

## Findings

### **Sounding Rocket Working Group**

National Aeronautics and Space Administration

Meeting of December 20, 2006

#### **1. Program Funding Crisis**

*Summary.*

**The Sounding Rocket Working Group believes that the proposed cuts to the operations budget put NASA's sounding rocket program in great peril.** Numerous NASA scientific advisory groups and the National Research Council have concluded that NASA's Sounding Rocket Program should be strengthened and preserved, not decimated. Because of the infrastructure costs at WFF needed to maintain the program regardless of the number and type of launches, even small cuts to an already weakened program have significant negative impact. We urge that the funding cut from NASA's sounding rocket budget since 2005 be re-instated.

*Background.*

The sounding rocket user community, represented by NASA's Sounding Rocket Working Group (SRWG), is greatly alarmed by recent cuts to the rocket operations budget. These cuts threaten the three hallmarks of the sounding rocket program:

- (1) to carry out forefront scientific research, responding quickly and efficiently to new opportunities;
- (2) to test new instruments and systems in space;
- (3) to provide, at the graduate level, hands-on training in space research and instrument development.

They also imperil the ability of the rocket program to support NASA satellite missions by providing critically important validation and calibration of orbiting instruments, such as been recently carried out with TIMED, SOHO, and SORCE, and is anticipated to be carried out with SDO and AIM. The rocket program may also be expected to develop and test technology essential for implementing NASA's new Exploration initiative.

The purpose of this letter is to urge, in the strongest possible terms, your support in resolving the fiscal crisis facing NASA's Sounding Rocket Program. As discussed below, approximately \$50M is required over the next five years to restore the program to health and a minimum of \$25M is needed over this period (~\$5M/year) in order to keep the program at its minimum viable level.

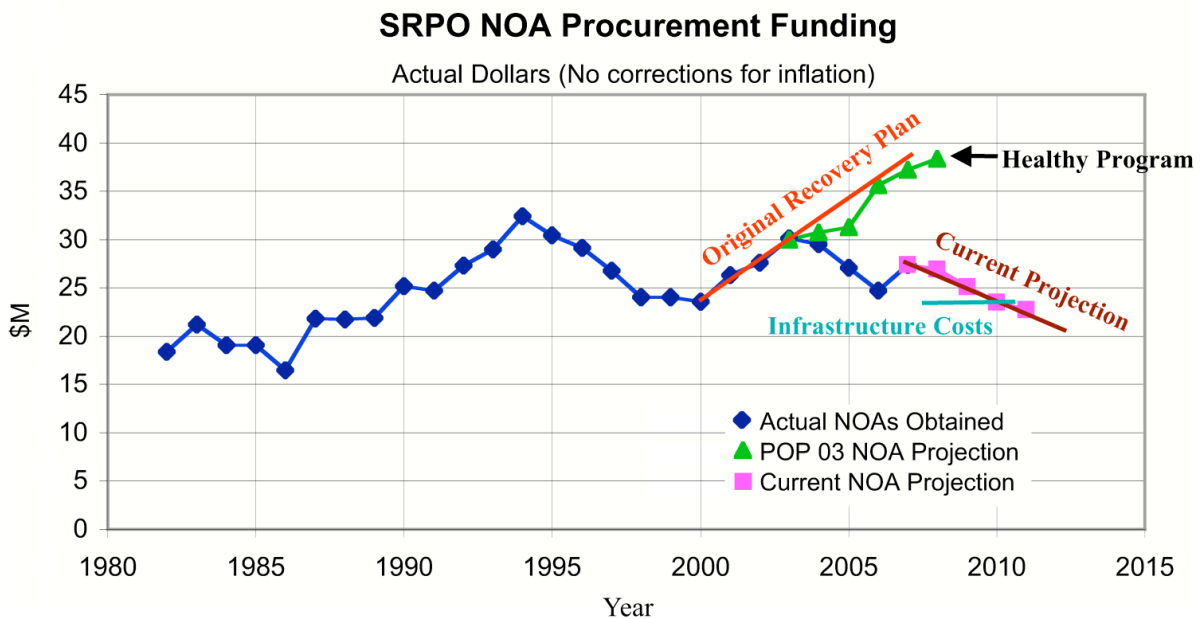
*The Current Fiscal Crisis*

Both the sounding rocket program budget and the main operations contract at Wallops Flight Facility (WFF) have changed considerably over the past decade. The Sounding Rocket Operations Budget (including funding for payload development) is shown in the graph below. Although rocket operations funding was substantially decreased in the latter half of the 1990's, the program was able to survive for several years by using

reserve or carryover funds and by depleting its inventory of rocket motors. The advent of the NASA Sounding Rocket Operations Contract (NSROC) in 1999, together with both the loss of a large number of civil servants and the lack of any inflationary adjustments, placed additional strains on program finances.

Creative efforts by sounding rocket program managers at both NASA Headquarters and WFF led, in the first half of this decade, to a new, approved budget that included an infusion of sustained annual funding that was to begin in FY06 and be used to replenish the motor inventory and stabilize the program in the years to come. The sounding rocket community thus looked forward to a long awaited recovery in 2006 that would enable the minimum viable program to continue. Modest increases (overguides) were also sought to build some reserves in the motor inventory and for new technology development, including the exciting High Altitude Sounding Rocket.

In contrast to this promised increased funding, NASA’s initial response to the President’s Exploration Initiative in January, 2004, contained severe cuts to the sounding rocket program budget: \$4.2M in FY05, \$10.9M in FY06, \$9.4M in FY07, and \$11.7M in FY08 – **a \$36M cut over a four-year period**. Compounded by prior cuts that left the program severely weakened, these new cuts essentially crippled a program that has served the nation exceedingly well for over 45 years.



The Sounding Rocket Working Group believes that the proposed cuts to the operations budget put NASA’s sounding rocket program in great peril. Numerous NASA scientific advisory groups and the National Research Council have concluded that NASA’s Sounding Rocket Program should be strengthened and preserved, not decimated. (Some of these endorsements were documented in a similar finding by the SRWG from its June, 2004 meeting.) Because of the infrastructure costs at WFF needed to maintain the program regardless of the number and type of launches, even small cuts to an already weakened program have significant negative impact. We urge that the funding cut from NASA’s sounding rocket budget since 2005 be re-instated.

## **2. Reducing Costs per Mission**

### *Summary.*

The SRWG is very concerned with the overall funding shortages for the program and is searching for ways to mitigate the costs per rocket as a means to launch more payloads for a given overall funding allocation from NASA HQ. Consequently, the SRWG requests insight and information concerning the costs per payload. We are particularly interested in learning the extent that flying payloads similar to past ones is an effective means to reduce costs. The SRWG also seeks to understand to what extent the new NSROC contract will include incentives to lower the cost impacts to the program.

### *Background.*

The costs of the NASA-funded missions were revealed in the meeting of January 19, 2005, in which the user community learned that most Black Brant-class missions cost Wallops in the neighborhood of \$2.5-3.0M, including operations costs. Detailed information on costs, however, has not been provided to the users. In an effort to learn how these costs might be decreased, the SRWG requests insight and information concerning the costs per payload broken down by sub-systems, particularly as the user requirements have such a direct impact on the costs. We note that the SRWG has had similar findings, requesting such cost information feedback, specifically Finding #7 from the June, 2000 meeting, the general Finding for the combined December, 2000 and June, 2001 meetings, and Finding #3 from the June 19, 2005 meeting. If detailed information is proprietary, perhaps approximate costs could be provided?

To illustrate our concerns, the user community notes that a payload that is similar to one that has flown previously appears to still cost a significant amount, even if it is put in a category reflecting a “near reflight”. In other words, payloads with a great deal of similarity to previous ones do not appear to cost much less than new payloads of a similar complexity, except in cases where the payload is an *exact* re-flight of a *recovered* payload. Thus, it appears that the main cost of each mission is due to personnel, hardware, testing, and operations and not so much the design time. We conclude that there is not much financial incentive for users to propose to fly experiments similar to previous ones, except from the standpoint of reducing risk. We would appreciate comments on this conclusion from the Sounding Rocket Program Office.

Looking ahead, the SRWG hopes that the new NSROC contract will include stronger incentives for NSROC to lower the mission cost impacts to the program.

## **3. Impact of “Reimbursable” Missions on the Science Program**

### *Summary.*

The SRWG is concerned that the reimbursable portion of the NSROC activities appear, at least from our vantage point, to increasingly inflict an undue stress on the performance of NASA-funded science missions, even though NSROC has consistently demonstrated that they can meet such “dual-challenge” responsibilities. Although we recognize that the reimbursable activities pay their own way and, in times of fiscal constraints at NASA, help keep the program afloat, the SRWG wonders if improved planning and management might help mitigate some of the tension recently observed between NASA-funded and DoD-funded projects.

### *Background.*

Reimbursable programs have become an important part of the NASA Sounding Rocket program, since the onset of the NSROC contract structure that started in 2000. The inclusion of reimbursable work (mostly DoD funded) was “welcomed with caution” at the onset, as there was an immediate fear that it might one day take priority over NASA-funded work. (See Finding #3 of January, 2003 SRWG meeting). Despite assurances that this would not happen, as the number of NASA-funded projects has diminished and the number of reimbursable projects has grown, there appear to arise conflicts over priorities (e.g., availability of personnel, machine shop, etc.). Furthermore, where this competition is between a NASA science mission and a reimbursable mission, the NASA mission appears, at least in our view, to suffer. Although ultimately, NSROC has, remarkably, been able to satisfy both sets of customers, this has not been without cost. Specifically, the SRWG continually hears of NSROC personnel “burn out”, for many working overtime is typical, key managers work more than one job, staff attrition, etc. This, in turn, provides for a stressful situation, as discussed in Finding #6 of June, 2005 SRWG meeting. Furthermore, in cases where personnel have not been available for NASA payload design work and integration activities, some users have found their schedules impacted or “drawn out”, resulting in significantly higher experimenter costs.

Although we recognize that the reimbursable activities “pay their own way” and, in times of fiscal constraints at NASA, help keep the program afloat, the SRWG urges NSROC to consider improvements in the management of projects such that the reimbursable work does not negatively impact the NASA-funded science projects.

## **4. Increase in Safety Requirements and Resources Impact**

### *Summary.*

The SRWG was surprised to learn that safety requirements have jumped and that the number of persons working safety issues in the rocket program (and being funded by the program) has significantly increased. The SRWG wishes to better understand the reasons for the increase in safety officers, their roles and responsibilities, and their impact on the operations as well as the sounding rocket budget.

### *Background.*

The SRWG was surprised to learn that 17 of approximately 140 FTE associated with the rocket program at Wallops are dedicated to safety or quality assurance. Although launching rockets has inherent dangers, and although the SRWG is not expert in the practices of safety professionals, employment of more than 10% of the program’s workforce by the Safety Department would seem to be in excess of the usual norms. We have heard that new safety requirements have greatly burdened the program and have led to a stretching out of field work, for example at the recent Poker Flat campaign. The SRWG would like to better understand the reasons for the increase in safety officers, their roles and responsibilities, and their impact on operations as well as on the budget.

## **5. Recent “Extended” Integrations and Procedures**

### *Summary.*

The SRWG has been informed by a number of users (including several who are currently on the committee) that recent integration schedules took far longer (10 weeks compared to 3-4 weeks in the past). The long integration is expensive for the payload teams as it ties up technicians, engineers, and scientists for lengths of time considerably longer than those budgeted. The SRWG is chiefly concerned about procedures and communication. We would like to better understand the role of the “Pre-integration Review” at Wallops and how the payload status is communicated to the PI and experiment teams prior to their travel to Wallops for integration.

### *Background.*

Several experimenters experienced some exceedingly lengthy integrations in the Fall of 2006. For example, an integration that typically would last about three-four weeks ended up taking about 10 weeks. In two cases, payload systems were not ready (built and tested) when the experimenters arrived with their instruments for integration. Although in some cases, the experimenters contributed to some of the integration “stretch-outs”, they were not the main cause, at least in these recent cases discussed by the committee. Apparently the pre-integration review system at Wallops that ensures that payloads are built and checked out prior to the experimenter’s arrival was not explicitly followed last Fall. Another problem that was apparent was the lack of available personnel from NSROC who were needed in the field during critical times precisely when they were also needed at Wallops.

The SRWG would like to better understand the pre-integration procedures and review at Wallops. Is the review documented? Does the SRPO participate? Further, since we understand far too well that unforeseen technical problems may arise, the SRWG believes that communications between the payload teams at Wallops and the experimenters should be improved so that experimenters do not arrive prior to when they are needed, or prior to when their time would be most efficiently utilized. This is particularly important for experiment teams that travel to Wallops from foreign countries.

Finally, we note that the financial consequences of extended integrations for experimenters is severe. One of the most expensive mission phases for the experimenter is integration because of its deployment of dedicated personnel to the field. Substantial and unexpected delays during integration can rapidly deplete the funds of an experiment team, even to the extent that imprudent practices must be employed, such as staffing the integration only during the most critical phases, or with non-expert personnel.

## **6. High Precision Star Tracker for Astronomy Payloads**

### *Summary.*

The SRWG is pleased that Wallops continues to pursue development of a highly precise star tracker with 1-2 arc-sec resolution for Astronomy payloads based on the ST5000 system developed at the University of Wisconsin (UW). Whereas it has been suggested that UW provide such units for Wallops, the SRWG (including a representative from UW) believes that it is far better for NSROC to fabricate and test these units and that a separate, smaller contract with UW be set up to handle problem solving and future improvements such as jitter reduction.

### *Background.*

The ST5000 star-tracker, developed at the University of Wisconsin (UW), is one of the more significant developments in the NASA sounding rocket program in recent times, one which has been accentuated by the decision at WFF to develop in-house the new celestial attitude control system (CACCS) for very precise astronomical pointing. The ST5000 is far more precise than the old and trusted Ball Brothers (BB) tracker, for it is able, during a stabilized pointing at an arbitrary star field, to generate a position signal with an intrinsic jitter in the range 1-2 arc sec, to be compared with a figure of 5-10 arc sec previously attained primarily by the BB tracker on centered bright stars. Further, in any pointing attitude, whether this be planned or the result of the ACS losing its attitude reference frame ('lost-in-space'), it can recognize the star field using its own internally stored all-sky catalog, and in an emergency generate error signals which allow the payload to find its way to the desired target. These characteristics would assume still greater importance if, in the future, the SRPO were to build and fly payloads for low-cost orbital missions.

At the recent SRWG meeting, NSROC raised the possibility of meeting the requirement to provide the ACS ST5000 star-trackers for Wallops in the years to come through a contract with UW. Dr. Nordsieck of UW stressed at the meeting that the group at UW responsible for the ST5000 was too small for this task, and moreover its purpose at the university was to function as a small creative team which would address new research needs. Hence, in this context, manufacturing trackers at UW for WFF would be inappropriate. The SRWG agrees with this view and proposes the following:

- 1) Manufacture and calibration of the ST5000 for the sounding rocket program, and for any orbital programs which may develop in the future, should be undertaken by a section in the GNC branch at NSROC set up for this purpose.
- 2) The ST5000 contract with UW should be maintained. In this manner, the technology and experience built up over the past 10 years of ST5000 development may be transferred efficiently to NSROC, the UW group can work on unexpected difficult problems encountered by NSROC in using the ST5000, and finally the UW group can develop the improvements to the ST5000 which will be demanded by future missions, for example a reduction of the intrinsic jitter to a fraction of an arc second.

## **7. Appreciation: Frank Lau**

### *Summary.*

The SRWG applauds the work of Mr. Frank Lau during his 41 years of service to NASA and its Sounding Rocket Program. Frank's contributions in the areas of attitude control systems, management of solar rocket missions, and management of the NASA contract with the White Sands Missile Range have been superb. The SRWG offers its sincere appreciation and thanks for Frank Lau's dedication and contributions to the rocket program. He will be greatly missed.

### *Background.*

On behalf of the NASA Sounding Rocket Working Group (SRWG) and sounding rocket user community, we offer our sincere congratulations to Frank Lau on his retirement.

Frank's 41 years of service for the NASA sounding rocket program, first at GSFC and then at WFF, have been outstanding. His contributions in the areas of attitude control systems, management of solar rocket missions, and management of the NASA contract with the White Sands Missile Range have been superb and are greatly appreciated by the user community. Indeed, Mr. Lau has received several NASA Achievement Awards for these exemplary efforts over the years.

Beyond his technical performance, Frank Lau's strong dedication and commitment to making NASA's sounding rocket program the best possible have greatly contributed to the success of the program from which unprecedented scientific research could be achieved. For these superb contributions, the SRWG offers its sincere appreciation and thanks. We extend our congratulations and best wishes to Frank for the years ahead.

### **NASA Sounding Rocket Working Group**

Dr. Robert F. Pfaff, Jr. (Chair)  
NASA/Goddard Space Flight Center

Dr. Scott Bounds  
University of Iowa

Dr. Webster Cash  
University of Colorado

Dr. Supriya Chakrabarti  
Boston University

Dr. John Craven  
University of Alaska

Dr. Ray Cruddace  
Naval Research Laboratory

Dr. James Hecht  
The Aerospace Corporation

Dr. Paul Kintner  
Cornell University

Dr. Dan Moses  
Naval Research Laboratory

Dr. Ken Nordsieck  
University of Wisconsin

Dr. Thomas Woods  
University of Colorado