Space Science Board Assessment of the Scientific Value of a Space Station: Letter Report

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AUTHORS

Space Science Board, Commission on Physical Sciences, Mathematics, and Resources, National Research Council

NATIONAL RESEARCH COUNCIL

COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND RESOURCES

2101 Constitution Avenue Washington, D C 20418

SPACE SCIENCE BOARD

OFFICE LOCATION
JOSEPH HENRY BUILDING
21ST STREET AND
PENNSYLVANIA AVENUE N W

September 9, 1983

Mr. James Beggs
Administrator
National Aeronautics and Space
Administration
Washington, D.C. 20546

Dear Jim:

Last September the Space Science Board agreed to work with NASA in determining the technical capabilities a space station should have in order to address effectively the scientific objectives of the various space science disciplines. During the past year, the Board and its committees have had frequent interactions with the NASA Space Station Task Force, led by John Hodge, in fulfilling that commitment. We have been very favorably impressed by the careful consultation with the community of potential space station users that NASA has maintained during this exercise. In due time, we plan to transmit to you formally the results of the past year exercises by the Board and its committees.

Mr. Hodge has briefed the Board concerning the characteristics of the space station now being proposed by NASA. In the reports enclosed with this letter, the Board addresses two separate issues. The first issue is the degree to which the space station now being considered will be required in order to reach the objectives of the Space Science disciplines during the next twenty years. This evaluation, in the Board's opinion, must be made in the light of the adequacy of the presently available space transportation system to meet space science needs without augmentation by the proposed space station capabilities. Our finding is that present systems are adequate to these needs. Therefore, on the issue of meeting the needs of space science, our recommendation would be to use the space shuttle, together with requisite upper stages, maneuvering and propulsion systems for missions to be flown during this century. To meet longer range science objectives, a space station might prove to be very useful in various ways if it were suitably designed. The Board would be happy to work with you to define such a space station if you proceed with plans for it.

As we pointed out in our letter of September 13, 1982, the Board agrees with you that the question of whether to go forward with a space station is not apt to be made on the grounds of its usefulness to space

science and applications alone. Thus, the report entitled "Space Science Board Assessment of the Scientific Value of a Space Station" should not be regarded as establishing a Board position on the question of whether the nation should or should not now or in the future develop such a space station. On the other hand, the Board has considered some additional issues that lie within its competence. These have to do with conditions that should exist as any space station is being developed and after it becomes operational, if a healthy and vigorous space science program is to be maintained concurrently. A discussion of these issues is the content of our second report, "Space Science in a Space Station Era" which is also being forwarded to you with this letter.

Sincerely,

Tom

Thomas M. Donahue
Chairman

cc: F. Press
P. Smith
H. Friedman

SPACE SCIENCE BOARD ASSESSMENT OF THE SCIENTIFIC VALUE OF A SPACE STATION

During the past year, the Space Science Board has examined the question of what space systems are required to launch and support adequately the space science missions designed to attain the high priority science objectives identified by the Board and its committees. These missions are very numerous, challenging, and exciting. However, the rate at which they are launched would have to increase significantly above the current rate if all of the missions needed to fulfill this program are to be flown during the next two decades. The means of launching and tending them is now available or being developed in the form of expendable launch vehicles and the space shuttle, augmented as required by adequate high energy upper stages. One reason for the present slow pace is the delay in bringing the shuttle and its upper stages to full operational status. Another is that we have not yet learned how to use the shuttle efficiently and effectively as a manned orbiting laboratory. The Space Science Board urges that the present launch systems be fully and flexibly exploited and adequate resources be brought to bear so that the stated objectives of space science can be reached in a timely fashion. The results of following this course should be a rich harvest of discoveries and insights in all disciplines of space science.

The Space Science Board has carefully examined the proposal by NASA for a manned space station in low Earth orbit designed to engage in a number of major activities. A significant portion of these activities involves support of space science missions. The Board has also examined the set of specific missions proposed for implementation from the space station system during the years 1991-2000. It has found that few of these missions would acquire significant scientific or technical enhancement by virtue of being implemented from this space station. In view of this and the adequacy of the present space transportation system for the purposes of space science, the Board sees no scientific need for this space station during the next twenty years.

In the longer term, the Space Science Board sees the possibility that a suitably designed space station could serve as a very useful facility in support of future space science activities. Such a space station could provide means for erecting and fabricating large and novel structures in space, and for servicing, fueling, and retrieval of payloads in orbit. If NASA wishes to develop plans for such an ambitious and technically demanding space station for the next century, the Space Science Board would be pleased to work with NASA in defining the properties of such a space station.

SPACE SCIENCE IN A SPACE STATION ERA

In a recent statement entitled, "Space Science Board Assessment of the Scientific Value of a Space Station," the Space Science Board has addressed the issue of the space science need for a space station. It found no need for a space station to support missions addressing high priority science issues for the next two decades. On the other hand, it found that a suitable space station could offer important services to space science in the more distant future.

The Space Science Board realizes that the nation may decide to commit itself to the deployment of a space station in support of needs and objectives other than or in addition to those of space science alone. The characteristics of such a space station should be carefully determined to conform to the principal activity that it is intended to support. For example, it is not obvious that a space station optimized as a transportation node for travel between the Earth and other solar system objects would also be an entirely suitable platform from which to launch and support science and applications missions. Whatever the eventual properties of such a space station, there will probably be a set of high priority science missions that require orbits and operational support for maximum effectiveness other than those available from that station. If a space station program should be undertaken and it is meant to be useful to space science, the Space Science Board urges that the means to initiate and operate space science missions in a timely fashion and in reasonable accord with priority ordering of those missions be maintained. Ordering of missions would then be determined by scientific priority rather than the nature of the launch or support system required. The Board also urges that the scientific program be structured so as to be protected from delay in space station development or changes in its capability.

The Board also wishes to make the following specific recommendations and observations.

Scientific instruments that can be deployed in orbits compatible with space station orbits should be flown in optimal scientific orbits and on separate platforms if that is necessary to preserve them from contamination, interference, and degradation of pointing stability and control that may be associated with the manned modules.

If the space station is designed to provide a servicing capability beyond that provided by the shuttle, that capability should allow retrieval of instruments from a wide variety of orbits.

The deployment of a space station designed in part to support space science implies an increase in the level of space science activity above that presently planned. If such a space station is to be utilized effectively, the space station system should be accessible and affordable for scientific use, and there should be a real increase in the level of support for that activity.

A commitment by the nation to long duration human space flight, whether in Earth orbit or beyond, calls for the establishment of a facility for space biological and medical research on the effects on individuals of very long exposure to the "low g" environment. In this sense, the relationship of the life sciences to a space station is a special one.

Thus, a manned space station could eventually provide significant opportunities for a number of disciplines in space science provided there is a commensurate increase in the total level of space science activity. Realization of those opportunities would depend on the extent to which the capability to carry out space science research is kept viable, important experimental and theoretical activity is continued, and new endeavors are initiated while the space station is being developed. After the space station becomes operational, realization of those opportunities would depend on the provision of a sufficient number and variety of flight opportunities, many involving unmanned space craft and flight to regions of space near the Earth and further out in the solar system at distances and locations inaccessible to a manned platform.