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SPACE STATION SYSTEM DESIGN REVIEW COMPLETED

Plans for the International Space Station are maturing rapidly and the orbiting research facility is on track for assembly to begin in 1997 as scheduled, program managers said today after completion of the system design review.

"This was a major milestone for the International Space Station," said Space Station Director Wilbur Trafton. "The space station team has just conducted a comprehensive review of the requirements, configuration and the maturity of the station's technical definition. We now have a solid baseline for the program. We have an executable schedule with costs that maintain acceptable reserves within our budget cap."

A major milestone in the space station program, the system design review (SDR), included participants from NASA, the Canadian Space Agency, the European Space Agency, the Italian Space Agency, the Japanese Space Agency, the Russian Space Agency, the prime contractor Boeing and Tier I subcontractors Rocketdyne and McDonnell Douglas.

Managers reviewed and evaluated the overall configuration, technical requirements and detailed specifications for the space station during the meeting which concluded Wednesday at the Johnson Space Center.

"I'm extremely pleased with the results of this program review," said Program Manager Randy Brinkley. "The results of the SDR demonstrate that the International Space Station has a high degree of design maturity. This program is right on track to providing the science community with a world class orbiting laboratory."

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The SDR resulted in a consensus among program managers on the technical validity of the design and completeness of the station's system specifications, the operations concept and requirements for interfaces with the Space Shuttle and Russian launch vehicles. Refinements to cost and program schedules also were presented.

Baseline Configuration

Using approximately 75 percent of Space Station Freedom hardware, the completed International Space Station consists of U.S. elements including the integrated truss, habitation module and laboratory module; the Russian science power platform, service module and functional cargo block vehicle (FGB); the ESA laboratory module; Japanese experiment module and exposed facility and the Canadian remote manipulator system.

The station will operate at an altitude of approximately 240 n.m. (444 km) and will orbit in a 51.6 degree inclination which will offer better Earth observation opportunities. The International Space Station increases crew size from four to six. It will have 33 standard user racks for science operations.

Schedule

The planned assembly of the station will begin with launch of the Russian "FGB" vehicle in November 1997. A docking compartment will be added before the first American launch in December 1997. The Russian service module will be added to the station in January 1998 followed by the universal docking module and the science power platform. The U.S. laboratory module will be launched on the third U.S. flight in May 1998 and will signal the beginning of human-tended science operations.

The Canadian-built robotic arm will be launched on the next flight in June 1998 and the addition of the Soyuz transfer vehicle in August 1998 will provide capabilities for extended on-orbit operations. The Japanese experiment module will be launched in early 2000 and the ESA laboratory module will be added in June 2001. Assembly will be complete in June 2002. In total, the sequence provides for 13 Russian assembly flights and 16 U.S. assembly flights. Use of the Ariane V launcher to lift the European module to the station also has been added to the technical baseline.

Cost

The U.S. contribution to the station is estimated to cost \$17.4 billion from Fiscal Year 1994 until assembly is complete in 2002. This includes annual budget appropriations of about \$2.1 billion and consists of development, vehicle and ground operations costs and utilization support during the assembly period.

International Partner Status

Canada completed the critical design review for the Space Station remote manipulator system in 1993. Changes in the subsystem design requirement and assembly sequence currently are being addressed.

The critical design review for the Japanese experiment module is scheduled for 1996. Currently all development activities are on track for launch in early 2000. The European attached pressurized module (APM) preliminary design review is scheduled for 1996 with the critical design review scheduled for 1998. Program managers also are investigating the feasibility of launching the APM on an Ariane V booster as a baseline.

The inter-government agreements for the station currently are being amended to include Russia as a full partner. The memorandum of understanding and joint management plan with Russia will be completed in mid-1994 and negotiation of a fixed price contract is currently in work.

Extravehicular Activities

The amount of extravehicular activity (EVA) in the critical path for station assembly has been significantly reduced. EVA crew hours for maintenance during the station's 10-year operational lifetime also have been significantly reduced.

Ground Control

The ground system for the International Space Station builds on the interfaces for the Shuttle and Freedom programs. The design is being optimized to reduce developmental and recurring costs. All drivers for the ground control systems are well understood and the final specification will be baselined for May.

Station systems

All station systems have a high degree of design maturity. For example, the guidance, navigation and control system design is 97 percent complete. The communications and tracking system design is very mature and analysis and testing to date show that all station requirements will be met. The critical design reviews for the audio, video, S-band and Ku-band systems have been completed with more than 90 percent of the flight material on order or available inhouse. The thermal control system has been significantly simplified. The external active thermal control system has the most significant changes but still retains 40-50 percent of the previous hardware designs.

The internal active thermal control system retains 80-90 percent and the photovoltaic active thermal control system retains 100 percent of the existing hardware design. Also, analysis shows that designs for the life support systems also are progressing well with development programs completed for all major subsystems. A number of key environmental system tests have been completed using prototype hardware and 90 percent of the hardware has passed a critical design review.

Transition Activities

Since the transition activities began last fall, 1,050 open issues from the Freedom program have been resolved. Another 471 new program issues also have been closed during that time. At the close of the SDR, only 17 issues remain open. Those issues include providing for additional on-orbit payload storage, addressing Japanese experiment module and ESA module ventilation noise levels and determining the location and specifications for an optical quality window in the station design.

"We've closed nearly 100 issues for every technical issue still to be resolved and for the few remaining open items, each has a plan on how to close it and a timetable within which it will be closed," Trafton said. "The team is tackling the tough issues, making decisions and moving ahead with a space station that can be built on schedule and at the cost which the Administration and the Congress have established for this program."

With the completion of the SDR, the space station team will refine the design to more detailed levels. In April 1995, the program will conduct the critical design review for the station, a milestone that means the detailed engineering design essentially will be complete.

"We have come a long way in a short amount of time, and that is due to an unbelievable level of professional dedication and hard work by all the program team members," Brinkley said. "Because of these people, the International Space Station will be on orbit and performing valuable science as the nation and the world enters the next century."