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Japanese Experiment Module (JEM)

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ABSTRACT

This paper describes Japanese hardware elements studied during the definition phase of phase B. The hardware is called JEM (Japanese Experiment Module) and will be attached to the Space Station core.

JEM consists of a Pressurized Module, an Exposed Facility, a scientific/equipment airlock, a local remote manipulator, and Experimental Logistic Module. With all those hardware elements JEM will accommodate general scientific and technology development research (some of them are to utilize the advantage of microgravity environment), and also accommodate control panels for the Space Station Mobile Remote Manipulator System and attached payloads.

INTRODUCTION

The Japanese government and NASA agreed and signed a Memorandum of Understanding on May 9,1985 that the Japanese will participate in the Space Station Program with JEM for phase B study. The definition phase has just finished and the preliminary design phase will start shortly.

JEM is a multipurpose experiment module and to be attached to the NASA Space Station (SS) core for material processing, life science experiments, advanced technology development, etc. Throughout the definition phase JEM's functions are studied and arranged so that it provides the functions unique and useful to the integrated Space Station, for example, a scientific airlock and an exposed facility with a remote manipulator which can be operated under direct viewing.

The concept of JEM's architecture is shown in Fig-1. At IOC it has three main hardware elements, Pressurized Module (PM), Exposed Facility (EF), and Experimental Logistic Module (ELM), and 2 functional hardware elements which integrate JEM functionally and make it useful and operable, a local remote manipulator and an airlock. The IOC configuration of JEM is shown in Fig.-2.

PRESSURIZED MODULE (PM)

The PM is attached directly with the NASA Space Station core and designed as a space-based facility with a shirt-sleeve environment for conducting experiments, such as space medical science, biology, manufacturing materials, and biotechnology without a special space suit. PM has a berthing/unberthing

system which connects PM to the other modules, the ELM and the EF, and transfers resources and electrical signals through.

The work station for the remote manipulator is located at the farther end of PM from SS and close to EF in order to view the manipulator operations around EF. Also the airlock is located this end of the module so that the materials used for EF can be picked up by the manipulator and put through the airlock in one continuous operation with direct viewing.

This capability will reduce the need for extravehicular activities and save manpower resources. This is one of the unique and important contributions JEM will make to the Space Station Program.

EXPOSED FACILITY (EF)

The EF is the experimental facility for science observations, earth observations, communication, and advanced technology developments which require exposed space environment. EF is also valuable for many material processing experiments which are better conducted outside of the PM because of the toxicity of the materials used.

The EF is separated into two palettes to fit in the cargo bay of orbiters efficiently. This configuration gives the designer many options to design and operate. One of the options is providing a third palette on orbit to exchange with the second one and store it on the keel while not in use.

EXPERIMENT LOGISTIC MODULE (ELM)

ELM transports and stores experiment specimens, gases, and equipments as well as spare parts for JEM and will be exchanged every 180 days according to JEM's logistics plan. As shown in Fig-2 ELM will be berthed on top of the PM. Another important function of the ELM is the use as a rescue container for safe haven when JEM is isolated by accident.

ELM consists of three sections as shown in Fig-3. The first is the pressurized section, which transports and stores JEM logistic items in a pressurized atmosphere and has evacuation provisions for emergencies. The second is the exposed equipment section, which transports and stores JEM logistic items in exposed environment. The last is the gas supply section, which transports and stores the experiment gases.

This modularized design of ELM makes it possible to launch only necessary sections of ELM to reduce launch cost. And also the gas supply section can be attached to the bottom of PM to reduce the plumbing requirements.

SUMMARY

Definition phase has just finished and during this phase the design has been refined and changed in detail, but the basic concept of JEM survived and is getting firm. This gave confidence and rewarded feeling to the designers that JEM is a very important part of the integrated Space Station System.

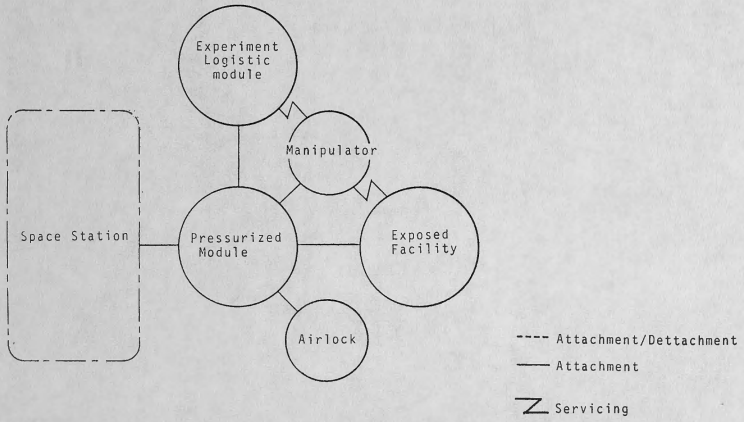

FIGURE 1. JEM ARCHITECTURE

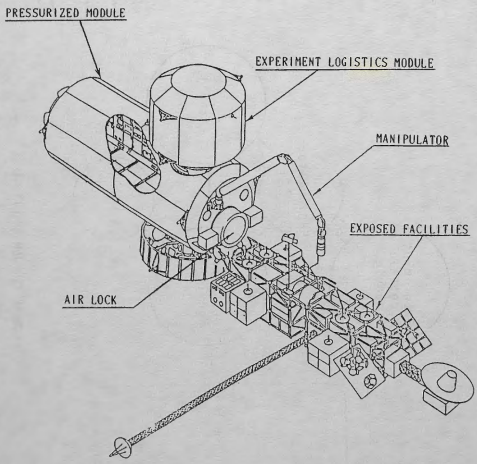

FIGURE 2. IOC CONFIGURATION OF JEM

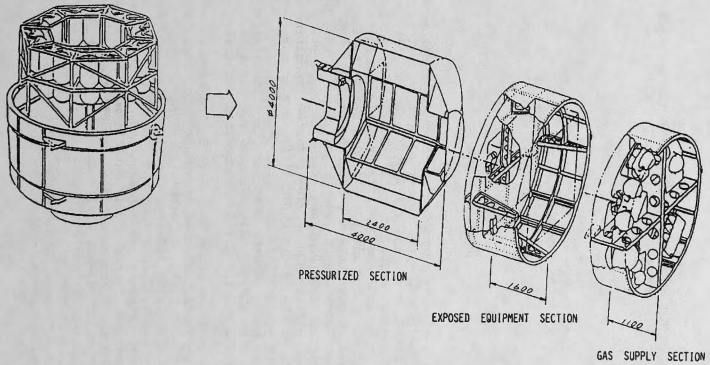

FIGURE 3. CONFIGURATION OF EXPERIMENT LOGISTIC MODULE