SCIENCE NEWS OF THE WEEK

Voyager: Hard Start on a Long Road

An interplanetary journey that may turn out to be the longest mission in the history of the Space Age began last Saturday, Aug. 20, at 10:29 44 a.m., EDT. The Voyager 2 spacecraft headed up and out from its Florida launchpad, bound for encounters with Jupiter, Saturn (and their moons) and perhaps Uranus, 19 times the earth's distance from the sun and apparently girded by newly discovered rings. The date with Uranus will not take place before January 1986, and there is a slim chance that the probe will then be sent on to a rendezvous with Neptune, nearly four years later.

"But I hope," says an official at Jet Propulsion Laboratory in Pasadena, control site for the mission (except for the launch), "it won't all be like this."

The JPL facility has been the control center for many lunar and planetary flights, including the Viking mission to Mars. The one before Viking was Mariner 10, which took off for Venus in 1973 with the possibility of frozen cameras and completed its third and final encounter with Mercury in 1975, only days before running out of gas. The mission was a stunning success, but it was in large measure due to the flight team at JPL, which kept the craft going despite problems that beset it throughout its 17-month journey.

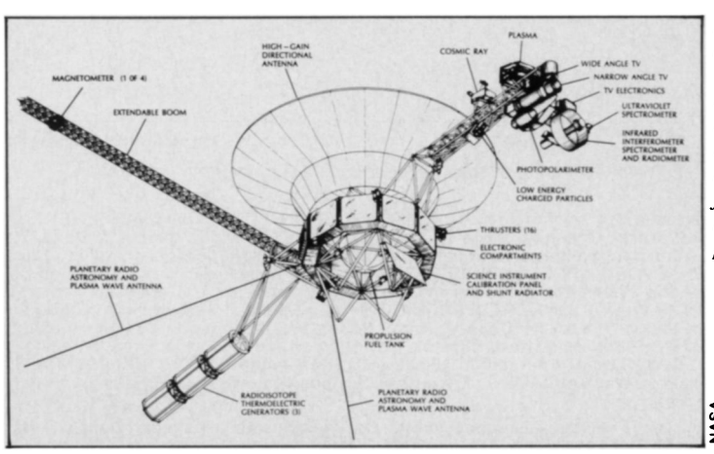
The beginning of Voyager 2's journey—which could last a dozen years—also was marked by a number of technical problems, or "glitches," and the comparison with Mariner 10 was probably inevitable. But this does not mean that anyone is predicting 12 years of troubled flight. Every spacecraft ever launched has had at least a few difficulties, and most of Voyager 2's had been resolved within hours or days of liftoff.

A few days before the launch, while the spacecraft was still being checked out prior to being installed atop the rocket that would carry it aloft, a computer in its attitude control system mysteriously shut itself off. With the launching so close at hand, engineers elected to replace the whole spacecraft with one that was to have followed it in a second launching Sept. 1, bound only for Jupiter and Saturn. This allowed time to replace the ailing computer in time for the second launch with one from a third spacecraft that had been built as a test model.

When the newly swapped spacecraft was finally ready to go, sitting on its rocket with the countdown in progress, an apparently faulty valve in the rocket caused launch officials to call two "holds." As in some previous missions, however, the glitch turned out to be merely in the fault-detection equipment on the ground; the rocket itself functioned perfectly. A seeming problem with the spacecraft's gyros during the ascent also turned out to be in the testing regime, rather than with the gyros.

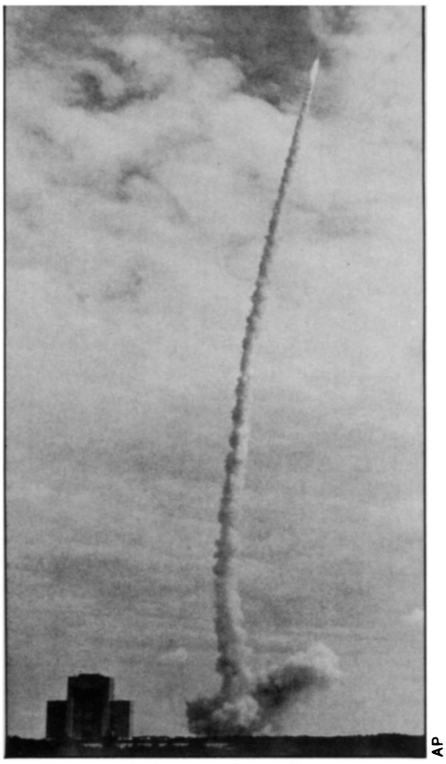
Once separated from the rocket that had launched it, the craft received an additional push from a small rocket engine of its own, which was then jettisoned by means of explosive bolts. The separation apparently gave the spacecraft an unexpectedly large kick, causing it to tumble in two of its three axes, but again, the problem was conquered when on-board systems and ground controllers combined to stabilize it.

The most serious problem in flight occurred when the spacecraft's "science boom," an extendable arm carrying cameras and other instruments, apparently failed to lock in its fully open position after it was deployed. Two other booms, carrying the craft's nuclear power supplies and a pair of magnetometers, worked fine, but a microswitch on the science boom failed to send the signal indicating that the boom was locked open. There was no immediate way to tell how far the boom had opened.



NASA

Spacecraft diagram shows Voyager's instrument-laden "science boom" (upper right), which failed initially to reach its locked position.


AP

Voyager 2 departs Cape Canaveral.

That question was answered by one of Voyager's principal scientists, Herbert Bridge of MIT, whose plasma sensor was mounted on the boom. Calling the NASA Goddard Space Flight Center in Maryland, he requested data from another satellite, IMP-8, showing the alignment of the solar-wind plasma at the time. Combining that with data from Voyager 2's own magnetometers, Bridge was able to deduce the alignment of the plasma sensor, and thence to conclude that the boom was within 2° of its locked position. It was designed to lock within .05°, and flight officials this week were considering ways to nudge the boom the extra distance. Even if it could not be locked, said Spacecraft Systems Manager Ray Heacock, the boom is held open by springs, and its motions are minimized by a fluid damper. Still, a locked boom is a better instrument mount, and officials planned to use the boom's cameras later this week to photograph a part of the spacecraft and the star field in an effort to figure out exactly how far the boom would have to be moved to lock itself in place.

The second spacecraft to be launched, meanwhile, is known as Voyager 1, since it will follow a faster course and reach Jupiter and Saturn ahead of Voyager 2. Its launch has been delayed from Sept. 1 to at least Sept. 3, so that its boom mechanisms can be checked, but for the scientists, says Mission Analysis and Engineering Manager Charles Kohlhase the delay is actually an advantage. One of the goals of Voyager 1 is to fly close to Jupiter's moon Io, and each day of delay in the launching will bring the craft slightly closer to Io at encounter. (This only works through Sept. 12, after which the numbers start to get worse.) The delay will also save fuel by reducing the size of the engine-firing needed to direct the craft from Jupiter to Saturn. □

Science Service, Inc. is collaborating with JSTOR to digitize, preserve, and extend access to *Science News*. www.jstor.org