Sounding Rocket Working Group

National Aeronautics and Space Administration

Meeting of July 18, 2012

Findings

1. "Benchmark" Reviews to Ensure Payload Readiness at White Sands

Summary

Experiment delays including major postponements/cancellations present significant scheduling, coordination, and cost implications for NASA HQ, the SRPO, and NSROC, particularly for launches from the White Sands Missile Range. The SRWG recommends that two benchmark reviews or "checks" -- at intervals of (for example) 180 days and 45 days prior to the scheduled launch date -- be instigated by Wallops with the P.I., NSROC, and the SRPO represented, to identify and help mitigate the unintended consequences and cost penalties relative to such unexpected delays.

Background

Experiment delays and, in some cases, major experiment postponements and even cancellations present significant scheduling and coordination concern for NASA HQ, the Sounding Rocket Project Office (SRPO), and the NASA Sounding Rocket Contract (NSROC). Departures from agreed-upon launch readiness dates, specifically for rockets scheduled for launches from the White Sands Missile Range (WSMR), have significant cost and labor implications, that in many cases are not fully appreciated by the Principal Investigator (P.I.) since these costs are not borne by the experiment teams. For example, non-refundable range fees at WSMR are now levied several weeks prior to the launch date, which are lost when a slip occurs after this time. Furthermore, delays of this nature impact the NSROC work flow and staff morale, as well as the SRPO and NASA HQ manifest planning.

As communicated to the experiment community at the recent SRWG meeting, delays that are identified well in advance are most easily accommodated while week-to-week slips are far more problematic. The SRWG, via this Finding, recommends that benchmark "status checks" or reviews be instigated, at intervals prior to the launch date with the P.I. team, NSROC, and the SRPO represented, in order to establish the experiment status and to determine whether such delays will indeed take place.

The SRWG recommends that two such interchange meetings be required prior to the shipment of the science payload and the NSROC-supplied subsystems to WSMR.

Although pre-integration and pre-ship reviews are already part of the normal operations flow at Wallops, these additional status/schedule review "benchmarks" should be instigated, particularly with respect to WSMR payloads. These "checks" will help reduce the unintended consequences and cost penalties relative to unexpected delays.

The SRWG therefore suggests:

-- At 90-180 days (interval is at the discretion of the SRPO at Wallops) prior to launch, a meeting or teleconference be instigated by the SRPO at Wallops whereby, the experiment team, NSROC, and the SRPO review the status of the subsystems and the experiment and demonstrate that the mission will meet its pre-determined launch date at WSMR. The PI must discuss the status of the experiment and identify any schedule drivers that may delay shipment.

-- At 45 days prior launch, a second meeting or teleconference be instigated by the SRPO at Wallops to show that the experiment, NSROC, and SRPO are all fully aware of the payload/experiment readiness for shipment to the range. In principal, this review would serve as a final "gate" through which the payload team must pass prior to the expenditure of range fees and travel costs by the SRPO and NSROC.

It is understood that the times corresponding to 90-180 days and 45 days are simply suggested benchmark intervals. We anticipate that Wallops (SRPO) will determine the most appropriate times for these status checks.

2. Improving Communications between the Experimenter and NSROC Teams

Summary

Improved, regular communications between the experiment and NSROC teams are recommended. One consequence of such interactions might be the reduction in design and fabrication errors that appear to be occurring at increasing rates. Suggestions for the nature and frequency of such communications are presented.

Background

At the recent SRWG meeting, the lack of optimal communications between experiment teams and NSROC was identified as a possible problem that has hindered efficiency and may have contributed to recent design and fabrication errors.

Although the best practices for open communications depend, to some extent, on the make-up and experience of the specific experiment and NSROC teams, as well as on the specific mission and its schedule, the SRWG recommends some general approaches that have, for some teams, provided tangible results.

For example, for highly complex Geospace missions, regular group telecons between

the experiment team (including graduate students and new engineers) and the NSROC team have been shown to have particular value. Such telecons might be on a weekly basis up until the Design Review and also leading up to integration, and perhaps at a more relaxed rate (monthly?) at other times. The best practice (optimal use of team time) certainly will depend on the complexity level of the mission and the size of the team, as well as the level of new design in the mission.

In all cases, it is suggested that these telecons embrace wide-ranging, open discussions, as opposed to telecons specifically scheduled to address a particular problem. This allows the team to become familiar with each other and to discuss various aspects of design choices without the immediate need to solve a particular problem within the overall design (although such focused discussions are, of course, also necessary, as appropriate). Within the framework of such open discussions, the relative merits of different choices can be evaluated with all team members encouraged to contribute.

3. Technology Transfer -- Adopting Experiment Team Innovation

Summary

The SRWG encourages the SRPO and NSROC to continue to make new technologies available for sounding rocket scientific payloads. In some instances, a cost effective way to achieve this could be to incorporate and standardize technologies already developed by experiment teams. Specific examples are on-board digital recording systems that allow very high-speed data collection, and sub-payload deployment mechanisms. We encourage the SRPO to pursue such technology transfer in an effort to revitalize its technology roadmap for applications that are appropriate to those of user contributions.

Background

The SRWG encourages the SRPO and NSROC to continue to make new technologies available for sounding rocket payloads. In some instances, a cost effective way to achieve this could be to incorporate and standardize technologies already developed by experiment teams. The SRWG feels strongly that a close collaboration between experiment teams and the sounding rocket program could foster the transfer of technologies that would benefit the program as a whole. We encourage the SRPO to pursue such technology transfer in an effort to revitalize its technology roadmap for applications that are appropriate for user contributions. Such possibilities might include both off-the-shelf technologies as well as advanced solutions developed “in house” by the various clever experimenter teams.

Examples of technologies that could be improved and disseminated within the experiment teams include:

-- Systems that take advantage of state-of-the-art data transfer and data interface

components.

-- Ground station interfaces which enable higher data rates as well as those which replace the aging GDP units.

-- Telemetry (TM) simulators that replicate on-board TM and ground station outputs. Such simulators would help ensure that experimenters can test their equipment thoroughly before formal integration. Many such systems have been developed by experiment teams, and could be generalized to support a wider audience. In some instances, this could result in dramatically increased capability and reduced cost for the program as a whole.

-- Other ideas: pump pull-away systems, cryogenic fill systems, on-board data storage solutions, sub-payload deployment mechanisms.

4. Continued Need for High Telemetry Rates and a Standard 20 Mb/sec system

Summary

The SRWG reiterates that state-of-the-art experiments continue to "push the envelope" by requiring higher telemetry (TM) data rates. Indeed, this is an important feature of the sounding rocket program that distinguishes it from satellite missions whose telemetry, by comparison, is considerably more limited. The SRWG urges the SRPO and NSROC to continue to work toward making a standard, 20 Mbit/s TM system available that maximizes the downlink capability of the existing S-band systems.

Background

A wide variety of science payloads, including solar, astrophysical, and geospace experiments, generate data at increasingly higher rates compared to previous instruments. For example, many celestial and solar missions are now generating data at rates that require on-board storage for comprehensive success. As noted by NSROC at the recent SRWG meeting, it is currently not feasible to implement X-band telemetry in the near-term to facilitate such high rate, full data downlinks. Although X-band systems might yield considerably higher rates in the long term, modestly higher data rates using available (S-band) technology would allow more capable state-of-the art instruments now and thus a vastly increased science yield.

For example, multiple 20 Mbit/sec transmitters are being implemented in a special arrangement for the Figueroa payload that uses S-band and which is scheduled for January 2013. This is a large step in the right direction. We note, however, that the 20 Mbit/s data systems are not being advertised as a new standard capability, which are of substantial interest for the experimenter community at large.

We urge the SRPO to adopt the 20 Mbit/s TM system as the standard system going

forward. This is particularly important since the now very old WFF93 system is not being modernized. A standard, 20 Mbps can be accomplished by either adopting the PSL system, modernizing the WFF93, or designing a new system. It is also essential that any system, including the WFF93, include higher speed data interfaces such as LVDS, fiber, etc. TM simulators should be made available that would enable the experimenters to develop and test payload interfaces before delivery to WFF.

Finally, we note that whereas the 20 Mbit/s capability is an essential complement to on-board storage systems, it cannot be replaced by on-board data storage systems. For example, on-board recording requires payload recovery to be successful. Furthermore, payloads with real-time command links may require high-speed data in order to enable uplink decisions and allow proper control of the payload.

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