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Technical Aspects of the United States Space Station,

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ABSTRACT

The United States Space Station, now planned for initial operational capability in 1994, will be a permanent, multi-purpose facility in-orbit. It will serve as a space-based laboratory to conduct basic research, an observatory for both Earth and celestial viewing, a depot to repair and service other spacecraft, a plant to manufacture metal alloys, pharmaceuticals or perfect crystals, an assembly plant to build structures too large to fit into the space shuttle cargo bay, as well as a warehouse to store replacement parts, consummables and even entire replacement satellites.

The Space Station concept provides for both manned and unmanned elements. The manned facility, as well as an unmanned free flying platform, will be placed in a low Earth orbit of about 400 km at an inclination of 28.5 degrees. Eventually, there will be two or more platforms associated with the Space Sstation at high inclination or polar orbit. Figure 1 illustrates a conceptual rendering of the "dual keel" configuration with pressurized living quarters and laboratories clustered together at the center. A free flying platform is being towed to the Space Station by an orbital manuvering vehicle (OMV).

Figure 2 shows the layout Space Station dual keel configuration. This configuration is rectangular in shape and features two parallel 100 m long vertical keels, crossed by a single horizontal beam which supports the photovoltaic and solar dynamics hybrid power generation system. The pressurized modules have been placed near the center of gravity which is the most advantageous position on the Station for conducting experiments that require a micro-gravity environment. Also shown on this picture is the location for accommodations for satellite servicing and storage, a refueling bay, OMV, and the Orbital Transfer Vehicle.

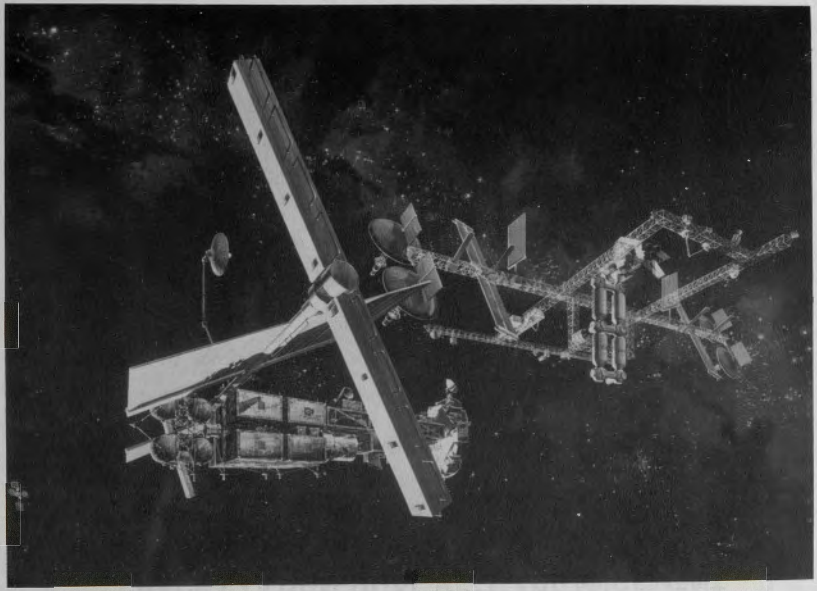
Figure 3 illustrates the Space Station Program schedule. The Phase B activity is now underway with the System Requirements Review (SRR) program milestone now being worked. SRR is a system engineering and integration process used in order to come to major decisions affecting Space Systems Systems, configuration, operations and evolutionary growth. These decisions are supported by NASA participating work package centers and international partners.

The international participation in the Space Station is illustrated in Figure 4. NASA has a long tradition of international cooperation in Space and the President has affirmed that policy by inviting U.S. friends and allies to participate in the development of the Sp[ace Station. NASA is now negotiating with Canada, the European Sp[ace Agency and with Japan with an aim at defining their precise roles in the program. Participation by Canada will be based on their experience acquired from building the Space Shuttle's robot manipulator arm and may include an integrated servicing and test facility. The European Space Agency (ESA) is interested in developing a pressurized module that could be used as a manned laboratory, a free flying experiment platform, and a resources module. Japan is proposing a multipurpose module, called the Japanese Experiment Module, that has pressurized workspace and an exposed workdeck.

An extensive technology development program is now under way to provide options that are both reliable and cost effective for the Space Station Program. Among these technologies which have the highest priority and the best potential for increasing the productivity of the Space Station are data management, environment control and life support, thermal control, and power generation, distribution and storage. The NASA Advanced Technology Advisory Committee is in the process of identifying automation and robotic technology that could be used in the Space Station. For FY 1986, $5 million has been earmarked for research in automation and robotics. These funds will be used to develop a telerobotic system that could be attached to a remote manipulator to aid in assembling and maintaining the Space Station. The telerobotic system will be used as a "smart" front end on OMV for remote operations and servicing of free flying payloads.

In the future, the Space Station could provide the necessary first step for major manned missions such as a permanent lunar base, a manned mission to Mars, a manned survey of the asteroids, a manned scientific and communications facility in geosynchronous orbit and a complex of advanced scientific and commercial facilities in low Earth orbit.

FIGURE 1



ARTIST'S RENDERING OF DUAL KEEL CONFIGURATION

FIGURE 2

SPACE STATION DUAL KEEL ARRANGEMENT

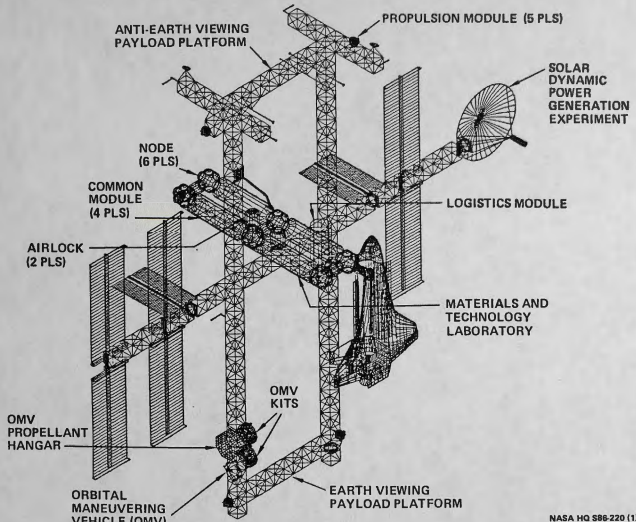


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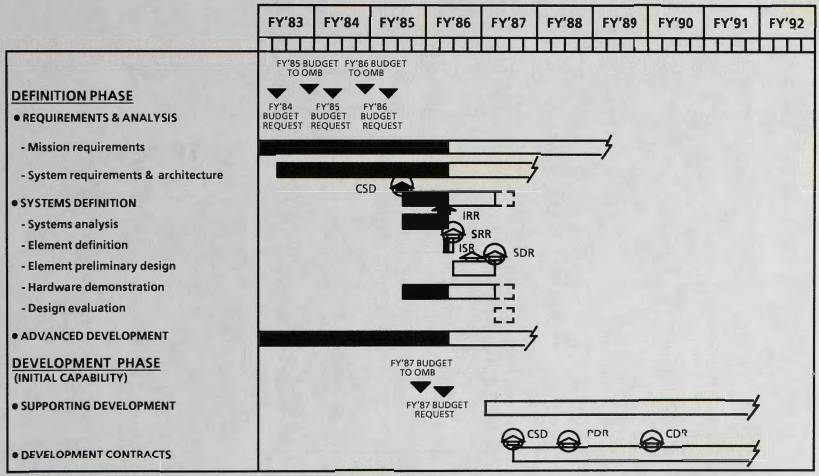
FIGURE 3

SPACE STATION PROGRAM SCHEDULE



CSD - CONTRACT START DATE
CDR - CRITICAL DESIGN REVIEW
IRR - INTERFACE REQUIREMENTS REVIEW
PDR - PRELIMINARY DESIGN REVIEW
ISR - INTERIM SYSTEMS REVIEW

SDR - SYSTEM DESIGN REVIEW
SRR - SYSTEM REQUIREMENTS REVIEW

- LEVEL A CONTROLLED MILESTONE
- LEVEL B CONTROLLED MILESTONE

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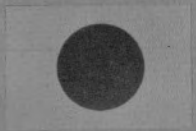
FIGURE 4

POTENTIAL INTERNATIONAL DEVELOPMENTS UNDER STUDY

CANADA:
- INTEGRATED SERVICING AND TEST FACILITY

ESA:
- LABORATORY MODULE
- RESOURCE MODULE
- SERVICING VEHICLE
- FREE-FLYING PLATFORM(S)



JAPAN:
- MULTI-PURPOSE EXPERIMENT MODULE
  - EXPERIMENT LOGISTICS MODULE
  - ATTACHED EXPERIMENT PALLETS
  - MANIPULATOR SYSTEM
  - SCIENTIFIC AIRLOCK

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