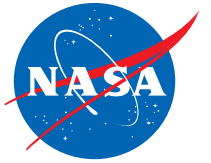


Scientific Balloon Missions of Opportunity

David D. Gregory, Assistant Chief, NASA Balloon Program Office

Conventional Balloon Missions

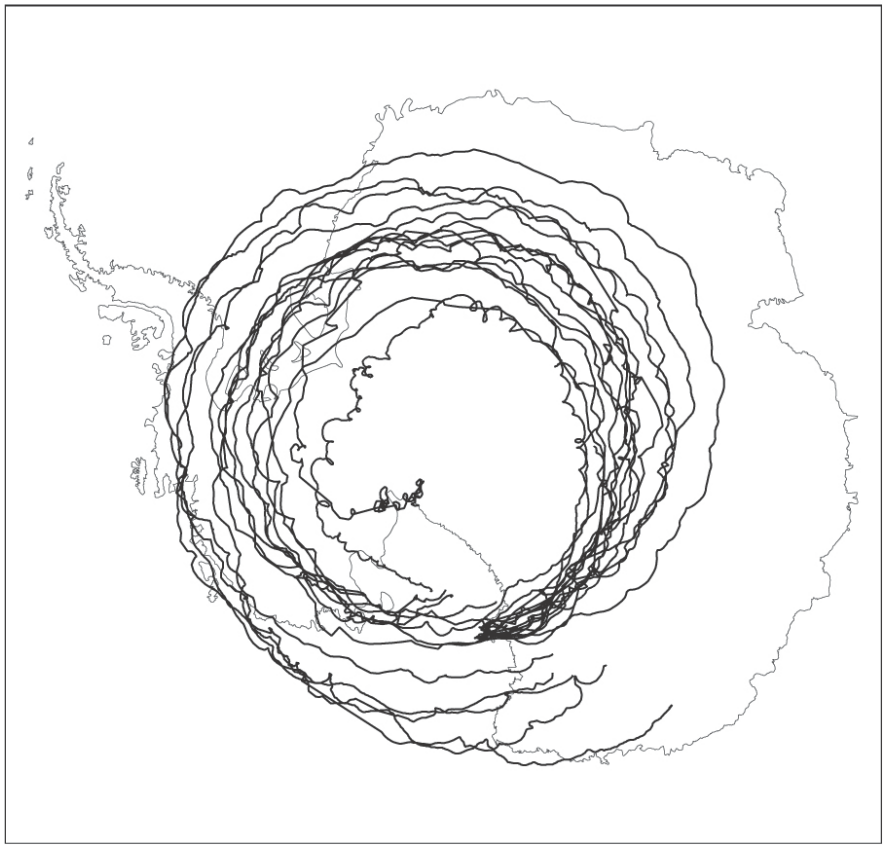
- NASA supports “conventional” missions launched from Fort Sumner, NM and other locations world-wide depending upon requirements.
- “Conventional” missions are those that are maintained within line of sight of the launch site or via downrange stations and typically last a few hours to typically less 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.)

Long Duration Balloon 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

Long Duration Balloon Missions - Sweden

- 2-3 Missions every other year from Esrange, Kiruna, Sweden to Northern Canada.
- Duration 5-6 days (currently there is no Russia overflight agreement with NASA).
- Launch window third week in May through middle July.
- Payload and balloon recovered same season, usually with helicopter.

Esrange Balloon Launch Facilities

In addition, ESRANGE is constructing new balloon payload preparation building, planned to be ready May 2001. Placement will be alongside the three current buildings at the launch pad.

Typical 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

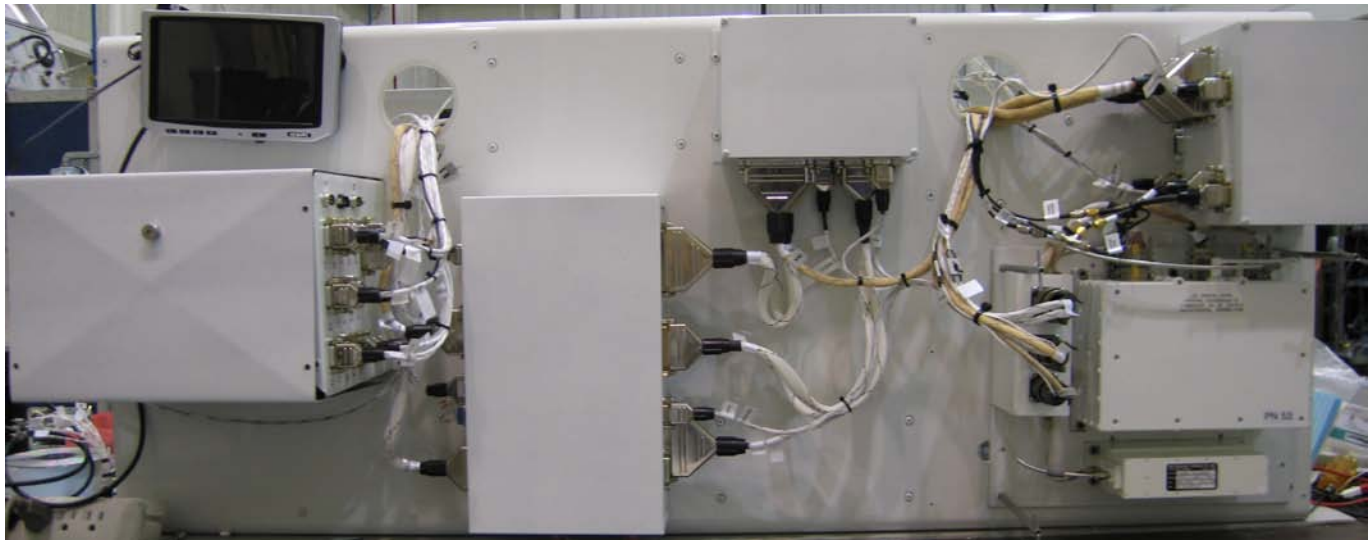
  Carry 4000 lb science (1814 kg) to 126,000 feet nominal altitude

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 ROC
- 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.

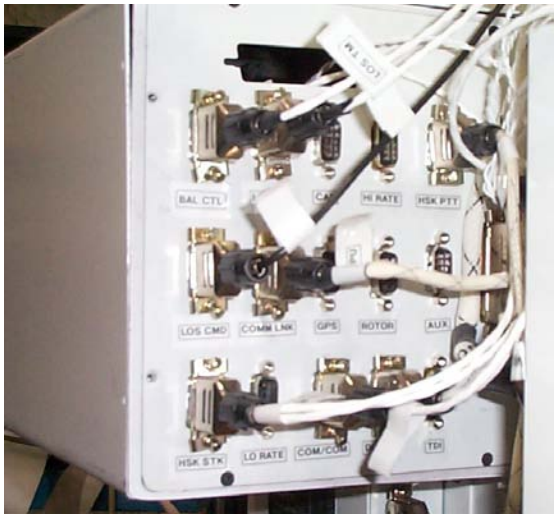
  255 “science stack” bytes approximately every 15 minutes.

  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

- Contact the NASA Balloon Program Office for planning and guidance.
- NASA is still working to fully qualify the Super Pressure balloon for support of missions up to 100 days duration. The goal is to support a ton of science to 110,000 feet (33.5 km).
- At this time, NASA encourages experimenters to be able to show that they can achieve their science using existing zero pressure NASA qualified balloons for either Conventional or for LDB missions.
- Given that the Super Pressure balloon has the potential to become a qualified vehicle during the lifetime of this proposal initiative, experimenters wishing to fly extended durations using Super Pressure balloons, should discuss how their science will be enhanced beyond that which can be achieved using only zero pressure balloons.

Balloon Program Office 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
- Maintain regular, informal contact with CSBF Operations management regarding progress and readiness of the project/mission
- Request Nuclear Launch Safety Approval (NLSA) per NPG 8715.3
- Works with NASA Safety to coordinate Ground Safety and Flight Safety.
- Solicit customer feedback

Columbia Scientific Balloon Facility Provides:

- Technical support for project formulation, planning, & preparation
- Flight and ground support systems, including integration and testing
- 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
- Mechanical certification of flight pressure vessels

Typical LDB 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

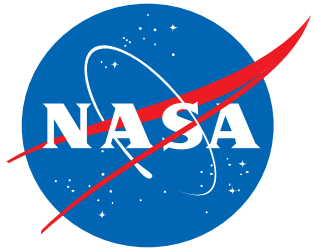
  Mr. David Pierce

  Chief, Balloon Program

  Wallops Flight Facility

  757-824-1453

  David.L.Pierce@NASA.GOV


NASA