

Sounding Rocket Working Group

National Aeronautics and Space Administration

Meeting of December 10-11, 2008

Findings

Findings are followed by two SRWG Sub-Committee reports:

“Comments on White Sands Upgrades”

“Comments on Poker Flat Science Instruments”

1. Sounding Rocket Project Office “Strategic Plan”

Summary.

The Sounding Rocket Working Group (SRWG) recognizes the value of planning long-term investments in a strategic manner. Beyond our input to the Sounding Rocket Technology Roadmap, the SRWG would also appreciate opportunities to participate, where appropriate, in developing the broader “Strategic Plan” with the Sounding Rocket Project Office (SRPO) and the NASA Sounding Rocket Operations Contractor (NSROC).

Background.

The SRWG was pleased to learn of the planned major upgrades for integration facilities for NASA payloads at the White Sands Missile Range (WSMR) and of the new ideas to improve operations and facilities at the Poker Flat Research Range (PFRR) that directly involve NASA sounding rocket missions.

These important improvements have been long overdue and appear to have been made possible by the reversal of a long-term trend toward smaller available resources. Indeed, it appears that the SRPO is regaining a position whereby it might upgrade, improve, and revitalize other aspects of the program as well. For this, the SRWG could not be happier.

As the SRWG recognizes the value of planning long-term investments in a strategic manner, we note that such a process ties individual investments to the higher-level objectives of the program in an explicit manner. In this way, investments have a maximal impact toward meeting, and exceeding, the mission performance expectations of the program, the majority of which are directly related to maximizing scientific pursuits.

Currently, the SRWG provides input to the SRPO “Technology Roadmap”. As a partner with the SRPO and NSROC, the SRWG would also appreciate the opportunity to participate, where appropriate, in the process by which such broader strategic decisions are made.

2. White Sands Operations -- Scheduling Issues and Concerns

Summary.

The SRWG is concerned about scheduling issues at the White Sands Missile Range (WSMR). We believe that insisting that missions meet various milestones prior to scheduling launch activities will not minimize the number of mission “scrubs”, but may in fact hinder the ability of the SRPO and PI to maintain flexible launch scheduling, an important feature of the program. The SRWG urges NASA management to engage in a dialogue with WSMR regarding improving the scheduling process.

Background.

The SRWG is very concerned about the slide entitled “WSMR Operations Trends – Schedules” presented by the SRPO at the December, 2008 meeting. This slide stated that there is a trend for NASA missions not to make their launch windows and that this trend could be reduced in the future by a change in scheduling protocol. The stated motivation for the new procedure is to reverse the loss of credibility with the WSMR that may result from these launch scrubs as well as to save operations costs.

The SRWG acknowledges that there are many reasons for launch scrubs and, whereas many of these are valid, they are normal for the sounding rocket program. The scrubs themselves appear to be unrelated incidents and not the result of a systematic trend requiring changes in integration and scheduling protocol.

The SRWG agrees that WSMR launch date requests submitted at the four-week planning meeting should be made on the basis of a careful review of the mission status and remaining schedule risks in the program. However, the requirements for each investigation are so different that the committee does not believe that a single set of milestones for all WSMR payloads should be instigated as this could greatly reduce the flexibility needed by both Wallops and the PIs to schedule their launches. In particular, the proposed approach of only making a launch request *after* the conclusion of all integration activities imposes an undue burden on the science investigations and removes the launch date as an important schedule incentive to complete integration. We do not believe that this would have a significant effect on reducing the launch scrub rate.

On the other hand, the timing of the launch date request should by no means be arbitrary. It should follow a careful review by the PI and Mission Manager of all schedule risks, including a candid evaluation of schedule reserve (slack). The PI should be made aware of the penalty for an overambitious field campaign schedule resulting in a launch scrub. In this manner, the SRPO can then exercise due diligence in this matter without the reduction of overall science program efficiency that would accompany the proposed “one size fits all” policy.

Finally, the SRWG believes that the SRPO should take the lead in raising the awareness of WSMR range personnel of the unique nature and benefits of the NASA Sounding Rocket Program including the need to maintain flexible launch date scheduling.

3. Proposal to Shift Certain Poker Flat Range Operations to the Science Operations Center

Summary.

Suggestions are provided regarding the SRPO proposal to relocate certain operational personnel at Poker Flat to a new facility located at the Poker Flat Science Operations Center.

Background.

The SRWG discussed the proposal of the SRPO that certain operational personnel at Poker Flat be relocated to a new facility located at the Science Operations Center (SOC). In this regard, the SRWG provides the following suggestions:

- The existing SOC does not appear to have adequate space that could be reallocated for this purpose. The proposal would thus appear to only be feasible if a dedicated extension was added to the existing SOC.
- A serious concern exists regarding extra vehicular traffic to the SOC, in particular the impacts of light pollution.
- If this change were to occur, additional bandwidth would be required to the SOC.
- The experiment teams would appreciate it if the extension is configured to allow either close interaction or full isolation between science and operational personnel, according to the experiment teams' needs for a given mission.

4. Use of Black Brant X, XI, and XII vehicles for Astrophysics and Solar Missions

Summary.

The SRWG requests that the SRPO study the possible use of the Black Brant X, XI and/or XII for launching astrophysical/solar payloads, with a view to making this an option for future proposals to NASA HQ for pertinent sounding rocket missions.

Background.

The available observation time in space by sounding rocket payloads, particularly in the case of astrophysical and solar instruments, is a constraint whose impact on the scientific results has become more significant over the years as more challenging goals have been set. As a result, in recent years SRPO has proposed the development of a new two-stage high-altitude sounding rocket (HASR), based on use of the Orion 50XGL and 30 motors, yielding 2400 sec (40 min) of observation above 100 km. However development of this vehicle has still to be approved, while the scientific need for more observation time becomes increasingly significant.

The sounding rocket program now relies almost exclusively on the Black Brant IX for astrophysical and solar missions, yet its launch vehicle inventory includes the proven

Black Brant X, XI and XII, 3 and 4-stage vehicles, which fly higher and so far have been used predominantly for auroral physics and other geospace investigations. For example, the observation time for a 1000 lb payload launched from WFF increases by over 60% when the BB IX is replaced by the BBXII. Such gains promise substantial increases in the scientific return and yet do not require any vehicle development.

However, some new technical developments would be necessary. The promising launch ranges are WFF and WSMR for northern hemisphere, and Kwajalein (Reagan Test Site) and Woomera for southern hemisphere launches. Missions from Kwajalein and WFF would require further development of techniques for ocean recovery of payloads. Further, payloads would have to be able to withstand the increased re-entry dynamic loads and temperatures experienced if the BB X, XI and/or XII vehicles were used.

The SRWG requests that WFF study the possible use of the BB X, XI and/or XII for launching astrophysical/solar payloads, with a view to making this an option in future proposals to NASA HQ for sounding rocket missions. The following technical questions are anticipated:

- (1) What are the range and launcher constraints upon use of these three Black Brant vehicles at WFF, WSMR, Kwajalein and Woomera?
- (2) What are the technical implications and cost of developing ocean recovery techniques for launches from WFF and Kwajalein?
- (3) What technical developments are required to accommodate the increased re-entry loads and temperatures associated with these three vehicles?

5. Request that Higher 20 Mbit T/M Rate Option Becomes “Standard”

Summary.

The SRWG applauds NSROC's recent work with high-rate telemetry systems including the 100+ Mbit directional antenna and the 20 Mbit augmentation to the WFF93 system. We highly encourage that the 20 Mbit augmentation to the WFF93 system be offered as a standard option to all future payloads and that NSROC and the SRPO continue to investigate methods of offering even higher data rates using both directional and omni transmitters.

Background.

Current and future payloads continue to grow in complexity and acquire ever increasing amounts of data during a rocket flight. It is becoming not uncommon for the scientific content of the mission to be constrained not just by mass and power envelopes but also by the available downlink rates on the sounding rocket platform. To enable the continued development of complex and scientifically rich payloads, we strongly encourage NSROC and the SRPO to enlarge the envelope of available downlink rates with a goal of achieving 100+ MBit per omnidirectional transmitter at all launch ranges. This includes investigating methods of offering high data-rates in the crowded and tightly controlled RF space at WSMR.

Further, we highly encourage that the 20 Mbit augmentation to the WFF93 system be offered as a standard option to all future payloads and that NSROC and the SRPO continue to investigate methods of offering even higher data rates using both directional and omni transmitters

6. NSROC communications

Summary.

The SRWG believes the NSROC mission close out reports are essential documents, yet are not routinely accessible to the experimenters. These should be readily sent to the PI upon completion. Further, the SRWG believes that the web sites for individual missions, provided by NSROC, may be very useful, depending on the mission.

Background.

The SRWG believes the NSROC mission close out reports are essential documents, yet are not routinely accessible to the experimenters. These should be readily sent to the PI upon completion. Such close out reports are particularly useful for understanding the performance of a given mission, as well as for planning future missions.

The SRWG believes that the web sites for individual missions, provided by NSROC, may be very useful for planning, documenting various aspects of integration, and for general communications with a payload team. Although these advantages may vary considerably between missions, the SRWG believes that the option to utilize such web sites should be offered and discussed with each mission P.I.

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SRWG Sub-Committee Report: “Comments on White Sands Upgrades”

The SRWG is excited to learn that facility improvements at WSMR are being pursued. The overall plan to move LC-35 N-200 / SPARCS activities to LC-36 VAB area is a good plan if additional facilities can be constructed to accommodate the total space needed for 3 simultaneous payload integrations. The SRWG suggests the following options to examine while planning the facility upgrades at WSMR. A subcommittee of the SRWG looks forward to reviewing the WSMR upgrade plans as they are updated.

- 1) Total space at VAB should be enough to accommodate 3 payload integrations. A large integration area for multiple payloads is acceptable. In such an approach, it is desirable to have the capability to isolate portions of the facility into separate integration areas. If the implementation of these improvements is conducted in two phases, a separate 3rd payload integration area could be part of the second phase of improvements.
- 2) The SRWG emphasizes the importance of control of the integration area environment for particulate and organic cleanliness as well as ESD. The SRWG envisions that the integration room could have ceiling-mounted blowers to maintain a simple down-flow clean environment, perhaps at class 100,000 level. Epoxy paint of normal construction walls provides a low cost solution for these surfaces. For higher level of cleanliness, a clean tent and flow benches would be used. Flow benches can provide class 1000 environment for optical assembly and clean-sensitive activities. ESD control is of utmost importance, so clean tent curtains and work bench areas need to be qualified for ESD control. Linoleum flooring is a low cost solution for ESD and cleanliness control of all areas of the room
- 3) The number of doors into the integration room should be limited to restrict the flow of people (dust) into the integration room. Access to any other area of the VAB should not involve traffic through the integration room. For example, the door for the stairways leading from the second floor should only be into the VAB and not the integration room. The external door in the integration room should only be used as an emergency exit (alarm on door).
- 4) The current VAB darkroom can be modified for SPARCS testing in a straightforward manner. However, the cleanliness level of this room must be upgraded in the process. The existing ceiling tile grid can be retained with the addition of drop-in cleanroom ceiling tiles and lighting panels. The existing HVAC is easily adapted to the necessary level of filtration. It is recommended the payload access door aperture be covered by a cleanroom strip curtain.
- 5) Maintenance of the cleanliness of these areas is critical to their functionality. However, this maintenance will be prohibitively expensive if it is simply contracted out. The SWRG suggests putting the day-to-day maintenance burden on the users of the facility. In this approach, the WSMR upgrade subcommittee will take the lead in developing a cleanliness manual for users of the VAB payload facility. Such a manual would contain a SOP and a maintenance checklist/schedule. In addition to the supplies and maintenance NSROC currently provided in support of N-200 and VAB clean tents, the SRWG recommends the provision of integration facility entryway sticky mats, disposable shoe covers, and basic cleaning tools (mops, buckets, wipes) dedicated to the facility in order to ensure a baseline. All other supplies (gowns, headcovers, gloves, etc.) will be specific to the individual requirements of an investigation and should be provided by the investigator.

- 6) The SRWG emphasizes the importance of near-line-of-sight communication between the integration facility, the ASCL room, and the ground station during any operation for solar payloads involving sequence testing. This capability in the current N-200 facility should be retained in the VAB accommodation.
- 7) Payload access between VAB high-bay and integration room may need to be reconsidered for a more direct path for long-payloads between these areas.
- 8) The SRWG recommends the phase-II payload integration facility addition be configured as a dedicated clean room unless the performance of the phase-I facility makes this redundant.
- 9) The SRWG emphasizes the need for adequate electrical power and internet connections to adequately accommodate multiple payload integrations. For example, consider 110 VAC and 220 VAC outlets and multiple breaker circuits.
- 10) The SPARCS vacuum station no longer meets the cleanliness requirements of contemporary payloads. The SRWG recommends replacement of the vacuum station with modern equipment either as a part of this facility improvement or as a general capital equipment procurement. Any new vacuum station should be designed to accommodate operation on the launcher up through the final countdown (e.g. the NASA 36.240 Woods configuration).

SRWG Sub-Committee Report: “Comments on Poker Flat Science Instruments”

The SRWG sub-committee for Poker Flat science instruments discussed the issue of which instruments should be funded through the NASA range contract and be made available for routine launch support. The following points were raised during discussion:

- Concern was expressed that PIs have over many seasons been generally disappointed with the level of readiness and reliability of the launch support instrumentation.
- The sub-committee recognizes that there should be a "baseline" set of instruments that the range contract should support for all missions. Beyond these, there is a wide array of additional instruments potentially available -- but the relative priority of these will be strongly dependent on the science objectives of each mission.
- The baseline support that the sub-committee felt should be available for all missions are:

	Poker	Fort Yukon	Kaktovik
Fluxgate Mag	X	X	X
All-Sky	X	X	X
MSP	X	X	X
Riometer	X		
Look-angle prediction	X	X	X

- These instruments should provide real-time displays of their data during launch operations, archiving of the data, and distribution of data to experiment teams in a timely manner ASAP after launch.
- For instruments such as the MSP and fluxgate magnetometers, the SRWG sub-committee also requires that these instruments have routine calibration and up-to-date baseline subtraction.
- In addition, the SRWG sub-committee expects that the range will provide observing spaces (with power and communication) at Poker, Ft. Yukon, and Kaktovik for PI-provided instruments that could be deployed in an ad-hoc fashion as needed by specific missions.
- The sub-committee noted that this is very much a minimal list, and that almost all experiments would require more support than this.
- The sub-committee noted that Toolik Lake is an emerging new site that could be very attractive for supporting a number of new missions in the future. Some consideration should be given to whether any instrumentation could or should be supported at this site.
- Other instruments that could/should be included under NASA support remains subject to negotiation. Examples include additional riometers and magnetometers, narrow-field cameras, grating spectrometers, induction magnetometers, photometers, Fabry-Perot spectrometers, and tomography receivers.