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CM Oman letter to NASA Life Sciences
Planning Study Committee, April 1987

April 30, 1987

Dr. James Bredt
Executive Secretary
Life Sciences Planning Study Committee
NASA
Room 300
Mail Code EBR
600 Independence Avenue, SW
Washington, DC 20546

(A year after the tragic loss of the Space Shuttle Challenger, NASA Hq. conducted strategic replanning effort in the space life sciences discipline, led by Frank Robbins and Jim Bredt. They asked several experienced Shuttle/Spacelab investigators to provide retrospective critiques of NASA's experiment development process.)

Dear Dr. Bredt:

As a longtime NASA Life Sciences grantee, a Lead Investigator/CoI on SL-1, D-1, and SLS-1/2 Spacelab vestibular experiments, I would like to submit the following observations and suggestions for consideration by the LSSPSC:

- NASA Life Sciences should add an additional stage of serious science peer review at the completion of the flight experiment development phase (i.e. after an experiment has actually been integrated on a specific mission), so as to insure that experiments which actually fly are still first rate.

Experienced NASA Investigators are nearly unanimous that "your experiment science never again looks as good as it did on the day you first proposed it". Limitations in crew time and availability, physiological interactions with other life science protocols, and shuttle resource limitations all can act to seriously compromise portions an experiment which seemed quite viable at the preliminary (post AO) peer review stage. During the experiment development phase, PIs are constantly having to fight to obtain or maintain adequate resources to perform their experiment. Some people are more successful than others at this, due to savvy, luck, or politics. But some loss of scientific viability has occurred in virtually every experiment I am familiar with, including my own. Because of the professional investment, PIs tend to try to "keep their foot in the door", and rarely pull the plug on a seriously degraded functional objective. Experiment scientists are supposed to help maintain quality control, but in my experience they are reluctant to do this for fear of jepordizing their working relationships with the PIs. By default, PSES do some of it, but I believe the quality of both Spacelab and middeck-DSO experiments would be significantly improved if the PI knew he had to pass muster with a friendly but serious and objective science peer review committee in his discipline prior to the actual flight of his experiment. The committee would be asked to make constructive suggestions for improvements in procedures, and help NASA and the IWG identify portions of experiments which are sufficiently scientifically weak that they ought to be "fixed or forgotten". Actual experiment time during a mission costs hundreds of thousands per crew hour for

launch costs alone. And Life Sciences can ill afford to fly weak science. The traditionally negative attitude in the Astronaut office toward life science experiments will not really change until we eliminate poorly designed experiments.

- With all the enthusiasm for Space Station, it is critical that Life Sciences not lose sight of the various opportunities provided on the shuttle itself. Also, I think it likely that Spacelab scale life sciences research on Space Station will not be a reality until the late nineties, at the earliest, and the strategic plan should acknowledge this real possibility.

- Life Sciences should continue the recent emphasis on developing experiments for flight on other than dedicated life sciences missions, and put more emphasis on non-Spacelab, non-space station opportunities as well. For too long, there was an emphasis on having all the major experiments on one "showcase" dedicated life sciences mission. The problem with this is that the experiments step on each others toes too much competing for the same scarce resources.

- Ideally, NASA should adopt an AO/peer review approach for all space life science experiments which is truly international in scope. This is very important for Space Station as well as shuttle missions. At present, NASA Spacelab, NASA DSO/DTO, ESA, Germany, Canada, and Japan all have separate peer review systems, and due to lack of coordination and varying delays in experiment development, scientific precedence of experiment concepts is being lost. Several NASA Spacelab PIs have seen portions of their experiments proposed later and flown earlier by others. On SL-1 we flew two largely similar NASA and ESA Sled experiments. The proposals for these experiments were peer reviewed on opposite sides of the ocean, and never competitively compared. In retrospect, we clearly should have flown just one experiment, representing the best ideas from both teams.

- The philosophy of DSO/DTO experiments and the peer review process for them needs a comprehensive reexamination. Despite JSC attempts to formalize the process, the common perception is still that the DTO process remains a back door for getting pet cut and try projects on the shuttle. The scientific quality and viability of some of the lash-up "life sciences" experiments which "political" and "international" payload specialists have been asked to do strikes me as mixed at best. Regardless of whether one endorses the idea of political payload specialists, the life science experiments these people do while on orbit gets a great deal of visibility, not all of it good in the scientific community, and many serious space life scientists I know feel they are being tarred with the same brush.

- The objective science return from student demonstration experiments in the life sciences (or lack of it) should be more heavily weighed against the PR and educational value of these activities. In some cases, students have been exploited to the point where virtually all they do is show up for the press conferences. We shouldn't shrug this off as politics.

- Technical improvements could be made in Spacelab and the way we use it so as to make it easier and cheaper to do life sciences research:

The existing Spacelab computer is totally inadequate, and has been shunned by virtually all life sciences PIs. At least one more air/ground voice link to the POCC is needed. The LSLE PDP-8 microcomputer is technically obsolete, inadequate, and inflexible. I believe we need to rethink the way we go about gathering data from life sciences experiments, and put more emphasis on onboard dedicated experiment processors, interactive onboard analysis, and on board storage. Wherever possible, we should avoid all the VERY expensive engineering associated with sending data to the POCC and SMA in real time via the HRM, unless the PI can really prove he needs it during the mission, and that it will truly effect experiment reliability or replanning. I saw little real time ground data analysis result in important science feedback to Spacelab on SL-1 and D-1. PIs in the SMA were generally just taking a quick look at the technical quality of their data. PI monitoring of the experiment via video is very important, but I believe PSES can and should be responsible for making the go/no decision on the technical quality of the data, and interact with PIs when problems arise via voice and video. PIs want to be part of the action, and have enjoyed being in the SMA looking at the data which they have worked so long to get coming out in front of them. But this is a very expensive.

- In the post Challenger and Space Station era, the Spacelab PS concept may need some rethinking. If the total number of seats available on Spacelab missions is reduced, there will be pressure from the Astronaut Office to reduce the number of Payload Specialists. Of course career astronauts are essential for shuttle operations, but OSSA and Life Sciences should be prepared to fight very hard to maintain the viability of the basic Payload Specialist concept. I believe a solution is ultimately establish a cadre of Payload Specialists who are "permanent" (but not career) NASA employees made up of researchers taking a 5-8 year planned sabbatical. These people would spend a year or two getting more serious Spacelab systems training, so fewer MSes would be required on each mission. A Life Sciences PS would then train as a back up for one SLS mission, and then fly as prime on the next similar flight. Then he or she would go back to his government or university lab, resume a research career, and also help his colleagues and congressmen get enthusiastic about the possibilities of space research.

- The Life Sciences flight experiments engineering groups at JSC have been chronically understaffed and overcommitted. These groups need to be augmented both in terms of personnel and budget. The capability of actually building small items of life sciences flight hardware at the NASA centers would help maintain a technically strong staff. Over the years, NASA LS engineering groups have succeeded in keeping some extraordinarily dedicated and competent engineering professionals, but the effectiveness of even these people has been significantly compromised because their oversight responsibilities have been matrixed over far too many projects and missions. Partly as a result of inadequate technical monitoring and tight budgets, a surprising number of the items in the LSLE equipment inventory have proven inadequate or unreliable in performance. (Notorious examples include the GAMS, PMS, CDTR, the mid-deck rotator).

- In planning flight experiments, NASA management should set aside and defend somewhat larger fiscal reserves. Larger reserves are needed to fund research teams across the inevitable launch slips, and also because PIs seem to consistently underestimate the time and money required to fix problems and do post mission data analysis. "No cost contract extensions" only put university research teams further behind, fiscally.

- More PIs need to take a more active role in explaining what is exciting about space life sciences to NASA upper management and congressional staff. NASA upper management has historically not understood what life sciences is about, and Life Science managers only rarely percolate into higher management levels. PIs could help more, but are busy, and often don't have a broad view, but need to overcome their reticence. Some informal but specific advice from NASA Hq. would be useful.

- The USRA/Baylor Life Sciences symposia provide a very useful focus for bringing together the various disciplines, and should be continued. Support for all grantees to attend these meetings should be allocated.

- Maintaining a NASA basic research grant is far from easy for all the wrong reasons.

It seems NASA activities are chronically 30% underfunded by OMB. NASA Life Science managers seem to scope their annual programs on the basis of optimistic "going-in-to-OMB" budgets, and when the cuts come back, they are passed down the chain, sometimes equitably, sometimes not. In any event, most people wind up with only two thirds of a loaf. Worse, it somehow seems to happen virtually every fiscal year. Program managers could make things work much more easily if they maintained more realistic reserves.

NASA center procurement office hassles are constantly with us, often despite the best efforts of the NASA science or technical monitor involved: JSC and ARC procurement offices are primarily used to dealing with big aerospace contractors, and are usually not responsive to university needs. Delays in the paperwork phase of procurement have been the rule, rather than the exception, in my experience. (One procurement guy I know of actually tore up the paperwork on my grant out of frustration, and didn't tell my technical monitor about it for a month and a half. Such lack of professionalism is really frustrating!) The resulting funding gaps create serious fiscal problems for small university labs such as ours who cannot quickly hire and fire, or reassign personnel easily to other projects, and who have no corporate funds available to cover such deficits. Rapid procurement of small computing equipment is needlessly delayed by the archaic DIPEC procurement review process, which really is only appropriate for mainframes.

- Finally, some brief comments on specific science aspects:

I am impressed by what has been achieved so far by the European Biorack experimenters, and by the presently underfunded Space Biology program.

Vestibular/space motion sickness problems will not go away, just because we are flying longer duration missions, and will likely be significant factors in long duration lunar and mars missions. The notion that a "cure" for space sickness would be found on early shuttle flight DSOs was unfortunately oversold to NASA top management.

I would like to thank you, Dr. Robbins, and the other members of the LSSPSC for their attention to these comments, and also for what I know is a substantial commitment of time and effort so as to provide the NASA space life sciences community with a realistic strategic plan. If necessary, I would be happy to amplify or clarify any of the ideas presented above. I can be reached at (617) 253-7508.

With best wishes.

Sincerely,

A handwritten signature in black ink that reads "Charles M. Oman". The signature is written in a cursive, slightly slanted style.

Charles M. Oman, PhD
Director (acting)

cc: Prof. FC Robbins
Prof. LR Young