### **Sounding Rocket Working Group**

National Aeronautics and Space Administration

Meeting of February 1-2, 2023

### Findings

### 1. Sounding Rocket Data Availability and Public Archiving

#### Summary

The Sounding Rocket user community fully embraces sharing scientific data acquired via sounding rocket missions and welcomes an opportunity to discuss data availability/archiving guidelines with the program. Although sharing processed, "primary" sounding rocket data is compatible with the agency's goals, some highly innovative, experimental data from low TRL sensors, whose inclusion is a hallmark of the program, may not readily furnish calibrated processed data products within time frames consistent with those of the primary data. Hence, although the SRWG supports the spirit of sharing all data, imposing an "across the board" policy does not appear to be fully appropriate for all sounding rocket data. Although sounding rocket telemetry data are routinely stored in a timely manner at Wallops, the working group believes that processed, primary data management plan. We look forward to working with NASA HQ and the SR Program Office to discuss guidelines and procedures for sounding rocket data availability and archiving that are most relevant to the program.

#### Background

Public access to data derived from NASA-funded activities is a prized feature of the agency's research policies. It provides a greater scientific return on investment, permits synthesis of new understanding from disparate kinds of data, and increases access and inclusivity across science. The recent announcement of Science Mission Directorate Policy SPD-41a clearly states NASA's commitment to public data access and archiving, while providing guidelines for how flight missions should design their Data Management and Archiving plans. The Sounding Rocket Working Group appreciates the presentation at the February 2023 SRWG meeting from Dr. Matt McClure at NASA HQ regarding SR data policies and an invitation for a dialogue on how best to incorporate sounding rocket data in the agency's larger data archiving plans.

The members of the SRWG are in full agreement with the principles of unrestricted data access, and we note that many sounding rocket missions already participate in public data archiving through a variety of means. However, the SRWG would like to sound a note of caution regarding a "one size fits all approach" to policies regarding data archiving. Sounding rockets, by design, are built and deployed under time- and financially-limited grants to perform niche science measurements, often with low-TRL technologies and highly experimental measurement methodologies. The data analysis resources available to sounding rocket PIs do not mirror those

available to larger missions, who typically enjoy factors ~10-100x larger science budgets. Further, raw sounding rocket data can be challenging to interpret, as they are taken by specialized instruments under very specific conditions that can be difficult to characterize and communicate in a uniform and timely manner.

Sharing processed, primary sounding rocket data is compatible with the agency's goals and context of the open science policies and, we believe, should be the focus of the data archiving discussion. Data from highly innovative, experimental, low TRL sensors may not readily furnish calibrated processed data products, particularly within time frames consistent with those of the primary data. Hence, although the SRWG supports the spirit of sharing all data, imposing an "across the board" policy does not appear to be fully appropriate for all data from sounding rocket missions. Although sounding rocket telemetry data are routinely stored in a timely manner at Wallops, the working group believes that processed, primary data products are most useful to the community and should be identified as such within the data management plan.

The working group welcomed Dr. McClure's invitation tendered during his presentation to the SRWG to iterate with NASA on a viable and constructive path towards sounding rocket data public release and archiving. In order to provide a realistic interpretation of sounding rocket data archiving while addressing the spirit of NASA's policies relating to public data release, the SRWG would like to express its views regarding the idea of "usefulness" of data for discussions relevant to open data policies applied to sounding rocket data.

Our suggestions regarding the most useful sounding rocket data are as follows:

- 1. Only reduced, primary data that would be broadly interpretable by subject scientists be required to be made public.
- 2. Data release schedules should be flexible and responsive to the plans of the research and the science teams' evolving understanding of the data.
- 3. The suitability of Data Management Plans associated with sounding rocket proposals should be judged by the relevant Program Scientist at NASA with the following metrics in mind: (a) suitability and scientific usefulness of delivered data products; (b) schedule of delivery with respect to the overall research plan; and (c) reasonableness of the requested level of support in the context of the overall program funding.
- 4. With respect to software and code, we note that these can be highly mission specific and evolve rapidly, and hence are difficult to archive and maintain. We suggest that language similar to the "Stand-Alone Code Exemption" found on page 4 of ROSES Appendix D.1 be adopted across sounding rocket-supporting programs.

We note that sounding rocket telemetry data are routinely stored in a timely manner by the SR Program Office at the Wallops Flight Facility. Such telemetry data include instrument science and engineering data, as well as payload sub-system engineering and ancillary data. It is unclear if such raw telemetry data would be useful to the broader community without sufficient auxiliary support from the science and engineering teams.

## 2. PI Involvement with Mission Close-out Reports

#### Summary

After a mission is concluded, the PI provides an assessment of the mission to the SR Program Office while the Mission Management/NSROC team provides a Mission "Close-out" report, discussing the technical performance of the payload as well as operations. Such Close-out reports are not routinely distributed to the PI teams unless requested. Some PIs may be more involved than others in the technical aspects of the mission performance. Many would like to understand all the technical issues involved in their mission performance to better inform future planning and proposals. This is particularly important for any instrument anomalies that may have been related to the mission performance. We ask that PIs be included in the distribution list for mission close out reports, and their comments solicited in all discussions relevant to instrument performance.

### Background

After a sounding rocket mission is completed, the Principal Investigator (PI) writes a formal assessment of the instrument and payload performance as well as the vehicle and mission operations which is communicated to the Chief of the Sounding Rocket Program Office. In parallel, the mission management/NSROC team produces a technical assessment of the performance of the rocket(s) and payload(s). This Mission Close-out report is delivered to the SRPO within 6 months of launch. Although the PI is not involved in the Wallops technical assessment, we nevertheless encourage the PI to be engaged in any relevant aspects of the mission, particularly if aspects of scientific instrument performance are featured in the Close-out report.

Some PIs have recently shared that they are not aware of the Close-out report. We ask that PIs be included in the distribution list for mission close out reports, and their comments solicited in all discussions relevant to instrument performance.

## 3. Flare Campaign -- Extending Poker Flat Windows into May

#### Summary

The Poker Flat Research Range continues to provide an unparalleled launch range for the nation for conducting scientific research using sounding rocket platforms. In recent years, launches have expanded from traditional high latitude geospace missions to include astrophysics and solar physics missions, particularly as land recovery is an option, as well as providing extended windows for mission operations not generally available at White Sands Missile Range. In view of solar missions, it is highly desirable that the Poker Flat research range be available for extended portions of the year (past May 1) when the solar elevation is higher. Aware that the land downrange at Poker Flat is used by others during the summer months, we ask that an extension of the normal Poker Flat operations past May 1 be explored in earnest to optimize launch operations for various missions, in particular the upcoming Solar Flare campaign.

## Background

The Poker Flat Research Range (PFRR) continues to provide an exceedingly well-equipped and viable location to host sounding rocket campaigns for Geospace, Astrophysics, and Solar missions. Currently, the range is not available for sounding rocket use from May 1 to September 30, as the land downrange is used for other purposes. In view of the significant advantages of carrying out solar missions when the sun's elevation is higher in the sky, the working group requests that the Poker Flat availability beyond May 1 and prior to September 30, be explored. As has been noted previously, other scientific missions, such as those that explore noctilucent clouds which occur in the summer polar mesosphere, may, on occasion, request access to Poker Flat in the summer period.

NASA's upcoming Solar Flare rocket campaign at Poker Flat in Spring, 2024 would greatly benefit from possible window extensions into May. The SRWG requests that the possibility of extending the Poker Flat launch opportunities be explored to provide this schedule margin. In general, we would like to understand what the process, timeline, and success rate is for seeking a waiver at Poker for launches in the months of May and/or September.

With respect to the Solar Flare Campaign, the following background information provides the motivation for a request to extend the window. The three solar flare missions each require a 4-hour launch window with a required solar elevation available for each launch-attempt day. Reasonable solar elevation (which varies by instrument target wavelength) is key to avoiding a high atmospheric column density within the field of view of an experiment. Critically, however, solar rocket launches rely on use of the SPARCS for pointing at the Sun. The campaign became aware recently that the Lockheed Intermediate Sun Sensor (LISS) has a solar elevation viewing requirement of no less than 18 degrees.

Considering the high latitude of PFRR, the solar elevation profile changes rapidly each day. The late spring and summer months (May 1 – September 30), which are most conducive to solar viewing, are not available for launches due to environmental and forest usage factors. Based on the daily solar elevation profile, the need for at least 4 hours in which the sun is above 18 degrees, and the location restrictions, the annual opportunity to conduct a flare campaign from the PFRR is very limited between late March and May 1. Furthermore, the solar viewing requirement is only marginally met after the range opens again in October.

The roughly 6-week "spring window" per year is a significant constraint on solar campaigns coordinating multiple mission development timelines while relying on solar activity to meet the science objectives. Any slips in the schedule or unfavorable flaring conditions would likely result in delaying the campaign a year at a time. We note that geophysics missions, such as BeamPIE, would have also benefited from an extended spring season by not needing to delay past the summer. Thus, the general ability to extend the Poker Flat range operations poses significant advantage to the sounding rocket program in general.

## 4. Safety Requirements and Communication

#### Summary:

Complex payloads, especially those that involve cryogenics, require extensive safety protocols. It is essential that the PI understand the safety requirements, and that the safety office understand the potential mission hazards as early as possible in the development of the mission. Late requirements, late documents, late review, and late changes can seriously affect schedule and team preparation, adding significant and unnecessary risk to mission success. The SRWG urges the SRPO to facilitate early, continuous, and direct communication between the payload team and the safety office resulting in early agreement on payload requirements. For example, there should be a face-to-face discussion between the safety office and the payload team at the MIC. In addition, if requirements change based on changes in policy or lessons-learned from other programs, these should be communicated to the payload team as soon as possible, and well as in advance of the Pre-Integration Review (PIR). The SRWG strongly believes that all safety requirements are revised for one mission, these should be propagated to related missions, new missions, and re-flight missions, i.e. SRPO should maintain a list of likely safety requirements for each type of payload that is reviewed regularly between the mission manager and the PI.

### Background:

Mission schedules and payload operations require well developed procedures, including those that involve hazardous operations such as cryogenics. Recently, changing requirements, protocols, and late agreements have hampered operations both at WFF and in the field. All parties recognize that sounding rocket missions should be safe for personnel, NASA assets, and experiments. However, more effective communication between the payload team and the safety office is needed to streamline operations and reduce stress on personnel. The process should start early, preferably with *direct discussions* at the MIC between the PI and the responsible safety person(s). Direct conversations would greatly facilitate a clear understanding by both sides of what the hazards are and what the requirements to mitigate them will be. An agreement should be made at this point as to the required safety features, documents, and the scope of the requirements. Direct communication between the PI and mission manager with the safety office should continue during mission development culminating with a list of safety requirements around which the payload team can develop the required procedures.

This process should be complete by the Requirements Review. We recognize that there are policy changes and lessons-learned from other programs that must be applied to any payload under development, but these need to be communicated to the payload team in a timely manner. Further, it appears that there are currently no well-defined lines of communication for this process. In recent missions, Goddard's Code 300 has communicated new requirements to a safety person in NSROC, or to the mission manager, and they were not passed on to the PI. Similarly, there have been changes made in the mission or procedures that were known well in advance by the SRPO but came to the attention of safety only at the PIR or MRR. The situation we are trying to avoid is new requirements interfering with tight payload schedules, as well as the additional stress on payload teams. The final agreement on all requirements and documentation should be completed and closed significantly before PIR. It appears necessary for SRPO to maintain a list of current missions with a particular type of hazard so they will know which PIs need to be notified. For

example, when an updated requirement is levied on a chemical release mission, all in-process missions with chemical hazards will be notified (this assumes that the other recommendation above is followed, and all new missions and re-flights should be notified of the requirement at their MIC).

# 5. Appreciation for Everything Wallops did to make the SR Symposium a Success

### Summary

NASA's first Sounding Rocket Symposium took place on August 17-19, 2022, at the Wallops Flight Facility and was, by all measures, a resounding success. 187 community members registered for the event with over 85 "in person" community members attending the various presentations, tours, and poster sessions. We thank the Wallops Flight Facility staff in particular for their incredible support in making the symposium a success. Follow-on symposia and the continuation of new-PI development forums fostered by this initial symposium, are recommended.

### Background

The working group applauds the incredible support provided by Wallops in ensuring the success of the Inaugural NASA Sounding Rocket Symposium which took place on August 17-19, 2022. The feedback on the event was overwhelmingly positive with ample opportunity for growth. The fact that 187 community members registered for the event with over 85 "in person" community members attending the various presentations, tours, and poster sessions, attests to the popularity of sounding rockets within NASA's research program. Strong attendance and well-received "keynote" presentations were delivered by nationally-recognized sounding rocket researchers in all disciplines supported by the program -- Astrophysics, Solar, and Geospace.

The working group recommends that a follow-on bi-annual symposium be considered, perhaps held in 2025 to be "off-cycle" with the bi-annual European Sounding Rocket and Balloon Conference "counterpart". An organizing committee to coordinate location, dates, and expansion of topics would need to be set up no later than summer 2024. In addition, based on symposium feedback, regular (at least annually) new-PI development forums would be welcomed by the community, led by the Program Office and Wallops.

## NASA Sounding Rocket Working Group

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