

Findings

Sounding Rocket Working Group

National Aeronautics and Space Administration

Meeting of January 23-24, 2008

1. Preparing for the New NSROC Contract

Summary.

As NASA is preparing to instigate a new NASA Sounding Rocket Contract (NSROC) to provide support services to the Sounding Rocket Program, the SRWG offers suggestions, remarks, and concerns regarding how the new contract might be set up:

(A) The SRWG strongly recommends that the present contract “award fee” structure be maintained and, in fact, strengthened, to ensure that costs are kept low and the contractor is a true partner with the experiment team with respect to innovation and problem solving.

(B) The SRWG urges that a 10 year contract be maintained instead of the proposed 5 year contract as the latter would introduce burdensome disconnects in a program that is based on missions that are nominally 3 years long, but may often be longer.

(C) Civil servant involvement should be included, where appropriate, in the contract structure, for example to manage “special” missions for the agency, to chair review panels, and to enable technical training for Goddard (and any other NASA center) engineers and managers.

(D) To avoid problems at the range regarding authority during operations, we urge that either the contractor be given full charge of operations (which has proven difficult since the range agreements are with the government), or that civil servants manage the launch operations, with support by NSROC personnel.

(E) To save money, we suggest that the US Government procure as much hardware as possible, including rocket motors. This will also enable the inventory to stay in government hands when the contract is re-competed every 5-10 years.

(F) The Principal Investigator must remain firmly in charge of each project and should be consulted in assessing NSROC’s performance on the individual mission and the sounding rocket program as a whole.

Background.

The current NASA Sounding Rocket Contract (NSROC) will expire in one year, after which time, a new contract will be issued by NASA. The SRWG has been involved with NSROC since its inception and has issued a number of finding regarding how the program is managed and operated, particularly after it was transitioned from a civil servant-run program to one where the contractor is basically in charge of the missions.

(See, for example, the SRWG joint finding of its December 7, 2000 and June 15, 2001 meetings). Despite our initial skepticism, the SRWG has endorsed the NSROC approach and believes it serves the agency program objectives exceedingly well.

In this finding, we underscore those features of the current NSROC contract structure that we feel must be maintained, from both the scientific research and program standpoint, as well as offer suggestions for new contract features, since clearly this is the appropriate time to implement new ideas. We offer 6 such comments/suggestions below, and look forward to continued discussions with the Sounding Rocket Program Office (SRPO) beyond the presentation that was provided to us at the SRWG meeting in January, 2008.

A.) Contract Structure to Incentivise Contractor to Save Costs and Encourage Innovation

NASA's Sounding Rocket program is perhaps the last of the true "skunk works" operations at NASA. The unparalleled success of the program rests firmly on the fact that the program is enacted as a partnership between the scientist (P.I. and his/her team) and the Wallops engineering team (NSROC) that has been tasked to design, build, test, and launch a payload (or payloads) to fulfill cutting-edge scientific research. Often, this requires that NSROC develop innovative, new payload designs, in close cooperation with the PI science instrumentation, which is often also being developed for the first time in parallel with the Wallops engineering activities. Furthermore, since many of the NASA science missions are launched into one-of-a-kind geophysical events, the need for creative solutions to optimize and meet launch conditions (innovative countdowns, real-time data displays, joy stick operations, etc.), also require a close partnership between the science team and NSROC.

To this end, *the current contract structure of an award fee plus incentive fee makes sense and is appropriate for the program.* This structure incorporates both an objective and subjective criteria on which to award fee. The latter is important for cases where a mission falls between minimum and comprehensive success, as well as provides a means to reward the contractor for both innovation and time-saving measures (expedient integration and operations). By contrast, a contract that is based on a fixed fee, makes little sense for this type of program. The contractor would then be expected to inflate costs to make sure the company is well covered for any unforeseen contingency and removes any official incentive to save costs or be innovative.

B.) Five year vs. Ten year Contract

The SRWG was informed at its recent meeting that the new NSROC contract is likely to cover only a 5 year period, as opposed to 10 year (5 + 5 year) contract, as is presently the case. The SRWG believes that a 10 year contract is far more appropriate for the program. The reason is that most missions require a minimum of 3 years to be enacted. It is important to have continuity with the same engineering and management team working with each project for as much time as possible. A 10 year contract provides far fewer disruptions to the multiple parallel flight programs that are in process at any one time. For example, re-competing the contract every 5 years has the potential to disrupt the 20-30 flight programs that would be in various phases of development at any given time. We find this additional risk to this large number of flight programs to be unnecessary, particularly since it could be substantially minimized by a longer NSROC contract.

C.) Civil Servant Involvement

The SRWG urges that civil servants participate in the program beyond their current role. In particular, we believe that civil servants should be allowed to manage and/or provide

engineering expertise for any NASA sounding rocket mission when the need arises (e.g., missions that address special agency needs, missions that provide training of certain civil servant skills, and/or missions or campaigns with a significant foreign component).

We have also suggested over the years that a civil servant should chair (or at least serve on) the Design Review and Mission Readiness Panels to ensure an objective assessment is made of all critical decisions, particularly ones involving the need to expend additional contractor resources. Although the current NSROC team has demonstrated that they are fully capable of “policing” themselves, there is nonetheless a conflict of interest. Further, the new contractor may not be as even-handed, particularly as they come up to speed on how to manage the individual projects.

Finally, as it is well-established that the program provides an excellent opportunity to train engineers, technicians, and managers, it would therefore be appropriate that NASA civil servant employees would also benefit from this opportunity, providing well-defined tasks working closely with the NSROC team.

D.) Operations

One area where the NSROC activities have encountered some difficulties has been in the area of operations, as noted in previous SRWG findings. This is primarily because the various range contracts and agreements (e.g., White Sands, Poker Flat) are made between the range and NASA, whereas the NSROC manager requires a great deal of real-time authority to get the mission staged and launched. We urge that the new NSROC contract be structured so that missions are led by civil servant field managers during the operations phase, or that NSROC be given much more authority at the launch site.

E.) Procurement

As the SRWG has suggested in the past, in order to save money, we recommend that the US Government procure as much hardware as possible, including rocket motors for the sounding rocket program. This will also enable the inventory to stay in government hands when the contract is re-competed every 5-10 years. Not having access to the relevant financial records, the SRWG requests that a simple analysis of major procurements for the program over the last 9 years be provided in order for the SRWG to better understand whether indeed significant money might have been saved via government purchases compared to those of the NSROC contractor.

F.) PI Involvement in Mission and NSROC Assessments

A hallmark of the program since its inception, the Principal Investigator (P.I.) is firmly in charge of his/her sounding rocket mission. The P.I. is thus the logical source to provide the assessment of individual mission performance, which includes an assessment of the NSROC contractor performance. He/she should also be consulted regarding overall NSROC performance, when it is appropriate to carry out assessments of the program. When the first NSROC contract was enacted in 2000, a review was conducted two years later to ensure that the most important program elements were still being met from the user (scientist) perspective. The SRWG believes that such a review would also be appropriate, and should be included, for all follow-on contracts.

2. Working with Export Control (ITAR) Guidelines within the Sounding Rocket Program

Summary

The SRWG commends NASA HQ, the SRPO, and NSROC for finding a workable interim solution, involving Technical Assistance Agreements, to the extremely difficult problem of complying with a top level interpretation of the US export control regulations in a hands-on, research-oriented space-flight program that services a wide variety of basic science investigations with extensive involvement of Foreign National students enrolled in US educational institutions and of collaborations with Foreign National co-investigator institutions. The SRWG extends its appreciation to NASA HQ for organizing a panel of agency experts that discussed the ITAR restrictions and received user input on how ITAR is affecting our scientific research programs.

Background

Sounding rockets traditionally include the extensive involvement of Foreign National students enrolled in US educational institutions, collaborations with Foreign National co-investigator institutions, and rocket launches on foreign ranges, which are necessary to carry out many geophysical research programs, as well as astrophysical missions that must observe southern hemisphere celestial targets. The SRWG is very concerned about the impact of national export control policies on the sounding rocket program, as they impact the ability to bring instrumentation to foreign ranges to conduct scientific research, the interactions of the payload science and engineering teams with Foreign National graduate students and collaborators, and the ability to share data, including such ancillary information as rocket trajectories and payload orientations.

As the merits of the ITAR restrictions are debated at higher levels, the SRWG commends NASA HQ, the SRPO, and NSROC for finding a workable interim solution involving Technical Assistance Agreements (TAA) to enable research to continue with Foreign National involvement. From the user perspective, the SRWG seeks ways to work with the SRPO and NSROC to efficiently and accurately administer the TAA paperwork so that this process does not require inordinate time and resources. The SRWG hopes that this process can become streamlined to the extent that it becomes “routine”.

The second day of the SRWG meeting included a panel of agency experts that discussed the ITAR restrictions and received user input on how ITAR is affecting our scientific research programs. The panel was highly informative and quite useful to the committee. The SRWG extends its appreciation to NASA HQ for organizing this information exchange and discussion.

3. Escalating Quality Assurance Oversight on Sounding Rocket Missions

Summary

The Sounding Rocket Program is based on an acceptable level of risk that is higher than for other NASA programs. The SRWG finds the current NASA mishap categories inappropriate for the Sounding Rocket Program. The cost threshold for a Category A level mission assurance (mishap) is \$1M which now includes almost every sounding rocket mission. The SRWG strongly recommends that the SRPO retain control of mission assurance (mishap investigations) for missions < \$5M. In particular, all reviews

arising from failures and anomalies in missions at or below this level that do not involve injury or loss of life should be conducted by the SRPO.

Background

The Sounding Rocket Program is charged with three mission objectives, each of which requires a different approach to mission assurance in comparison to other NASA flight programs: (1) development and training of experimental space scientists, engineers & mission managers, (2) development through flight test of unproven technologies for future orbital missions, and (3) investigation of science questions with either immediate payoff or potential for opening new lines of investigation. Each of these activities involves a greater level of acceptable mission success risk to achieve goals vital for future activities. The NASA SRPO excels in optimizing its activities within this very specialized risk environment.

With current technology costs and cost accounting, a large number of SRPO missions fall within the \$1M to \$5M cost level. These missions are achieved with an outstanding success rate under a mission assurance approach refined over decades of experience in this risk environment. Unfortunately, the threshold for Category A mishaps is currently \$1M and has not been adjusted to account for the unique features of the Sounding Rocket Program. The SRWG strongly recommends that the SRPO retain control of mission assurance (mishap investigations) for missions < \$5M. In particular, all reviews arising from failures and anomalies in missions at or below this level that do not involve injury or loss of life should be conducted by the SRPO. The consequence of not making this adjustment is an increase of the overall program cost without any specific improvement in mission success. If this continues, there will be a net reduction of program success as resources are drained from productive activity to an activity with no demonstrable program utility.

4. Parachute Disreefing

Summary.

The SRWG applauds the NSROC efforts in exploring the cause of premature parachute “disreefing” which occurs at a rate of ~ 15%. Although this has not resulted in the loss or serious damage of recent payloads, NSROC has taken proactive steps to determine the root causes of disreefing, and develop mitigation and prevention plans to minimize its occurrence. These proactive steps have the potential to save significant costs to the sounding rocket program, especially if they prevent damage to expensive solar and astrophysics payloads, which are commonly recovered and reflown many times.

Background.

Premature parachute “disreefing” is the name for the situation where 1000 lb. parachutes used for recovery of payloads are fully deployed too rapidly. In principle, this can cause damage to the payload, or even total payload failure. Although premature disreefing has occurred on a number of flights (8 of 56) since NSROC’s inception, it has only resulted in payload damage or failure on a small number of occasions, and most of those were early in the NSROC tenure.

Despite there having been no recent major damage to payloads, NSROC has recognized the potential for significant problems due to premature disreefing and has taken proactive steps to investigate and mitigate the causes of this phenomenon. Most recently, the

36.220 McCandliss and 36.241 Rabin flights exhibited this behavior. Although no definitive root cause has yet been identified, two possible scenarios include high levels of payload dynamics during the drogue stage, and sharp edges on the reefing line cutters. NSROC is performing lab testing and has instituted a monitoring program to better understand the causes of premature disreefing.

This level of proactive engineering and investigation has the potential to save the program significantly, and is the type of detailed analysis that can reduce risk to the program while not significantly increasing cost. The SRWG applauds NSROC efforts in this area, and believes that this investigative program should serve as a standard for systems-level engineering and risk mitigation.

5. Downrange Support of Investigations at the Poker Flat Research Range

Summary

The SRWG remains concerned about downrange support at the Poker Flat Research Range (PFRR) and seeks to clarify the SRPO and PFRR contractual agreement regarding the maintenance of the downrange ground-based science facilities.

Background

The vast majority of launches from PFRR require knowledge of ionospheric parameters prior to, during, and after launch and is typically based on data from ground-based all-sky cameras, meridian scanning photometers and magnetometers. This knowledge is of particular importance from “downrange” locations along the rocket trajectory where the payload instruments will gather their measurements, and is usually needed real-time, in order to provide information upon which the launch decision is made. Indeed, the health and availability of the downrange science instrumentation directly impacts the quality and efficiency of scientific research conducted at the range. The SRWG is concerned that some of these core instruments are not adequately supported during PFRR campaigns, and are not adequately tested prior to launch campaigns. We seek an understanding of which instruments are currently supported by the SRPO-PFRR contract.

Following the successful PFRR campaign in January/February 2007, a number of issues were brought to light which directly impact the ability and efficiency with which users carry out scientific research at the PFRR. For example, it became evident that many of the downrange science instruments at Fort Yukon and Kaktovik are in disrepair. Neither of the meridian scanning photometers at these locations were functioning. Although the science teams are generally responsible for funding and operating mission-specific ground-based science instruments, it is the SRWG’s understanding that the maintenance of a suite of standard ground-based science facilities are covered under the contract between NASA/WFF and the University of Alaska at Fairbanks. The SRWG requests clarification concerning which facility components are covered under this contract.

Given that science instrumentation evolves and there will always be a desire for improvements and additional measurements, the SRWG suggests that a sub-committee of users be formed to discuss ways to optimize the instrumentation and its operation and maintenance, including data transfer, display, and archiving, within the resource constraints and contractual agreements that exist between NASA/WFF and the PFRR.

6. University Student Experiment Ride Share (USERS) Program

Summary.

The SRWG is pleased to learn about the new University Student Experiment Ride Share (USERS) program at the Wallops Flight Facility. The need for a program such as this is clear. The training of undergraduates in space science and engineering is important to all interests in the field, yet opportunities for students to be involved in the development, construction and testing of space hardware is very limited, at best. The USERS program may well fill an important need in fulfilling NASA's need for scientists and engineers in the future and is strongly endorsed by the SRWG.

Background.

The USERS program provides opportunities for up to four universities to provide instruments that will be flown on a sounding rocket from Wallops Island. At this point, the expectation is that this will become an annual event, with launches occurring each fall. Under the current structure, a single university, called the "integrating school" provides nominal support to the participating schools, including details related to mechanical and electrical interfaces, telemetry issues, etc. Once the instruments are built, they are to be delivered to the integrating school for integration into the payload. Afterwards, the entire payload is delivered to Wallops for detailed testing and then launched. Financially, each of the four participating institutions is required to contribute a nominal sum (e.g., from \$5 to \$15k) to the launch.

The USERS program, with its quick, 1-year turnaround, promises to provide an excellent mechanism to draw students into the field and is a solid investment on the part of NASA. It is our understanding that the program is going ahead in its first year as a trial. The SRWG commends the SRPO for this endeavor and hopes that the new program will be successful.

7. "Rocket Reports" Newsletter and Plans for a Program Brochure

The SRWG is pleased with the quarterly publication of the "Rocket Report" newsletter by the SRPO and salutes the work of Mr. Charles Brodell and Ms. Berit Bland for this accomplishment. The SRWG recognizes the importance of providing information to both the agency and the public regarding NASA's highly successful Sounding Rocket Program and plans to work closely with Wallops to produce a high quality brochure that highlights many of its unique features and important scientific accomplishments.

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