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MANNED MANEUVERING UNIT

Martin Marietta developed the first space backpack to maneuver astronauts outside an orbiting spacecraft. The National Aeronautics and Space Administration (NASA) is funding Denver Aerospace to prepare a backpack, called a Manned Maneuvering Unit, for an early Space Shuttle mission. NASA's Shuttle astronauts will use the Manned Maneuvering Unit to circle and inspect the airplane-like orbiter while in space. The Manned Maneuvering Unit will allow the astronauts to perform a variety of activities outside the spacecraft such as satellite retrieval, science investigations and observations, in-space construction, and rescue operations.

A 6-degree-of-freedom space operations simulator is used to develop flight techniques for operation of the Manned Maneuvering Unit. In the training, astronauts fly missions against a full-size mockup of a portion of the underside of the Space Shuttle orbiter. Controls of the simulator are like those of the Manned Maneuvering Unit. Manipulating them allows the astronauts to move in the x, y and z axes, and in pitch, yaw and roll.

FACTS DENVER AEROSPACE



Astronaut prepares to dock with the solar maximum mission satellite using the manned maneuvering unit to stabilize the tumbling satellite. It will then be brought into the Shuttle cargo bay with the RMS for repairs. Repair of the satellite is necessary to maintain continuous solar observational coverage. The solar maximum satellite is the first spacecraft designed for on-orbit servicing by the Shuttle. The defective attitude control system module is replaceable with a single power tool.

(NASA-CR-168700) MANNED MANEUVERING UNIT
(Martin Marietta Aerospace, Denver, COIC.)

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To use the maneuvering unit, an astronaut exits the crew compartment through an airlock into the cargo bay. He then dons the backpack and releases himself from the flight support station. To maneuver in space, the astronaut actuates the hand controls. A control electronic assembly translates the hand control movements and fires the thrusters. The astronaut can activate an autopilot system which will hold his attitude, freeing one hand.

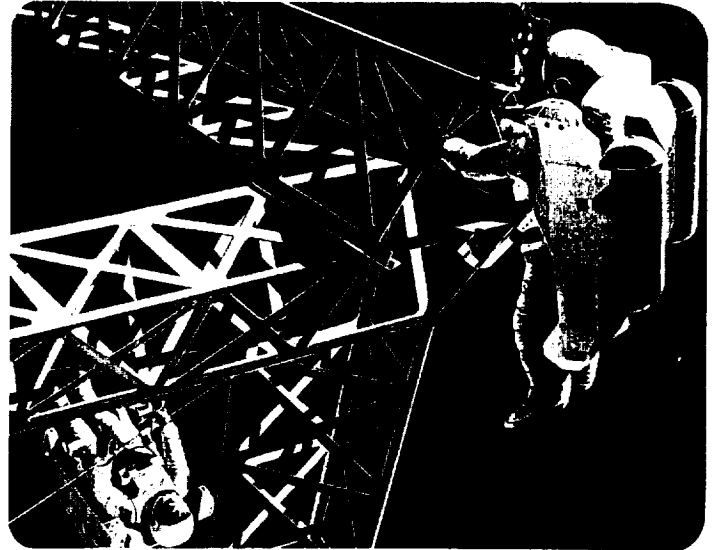
Typical missions outside the spacecraft may last up to 6 hours. The unit's nitrogen propulsion tanks can be recharged inside the orbiter.

The maneuvering unit is 124 centimeters high by 81 centimeters wide by 66 centimeters deep, and weighs approximately 136 kilograms with propellant.

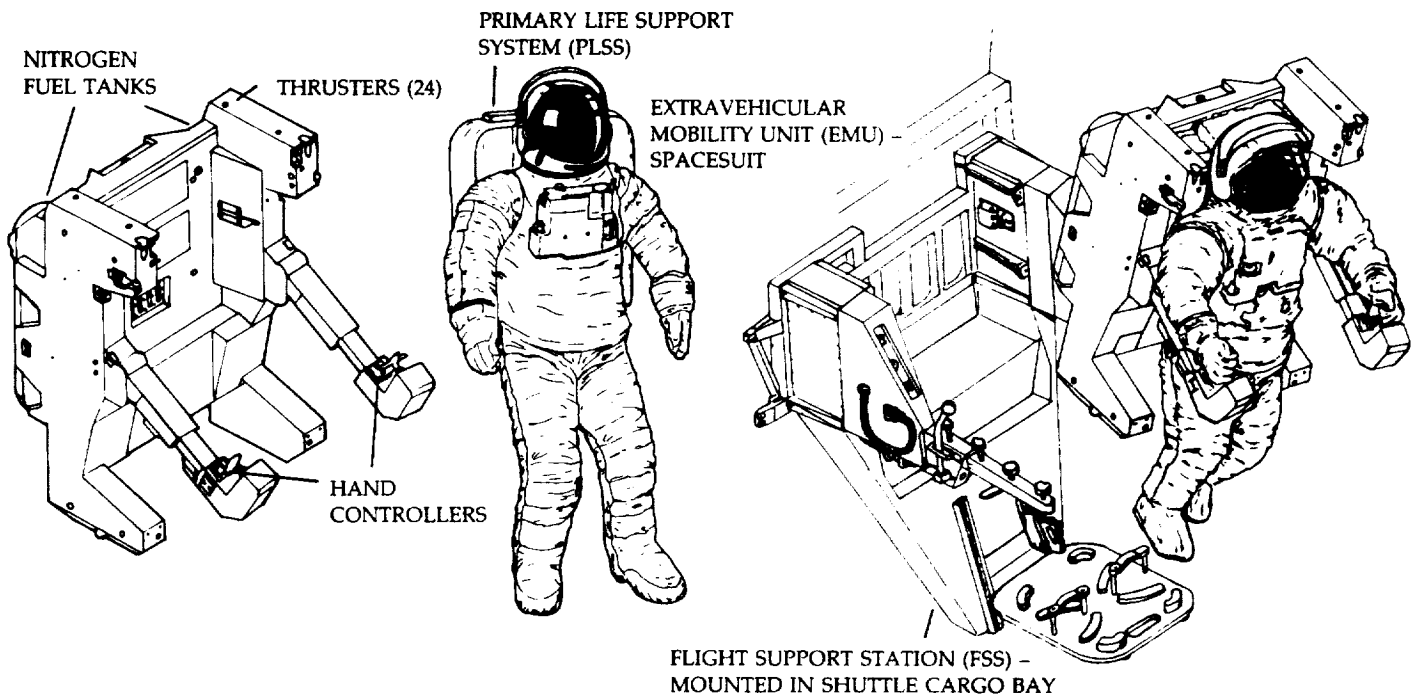
The main structure of the backpack is aluminum. Other elements of the unit include a 16.8-volt silver-zinc battery, a control electronics assembly, two hand controllers, and a cold gas nitrogen propulsion system.

The propulsion system consists of two 76-centimeter-long, 25-centimeter-diameter propellant tanks and 24 jets, each producing 7.56 newtons of thrust. The tanks are made of aluminum with a Kevlar filament overwrap. Each tank holds 5.9 kilograms of nitrogen and is pressurized to 2.069×10^7 pascals.

Martin Marietta has been developing backpack maneuvering units since the early 1970s. An early model, called the M509, was successfully test flown by five astronauts inside the Skylab space station in 1973 and 1974. The current model has been designed based on the data produced by the M509 flights.



SPACE SHUTTLE ASTRONAUTS ERECT A TRUSS FOR A LARGE SPACE SYSTEM.



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