SCIENCE NEWS OF THE WEEK

NASA Studies Rescue of Solar Max

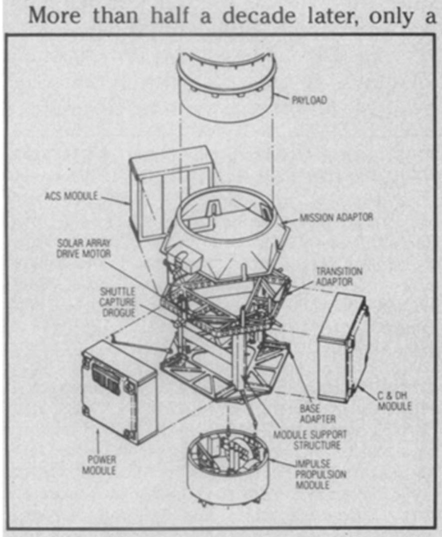
Early in 1976, the National Aeronautics and Space Administration unveiled plans for a device called the Multimission Modular Spacecraft. Markedly different from its years of one-of-a-kind predecessors, the MMS was designed to serve as the standardized hub of a variety of diverse satellites, ranging in weight from 200 pounds to as much as four tons and carrying payloads as small as a cubic foot or as large as a Greyhound bus. But even more radical was the "modular" part: a system of plug-in "black boxes" to handle attitude-control, data-processing and other routine functions—and which could be simply replaced in orbit from the space shuttle rather than let something as trivial as a blown fuse ruin an entire mission. It may not seem like a particularly innovative engineering concept, yet it represented a fundamental change in the whole design philosophy of the Space Age's high technology, and its repairability was tightly linked with the shuttle's touted role as a cost-cutter.

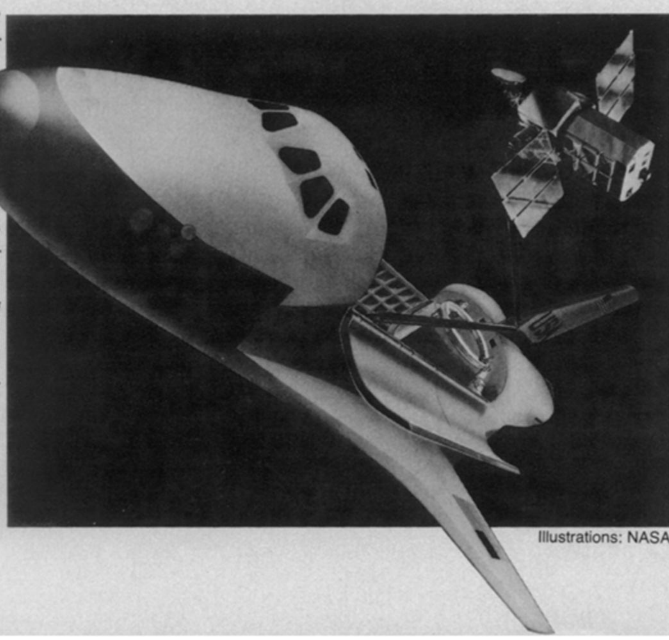
More than half a decade later, only a single MMS-based satellite has ever gotten into orbit. But it is the Solar Maximum Mission, a sophisticated probe launched on Feb. 14, 1980, with a suite of instruments designed to study the sun at the high point in its 11-year cycle of activity. The "Solar Max" project has cost some $77 million (not including its non-shuttle launching) —and last November its attitude-control system, responsible for keeping the craft properly pointed in space, began to fail. Of the seven instruments on board, only one, a coronagraph, had previously had any problems. With only the imprecise pointing of the backup attitude-control system to rely on, however, three others were rendered virtually useless, all, according to Solar Max officials, condemned by essentially nothing more than blown fuses.

Not even the MMS designers had planned to find a need for their easy-fix system quite so soon. Yet at NASA's Johnson Space Center in Houston, a team of engineers is studying just that possibility. In practice, the shuttle would go into orbit carrying a ring-shaped framework called the Flight Support System, together with a remotely controlled (and yet-to-be-tried) grappling arm. Astronauts would fly the shuttle near to the ailing satellite, grasp it with the arm and manipulate it back to a firm mounting on the ring-frame. There, either using the arm or during a spacewalk, they would remove the offending module and replace it with a new one, and, after a brief checkout, send Solar Max on its way.

But when could such a mission be flown? The shuttle's next test flight, second of four, will be the arm's first test, now scheduled for Sept. 30. Flight 3 will probably carry a scientific payload of astrophysics instruments, and the Defense Department is interested in number 4 (or #3, if the latter two are switched). Fixing Solar Max, furthermore, would clearly be considered an operational mission, an ambitious undertaking in light of the basic shuttle testing likely to remain. And after that, the shuttle is due to go into operational service in earnest, with paying customers whose payloads cannot be easily deferred.

Yet NASA would like very much to demonstrate the validity of the MMS idea. Also, Solar Max is expected to reenter and burn up in the atmosphere in 1984, whereas replacing the attitude-control module might allow putting the device into a low-drag orientation that could extend its life for two more years. There is even an existing spare module, prepared for the upcoming, MMS-based Landsat D. The fix-it plan exists. But can NASA make it work? □





Standardized, plug-in components cluster around the core of the Multimission Modular Spacecraft (above). Artist's concept (right) shows the ailing, MMS-based Solar Maximum Mission satellite being maneuvered by a remote-control arm over to a repair framework in the space shuttle's cargo bay, in a "fix-it" mission now under study.

Illustrations: NASA

Voyager 2: Signs of Jupiter's long tail

On March 19, 1976, the Pioneer 10 spacecraft was cruising out beyond the orbit of Saturn when its plasma sensor suddenly reported that the solar wind (a continual outpouring of charged particles from the sun) had disappeared, or at least gotten so weak that the instrument could no longer detect it. The effect lasted barely a day, and one assumption might have been that the probe had simply flown through the tail of Saturn's magnetic field, which would have blocked out the solar wind, except that Saturn was far around in its orbit from Pioneer 10. Instead, John Wolfe of NASA's Ames Research Center in California concluded that the spacecraft had apparently flown through *Jupiter's* magnetic tail — a vast 690 million kilometers from the planet.

If the tail is indeed that long (the Pioneer 10 data were not fully conclusive), it could mean that about every 13 years, when the two giant planets are roughly on a line from the sun, Saturn itself passes through it. Wolfe and others speculate that this could wreak major changes in Saturn's magnetosphere, allowing it to expand outwards toward the sun by removing the pressure of the solar wind that usually compresses it. The passage of the tail might even change the nature of the planet's trapped-radiation belts, by temporarily cutting off the influx of solar-wind particles that normally replenish the belts and replacing it with particles carried in along the tail.

By sheer coincidence, the Voyager 2 spacecraft may be in an ideal position to find out. It will fly past Saturn in August, which could turn out to be a time when the planet is being "washed" by the Jovian magnetotail. And the probe is already reporting signs that the tail is extending at least tendrils in Saturn's direction.

Recently analyzed data from Voyager 2's plasma-wave instrument have revealed that earlier this year the spacecraft appar-