On Life Sciences Facilities for Space Station Freedom: Letter Report

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

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NATIONAL RESEARCH COUNCIL

COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND RESOURCES

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SPACE SCIENCE BOARD

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Andrew Stofan
Associate Administrator
Office of Space Station
National Aeronautics and Space
Administration
Washington, D.C. 20546

Dear Mr. Stofan:

The Space Science Board's Committee on Space Biology and Medicine has recently published a report: A Strategy for Space Biology and Medicine for the 1980's and 1990's. In it, we have made two very strong recommendations for the space station: (1) a Variable Force Centrifuge of the largest possible dimensions, and (2) a Dedicated Life Sciences Laboratory.

As NASA is actively engaged in planning the design of the space station and making decisions about its initial configuration, we felt compelled to bring these recommendations to your attention while there is still time to affect these decisions and to maximize the station's usefulness to space biology and medical research.

Unlike the more traditional space sciences, which are primarily observational with essentially no control of the phenomena under study, space biology and medicine require interactive experimental approaches. Establishment of new ideas frequently requires intervention in experimental design during the course of experiments, often resulting in modification of hypotheses and generation of new ideas. A permanently occupied Space Station will, for the first time, permit relatively long-term laboratory experiments to be performed in a microgravity environment using the empirical methods so successfully employed in hundreds of laboratories on Earth. In this sense, the necessity of a space station for life sciences research is unique.

The field of space biology and medicine is in its infancy. It has been based on ground-based research coupled with limited flight opportunities which, in some disciplines, has allowed the generation of models. They can only be verified by sustained experimental opportunities in space which are also required to create and verify new models. It is safe to say that without dedicated opportunities on the space station, space biology and medicine will not evolve much further as a discipline. That would, in turn, preclude any long term human presence in space.

In its report, the Committee on Space Biology and Medicine makes the following recommendation:

> We have been apprised of the engineering problems involved in the inclusion of a large centrifuge in a freely floating Space Station. The committee still recommends that a Variable Force Centrifuge (VFC) of the largest possible dimensions be designed, built, and included in the initial operating configuration of the Life Sciences Laboratory. It does so because a VFC is an essential instrument for the future of space biology and medicine.

The VFC not only provides an onboard 1g control for experiments concerned with the effects of microgravity on biological processes, it also provides the opportunity to study the effects of varying gravitational forces on such processes. Concerning the deleterious effects of microgravity that have already been documented, a VFC will allow investigators to determine also whether there is a threshold force required for a response to occur or, conversely, to reverse a given response. The centrifuge should be large enough to accommodate experiments on primates, possibly humans, rodents, and larger plants. A VFC is an essential instrument for the future of space biology and medicine.

The Space Science Board has documented the need for a centrifuge for space biology and medical research in a number of published reports. Every other group that advises NASA on life sciences issues supports this recommendation. They range from the President's National Commission on Space to the Task Force on Scientific Uses of the Space Station and the NASA Life Science Advisory Committee.

To summarize, of the facilities that have been recommended for medical and biological research on Space Station, there is uniform support in the life sciences community for giving highest priority to inclusion of the VFC in the Initial Operating Configuration It would be of greatest value when coupled with a dedicated Life Sciences Laboratory. Thus, for maximum advantage, the VFC should be included as part of a Life Sciences laboratory or a node connected to a dedicated life sciences module.

Sincerely,

L. Dennis Smith
Chairman
Committee on Space Biology and Medicine
Space Science Board