

Flipped Switch Sealed the Fate of Genesis Spacecraft

A design error by spacecraft contractor Lockheed Martin Astronautics Inc. caused engineers to install critical sensors upside down in the Genesis sample return capsule, dooming it to slam into the Utah desert floor last month at 360 kilometers per hour, according to the chair of the mishap investigation board. The accident, Lockheed Martin's third major incident of late, may be another reminder of an era when space missions were underfunded, too rushed, and undermanaged. Chances are good, however, that an identically equipped spacecraft, Stardust, will escape a similar fate.

According to board chair Michael Ryschkewitsch of NASA's Goddard Space Flight Center in Greenbelt, Maryland, if the two pairs of sensors had been installed right-side up, they would have triggered Genesis's parachutes. Flipped according to incorrect drawings that assemblers were following, the sensors' spring-loaded weights were already at the end of their range of possible motion as the capsule hit the upper atmosphere and began slowing, so deceleration could not drive them through the required trigger point.

The snafu recalls two earlier mishaps involving Denver-based Lockheed Martin as

contractor and NASA's Jet Propulsion Laboratory (JPL) as spacecraft operator. In 1999, the Mars Climate Orbiter broke up as it skimmed too close to Mars. Engineers at the two organizations had misunderstood which units of thrust—English or metric—the other group was using. And in the same year, Mars Polar Lander crashed onto the

surface after a software error caused its retro-rockets to shut down too far above the surface.

Before pointing fingers over Genesis, says space policy analyst John Logsdon of George Washington University in Washington, D.C., critics should consider its history. Although Genesis launched late enough to get additional reviews after the 1999 Mars losses, it was designed years earlier, at the height of the "faster, cheaper, better" era of NASA mission design. Spacecraft were being designed, built, and operated by fewer people in less time than



Fateful reversal. Incorrect drawings led assemblers to install critical sensors upside down.

ever before. Genesis was thus prone to the same sorts of problems as the Mars probes, although its particular problem "still should have been caught" by later reviews, says Logsdon. In its final report, due out by early December, Ryschkewitsch's board hopes to document

why those reexaminations failed.

More pressing, perhaps, is the state of the Stardust spacecraft's sensors. Also a Lockheed Martin/JPL mission, Stardust will be depending on identical sensors to trigger its landing sequence in January 2006 as it returns samples of comet dust. "Preliminary indications are that the design and installation of the switches on Stardust are correct," says NASA deputy associate administrator Orlando Figueroa. Time will no doubt tell.

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