Two More Rocket Launches Fail

The failure of two more rocket launches last week dealt a minor but discouraging blow to U.S. efforts to reinvigorate the space program.

The first failure came on 23 August when a small Aries rocket malfunctioned and had to be destroyed a few moments after launch from White Sands, New Mexico. Except for the loss of the payload—an x-ray detector developed at Columbia University to study the emissions of distant galaxies during its 6-minute flight outside the atmosphere—the setback was more symbolic than real, says National Aeronautics and Space Administration spokeswoman Joyce Milliner. "We expect failures," she says.

Virtually all of NASA's suborbital flights are conducted with surplus military boosters that the agency gets for free, Milliner explains: "We use them as an inexpensive truck to do science." The Aries used on 23 August, for example, was a solid-fuel rocket originally manufactured 22 years ago for the Minuteman I program. Ironically, she adds, although many of the surplus boosters have deteriorated with age and have to be discarded, this particular Aries worked perfectly. The malfunction has been traced to a human error in installing a new guidance system. "We've launched 30 flights this year [in the suborbital science program] and this is only the second one we've lost," she says.

On 28 August, a more serious launch failure occurred when mission officers had to blow up an unarmed Minuteman 3 missile during a 30-minute test flight between Vandenberg Air Force Base in California and Kwajalein Atoll in the South Pacific. The Air Force released few details about the incident, except to say that there was no immediate indication of what had caused the problem.

The destruction of the Minuteman 3 marked the sixth failure of a U.S. launch system this year. The others include the space shuttle Challenger disaster on 28 January, the explosion of a Titan missile carrying a spy satellite over Vandenberg on 18 April, the failure of a Nike-Orion suborbital rocket at White Sands on 25 April, the destruction of a Delta rocket carrying a weather satellite from Cape Canaveral on 3 May, and the Aries mishap.

Meanwhile, the next major U.S. launch has been delayed for the 15th time. The discovery of leaking fuel ducts in the Atlas-E booster, which is to carry a weather satellite into orbit from Vandenberg, has forced a postponement of the launch until 13 September at the earliest. This particular Atlas vehicle is 25 years old, although it has been refurbished, and flight engineers are being exceedingly cautious. The string of failures to date has made this launch a potent symbol of the space program as a whole. ■

M. MITCHELL WALDROP

Heavy Water: Where Did India Obtain It?

The adequacy of the International Atomic Energy Agency's inspections of nuclear facilities is again under fire. The agency is responsible for monitoring nuclear power research activities to assure that materials and technology provided under treaty for peaceful purposes are not used to develop weapons. IAEA, however, may have failed to detect a diversion of India's heavy water stockpiles for the purpose of opening new reactors capable of producing weapons-grade plutonium. Much of the country's heavy water has been supplied under safeguards by Canada, the Soviet Union, and the United States under agreements that require inspection of some Indian nuclear facilities.

Gary Milhollin of the Natural Resources Defense Council, who is a former consultant for the Nuclear Regulatory Commission, contends that between 1983 and 1985 heavy water must have been obtained from the People's Republic of China, and/or diverted illegally from stocks subject to safeguards. The motivation, he says, was India's desire to start up three new research and power reactors. India's domestic heavy water production could not have supplied but a small portion of the reactors' needs, he says.

These new facilities, the Dhruva research reactor, and the MAPP-I and MAPP-II power reactors are not subject to international inspection under IAEA. The matter is of concern because of the nature of the Indian reactors which, when run with heavy water, can transform unenriched natural uranium into plutonium. Until now, says Milhollin, Indian reactors have produced enough plutonium to produce five to 10 nuclear bombs, but this material is pledged for peaceful use.

The three reactors, however, will produce enough plutonium for 15 bombs per year, he says. This material is not subject to supplier country safeguards. At this moment, Milhollin says, there is no evidence that India actually is building a nuclear arsenal.

At issue are several matters: whether IAEA failed to detect a major diversion of heavy water supplied by IAEA members; conduct by India that could spur the proliferation of nuclear weapons in neighboring states; and whether China is adhering to its public pledges and duty as an IAEA member not to foster weapons proliferation. Although Indian and Chinese government officials have denied Milhollin's accusations, he singles out China as the likely supplier because the Soviet Union and the United States and its Western allies have a strong record of adhering to IAEA safeguards.

India in fact could have started importing heavy water from China as early as 1983, or diverting inventories of heavy water subject to international safeguards to the MAPP-I reactor located near Madras, Milhollin claims. Although the Soviets had pledged to provide some heavy water supplies during the period, Milhollin calculates India still needed 68 metric tons of heavy water that was not subject to safeguards in 1983. Milhollin concedes that unsafeguarded water from the RAPP-I reactor in Rajasthan province legally could have been shipped to MAPP-I. The Rajasthan reactor was shut down for most of 1983. But Indian officials, he says, have provided no documented explanation of these events.

Similarly, in 1985 when MAPP II and the Dhruva research reactor were coming on-line, India faced a shortfall of 293 metric tons. It is unlikely, Milhollin says, that any portion of these needs were fulfilled by the diversion of heavy water from RAPP-I, which again operated only a small portion of that year. The MAPP-II reactor alone required 250 metric tons of heavy water and the Dhruva research reactor needed another 78 tons, says Milhollin, whose analysis is detailed in the fall issue of the journal *Foreign Affairs*.

The IAEA has conducted an investigation of the Indian heavy water issue, says Peter Tempus, the agency's deputy director general for safeguards. Tempus declined to discuss the report's conclusions with *Science*. Although the IAEA officials say the findings were recently presented to United States officials in Vienna, Austria, State Department staffers working in the nuclear nonproliferation area say they have yet to see the report.

Milhollin's assertions are based on data collected from a variety of sources: newspaper accounts, statements of Indian government officials, analyses by American think tanks and federal government records, as well as IAEA documents. Congressional aides familiar with the Indian heavy water issue say Milhollin's assertions are not without merit. Apparently, U.S. intelligence agencies also have examined the matter. But what Congress or the Administration can do about the situation is uncertain. ■

MARK CRAWFORD