloon vehicle
- Launch support systems
- Coordinate launch site facilities
- Adhere to flight safety criteria
- All flight operations support elements
- Requirements reviews, flight readiness reviews, and post-flight reviews
- Mechanical certification of all flight hardware including pressure vessels

Typical LDB/ULDB Balloon Mission Timeline:

- Submit CSBF Flight Application Form two years prior to planned mission.
- NASA/WFF led Project Initiation Conference one year prior to mission.
- Pre-Deployment I&T with CSBF support systems 6 months prior to mission.
- Arrive launch site and commence pre-flight readiness preparations 2-4 weeks prior to planned launch date.
- Antarctica requires 6 month lead times for processing of personnel planning to travel to Antarctica.

First Point of Contact for Proposers Seeking BPO Support:

- Contact the NASA Balloon Program Office
Ms. Debora Fairbrother
Chief, Balloon Program
Wallops Flight Facility
757-824-1453
Debora.A.Fairbrother@NASA.Gov

