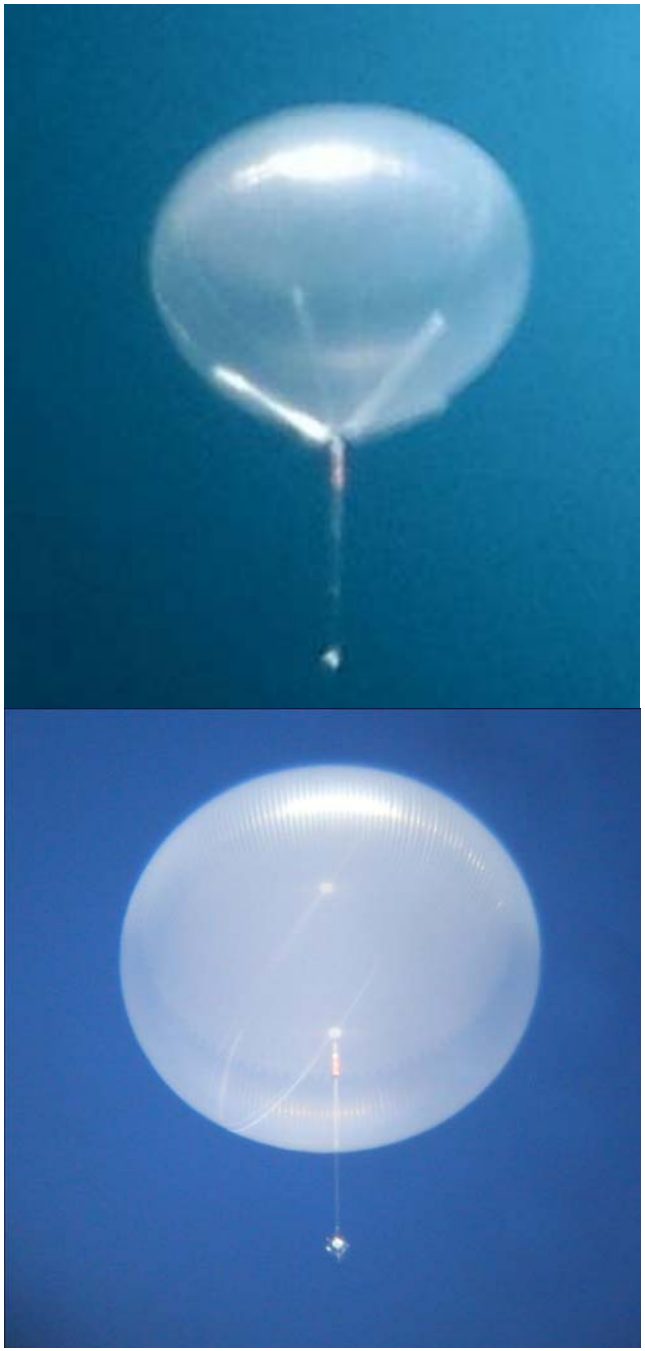
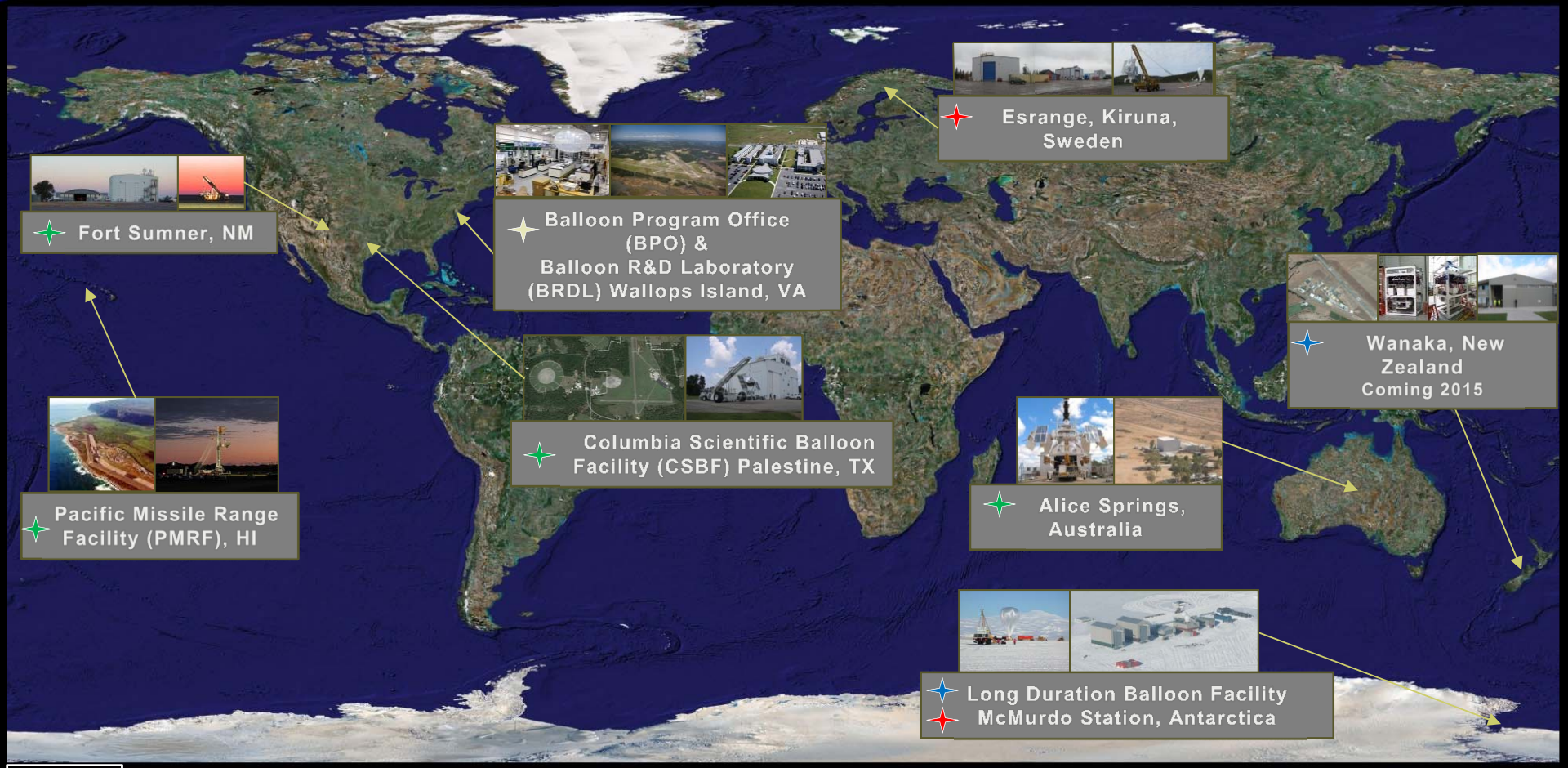
National Aeronautics and Space Administration

Scientific Balloon Missions of Opportunity

Debora A. Fairbrother, Chief, NASA Balloon Program Office



SCIENTIFIC BALLOON LOCATIONS



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 1 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.

Long Duration Balloon Missions - Sweden

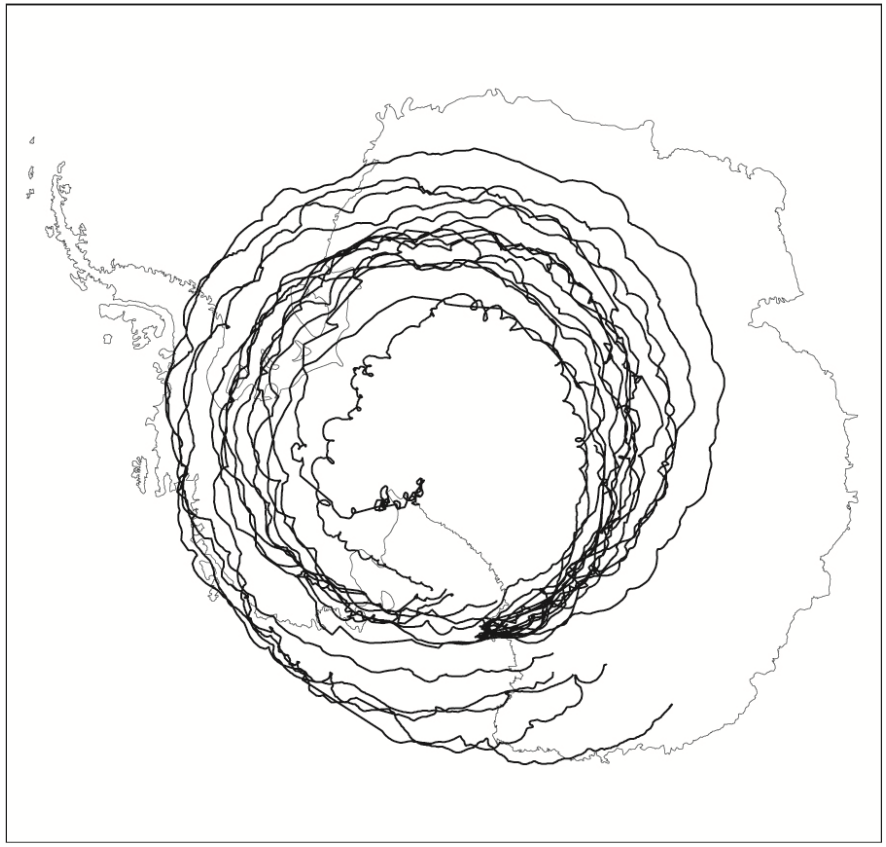
- 2-3 Missions during campaign from Esrange, Sweden to Northern Canada when requested by science.
- Duration 5-6 days (currently there is no Russia overflight agreement with NASA).
- Launch window third week in May through middle July.
- Payload and balloon recovered same season, usually with helicopter.

Esrange Balloon Launch Facilities

LDB/ULDB Missions - Antarctica

- 2-3 LDB Missions Launched Annually From McMurdo, Antarctica.
- Durations upwards of 55 days, 21 days nominal. Determined by time of launch and NSF resources for support and recovery.
- Launch window is December 1 through January 10, each year.
- Arrive on site to perform pre-flight preparations October 25 – January 31.
- 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 (or year after).

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.
- First flight scheduled for March 2015.

Typical ZP Balloon / Altitude Capabilities

- 29 MCF Balloon

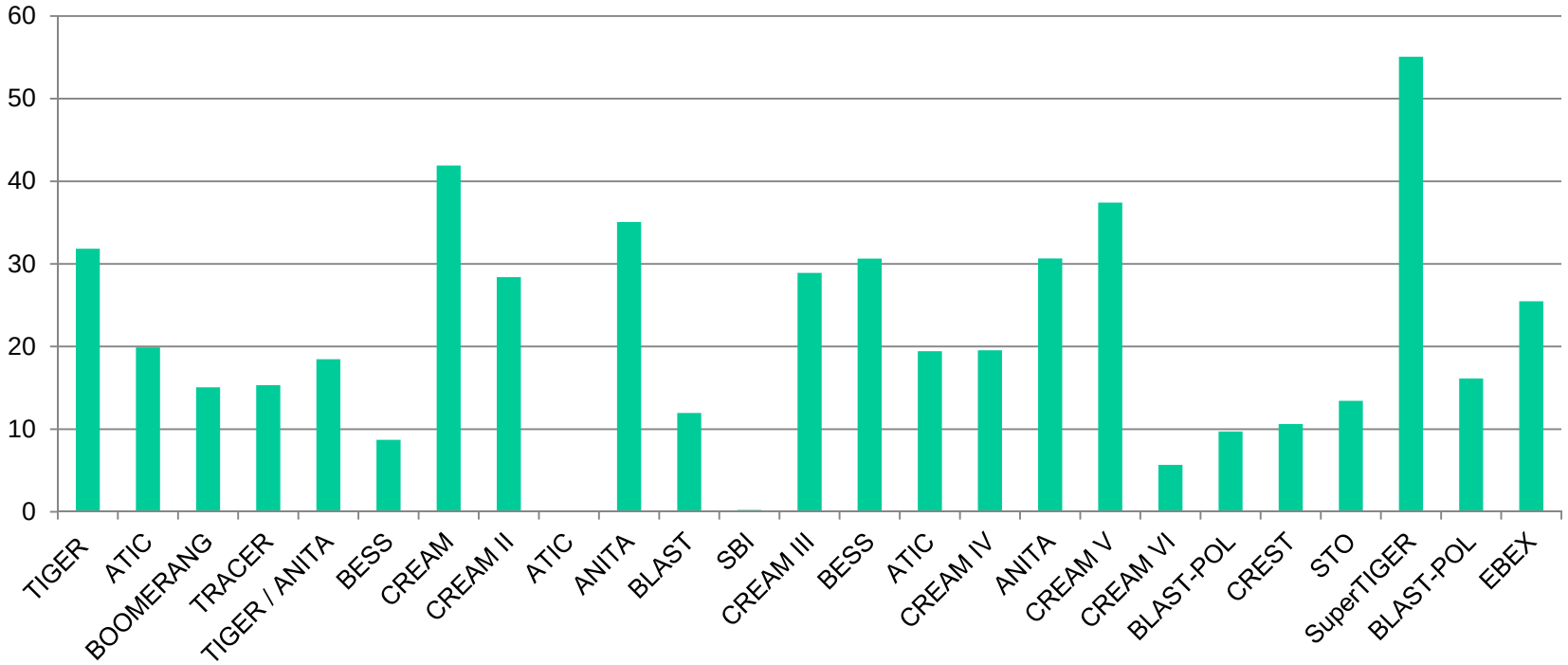
  Carry ~4,000 lb science (1,814 kg) to 120,000 feet nominal altitude
- 34 MCF Heavy Lift Balloon

  Carry ~5,000 lb science (2,268 kg) to 117,000 feet nominal altitude
- 40 MCF Balloon

  Carry ~4,000 lb science (1,814 kg) to 126,000 feet nominal altitude

Duration of Antarctic LDB Science Missions

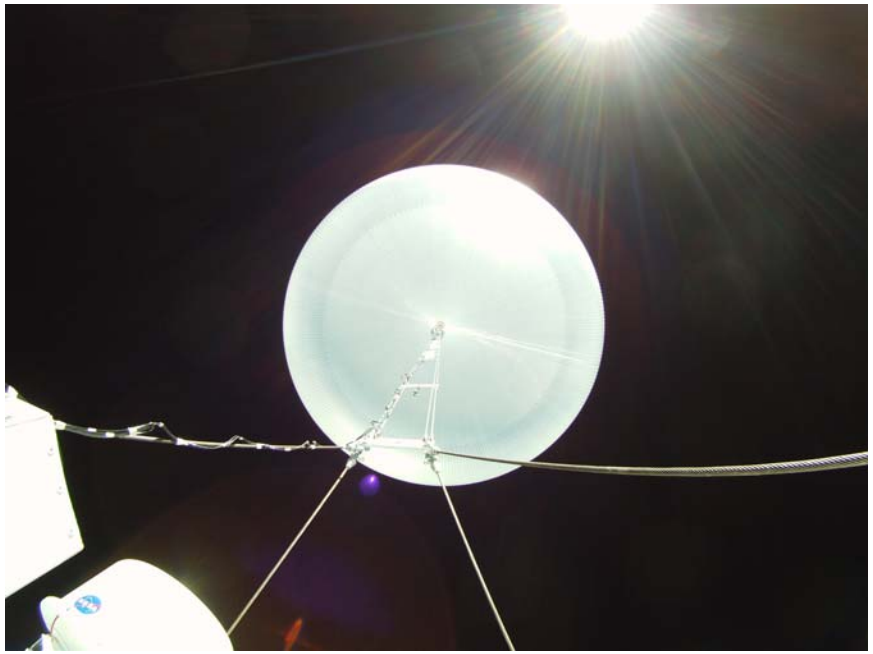
Over course of last decade (2002-2012)



- 25* long-duration balloon (LDB) Antarctica science flights since December 2001
  - * - Does not include Engineering Science or Vehicle Test Flights
  - Average Duration is 20 days
  - 1 Balloon Failure – Wefel(ATIC) Dec 2005
  - 1 Instrument Failure – Rust (SBI) Dec 2006

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. (~2,000 pounds)



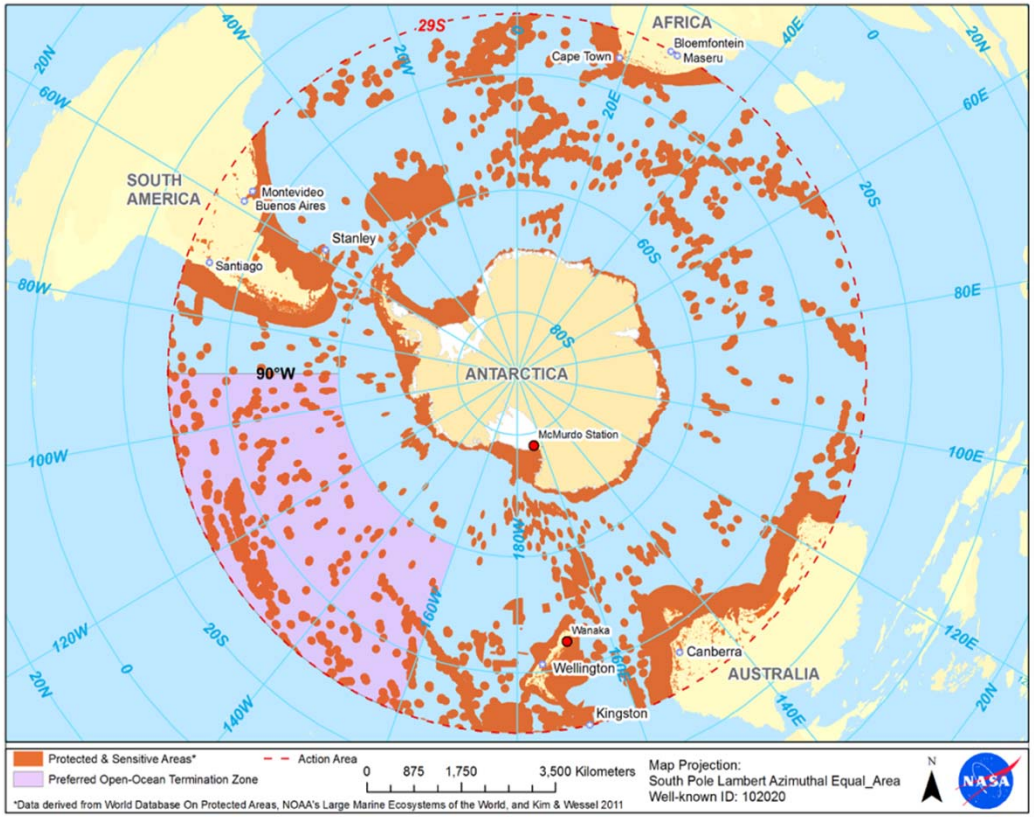
Volume	Flight Number	Launch Date	Suspended Weight	Altitude	Duration
7 MCF	591 NT	Dec 28, 2008	1,500 Lbs	110 KFT	54 days
14.9 MCF	616 NT	Jan 9, 2011	4,000 Lbs	110 KFT	22 days
18.8 MCF	631NT	Aug 14, 2012	5,000 Lbs	110 KFT	6.5 hours
26 MCF			4,000 Lbs	117 KFT	

Ultra Long Duration Balloon Missions

- NASA is progressing to fully qualify the Super Pressure Balloon (SPB) for support of missions up to 100 days duration. In August 2012, NASA demonstrated successful deployment of 18.8 MCF SPB which supported 5,000 pounds suspended to 110,000 feet.
- NASA expects that the SPB will become a qualified vehicle by the time that a balloon investigation selected from this solicitation would be launched.
- Next flights of 18.8 MCF SPB scheduled for December 2014 from Antarctica and then March 2015 from New Zealand.

Antarctic Off Continent and New Zealand

- WFF Completed a Biological Evaluation and Environmental Assessment for 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.



Non-recovery due to ocean termination is potential.

NASA Provides:

- Overall management of the balloon flight program
- Project planning support and management
- Requires operational and science performance and readiness reviews
- Approve the mission for flight
- Authorize financial expenditures
- Maintain Inter-Agency Agreements
- Request Balloon Risk 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:

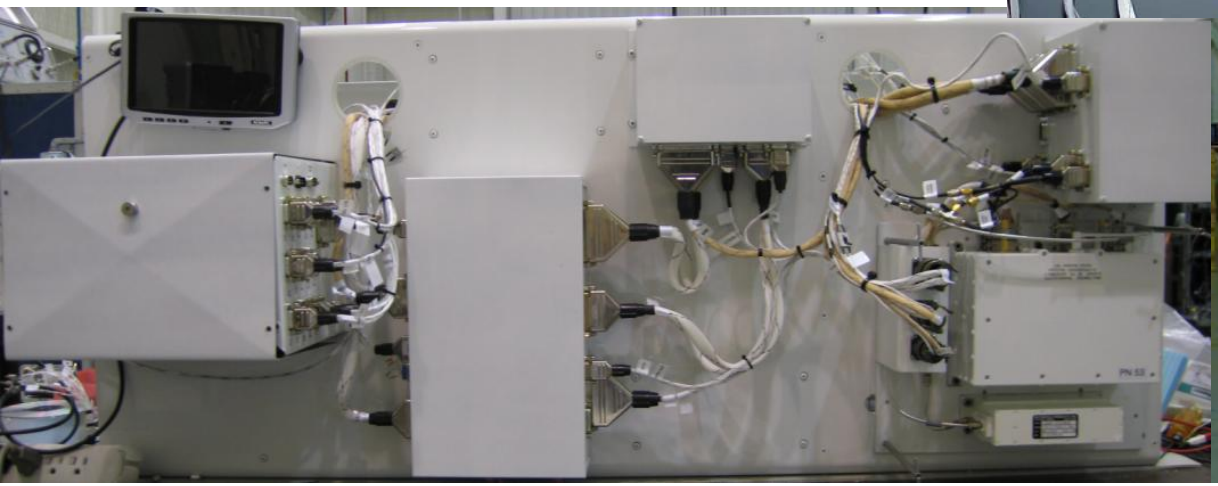
- Technical support for project formulation, planning, & preparation
- Flight and ground support systems, including integration, testing and safety
- Balloon vehicle
- Launch support systems
- Coordinate launch site facilities
- Adhere to flight safety criteria
- All flight operations support elements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

LDB Flight Systems

- Standard Flight Systems Provided by NASA / CSBF
- Support Instrumentation Package (SIP)

  TDRSS or Iridium
- Coarse azimuth rotator upon science request

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



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 in Palestine, Texas six months prior to mission. BPO is evaluating possibility of compatibility at Plum Brook facility.
- 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

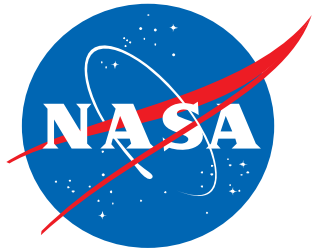
  Ms. Debora Fairbrother

  Chief, Balloon Program

  Wallops Flight Facility

  757-824-1453

  Debora.A.Fairbrother@nasa.gov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