

October 28, 1997

To: M4 Co-I's

From: Dan Clemens

re: M4 Debrief

As indicated in my email I sent out two weeks ago, M4 was not selected for development in the latest SMEX proposal round. The selected proposals were GALEX (a UV galaxy evolution mission) and HESSI (a solar imager). A third mission called BOLT (a gamma ray burst locator) was selected as a “backup” for the first two. A Mission of Opportunity (MOO) project called TWINS (a magnetospheric imager) was selected to fly as an extra payload on an upcoming non-NASA flight.

Unlike smaller NASA or NSF initiatives, NASA SMEX mission proposals receive no written feedback concerning the selection process or panel reactions to our proposal. Instead, PIs receive a phone or in-person “debrief” from a cognizant NASA official. For the M4 proposal, Dr. Harley Thronson at NASA HQ was the designated debriefer. Because he and I have known each other for some time, I believe our debrief was frank, useful, and complete.

The SMEX review consisted of an overlapping pair of reviews: a scientific review and a TCMO (technology, management, cost, and outreach) review. The TCMO review was done by experienced project managers, personnel with accounting and procurement experience, and professionals in outreach and education. The TCMO was performed at NASA Langley a few weeks before the science review, and was merged in at the completion of the science review. There was some overlap of staff in that a few of the TCMO folks sat in on the science reviews, presumably to answer questions or offer comments if requested. The TCMO review did not address questions of science or science quality.

Science Review - Summary

M4 was judged by the science panel to be excellent science. They placed M4 in the highest scientific category, a distinction shared with only about 20% of all of the proposals. Harley read to me some of the verbatim comments:

“well focussed proposal on an important topic”

“major impact on the field due to the currently limited amount of data”

“impressive experience of PI and Co-Is”

“simple spacecraft”

TMCO Review - Summary

M4 essentially failed the TMCO review for cost reasons. The Aerospace Corporation was selected to provide an independent cost estimate for M4. They found that the M4 costs would be expected to at the cost cap for the SMEX program, with no cost margin available within the cost cap. This led the TMCO review to judge M4 to be “high risk” in the cost category.

A second serious concern arising during the TMCO review, but judged to be non-fatal, was that the M4 organization was confusing, unclear, and displayed too many overlapping roles and responsibilities. The items singled out for comment were:

1. The PI assigned too much responsibility to himself. They were particularly troubled that the PI was proposing to act as System Engineer, without any demonstrated experience.
2. The Project Manager was not selected at proposal time, and they were of the opinion that delaying PM selection until the end of Phase A was much too late.
3. The proposal was unclear about how the M4 project would interface to NASA for oversight issues.
4. The roles of Goddard Space Flight Center and the University of Arizona were unclear.
5. The four levels of reviews were judged to be an enormous overhead for a SMEX project.

Comment on Summaries

At this point, it is worth viewing these summaries with a bit of perspective. First, we should be exceedingly pleased – the science review shows that we have a solid, important scientific experiment which is worthy of being performed. [For anyone doubting the strength of this statement, I can send on copies of the PIREX debriefing notes which previously called out the science area as underdeveloped and weak.] M4 science should be performed.

Second, we all knew cost was the biggest problem for M4. We engaged in several de-scoping activities to reduce costs as much as possible. At submission time, we were able to show only 2 - 7% cost margin (depending on how you apply the PI “correction” to the Ball ROM cost estimate). I find it very interesting that Aerospace Corp came up with similar numbers, although higher by about those same percentages. I see this agreement as a fundamental validation that our M4 concept is sound and well-developed. It is unfortunate that the costs are higher than can be contained in the SMEX cost cap. However, our cost estimating philosophy has been judged to be correct. [Again, I can send the PIREX debrief which identifies our previous cost estimating skills as weak.]

Minor Comments

There was the usual long list of items worthy of comment by the review teams. Some are positive in nature, most are negative. None of these were fatal, but by their communication to us we have a finite list of items to rectify. The order follows my notes of Harley’s debrief.

1. Radiation Effects. During normal operations, some number of pixels in the detector arrays will be non-optimally functional or completely non-functional due to recent radiation hits. We have included the capability for detector annealing twice per orbit and photometric recalibration for each observation. However, one reviewer was troubled that we did not address the effects to normal operations of detector array pixels being affected by radiation bombardment. I think the concern is that after an anneal action, if a pixel

is hit hard enough by particles it may not function until the next anneal action or it may never recover. Our mapping strategy should show how the scientific return will not be compromised by such pixel losses.

2. Spacecraft ground systems and operations support. The reviewers thought that we had “too many decisions left open.” This presumably included the detailed path by which we would get data down from the satellite and through to the science operations center. I think they were looking for cognate letters of support from GSFC or other agency capable of supplying these functions.
3. Schedule. There was a serious concern about our schedule appearing too optimistic. They would have preferred a more “standard” schedule of design, development, and lots of time for integration and testing. Our shortened integration and testing activities (3 - 4 months) were identified as risky.
4. Ejectable Cover. This was identified as a major area of risk. They liked the idea of prototyping this system, however.
5. A quote – one that Harley was unable to translate – I pass it on in case someone else can decipher sense from it: “However, no discussion of cold-launched cryostat or detector risk mitigation options.”
6. Satellite robotic operations. A strength! They liked the idea that several days worth of commands could be uploaded to M4 and that M4 would operate unattended for days at a time.
7. Particle hits. A “minor mission design problem.” This is a repetition of item 1., above.
8. Spacecraft details were deferred to Phase A. We left open the selection of the S/C bus (Ball or Goddard) until Phase A.
9. Mass margin too low. This was judged important because the instrument and spacecraft were not yet developed.
10. Volume margin too low. The M4 plan showing the stowed configuration inside the Pegasus shroud envelope has no room for volume growth.
11. Outreach was mixed. In general they liked our words. They commended our commitment to good funding, good teaming, and good liaison to teachers. They liked the disadvantaged business component. They did not like the video conferencing via the internet plan. They saw no direct reference to inclusion of minorities, nor to the OSS strategy document.

Overall Summary

Harley provided the following three part overall summary:

Excellent Science - in the highest category.

Very Good Technical Merit - our design was appropriate to the problem.

High Risk TMC0 review - cost at the cap; delay of major decisions.

The “Dogs that Didn’t Bark”

This refers to a Sherlock Holmes mystery wherein the solution turns on the fact that a very attentive guard dog did not bark during the commission of the crime. In this M4

debrief, there were three particular areas I was listening for, but did not hear (even when I asked Harley about them directly).

First, the detector arrays were not identified as a problem. They do not yet have flight heritage, but have been subjected to the most detailed laboratory scrutiny. When I asked Harley about them, he felt that they were judged to be at just about the ideal mix of emerging technology but high reliability and performance.

Second, the PI was not called out as a weakness. In the previous PIREX debrief, the **Science Team** was called out as strong, but the PI as inexperienced. That perception seems to have changed after four years. This is not simple silly vanity – if the PI is a major weak link in the project, then replacement is necessary. [dang - there went my chance...]

Third, Boston University was not called out as a weakness. In the four years since PIREX, Boston University has strengthened its role in space via the *TERRIERS* satellite and via *POLAR* and other missions. It is gratifying to see that the TCMO review in particular did not view the management systems at Boston University as inexperienced or inadequate as happened in the PIREX review.

So where are we? I believe that the extensive engineering work done at Ball Aerospace for the M4 SMEX proposal, as validated by the Aerospace Corporation costing review, has shown that flying modest duration superfluid helium cryostats with any telescope, no matter how small, cannot fit within the SMEX cost cap. In trying to force a fit within the cost cap, we were constrained to adopt some non-optimal choices and systems for M4, mostly in operations areas.

Nevertheless, the science offered by the M4 concept is compelling and important.

I believe NASA would like to see M4 come back as a MIDEX proposal. As such, the cost cap is doubled, the mass and volume limits are relaxed, and many of the non-optimal choices can be revisited and improved.

The next MIDEX round has almost begun. The draft call for proposals is due out any day. I am unsure of when the final call will be released, or when the proposals will be due, but spring is most likely.

In my next memo, I will outline how I think M4 would fit with the MIDEX opportunity, and try to summarize Boston University's interest in pursuing this opportunity.

In closing, I wish to convey my sincere thanks to you for working on the M4 SMEX proposal concept and document. We “won” the science race with the program presented by this exceedingly strong and capable team. We were not selected this time but we have reached a higher rung on the ladder. I recommend continuing the climb.

Attachments: Huntress Letter; SMEX selection PR release