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## Science & Technology

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# Shuttle's first repair of a satellite

by Marsha Freeman

The April 6 Space Shuttle mission is performing the first in-orbit repair of a crippled satellite. The Space Shuttle, although hailed as a reusable space "truck" for transporting things to Earth orbit, is about to become important as a temporary manned platform for doing work in space.

The Shuttle will be used to repair a satellite sent aloft on Feb. 14, 1980 to observe the Sun during one of its periods of maximum activity. After 10 months of operation, during which the Solar Maximum Mission collected extensive data on solar flares and other activity, the spacecraft "blew" three fuses in its attitude control system.

This has meant that the satellite does not maintain a constant, accurate orientation toward the Sun, and only three of its seven scientific instruments have been able to collect data for the past three years. The spacecraft is slowly spinning.

Scientists hope that the planned repairs on the Solar Max attitude control system and the scientific instruments will enable full capability to be restored to the \$50 million satellite, which would cost over \$200 million to replace.

### A dress rehearsal

The tenth, most recent, Shuttle mission was a practice run for this mission's Solar Max Repair; the new Manned Maneuvering Unit powered back-packs were tested out by two astronauts, who took turns foraying up to 300 feet away from the orbiter Challenger. This was necessary since the Solar Max is spinning, and must be brought to a standstill before it can be taken into the payload bay of the orbiter to be fixed.

On this flight, mission specialist Dr. George Nelson, an astronomer, is scheduled to fly out to Solar Max to stop it from spinning. When it is within reach of the Shuttle's Remote Manipulator Arm, it will be grappled by the arm, maneuvered from inside the orbiter by mission specialist Terry Hart. The practice for this maneuver was aborted on the last mission when the arm malfunctioned, but it has been used on payloads on previous missions.

Once the satellite is inside the payload bay the repair work will begin.

By the first repair day, which will take place on the third day of the mission, Commander Robert Crippen's flight crew will have brought the Challenger up to an altitude of over 300 miles, within reach of Solar Max, parking the orbiter about 300 feet away. Engineers in the Payload Operations Control Center at the NASA Goddard Center will send commands to the spacecraft to deactivate the attitude control system on board, making it easier for Nelson to stop it from spinning.

The task for the first day of repair will be to replace the attitude control module, which was designed for easy space replacement. This module, which weighs about 200 pounds, is secured to the satellite by two bolts at the top and bottom.

The more difficult task on the first repair day will be to begin replacement of the Main Electronics Box, which was not designed for modular replacement, on the Coronagraph/Polarimeter. This will require using a pair of scissors to cut through the side of the satellite, and manipulating small screws, a difficult job with gloves on.

On the fifth day of the mission, after the mission specialists have had a day to rest, Nelson and mission specialist Dr. James Van Hoften will again don their space suits and work on Solar Max in the payload bay.

The orbiter Challenger will have been flown up to an altitude of 328 statute miles. This higher altitude is expected to give Solar Max two additional years of effective operation. Before it is redeployed, however, Van Hoften will finish the Coronagraph Electronics Box repair. When this is completed, if the major attitude control repair has gone according to plan, Solar Max will be picked up by the arm and held off to the side of the Challenger.

Engineers at Goddard will conduct tests with the satellite's new attitude control system, and reprogram its computers. The Solar Max will remain on the arm outside the payload bay overnight.

The next day, Hart will position the satellite above the Shuttle, and after receiving the go-ahead from Goddard, will gently drop the satellite from the grasp of the arm, placing it back in orbit.

The orbiter will remain in close proximity to the satellite for about eight hours, before the astronauts start their preparations for re-entry. In the event that the attitude repair fails, the satellite would be stowed in the orbiter, and brought back to Earth to be fixed.

This Solar Max repair is the first demonstration with the Shuttle system of the advantages of having men in space for at least a few days at a time.

The manned space station which NASA is planning to have operational by 1992, will provide a base of operations for men in space for months at a time. Meanwhile, these short-term manned Shuttle missions are giving astronauts experience in working in space, developing the tools for further missions, and laying the technology base for long-term space operations.