

NASA PLANS FOR A SPACE STATION

Clark Covington
Space Station Program Manager
NASA, Johnson Space Center
Houston, TX

In the State of the Union Message, January 25, 1984, the President stated "Tonight I am directing NASA to develop a permanently manned Space Station and to do it within a decade. A Space Station will permit quantum leaps in our research in science, communications, in materials science and life saving medicines which can be manufactured only in space."

The Space Station forms part of the growing space infrastructure, which includes the Space Shuttle. Other components will be added in the future. The Space Station is an operational base which includes a number of modules for living quarters, logistic supplies and support, laboratory facilities, utility services, and berthing and assembly activities. The Space Station can grow by the addition of additional modules for laboratories, construction, assembly, and orbital transfer vehicle support. Pallets also can be attached to the Space Station and appropriate equipment mounted on them.

The Space Station also provides a base for maintaining, servicing and controlling unmanned platforms where microgravity experiments and processes, remote sensing and scientific observations of Earth, the solar system and the universe beyond could be performed. Such unmanned platforms could be free flying or tethered to the Space Station and maintained and serviced by extravehicular activities using orbital maneuvering units and orbital transfer vehicles. There are several possible orbital locations for the Space Station and associated platforms. The Space Station is envisaged as a multipurpose facility which can serve a wide range of scientific and technology development activities. It would serve as an in-orbit laboratory, a permanent space observatory, and a node in the space transportation system (which may be extended to other orbits or planets in the solar system). Finally, it would serve as a communications and data processing center between men and equipment in space and data acquisition facilities on Earth. The Space Station could also serve as a manufacturing and assembly facility to service free-flying satellites and as the storage depot for food, equipment and supplies needed to perform various missions.

The rationale for developing a Space Station includes the following:

- o Ensure U.S. leadership in space during the 1990s.
- o Stimulate development of advanced technologies.
- o Develop fully the commercial potential of space.
- o Provide a versatile, efficient system for space science and applications.
- o Couple maturing international space programs to U.S. space systems and provide a vehicle for international cooperation in space.
- o Enable the U.S. to function more efficiently in space and build on previous national investments.
- o Increase prestige abroad and pride at home.
- o Stimulate interest in scientific and technical education.
- o Maintain the continuity and focus of the nation's civilian space program.
- o Provide options for future national endeavors in space.

The decision to develop a Space Station in 10 years recognizes that the development program will take time, that the Shuttle is becoming operational, that the Soviet threat to U.S. leadership in space is real and that the U.S. economy requires investment in new technology.

A number of alternative approaches to the Space Station have been considered, including:

- o A Space Shuttle with expanded capabilities and extended stay times in orbit. However, it would be costly to design and refurbish a Space Shuttle for this purpose and it would be less capable of performing the needed functions than a Space Station. The Space Shuttle does not represent a needed step towards Space Station design. Further, refurbishing the Shuttle would compete with other future Shuttle improvements.
- o An unmanned Space Station. A Space Station would require development of sophisticated automated equipment. Even if equipment could be developed during the next 10 years, it would be less capable to meet the goals for the Space Station than a manned facility and it would not assure obtaining the objective of leadership in space.

The Space Station development program is not expected to crowd out science programs. Space science prospered during the Apollo program. The funds which were made available for the Space Shuttle development would not have been appropriated for science. Scientific activities just as the Space Station development must be approved by the Office of Management and Budget and Congressional on their own merits. Although the Space Station is not essential for current space science programs, it would be an effective system for the future, enabling scientific investigations not now possible.

The Space Station is designed to serve civil requirements, but it is likely that the Department of Defense may conduct R&D aboard a NASA Space Station. The notion that the Soviet Salyut Station employs second-rate technology and represents no threat is misplaced. The Soviet space program is growing quantitatively and qualitatively, so Salyut and its successors represent a threat to U.S. leadership in space.

International interest in the U.S. Space Station program is growing. This interest derives in part from existing contributions to the Space Shuttle, past and present cooperative activities with NASA, recognition that a U.S. Space Station is the next large development program, the maturity of U.S. and other countries' aerospace industries and the winding down of Spacelab development in Europe.

Several countries have already asked how they can be involved in NASA's planning for the Space Station. The European Space Agency, Germany, France, Canada, and Japan are conducting separate, parallel mission requirement studies to complement NASA's studies. Both the European Space Agency and Japan are examining elements that they could develop for a U.S. Space Station. Italy's present satellite systems study includes possible application of a tether to a Space Station.

So far, no other nations have made commitments to participate in the Space Station program. Potential partners must be sensitive to U.S. concerns pertaining to national security, technology transfer, exploiting jobs, and efficient management. NASA is presently undertaking initiatives including visits

to Europe, Canada, and Japan for high-level discussions on international participation in the Space Station. The plan for international cooperation will be developed based on these discussions. A target date of early 1985 has been set for completion of an agreement on management relationships and the definition of specific cooperative programs.

Planning guidelines have been established for the Space Station development. The management-related guidelines include

- o A 3-year extensive definition phase (5 to 10 percent of program costs).
- o NASA-wide participation in Space Station development.
- o Development of funding to be made available in FY 1987.
- o Initial operations of the Space Station are being planned for the early 1990s.
- o Cost of obtaining initial operational capability (IOC) estimated at \$8 billion.
- o Extensive user involvement in science applications, technology and commercial activities in international participation.

Engineering-related guidelines include the requirements that the Shuttle will

- o Be continuously habitable.
- o Be Space Shuttle dependent.
- o Contain both manned and unmanned elements.
- o Be part of an evolutionary development.
- o Be maintainable and restorable.
- o Be capable of autonomous operations.
- o Be customer friendly.
- o Be technology transparent.

The Space Station program schedule milestone include the issuance of the request for a proposal for Phase B, "Definition Studies" in the summer of 1985, the start of the definition phase of the Space Station in February 1985, and the election of contractors by the end of 1984. The budget for Space Station development in FY 1985 is \$170 million which, at the present time, includes:

<u>Item</u>	<u>\$ Million</u>
Utilization requirements	14.1
Supporting studies	5.8
Focused technology	54.2
Advance development	20.2
Flight experiment	11.0
Systems definition/integration	58.3
Program support	6.4

The Space Station program assumes a NASA budgetary framework of 1 percent real growth per year and identifies 600 NASA personnel in direct support of Space Station development.

The Space Station program utilization philosophy is strongly motivated to be customer friendly. Throughout the Space Station evolution an ongoing process will

- o Develop an informed customer community.
- o Influence Space Station capabilities with realistic requirements.
- o Accommodate flexible customer schedules and use profiles.
- o Provide total accommodation requirements to achieve an operational performance envelope.
- o Specify an evolving customer accommodation requirement that will support an evolving space market.
- o Provide requirements traceable back to the source.
- o Provide a forum to resolve conflicting design, operational or utility issues.
- o Establish communications between basic research, technology development, applied research, and applications communities.

The Space Station will be geared to commercial use because space is already commercialized by the communications industry and encouraging private sector activities in space is part of U.S. national space policy. Several NASA activities already have a commercial dimension, including expendable launch vehicles and the Space Shuttle. The Space Station could provide laboratory and servicing capabilities to private sector endeavors in space. Materials processing has already been identified as a particularly promising area.

The Space Station planning process includes commercial working groups and contracts to nonaerospace industries. Commercial requirements are expected to influence Space Station design, particularly requirements to protect proprietary data, and provide required power and other support activities.

To realize the commercial potential of a Space Station no quick sell is envisaged. On the contrary, commercial utilization of a Space Station will require considerable early success as a result of research and experimentation. Some of this research could be conducted with NASA's ground facilities such as drop towers, aircraft, and the Space Shuttle.

NASA realizes that it must reach researchers and management in industry. Therefore, it will nurture contacts with industry because otherwise the enterprise will sour. Continuity and consistency plus patience are the essential ingredients. NASA believes that commercial endeavors that use a Space Station involve risk but that the potential benefits are both real and large. The challenges faced by NASA in the development of the Space Station are fully recognized and include the need to

- o Design for "permanence," maintainability and growth.
- o Build to cost and schedule.
- o Conduct systems engineering/integration in-house.
- o Orchestrate the international dimension including politics, technology, development and operations, and management.
- o Maintain customer focus when time, money and engineering begin to pinch.

The Space Station represents determined steps by NASA to build a space infrastructure. Figures 1, 2, and 3 indicate possible Space Station designs which will be further defined, modified, and developed. The Space Station is a major U.S. effort designed to lay the foundation for expanded space activities in this and the next century so that "We can follow our dreams to distant stars, living and working in space for peaceful, economic, and scientific gain." (President Ronald Reagan, State of the Union Message, January 25, 1984.)