12 March 1999

Memo To: Distribution

From: David D. Gregory, PSL / Balloon Project Office

Subject: Minutes and Action Items from the "Antarctica 1999/2000 LDB Campaign"

1.0 General

A Project Initiation Conference (PIC) was conducted on January 28, 1999 at the NASA Wallops Flight Facility. This was a one-day meeting for the purpose to review the science requirements and NSBF operation support plans for a Long Duration Balloon (LDB) campaign to be conducted November 1999 through January 2000 at McMurdo Station, Antarctica. A list of attendees at this meeting is included at the end of this report.

2.0 Minutes:

There were three candidate LDB payloads identified for this campaign. Due to limitations with the launch site payload facility, only two of the three payloads can be supported this year.

Flare-Genesis, Dr. David Rust (P.I.), John Hopkins University, Applied Physics Laboratory

Experiment Objectives:

- Map the magnetic fields and magnetic helicity density in flare producing regions over long periods of time with a spatial resolution of 0.2 seconds of arc.
- Determine the physical mechanisms of solar flares and coronal mass ejections.
- Improve solar forecast techniques.
- Determine the magnetic structure and evolution of sunspots, filaments and prominences.
- Study solar oscillations at the smallest scales.

Instrument:

The instrument is comprised of a pointed reflecting telescope (80 cm f/1.5) for solar imaging at 0.2 arcsec resolution. Imaging is captured using a 1534 x 1024 pixel CCD camera with 8 to 10 bit resolution and a 20 Mbyte/second read rate. A fast tip-tilt mirror is used for image motion control. The science provided gondola includes a reaction wheel and momentum transfer azimuth control pointing system. Images are stored onboard onto digital tapes which can be recovered after termination of flight or configured in playback mode during flight while within line-of-site of the ground station.

Summary:

Flare-Genesis has previously flown on conventional test flights and once as an Antarctica LDB flight. Dr. Rust stated that he has been informed by HQ that his funding is approved.

Flare-Genesis has undergone refurbishment since the last flight. However, the main mirror may yet need re-coating (if required, to be accomplished March 1). Dr. Rust believes the science payload weight will be ~100 pounds less than the 3150 lbs. last flown in Antarctica. Modifications to improve instrument performance and/or corrections to problems experienced during the first Antarctica flight include:

- Simplified momentum transfer unit
- Enhanced pointing-error sensitivity
- Improved fast mirror system
- Removal of the two-beam (large & small scale image) requirement
- Reduced "pre-flight" preparation time
- Reduction in degrees of freedom to enhance mechanical robustness
- Development of an interferometer technique for secondary mirror alignment
- Better stability on filters and better thermal control to enhance the instrument's wavelength control
- Correction which caused the computer hang-up on last Antarctica flight
- Replaced with different O-ring material and repolish of connection surfaces and thermal vacuum testing of pressure vessels

Dr. Rust would like to utilize a TDRSS SIP. However, because of the limited availability of transponders that have already been assigned to other missions, the project can only sign up to support the original flight requirements (HF/INMARSAT) at this time. But in the event that requirements change for those other commitments, then Dr. Rust's request to use TDRSS will be re-evaluated.

Dr. Rust has no plans to install his own aircraft telemetry systems using a LC-130 hatchcover for antennas. He will utilize the NSBF provided line-of-sight system for possible fly-under data dumps.

Open issues being addressed by the science team prior to integration at Palestine include:

- Possible recoating of the main mirror
- Completing readiness of the MAX1 control computer
- Readiness & testing of the image motion compensation mirror
- Final installation of other new components, test & calibrate
- Perform flight simulations

TOPHAT, Dr. Ed Cheng (P.I.) and Chuck Naegeli (Instrument Payload Engineer), GSFC

Experiment Objectives:

- Measure the anisotropy in the Cosmic Ray Background Radiation (CMBR)
- Obtain a 48 degree diameter true sky map centered at the South Celestial Pole

Instrument:

The TOPHAT Spinner detector mount on the apex of the balloon. The power and telemetry support systems mount aboard the bottom gondola. Communications between the top instrument and gondola is via hardwire mounted in the parachute and balloon.

The top instrument allows large sky coverage using a scanning strategy. Systematic errors must be minimized. Therefore, measurement from the top of the balloon with

multi-band detectors should yield optimum performance to achieve these objectives. Science power is achieved using a solar panel with charge controller design.

Summary:

Erich Klein of the NSBF will continue to be the NASA's point of contact for addressing balloon, payload, inflation, and launch configuration issues. Chuck Naegeli has been recently assigned to represent the science interests as Payload Manager for this project. Chuck has taken over the role that was previously performed by Neil Martin. TOPHAT is fully funded.

The TOPHAT Spinner instrument (the top apex portion) has not been previously test flown because of the risk of damage after termination and due to the cost of replication and/or repair. However, a mass mockup has been test flown to verify the NSBF rigging, inflation, and launch methods. A previous test flight also included the science instrumentation that will be flown on the lower gondola along with a LDB SIP simulator.

Ed Cheng stated that 10 Kft. diurnal variation of altitude would be acceptable. Other information presented by the science team indicated that thermal analysis accomplished to date had indicated a possible need to add heater plates to the pressure vessel to raise the hard disk temperatures.

TOPHAT's original telemetry support requirement had specified the use of a TDRSS Transponder. Therefore, the TOPHAT experiment has first priority for assignment of the one transponder available for use in Antarctica this year.

Open issues now being addressed by the science team include:

- Completing the LOS data COM port
- Fabricating of 2 lower solar array frames, assembly of solar arrays, and functional tests
- Fabrication of the two balloon release mechanisms
- Thermal vacuum testing (scheduled for 2/14-2/28)
- Verification of spinner cg and mass
- Strength testing of light shield/spinner to tow balloon suspension cable attachment
- Update flight application forms

A separate meeting was conducted after the PIC between NSBF's Erich Klein and Chuck Naegeli to review previously identified configuration issues. Erich has provided a robust design and fabrication for the balloon apex for mounting of the top spinner instrument. Most recently, a test flight was conducted to verify the inflation, release, and flight of this experiment using a mass mockup atop the balloon. This was a successful test. But as Erich pointed out, the test flight mass properties must not be exceeded due to the limited experiences using this approach. Other work that NSBF has previously supported includes the delivery of a SIP (LDB Support Instrument Package) simulator to the science project for their use to verify data and command interfaces.

<u>Background Emission Anisotropy Scanning Telescope (BEAST),</u> Dr. Phillip Lubin (P.I) and Dr. Peter Meinhold (Co-P.I.), University of California at Santa Barbara

Experiment Objectives:

- (Study of) cosmic parameters via high quality maps of the Cosmic Microwave Background (CMBR.)

Instrument:

BEAST is a 2.2 meter aperture Gregorian telescope operated in a pointed mode. The detectors are comprised of eleven HEMTs that are actively cooled to 20K. Supplemental thermal control is achieved with a liquid cooling system. Azimuth pointing is achieved with an active swivel (rotator). Science power is derived using a UCSB solar panel and charge controller design.

Summary:

BEAST has yet to undergo a test flight which is tentatively scheduled for April 99 from Ft. Sumner. The test flight will include only eight of the eleven HEMT detectors. The remaining detectors are wide band detectors, which are currently undergoing fabrication, and these will be added following the Ft. Sumner test flight.

An issue was raised concerning the 20 degree clearance off the pin of the launch vehicle (this will be evaluated by NSBF). The science team has been in the process of coordinating the gondola design with NSBF with a few mechanical issues remaining to be analyzed.

Open issues being addressed by the science team prior to integration at Palestine include:

- Radiative Load / Sun shade final design
- G-M Cryocooler Viability
- Final telemetry configuration (TDRSS/LOS)
- Final mechanical/electrical integration of solar panels
- Electrical integration & test prior to the test flight
- Telescope response verification & alignment
- Flight software verification & servo testing
- Official mechanical certification
- Official thermal certification
- Test flight
- Shipping plans

As with the Flare-Genesis experiment, it was pointed out that BEAST could only be supported with TDRSS should prior plans change. Otherwise, BEAST would be supported with an INMARSAT/HF SIP.

LDB Systems Support, Bryan Stilwell, NSBF

NSBF can provide support for one TDRSS/INMARSAT configured flight and one HF/INMARSAT configured flight. An explanation of the telemetry capabilities and ground station configurations was presented. A summary of the successful performance of TDRSS on the last Antarctica LDB flight and a projection of satellite

coverage for 78 degrees south latitude for Antarctica was provided. No other telemetry support issues were brought forward for discussion.

Operation Support, Steven Peterzen, NSBF

A review of the campaign schedule and support capabilities in Antarctica was presented. NSBF presented a plan to procure a prefabricated building to better accommodate large payloads and solar arrays prior to launch. No other outstanding requirements were identified (except the previously mentioned capability of being able to support only two flights.)

Steven reminded everyone of the importance of starting the physical qualification process as early as possible. Physical qualifications must be completed by September 1. In the past, there have been delays due to personnel not getting physical clearances completed by the time of their scheduled departure for Antarctica. Everyone should keep in mind that NSF often requires follow-up examination, tooth extractions, etc. for what they consider to be high risk health issues. These problems are often not identified until after the initial physical examination record is reviewed by NSF/ASA. It's not uncommon for NSF/ASA to take from 6-8 weeks to respond to the initial review.

NSBF will schedule pre-deployment integration to be completed prior to August 14. The Mission Readiness Review (MRR) should be no later than August 14 in order to allow time to respond if any action items are generated that must be completed prior to shipment. Equipment wil ship no later than August 25 in order to stay on schedule with NSF's sea shipment which departs from Port Hueneme, CA.

Participants were reminded they must plan to arrive in the field far enough in advance to complete flight readiness preparations in time for the December 10 opening of the launch window.

[Note: In the past, there has been a tendency to underestimate from 7 to 14 days, the time needed to complete flight readiness in the field. Often, a number of factors are overlooked such as the additional time required to work in the harsh environment, over-reliance on the timing of a logistics train that has limited delivery assets compared to the amount of material going down to the ice, etc. When making your estimate of how much time it takes to get ready, be sure to contact NSBF to find out what are the possible schedule impacts you should consider. As the season progresses, it becomes extremely difficult to get the required NSF resources for under-flights, recovery, and ASA support personnel. If we end up trying to conduct two balloon flight operations in the last 2 to 3 weeks of our launch window, we will be at higher risk for not getting a timely recovery. And although we typically see many days of good weather, it's not uncommon for patterns to set in that preclude launch opportunities or outdoor calibration work that can last for several days to a week.]

3.0 Action Items

1.) Only two of the three candidates can be supported this year. Each group should proceed with their preparations. On June 1, the balloon program will reevaluate the candidate list. If all three candidates remain as viable contenders for participation in this year's campaign, then a request will be forwarded to NASA HQ to select the two primary candidates. The third experiment would be a backup until time of integration at Palestine, in the event one of the two primary candidates drop out.

2.) Flare-Genesis:

- Provide a summary of the cause, corrective action, and verification testing performed to resolve the failures experienced on the first Antarctica flight. (Due 3/31/99)
- Insure NSBF has the details concerning your S-Band transmitter and support ground station equipment for frequency authorization in Antarctica (Due 3/31/99)

3.) TOPHAT

- The last two test flight reports imply the spinner package can withstand the launch loads and that the instrument rotation won't induce spillage from the cryo-cooler. Confirm with Erich Klein that you believe this to be the case (Due prior to integration.)
- Complete the ongoing work and documentation as discussed with Erich Klein (items with dates need a response as soon as possible.)

    - Submit to NSBF an updated LDB Flight Request Form (2/12).
    - Confirm the two additional bolt holes required in the instrument base and interface to the platform reinforcing structure (2/14).
    - Confirm that instrument removal is not required in order to accomplish cryogen filling (2/22).
    - Confirm the final spinner instrument and all support package weights (2/22).
    - Confirm results of instrument and light shield 1000 lb pull test.

4.) BEAST

- Insure that an updated stress analysis is provided to NSBF's Thomas Harper prior to the test flight.
- Because it will not be configured on the test flight, provide a description of the test methods and results to be performed on the Gifford-McMahon cryo-cooler. Include with this, your assessment as to mission risk by not having it on the test flight. (Due prior to LDB integration at Palestine).

5.) NSBF

- Provide an assessment of the BEAST launch configuration to determine if there are problems associated with the 20 degree clearance rule. (Due 3/19/99)

6.) All

Scott Cannon at PSL, Las Cruces will be performing thermal certifications for the NSBF support systems. If you haven't already done so, get in contact with Scott now to insure you understand what information you need to provide him concerning your particular instrument's thermal analysis requirements. All thermal analysis requirements must be completed by 6/1/99 in order to allow Scott time to complete

his final review before the integration starting in July and MRR in August. All thermal analysis and configuration issues must be resolved prior to the MRR.

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4.0 PIC Attendees

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