Sounding Rocket Working Group

National Aeronautics and Space Administration

Meeting of February 4-5, 2010

Findings

1. High Altitude Rockets with Recoverable Payloads

Summary:

The SRWG requests that the SRPO study the capability of launching the Black Brant XI with payload recovery from White Sands Missile Range (WSMR) and the Black Brant XI and Black Brant XII vehicles with payload recovery from Wallops, Woomera Test Facility (WTF), and Kwajalein. The use and recovery of payloads launched to high altitudes on these vehicles will enable longer observing times for astrophysics and solar missions with telescopes that currently utilize rockets with lower apogees to facilitate their recovery and to remain within the confines of WSMR.

To facilitate the realization of these goals, the SRWG requests that the SRPO present at future SRWG meetings an analysis of how the following objectives might be achieved:

a.) A vehicle system capable of achieving the altitude performance of the current BB XI that would enable the 1-sigma impact dispersion to remain on range at WSMR.

b.) Preliminary status of the infrastructure, logistics, and technical modifications (e.g. payload modifications) necessary to support water recoveries.

c.) The capability of an alternate land range, with low energetic particle backgrounds at high altitudes, (e.g. WTF), to launch the BB XI and the BB XII with a recoverable payload.

Background:

The limited available observing time above 150 - 250 kilometers for sounding rocket payloads with recovery places extreme limits on the science goals that can be achieved and the new technologies that can be implemented by astrophysics and solar payloads that include telescopes and for which recovery is typically required.

Although the BB XI and BB XII high altitude launch vehicles are already well used by the Sounding Rocket Program at launch ranges such as Wallops, Poker Flat, and Andoya, these vehicles are currently not used by astrophysics/solar telescope payloads as their high apogees (~ 1000 km) preclude recovery with standard recovery systems. Furthermore, the small size of WSMR has deterred the launch of science payloads using the BB XI and XII vehicles as their downrange impact areas would be outside the range boundaries. Indeed, the small impact dispersion of the BB IX is achieved only with the help of the S-19 boost phase guidance system.

On the other hand, if recovery could be implemented for high altitude launches of the BBXI and BBXII vehicles, such a technical advance would significantly increase the available observing time above 150 km and, in particular, above 250 km, and hence advance the scientific return of these missions. We estimate that for launches from WFF (i.e. near sea-level), the gains in time above 250 km for the BB XII and XI relative to the BB IX are 164% and 114% respectively. The percentage gains in time over 150 km are 85% and 62% respectively.

If the gains in observing time promised by the BBXI and BB XII vehicles are to be realized, then a high altitude recovery system must be implemented, together with either: (1) a larger land range, (2) a means to stay within the WSMR range limits, or (3) sea recovery. We know that the SRPO has been investigating many of these options over the years, and we ask that a summary of the technical feasibility and cost-benefit analysis of these alternatives be presented.

Promising alternate ranges for launch of the BB XI and BB XII include WFF and two southern ranges: RTS (Kwajalein, Marshall Islands) and the WTF (Australia). The WTF can accommodate the impact range and dispersion of these vehicles, satisfy the requirement for low particle background at sounding rocket altitudes, allow payload recovery on land, and provide access to the region around the South Celestial Pole which is inaccessible from WSMR, a factor important to astrophysicists. It is therefore of great interest to the SRWG (see next finding).

Excepting the option for an alternate or modification to the Nihka stage currently used in the BBXII system, it should be emphasized that no new vehicle development is needed.

Additional background on using high altitude rockets to increase observing time for astrophysics and solar telescope payloads that require recovery is available in the SRWG sub-committee report: HARIASOT_SRWG_Sub-committee_Report.pdf.

2. Woomera Test Facility -- Towards Developing a New Standard Range for NASA Rocket Launches

Summary:

The SRWG applauds the Sounding Rocket Program Office (SRPO) for its recent inquiries into returning NASA launch operations to the Woomera Test Facility (WTF) in Australia. We wish to underscore our interest in this range and urge that a full feasibility study and implementation plan be developed as soon as possible with a view of using the range for standard launch operations with permanent or quasi-permanent infrastructure. The Woomera range is unique for its view of the southern sky, the potential for high altitude, recoverable payloads, and the possibility for multiple launch windows and less constrained access to the radio spectrum.

Background:

The Woomera Test Facility (WTF) in Australia has been used by the NASA sounding rocket program since 1961 for both astrophysics and geospace missions. From the standpoint of astrophysical payloads, the WTF provides an astronomical view of the southern sky, which includes the Large Magellanic Cloud (LMC), the closest galaxy to our own, the center of our own galaxy, and the southern galactic bulge, to name a few important astrophysical targets not available for observation from the White Sands

Missile Range (WSMR) in New Mexico. In addition, the Woomera range offers unique capabilities for launching high altitude rockets, enabling extended observing time, and less restrictive range operations than WSMR. The less restrictive range operations may allow for high bandwidth telemetry and multiple launch windows, and thus event triggered launches.

Unfortunately the Woomera range has only been utilized by NASA in campaign mode, where large parts of the launch infrastructure have to be deployed at the range for each campaign. The last such campaign was over 20 years ago to observe the SN1987a supernova in the LMC in 1989. There have been no campaigns since then given the large financial barrier to mounting such an endeavor. Now that the SRPO is returning to long term financial stability, developing the capability for land recovered, high altitude (generally astrophysical) payloads in the southern hemisphere should be among the program's priorities.

3. The Mosquito Project

Summary:

The Mosquito rocket has the potential of providing a relatively inexpensive method of sampling the 80 to 100 km region of the atmosphere with numerous launches in a single campaign. This capability has been among the highest priorities on the SRPO "technology roadmap" and is currently under development at NSROC. The SRWG requests an update on the current status of its development.

Background:

The Earth's upper mesosphere region between 80-100 km is one of the most dynamic in the upper atmosphere. Ground based radars and lidars provide some important data within these regions, but it has long been recognized that *in situ* measurements are necessary to advance our understanding of many of the important parameters and mechanisms at work at these altitudes.

In response to this need, the development of a small, inexpensive vehicle to sample this region with repeated launchings in a short period (e.g., 6 launches in a 3 hour period) has been among the highest priorities on the SRPO technology roadmap. Accordingly, the Mosquito rocket has been under development at NSROC for some time to fulfill these goals. Indeed, the Mosquito rocket promises to allow multiple measurements on a given day (night) and perhaps over several days (nights).

We understand there have been some new challenges regarding the Mosquito development that may be require choices to be made by the science community to make this project a reality. As the SRWG is eager to see this project advance in a timely fashion, we request an update on the current status of this vehicle/payload system.

4. Land Use Developments at the Poker Flat Research Range

Summary:

The Poker Flat Research Range (PFRR) continues to be an extremely important location for Geospace sounding rockets that study the high latitude upper atmosphere and auroral physics phenomena. Recent land use developments have been brought to the SRWG's attention, including a new cabin downrange for recreational use by the public and right of way permits for Alaskan natives and oil prospecting. The SRWG seeks to understand these developments insofar as they affect launch window and range use planning. We anticipate that experts at the University of Alaska Fairbanks will be encouraged to help resolve these issues, where appropriate.

Background:

The Poker Flat Research Range (PFRR) continues to be an extremely important location for Geospace sounding rockets that study the high latitude upper atmosphere and auroral physics phenomena. This range is owned by the University of Alaska and operated by the Geophysical Institute at the University of Alaska Fairbanks (UAF) under contract to NASA. The UAF has a significant interest in maintaining its ability to conduct sounding rocket-based experiments from PFRR, and has a member of its faculty currently represented on the SRWG.

At the last SRWG meeting, we were informed that there is an existing cabin downrange that is available for recreational use at certain times of the year by members of the public. Use of this cabin may preclude rocket launches and indeed, during the auroral rocket campaign this past winter, its use was a factor in the launch window planning of the LaBelle rocket (and perhaps other rockets as well.) As the cabin may become a factor in planning rocket launches into scientific events, we request an update from the SRPO on the expected impact of this cabin on future launch activities.

Agencies and Alaska Native Corporations are changing their permitting practices, so there are new ways for gaining the necessary right-of-way permits for PFRR operations. Similarly, drilling teams in the Yukon Flats area to the east of the pipeline may require access that ultimately impedes the use of the PFRR for sounding rocket purposes. The SRWG is concerned that launch activities at the PFRR may be hindered as a result of these new practices. The SRWG has been made aware that the UAF Geophysical Institute includes individuals knowledgeable about working with the specific Native-American communities, and suggest that the UAF's GI might be approached to play a more active role in resolving these issues, where appropriate.

NASA Sounding Rocket Working Group

Dr. Robert Pfaff, Jr. (Chair and Project Scientist)
NASA/Goddard Space Flight Center

Dr. Scott Porter (Deputy Project Scientist)
NASA/Goddard Space Flight Center

Committee Members:

Dr. Scott Bailey
Virginia Polytechnic Institute and State University

Dr. James Bock
Jet Propulsion Laboratory

Dr. Mark Conde
University of Alaska

Dr. Massimiliano Galeazzi
University of Miami

Dr. James Hecht
The Aerospace Corporation

Dr. Darrell Judge
University of Southern California

Dr. Mary Elizabeth Kaiser
Johns Hopkins University

Dr. Michael Kowalski
Naval Research Laboratory

Dr. Marc Lessard
University of New Hampshire

Dr. Douglas Rowland
NASA/Goddard Space Flight Center