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SPACE STATION ANALYSIS RESULTS

NASA Administrator Dr. James C. Fletcher today accepted the additional analysis conducted by the Office of Space Station and directed Andrew J. Stofan, associate administrator for the Space Station to implement the recommended technical and work package modifications to the Space Station configuration that resulted from the review conducted this past summer.

The additional analysis was in the areas of Space Station management, use of expendable launch vehicles (ELV), and cost impacts resulting from design changes.

In September, Fletcher directed the Space Station office to provide additional detail in the three areas as a prerequisite to approving recommendations following a review of the Space Station program.

A detailed engineering review of the Space Station configuration was performed by the Critical Evaluation Task Force (CETF). The task force examined the Space Station baseline configuration, specifically with respect to issues of transportation capability, flight assembly and checkout, operations and safety.

An Executive Technical Committee, headed by Stofan, provided technical oversight to the task force and performed the review of the Space Station work package alignment.

Design changes recommended by the CETF included replacing the nodes and tunnels in the original Space Station design with larger "resource" nodes. The nodes are used to connect the pressurized modules.

The expanded nodes will house racks of command and control equipment, which in the baseline configuration had been located outside on the framework of the Station, thereby reducing significantly the amount of extravehicular activity required to maintain and replace equipment over the lifetime of the facility.

The CETF also recommended revising the assembly sequence to provide early scientific return and reduce extravehicular activity on early Station assembly flights. The design also incorporates an initial power level of 37.5 kilowatts of power, achieves a permanent manned capability with fewer Shuttle flights, places the fixed servicing capabilities closer to the modules, and makes room for early payloads. The design also reduces EVA requirements for assembly and maintenance of the Space Station, and features an improved safe haven capability.

The oversight committee recommended a realignment of certain work package responsibilities. Under that realignment, the Marshall Space Flight Center responsibilities included the laboratory, habitation and logistics modules, engine elements of the Space Station's propulsion system and the resource node structure. The Johnson Space Center responsibilities included the external truss, distributed subsystems, EVA systems, manned space systems, components and hardware in the habitat module, airlock and resource node outfitting. The Goddard Space Flight Center's responsibilities included the Space Station platforms, attached payload accommodations, robotic servicer and NASA's role in servicing. And the Lewis Research Center's responsibilities included the power system. Contractual arrangements for the development phase between the Johnson Space Center and the Marshall Space Flight Center were to be reflected in specific exhibits in the contracts for each center's work package and were further documented in memoranda of understanding signed by both center directors.

The additional analysis requested by Fletcher focused on the functional and organizational dimension of the Space Station headquarters structure within the overall management of the program, the potential for using expendable launch vehicles, particularly with regard to Space Station launch and assembly, and the cost impacts of the task force recommended design modifications to the baseline configuration. A summary of the results follows:

MANAGEMENT

A detailed analysis of the management of the Space Station program, with emphasis on system engineering and integration, was conducted by a study team headed by Larry Ross, director, Space Flight Systems at the Lewis Research Center.

In June 1986, Fletcher announced that a Space Station program office would be established in the Washington, D.C., area, which would be responsible for overall technical direction and content of the Space Station program, including systems engineering and analysis, configuration management and the integration of all the elements into an operating system.

Ross' group examined the relationship between the program office in Washington, and the project offices at the NASA field centers. The resulting recommendation was consistent with NASA's earlier decision to establish a program office in the Washington, D.C., area. A major portion of the systems integration is to be performed at the NASA Centers through Space Station field offices which will be established at Goddard Space Flight Center, Greenbelt, Md.; Johnson Space Flight Center, Houston; Kennedy Space Center, Fla.; Lewis Research Center, Cleveland; and Marshall Space Flight Center, Huntsville, Ala. The Space Station project manager at each of the five centers will head the field office and will report directly to the program director in Washington.

The study team concluded that this approach provided the most effective means to achieve the required level of program control and program accountability, coupled with an ability to utilize effectively the expertise that resides at the field centers.

EXPENDABLE LAUNCH VEHICLES

The potential use of existing or near-operational ELVs in the Space Station program was examined by a team headed by John Dunning of the Space Station Project Office at the Lewis Research Center.

The teams' analysis demonstrated that, under certain conditions, the schedule for achieving both the man-tended and permanently manned milestones in the assembly sequence could be accelerated by 4 to 9 months through the use of ELVs. However, ELVs would increase the amount of EVA required during the first four Station-dedicated Shuttle assembly flights by 10 to 40 percent, would require basing an Orbital Maneuvering Vehicle at the Station throughout the assembly phase to control, boost, and reboost passive structural elements, and could impact the weight and design of Space Station components because of the higher dynamic forces associated with ELVs.

The analysis also demonstrated that the accelerated assembly schedule was dependent upon retaining the current Shuttle flight rate to support assembly of the Station, and required the availability of as many as three Titan 4 launches during the first 2 years of Station assembly activity.

This analysis led the Space Station office to conclude that the substantial technical and programmatic uncertainties, the increased operational risks associated with the use of ELVs for the initial assembly phase and the increase in costs required to compensate for these uncertainties and risk far outweighed the marginal schedule benefits to the Space Station program and it recommended the Space Shuttle be retained as the baseline transportation system for assemblying the Station's manned base.

However, the program will continue to retain the option of using an expendable launch vehicle to launch the polar platform, one of two unmanned free-flyers that are components of the Space Station program. The study group concluded an ELV could be used to launch the high inclination platform in the event of a delayed reactivation of the Shuttle launch site at Vandenberg Air Force Base.

Also, recognizing that ELV's can be used for Space Station, and that the agency is continuing to reevaluate its STS utilization strategy in the context of overall national needs, Stofan has directed the program office to participate in the agency's mixed fleet studies and be prepared to discuss possible alternative strategies to the baseline for both assembly, maintenance and resupply of the Space Station.

COST IMPACT

The final item that was examined was the cost impact of the configuration changes recommended by the CETF. The analysis shows a net increase of approximately $49 million due primarily to replacing the nodes and tunnels, as defined in the original baseline configuration, with larger "resource" nodes and to increasing the power level of the photovoltaic solar arrays from 25 to 37.5 kilowatts. In addition, two cupolas were added to the configuration as was some support structure for the reaction control system.

A separate major review of Space Station cost estimates is currently underway. This review, which began in September, is being conducted by a team of approximately 35 technical and resource experts from the Space Station office and the NASA Comptroller's office. Results of this review will be presented to the NASA Administrator in mid-January.

Based upon these analyses, Fletcher has directed the Space Station Program to implement the technical and work package modifications to the Space Station configuration as outlined in the recommendations of the earlier review. The Administrator has also approved the memoranda of understanding between the Johnson Space Center and the Marshall Space Flight Center concerning work package responsibilities.

Completion of the analysis clears the way for final preparation of the requests for proposals (RFPs) for detailed design and development of the Space Station which are scheduled to be released to industry in February 1987.

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