

## Findings

### **Sounding Rocket Working Group** National Aeronautics and Space Administration

Meeting of June 16, 2005

#### **I. Annual Operations at Poker Flat Research Range**

##### Summary:

*The SRWG strongly endorses the efforts of the SRPO to re-instigate annual launch operations at the Poker Flat Research Range. Not only does a new cost analysis show that there are no significant cost savings in the current bi-annual operations plan, but also annual operations would provide for risk mitigation, improved launch flexibility with respect to weather and other considerations, as well as potential scientific advantages.*

##### Background:

The decision in the 1990's to restrict the NASA sounding rocket operations at the Poker Flat Research Range to every other year (i.e., bi-annually) was enacted in an effort to conserve project resources. However, the fiscal assumptions upon which this decision were based are no longer accurate. A new analysis by the Sounding Rocket Project Office (SRPO) presented at the June 2005 SRWG meeting shows that cumulative costs for annual and bi-annual operations to support eight launches (4 yearly or 8 bi-yearly) are, respectively, \$417K and \$396K per flight. These numbers include the fact that NASA pays a flat fee of essentially \$1M/year to Poker Flat to maintain the facility, even in the years in which no rockets are launched, in addition to the costs needed for the operations. The difference in the annual versus bi-annual costs per flight is within the uncertainties of the analysis. Furthermore, there will be funds saved in NSROC overtime at Wallops and at PFRR by distributing the work over two seasons instead of forcing it into one season. In this regard, flight risk mitigation is an important, positive outcome that immediately results from a re-distribution of the NSROC staff workload for PFRR-related payload preparation and operations.

A second advantage of a switch to annual operations is the flexibility with the launch scheduling in cases where a mission can not be launched in a given year due to weather or technical problems. Not having to wait two years has immediate advantages for graduate students who are relying on the launch of a particular mission to obtain data for thesis research. Finally, there are possible scientific advantages of being able to conduct rocket operations each year. This is particularly true for missions that rely on correlative measurements with satellites with limited instrument lifetimes as well as missions launched into geophysical events that are dependent on solar cycle or other variables for which a two-year delay is potentially more detrimental than a one year delay. Given these reasons, the SRWG strongly endorses a plan by which NASA HQ and the SRPO re-instigate annual launch operations at the Poker Flat Research Range. Finally, we note that the actual launch operations at Poker in any given year ultimately depends on which rockets are approved for Poker Flat launches by NASA HQ. This finding endorses the possibility of rocket operations each year.

## **II. Financial Concerns and Resulting Delays**

### Summary:

*The SRWG continues to be concerned about the financial health of the rocket program, particularly the shortfall of funds needed to sustain NSROC, launch operations, and other program elements at Wallops. Despite much attention to this problem at NASA HQ and at the SRPO at Wallops, there does not appear to be any significant financial relief on the horizon. As a consequence, launches are being slipped and the overall number of rocket launches per year will continue to decrease. Furthermore, the number of staff at NSROC, including persons with unique technical expertise, is expected to ultimately decrease as a result of this predicament. Although the SRWG is pleased that a plan has been worked out to enable a new motor buy at this time, we note with great concern that, as a consequence of this, two Geospace missions have been delayed for two years.*

### Background:

The SRWG maintains a keen interest in the fiscal health of the sounding rocket program, and has expressed concern over the years regarding how the combination of budget cuts, increased NSROC costs, the loss of civil servant personnel, and the realities of “full cost accounting” at Goddard have seriously decreased the total number of rocket missions that can be supported each year by the agency. Despite much attention to this problem at NASA HQ and at the SRPO at Wallops, there does not appear to be any significant financial relief on the horizon. Indeed, launches are being slipped and the overall number of rocket launches per year will continue to decrease. Furthermore, the number of staff at NSROC, including persons with unique technical expertise invaluable to the rocket program, is expected to ultimately decrease.

Despite the grim financial news, the SRWG is pleased that a plan has been worked out to enable a new motor buy at this time. One of the consequences of the decision to proceed with the motor buy now, however, has been the slip by two years of the TRICE Geospace missions (Kletzing, 40.018 and 35.036) from Andoya, Norway. Although it is unfortunate that the Geospace community has shouldered this burden (as was true when the 5 Hecht Geospace rockets were cancelled a few years ago), the decision appears to be the most cost effective means to make some much needed funds available in the short term. The SRWG is in full agreement that the program must buy rocket motors now, as discussed in our finding from the last SRWG meeting. It is unfortunate that this requires a slip of two years of a two-rocket mission that had already completed its Design Review.

## **III. Black Brant Motors and Alternative Vehicles**

### Summary:

*The loss of the Mk1 Black Brant motor in the recent Lynch mission (40.017) has put a temporary hold on the procurement of new Brant motors. The SRWG eagerly anticipates learning the exact cause of the motor failure as well as the recovery plan and schedule for this vehicle. Whereas we endorse efforts to re-establish the means to procure Brant vehicles, the SRWG also believes that it is prudent for the SRPO to devise at this time an alternative approach, including a cost analysis plan, regarding the procurement of other similar class vehicles, such as the Oriole and ASAS motors, in the event that the Brant recovery is either not successful, or not completed on a timely basis.*

## Background:

The Black Brant (BB) VC is a major element of various NASA launch vehicles used to launch standard sounding rocket payloads. The current NASA inventory of BB VC sustainers will become fully depleted near the end of FY 2006, as discussed in the SRWG finding from the January, 2005 meeting. Bristol Aerospace does not intend to continue production of the 'standard' VC, but instead, plans to manufacture the Mk 1, an improved version of the VC, containing a propellant of new composition providing a higher total impulse. The current NASA/NSROC plan is to procure a number of Mk 1 motors.

This procurement is on hold following the failure of NASA 40.017 (Lynch), in which the standard VC in the third stage was replaced with a Mk 1. The igniter functioned, but failed to ignite the propellant grain. An extensive series of ground tests of the igniter system will be carried out this summer, to be followed by a test flight in Fall, 2005, of a BB XI, in which the third stage will be a Mk 1. If the ground and flight tests are satisfactory, then the path to a resumption of the Mk 1 procurement will be clear.

However, should these tests leave major questions unanswered, then an alternative procurement for the replacement of the standard VC would have to be implemented. At the SRWG meeting on 16 June 2005, the SRPO proposed two options:

- 1) The 22-inch diameter Oriole motor
- 2) The 21-inch diameter Advanced Solid Axial Stage (ASAS) motor

Both sustainers are more expensive than the VC and both would require development of a thrust termination system (TTS) to support launches from WSMR. Performance metrics are somewhat different than the BB VC, although these motors are in the same class as the Black Brant. Mr. Phil Eberspaker, Chief of the SRPO, stated that some consideration was being given to developing a steel motor casing for the ASAS to lower its cost.

In light of the uncertainty surrounding when and if the new Black Brant motors will be re-certified and available for procurement, we urge the SRPO to develop an alternate approach at this time, including a cost analysis plan, of the alternative vehicles. In this manner, the program will be ready to choose an alternative path, in the event that the Brant Mk1 recovery is either not successful, or is not completed on a timely basis. We see this as the most effective way to sustain the program objectives without a suspension of normal operations.

## **IV. Low cost mesospheric rocket development**

### Summary:

*The SRWG is encouraged by plans for a 4-inch diameter "Mesquito" payload that would be launched on a surplus MRLS motor. The SRWG was surprised that so little payload volume and mass were left available for the experiment hardware, however. Recognizing that standardization of the payload is the most effective way to keep costs low, the SRWG is assembling user recommendations for this payload/vehicle that will be presented separately. One overriding concern at this time is that the total cost of the payload, motor, and operations remain very low in order to preserve the original intent of this development -- i.e., that multiple launches (e.g., 4 - 6) of such payloads might be launched as part of a single experiment.*

### Background:

As stated in previous findings, the SRWG has much interest in the development of a small rocket for mesospheric research, and indeed this initiative remains part of the technology roadmap developed by the SRPO with SRWG input.

The SRWG was encouraged by the NSROC presentation of first cut plans for a low cost, mesospheric payload to replace the earlier “Dart” 2-inch diameter payloads. The proposed 4-inch diameter “Mesquito” payload would be launched on surplus MRLS motor. The SRWG was surprised that so little payload volume and mass were left available for the experiment hardware, however. Recognizing that standardization of the payload is the most effective way to keep costs low, the SRWG is assembling user recommendations for this new payload/vehicle that will be presented separately. We also note that passive mesospheric experiments (e.g., inflatable sphere and/or chaff whose motions are tracked by radars) may also use the MRLS motor.

Given the current, severely constrained fiscal environment, we are particularly interested in ensuring that the resulting payload, vehicle, and operations remain at a very low cost. In this fashion, the mesosphere rocket initiative will preserve the original intent of this development -- namely that multiple launches (e.g., 4 - 6) of such payloads might be launched as part of a single experiment that will not cost more than a single, standard rocket payload.

## **V. Kwajalein as a New “Standard” Range**

### Summary:

*The SRWG supports the inclusion of the Kwajalein range as a new standard location for the launch of sounding rockets without the need for a special campaign status. The unique range location near the equator, the existing infrastructure, and the powerful Altair scientific radar make this location a very appealing site in which to carry out Geospace experiments of the low latitude upper atmosphere. We note that since the Kwajalein range is not on the magnetic equator, however, those Geospace experiments that require close proximity to the magnetic equator will not be served by the Kwajalein launch location. However, astronomy payloads, with or without water recovery, may be able to take advantage of this location in the future in cases where southern hemisphere celestial targets are being studied.*

### Background:

The SRWG continues to follow with great interest the feasibility study being carried out by the SRPO of establishing the Kwajalein range as one where NASA sounding rocket operations might be carried out routinely, as is currently the case at ranges at White Sands, New Mexico, and Poker Flat, Alaska. As stated in our finding from the previous meeting, the SRWG applauds the work of the SRPO and NSROC in carrying out the very successful Equatorial Ionospheric Studies II (EQUIS-II) sounding rocket campaign in Kwajalein during the summer, 2004.

Kwajalein’s unique location near the earth’s equator opens the door to a large number of important scientific research problems, in a similar manner in which the Poker Flat range in

Alaska enables important high latitude science to be addressed. The unique range location near the equator, the existing infrastructure, and the powerful Altair scientific radar make this location a very appealing site in which to carry out Geospace experiments of the low latitude upper atmosphere. We note, however, that since the Kwajalein range is not directly on the magnetic equator, those Geospace experiments that require close proximity to the magnetic equator or to the unique NSF-funded Jicamarca observatory in Peru, will not be served by the Kwajalein launch location. On the other hand, future astronomy payloads, with or without water recovery, might be flown from the Kwajalein location where southern hemisphere celestial targets are studied.

The SRPO initial assessment that the Kwajalein range may be accessible to routine operations in much the same way that the White Sands and Poker Flat ranges are accessible now to NASA-funded science missions, is very encouraging news to the SRWG. The SRWG supports the inclusion of the Kwajalein range as a new standard location for the launch of sounding rockets without the need for a special campaign status.

## **VI. NSROC staffing**

### Summary:

*As program budget margins remain extremely tight, NSROC is understaffed. For example, some NSROC managers lead more than one section and high levels of overtime are now commonplace. The SRWG is concerned that these tight margins with respect to manpower will result in the inability of the SRPO to support selected missions and leave the program vulnerable to increased risk resulting from an overworked staff.*

### Background:

Years of erosion of the sounding rocket budget have significantly reduced available NSROC personnel. The effects of these budgetary strains are still with us and will not be fixed in a single year. This manpower crisis at NSROC can be seen in many different areas across the program.

That NSROC remains short staffed has been presented at several SRWG meetings, with little relief in sight. NSROC staffing levels have dropped 6 FTEs since the preceding Sounding Rocket Working Group meeting. In order to support the upcoming 2007 Poker season, NSROC anticipates enormous overtime efforts. The high level of overtime puts strain on the work force and adds to the overall mission cost.

For example, in order to cover the need for vehicle system engineering, Mr. Giovanni Rosanova has agreed to head both the mechanical engineering section and the vehicle system engineering section. Although on the one hand, this is another example of the heroic efforts which are so common at Wallops, by making such heroic efforts standard practice, it becomes difficult for such a manager to respond to any crisis that may arise. How can one person run the mechanical engineering section, the vehicle system engineering, and respond to a crisis that develops in either section, all within a 24 hour day? Despite our appreciation of the hard work of the NSROC and Wallops workforce, the SRWG finds the overall staffing situation at NSROC very troublesome.

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