D. BEATTIE

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NASA

National Aeronautics and
Space Administration

Washington, D.C.
20546

Reply to Attn of LJA

MAY 15 1990

Dr. John L. McLucas
Chairman, NASA Advisory Council
National Aeronautics and Space
Administration
Washington, DC 20546

Dear John:

The Space Station Advisory Committee (SSAC) met in Washington, DC, on May 9 and 10, 1990, for a fact-finding session. NASA Program Director Richard Kohrs provided an update on the program status and progress. The program is proceeding on schedule and the Preliminary Design Reviews (PDRs) have begun. They are scheduled to be completed this year, culminating with the program PDR in December. He reported the activity on several issues which have been raised as concerns by our committee.

The committee has been concerned that an unfavorable location of the centrifuge might result in unwanted traffic disturbances which would adversely affect the acceleration environment in the area of microgravity experiments. The decision has been made to locate the centrifuge in one of the nodes. The specific node has not been selected, but we are satisfied that the project is sensitive to the need to protect the microgravity environment as much as possible. The project is also trying to accommodate the request that a 2.5 meter centrifuge be used in lieu of the previously planned 1.8 meter version.

The issue of the amount of external maintenance and how it will be accomplished continues to receive high priority. This maintenance issue has a major influence on the amount of required EVA, the entailed crew time (which is at a premium), the degree to which automation and robotics can be employed, and the requirements placed on the space suit if high levels of EVA are required. NASA has an extensive effort underway to assess the extent of the external maintenance required, the ways of reducing it, and the most effective means for accomplishing it. At the request of the project, we have set up a subcommittee of our committee to examine these issues in some detail and to make recommendations to the program on how to proceed. We plan to have some input by the July time period.

Another issue which could have a significant influence on the SSF design is that of orbital debris. The current definition of the expected debris environment is highly

approximate. As a result, the degree of protection which will be required is unclear. In the case of large debris, that over about 1 centimeter in diameter, protection through the use of some kind of barrier imposes an unacceptable weight penalty. At the request of the program, our committee has established a subcommittee to examine this issue and make recommendations to NASA. We expect to have an input around the July time period.

A major difference between SSF and previous space systems is that this system is never fully assembled and checked out on the ground. This means that the ground systems verification program must be able to give positive assurance that the various elements of the station which will be assembled in space over a period of some 4 years will be physically and functionally compatible when they are brought together in space. NASA is giving this issue high attention and progress is being made in defining the required system verification process. At the request of the program, our committee has formed a subcommittee to study this issue. We have not yet set a time scale for completion of this study.

One of the major issues in system verification relates to software. It is anticipated that the total software package for SSF will be much larger than that for previous space systems. It is also being developed by several contractors and their subcontractors. NASA is well aware of the magnitude of the effort required to develop and verify the software. Our subcommittee on verification will include software in the scope of their activity.

Our committee has on numerous occasions expressed its concern that the design of SSF might not be giving adequate weight to the long-term usability of the station as a research and development facility. I am pleased to report that the program is now giving a high level of attention to the needs of the potential experimenters. This is reflected in recent organizational moves, in the assignment for a full two-year term of a Chief Scientist at headquarters, and in program configuration decisions which support the ability to perform good experimentation on the station. We have had a subcommittee working this issue and they have prepared the enclosed report, which contains several recommendations for consideration by the NAC and NASA. While significant progress has been made in accommodating the needs of the potential users, there is not yet a very effective mechanism within NASA for direct involvement of potential users of the experiment module in impacting configurations decisions. The committee believes that further work is required in order to accomplish this highly desirable involvement. At the present time this sort of interaction is essentially on a voluntary basis, which makes it very difficult for university people who have other full-time obligations demanding their time.

A major accomplishment of the program was the negotiation of an agreement with the international partners on a standard experiment rack configuration, including a definition of the standard utilities provided to each rack. The next step, providing a standard for drawers in the racks, will permit the use of the 3 experiment modules interchangeably. This is important because the United States has rights to 46% of the space in the European and Japanese modules and the Canadians have rights to 3% of the space in all 3 modules.

An area of accommodation for potential microgravity experimenters which is not yet resolved is the provision of an acceleration monitoring system. While the need for an understanding of the actual acceleration environment during the course of microgravity experimentation is clear, there appears to be a lack of definition of the total requirements for acceleration monitoring on the station. The committee urges that this issue be resolved promptly by NASA and that the criteria for the provision of acceleration monitoring be established and implemented.

Three areas of continuing interest to the committee will be addressed at future meetings:

a. The committee remains concerned over the capability of the SSF information handling system to store, communicate, and process the large amount of data that will be generated on board the station. The committee will review progress achieved in the last year.

b. An area which the committee has committed itself to monitor is that regarding plans for operational use of the station. This includes the entire process of planning and implementing experiments, getting them to and from the station, and accommodating the complete family of users, including commercial experimenters, quick reaction experiments, etc.

c. The committee has been encouraged by the recent organizational changes having to do with the conduct of system engineering and integration. The committee will be interested in how well those changes have actually improved the process in this strenuous year of design reviews.

The committee had been asked to examine the ramifications of conducting a program and operating in an international environment. Following a brief evaluation of the issue, it

was determined that this activity would be deferred and considered again at a later date.

Sincerely yours,

L J Adams

Laurence J. Adams
Chairman

Enclosure

cc:
W. Lenoir
R. Kohrs
S. Fries

bcc: SSAC Members

April 12, 1990

DEPARTMENT OF
AERONAUTICS AND ASTRONAUTICS

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MEMORANDUM

To: Mr. Lawrence Adams

From: Prof. Edward F. Crawley

Re: Station Institution

During the last several months the Committee on Station Institution has begun examining various aspects of the Station planning and management that will directly involve the user. Where appropriate we will make recommendations which we feel will eventually move the Station more towards the "Institution" we seek.

At our meeting in October, we identified six topics which we felt merited further investigation. Between the October and February meetings, two were resolved by Dick Kohrs without our prodding, but to our satisfaction at this time. The first was the granting of OSSA, OAET and OCP the right to be observer members of the Level II review board, with the right to enter Change Requests. The second was the reorganization of Level II to create a Deputy for Utilization and Operations, as proposed in the Operation Task Force Final Report of October 1987.

The third subject of concern was the potential impact of the Human Exploration Initiative accommodations on the science, engineering and commercial users of the SSF. The report we heard on Tuesday 13 February seemed to indicate that there were no immediate plans to alter the design or operation for the first few years. There is some feeling, held strongly by the Materials Science Community, that there should be a "window" of at least four years for microgravity research, before the HEI operations are begun. We will continue to monitor this aspect of the utilization planning; but I must observe, that should the nation commit to returning to the moon via SSF, I do not think that the needs of the microgravity community would be a compelling reason to delay the plan of exploration. We should make as the first priority for SSF to learn what are the real needs for microgravity, so that if and when this conflict arises, we can make an informed decision.

Three additional topics were discussed by our subcommittee at our meeting of Monday, February 12. These are the role of the Chief Scientist, the involvement of the "real" users, and the development of the utilization plan.

We discussed the perceived role of the Chief Scientist with the immediate past (interim) holder of the position, Dr. Ed Reeves of OSSA. By its history, it is obvious that this position has always been aligned with the space observing science community. It is said that it has served the role of an Ombudsman for the user community inside the SSF office, and of an advisor to the Program Director. The corresponding position of program scientist at Level II has been vacant since the office moved to Reston. We find it difficult to believe that a single individual can serve as a trusted and respected Ombudsman and knowledgeable advisor for the entire user community. We recommend that the Level II program scientist position be eliminated as an independent entity and that a slightly enlarged group support the Chief Scientist at Level I. It is proposed that the Chief Scientist have two assistants, so that among them they represent the physical sciences, life sciences, and engineering technologists.

It was pointed out by NASA that the position has become increasingly difficult to fill with respected and qualified outside personnel. One option is to fill the job with a career science administrator. We strongly oppose this approach. In fact, we feel that the role of this office should be strengthened to be a more meaningful user leader/representative on the inside, and be given some of the responsibilities for overall quality of effort usually assigned to a Chief Scientist, up to and including the right to visit the "laboratory." To this end we have prepared the attached draft of Chief Scientist Roles and Responsibilities. We hope that the SSF management engages us in a serious discussion of this topic in the next few months.

The second issue discussed at our subcommittee meeting is the involvement of "real" users, as opposed to user-sponsors such as OAET, OSSA, etc., in the planning process.

OSSA has established an effective "real" user advocacy group in the SSSAAS. We would like to recommend to the NAC that the parallel advisory committees in OAET and OCP be directed to form parallel Space Station Advisory subcommittees. These committees ideally would meet jointly with the SSSAAS, so that the briefing burden on the SSF program personnel not be increased, and so that common concerns for utilization be addressed efficiently.

The Level I user representation is via the Space Station User Board (SSUB), to be formed presumably by the appropriate Associate Administrators of OAET, OSSA, OCP and other users. OSSA has organized a sub-board, the Space Station Science and Applications Users Board, to coordinate the input

from other federal agencies on scientific uses of the SSF. We recommend that OAET and OSC form parallel sub-boards to coordinate respectively, the federal agencies' inputs on technology and commercial usage.

The Level II user representation for tactical planning is through the Space Station User Working Group (SSUWG). Made up of actual PIs, it would normally be formed about two years before flight. Because of the potential importance of the input from the first group of users, we recommend the formation of the first SSUWG as soon as the PIs are identified. In the case of attached payloads, this has already occurred. OAET and OSSA have plans to continue selection soon for other PIs. The first meeting of the SSUWG should be achievable within the year.

The third issue discussed at our subcommittee was the process of utilization planning. This was reviewed by Dr. Carolyn Greiner, the Level I Utilization and Operations Director. The Level I utilization planning is proceeding well, but we sensed a conflict between the time scale of planning (about six years) and that of new scientific discovery (often one or two years). We have requested at our next meeting a briefing on the resolution of this conflict and, in particular, the Small and Rapid Response program, and the Charter of the Utilization Operations Panel. At our meeting, we will also review the Level II utilization planning and, in particular, the charter of the SSUWG and Investigator Working Group (IWG).

cc: Institution Subcommittee
Prof. R. Bayuzick
Prof. R. Byerly, Jr.
Prof. J.L. Kerrebrock
Dr. Robert H. Moser
Dr. W.P.Raney
Mr. S.I. Weiss

Summary of Recommendations:

1. To SSP Office:

   a) Eliminate Level II Program Scientist
   b) Expand staff of Level I Chief Scientist
   c) Define roles and responsibilities as per attached descriptions
   d) To form the SSUWG as soon as practical

2. To the NAC:

   That advisory sub-committees under the NAC Standing Advisory Committees for OAET and OCP be set up to coordinate the input of technological and commercial uses of the SSF. These subcommittees would parallel the existing SSSAAS, and work in conjunction with it.

3. To OAET and OCP via NAC:

   That "sub-boards" of the SSUB be established by OAET and OCP to coordinate governmental requirements for the SSF. These sub-boards would parallel the SSSAUB created by OSSA.

Chief Scientist's Roles and Responsibilities

The Chief Scientist and staff should have the following functions:

1. User Requirements Advocate - Must have a thorough understanding of the requirements and needs of all research users, including those from the space science engineering and commercial communities. The Chief Scientist must challenge the requirements to determine their soundness and, once established, advocate them to the program.

2. Quality assurance of functionality - Must independently critique the implementation of user requirements to assure that the functionality of the Space Station is assured. This is quite distinct from the conventional role of assuring that the quality of an individual piece of hardware is assured. The functionality of the SSF includes such aspects as hardware accommodations, resource allocation, crew selection and training requirements, and operations and utilization planning. The role of the Chief Scientist is to ensure that the SSF will not only be a high quality facility, but a high quality functioning institution.

3. Ombudsman for the community - Must be a respected and knowledgeable leader from the community, who is accessible to the potential users and to the potential critics. The Chief Scientist must be prepared to evaluate the concerns of the users and press for resolution of reasonable concerns. This process naturally includes interface with various advisory groups, user panels, etc. It also requires the Chief Scientist to be able to successfully explain and defend to the users the final resolution of perceived concerns.

4. Multi-level operative - In view of the fact that we have recommended the elimination of the Level II Program Scientist, the Chief Scientist and staff must be given a role in helping to resolve user requirement conflicts at Level II, and perhaps even at Level III. Only by having a charter to liaise directly at the lowest practical organizational level, will the Chief Scientist be able to efficiently resolve such issues?

5. Advisor - Obviously the Chief Scientist plays a role of advisor to the Level I and Level II managers, helping to interpret user needs. The Chief Scientist may be called upon by the management to perform independent analyses and assessments as appropriate.

6. Interface with designated PIs. As the Space Station Users Working Group (SSUWG) and Investigator's Working Group (IWG) are

formed, the Chief Scientist should give leadership to the formation, institutionalization and empowerment of these groups.

7. International Representative - To an extent whose limits are not completely clear, the Chief Scientist has a role in interfacing with the international user community, at least to the extent of being knowledgeable of scientific plans and programs of partners. As the international science operational environment becomes more defined, this responsibility might grow if the US takes the lead in the overall coordination of the research use of the station.