

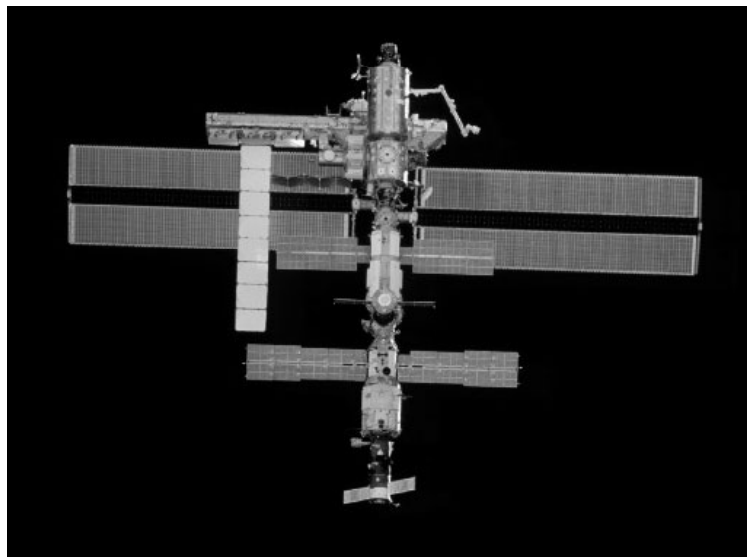
STUDENT SPACE DESIGN COMPETITION
Project Statement

Orbital Shipyard One

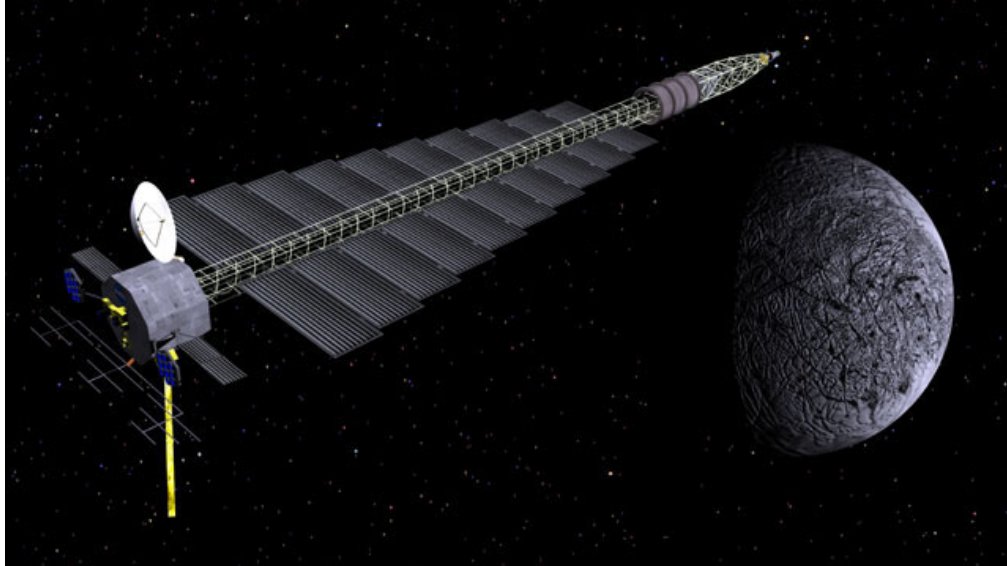
On February 1st, 2003, the Space Shuttle Columbia disintegrated during re-entry. The subsequent investigation determined that the leading edge of the shuttle's wing had been damaged during takeoff, allowing hot gases to penetrate the Shuttle, leading to the ultimate failure of the spacecraft. NASA is currently developing methods to detect and repair similar damage in the future; however, debate continues on whether or not it will actually be possible to effectively repair and/or service the Shuttle in orbit. An orbital shipyard module, attached to the International Space Station, could provide the means to service or repair the Shuttle in orbit, should similar damage occur in the future.

An orbital shipyard could have other benefits as well. A manned mission to Mars will likely involve spacecraft that are too big to place into orbit on a single launch, requiring multiple launches followed by assembly on orbit. An orbital-transfer vehicle or Earth-to-Moon conveyance will certainly need service and refueling between trips.

On-orbit assembly could also enhance the safety of a nuclear electric spacecraft such as the Jupiter Icy Moons Orbiter (JIMO). The nuclear reactor onboard JIMO will be launched in a sub-critical condition so that the amount of radioactivity onboard the spacecraft is essentially negligible. Ensuring that the reactor stays sub-critical during all possible launch accidents is a key component of space nuclear reactor safety. An orbital shipyard would make it possible to launch the JIMO reactor in a disassembled or unfueled configuration, guaranteeing that the reactor would remain sub-critical until it was assembled and started once safely in orbit.



Backdropped by the blackness of space, the International Space Station (ISS) was photographed by a crewmember aboard the Space Shuttle Endeavour during rendezvous and docking operations on November 25, 2002.



Artist's conception of the Jupiter Icy Moons Orbiter (JIMO). Assembling the spacecraft in orbit could enhance the launch safety of the nuclear components of the craft.

MISSION STATEMENT

Design an Orbital Shipyard Module to be added to the International Space Station as part of the efforts to return the Space Shuttle to safe and routine operations.

PROJECT REQUIREMENTS

The project design should satisfy the following mission requirements:

1. The shipyard module will be an addition to the International Space Station and will use the existing infrastructure available there.
2. The shipyard module will be placed in orbit using one or more currently available launch vehicles.
3. To allow for future developments in space flight, the shipyard should be able to accommodate a wide number of types and sizes of spacecraft.
4. The shipyard module should be capable of performing a number of tasks on a docked spacecraft including: assembly, service, repair, and fueling/refueling.
5. The shipyard module should minimize the amount of extra-vehicular activity required to complete the requested tasks.
6. The shipyard module should be as cost effective as possible.