

Old Reliable in trouble

The once faithful Delta booster is under investigation for recent mishaps

by Jonathan Eberhart

It is comforting, when investigating the causes of a problem, at least to know the problem for which the causes are being sought. For the engineers probing a series of failures in the usually reliable Delta rocket (SN: 9/13, p. 212), there seems to be no such assurance. The failures appear to be unrelated to each other in anything but time, and they came in a flood after years of relatively trouble-free operation.

The Delta was not originally a space launch vehicle at all, but was adapted from the Thor ballistic missile. Its first attempted launch as a Delta, on May 13, 1960, was a failure. But beginning with the second try, the huge Echo 1 orbiting balloon, the new booster compiled a string of 22 consecutive successes. Another failure, four years after the first one, was followed by eight successes in a row, a third mishap and then an enviable record of 25 so-called good birds without a malfunction. In 58 launches, only three failures: Old Reliable had its nickname.

Then on Sept 18, 1968, troubles with the booster caused the destruction of the \$6.5-million Intelsat III-A communications satellite. A few flights later, on July 25, 1969, another devilish Delta kept an identical satellite, Intelsat III-E, out of orbit. A month after that, the \$7-million Pioneer E deep-space probe succumbed to the Delta's difficulties. The National Aeronautics and Space Administration began an investigation.

But where to start? The Intelsat III-A booster's trouble was laid to a loose wire in a first-stage rate gyro circuit. The next failure took place while the Delta was out of range between tracking stations, but the vehicle's third stage apparently either did not fire at all or else shut down prematurely. Pioneer E was lost because of hydraulic difficulties with the third-stage attitude control system. There did not seem to be any common thread.

There still doesn't, after almost five months of probing by a pair of teams, one looking into the over-all state of the Delta and the other into the Pioneer mishap in particular.

The individual problems have been dealt with, but no insight has been

forthcoming as to why one of the United States' most reliable rockets should suddenly become troublesome. The loose wire was countered with a full-scale teach-in at the booster's manufacturer, the McDonnell-Douglas Corp., in better ways to crimp wire, complete with additional inspections and redesigned tools. Hydraulic valves such as those that cost NASA the Pioneer will henceforth have to meet more rigid specifications, not only for testing, but before NASA will even accept them for use in the rocket's plumbing. The failures, however, remain unconnected.

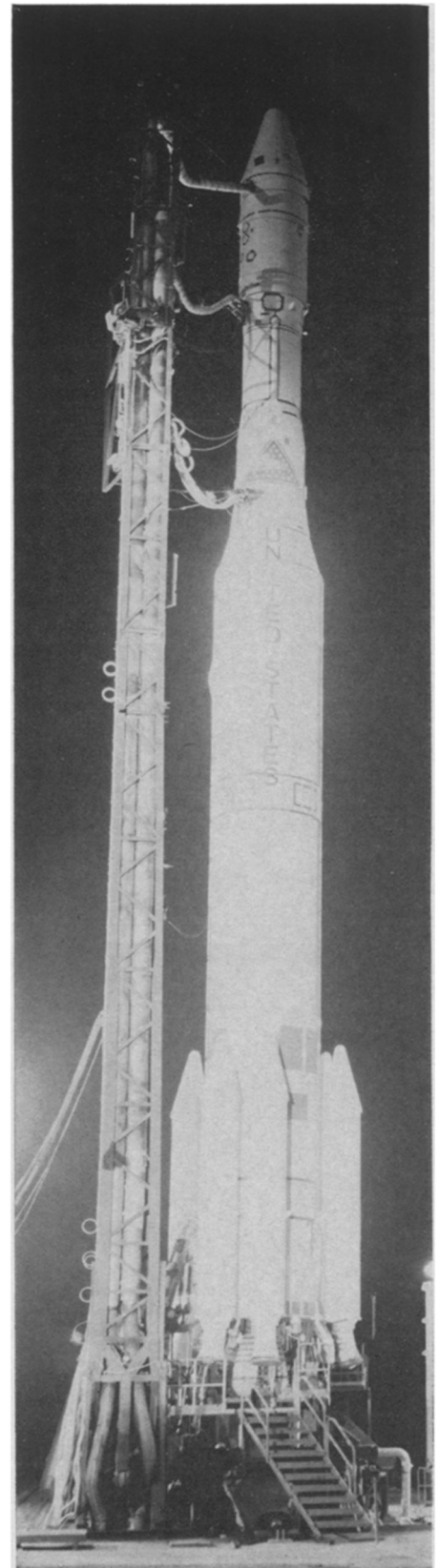
"It sort of leaves you up a tree," says NASA unmanned launch vehicle director Joseph Mahon, "which is just about where we're at now."

After running through the specific things that went wrong, the investigators turned to the more general forms of malaise that can gnaw at an engineering program's vitals, such as were turned up following the Apollo launchpad fire that killed three astronauts in 1967: laxity in general management, quality assurance, deficiency reviews and the like. These areas have all been studied, but as far as the teams can find out, says Mahon, "there has been no general letdown in procedures."

This is not to say, however, that the Delta cannot use some extra attention. A relatively old workhorse, it still includes some 1960-vintage components, and, says Mahon, has a need for "tender, loving care." Old parts are being replaced and updated, however, and an entire new guidance system is scheduled to go in early next year.

Since completion of the modifications recommended by the investigators, there have been only a few Delta launches. Skynet, the British military communications satellite, was successfully fired into orbit aboard a Delta in November, and another Intersat III was Delta-launched into a synchronous orbit Jan. 14. The Intelsat was delayed three times because of problems with the booster (and twice by high winds) before it finally took off, and the launch of the Tiros M weather-watcher was held up four times before its Jan. 23 liftoff.

Minor problems that get caught on the ground, however, are almost ex-



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pected in space launches, even by Deltas. It is the ones that don't show up until too late that cause investigations such as the present one, which Mahon estimates may go on for another three months.

"I think," he says, "we've got a case of statistics catching up with us." □