

FACT SHEET

Science Objectives

- Understanding and forecasting relativistic electron fluxes in the outer belt requires equal inquiry into their acceleration and loss mechanisms. RBSP goals include “differentiating among competing processes affecting precipitation and loss of radiation belt particles.” Both practical NASA priorities (safety of astronauts and equipment in the radiation belts) and scientific ones (SSSC priorities in plasma physics and particle acceleration) are addressed.
- BARREL restores the original scope of the RBSP concept by **measuring electron loss to the atmosphere** via bremsstrahlung x-rays.
- Loss of MeV electrons takes place in minutes-long events at the evening plasmopause (balloon data) and in relativistic microbursts in the morning sector.
- To pinpoint and quantify loss processes, BARREL measurements take place in conjunction with wave, particle, and plasma measurements by the RBSP spacecraft.
- Balloons allow unambiguous separation of temporal variations (ULF, EMIC, and microbursts) from spatial variations.
- Multiple balloons spaced in local time allow determination of the **total** instantaneous loss rate from the outer belt, revealing the true instantaneous balance between energization and loss in a variety of geomagnetic conditions.

Investigation Overview

- Three BARREL campaigns of ~ 1 month duration take place during the RBSP mission, from high latitudes ($L \sim 4-8$) in the summer (both Northern and Southern hemispheres).
- One campaign has balloons in conjunction with the satellite during morning hours of MLT (to study relativistic microbursts), while two have conjunctions in the evening for the more mysterious MeV duskside events.
- In each campaign, 15 40-lb payloads are launched at intervals of 1–2 days. Each payload operates for 10 days or more.

Instrumentation & Characteristics

- Each payload carries a $3'' \times 3''$ NaI scintillation detector to detect x-rays/gamma-rays in the range 20 keV to 10 MeV.
- The effective area ranges from 10–40 cm^2 depending on photon energy, and energy resolution ranges from 20% (lowest energies) to 4% (highest energies).
- This instrument design has been proven to be effective in characterizing MeV precipitation during the MINIS balloon campaign in January 2005.
- The balloon gondola supporting this instrument will include a solar power system, Iridium telemetry, magnetometer and sun sensors.

Investigation Management

- The Project Manager and Principal Investigator are at Dartmouth College, which will also be the site for I&T.
- The NaI instrument and instrument data system will be built at the University of Washington, to a well-proven design.
- The power system (including solar panels) will be built at the Space Sciences Laboratory, University of California, Berkeley.
- The ground segment, including uplink/downlink, quicklook data analysis, configuration control of GSE and analysis software, and data archiving and dissemination will be at the University of California, Santa Cruz, with visiting Mission Operators and Duty Scientists from the other institutions.
- Each balloon campaign will have a Campaign Manager; the PM will assist each CM with advance logistical planning.
- The PM will keep the team to the schedule and budget, and monitor progress with full-team weekly telecons and twice-yearly meetings.
- Mission Readiness Reviews will be held as per NSBF practice.

Schedule and Budget

- Due to the large amount of heritage, Phase A (17 months) will finish with a complete payload design in February 2007.
- Phase B will be construction and flight of two test payloads. Launches (with training of the field team) will take place in Sweden in July 2008 under the supervision of NSBF.
- Instrument build and I&T times are derived from experience with the MINIS campaign, with the addition of extra time for more thorough testing (functional, workmanship and environmental).
- The RBSP campaigns (15 balloons each) will take place in June/July 2011 (Arctic), December 2011/January 2012 (Antarctic), and June/July 2013 (Arctic). I&T for the first two campaigns is performed together, while that for the last campaign is done after the first two are completed.
- Data analysis and dissemination of primary results (during Phase E) takes place from August 2011 through February 2014.
- Total costs by phase (FY05 \$) are: phase A: \$275,505, phase B: \$1,456,349, phase C/D: \$2,884,071, phase E (including mission operations): \$2,570,443.