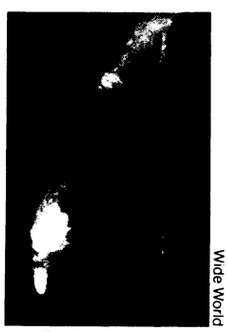
The Road to Space Gets Steeper Still

The catastrophic May 3 failure of the third U.S. attempt this year to send a payload into space cost considerably more than just the $57.5 million GOES-7 weather satellite and its $30 million Delta rocket. Added to the Jan. 28 explosion of the space shuttle Challenger and the April 18 blowup of an Air Force Titan 34D rocket, the blast joined an improbable array of mishaps that point toward the possibility of temporarily curtailing NASA's ability to put *anything* into orbit.

The remaining shuttles, Titan 34Ds and Deltas have all been grounded while the failures are under investigation. But NASA officials this week were also acknowledging a likely delay in the scheduled May 22 launching of the agency's other large rocket, the Atlas-Centaur, which has components similar to those of the Delta and this time would be carrying a Navy communications satellite. And the smaller Scout rocket, though its next planned use (carrying an Air Force satellite called Polar Bear) is not until October, is a solid-propellant vehicle whose first stage has similarities to the "strap-on" boosters of the Titan 34D. The Titan explosion, says a government official who asked not to be identified, was "definitely a solid-booster failure."



Wide World

Delta disaster.

In the most recent disaster, the Delta rocket carrying GOES-7 took off as planned, but its liquid-propellant main engine abruptly shut off about 71 seconds into the flight, sending the craft careening out of control until a safety official on the ground blew it up by radioed command some 21 seconds later. The only irregularity initially observed by NASA engineers looking back over telemetered data from the seconds before the engine stopped firing was a pair of electrical "spikes," each lasting only a few milliseconds and apparently indicating current surges that represented brief drainings of the craft's batteries. Though the cause of the surges was not certain, officials said they could have had the effect of allowing the engine's fuel valves to close prematurely.

The Delta's first stage also carried nine solid-propellant "strap-ons," but early analyses indicated that the solids had worked as planned. The first six ignited properly at liftoff and fired as expected for about a minute; then the three remaining solids ignited, and apparently were still firing when the rocket was destroyed.

Two more Deltas had been scheduled for launching later this year, one of them carrying GOES-H, next in the same series of National Oceanic and Atmospheric Administration (NOAA) satellites that was about to be joined by GOES-7. In a statement issued April 6, NOAA said the loss of GOES-7 is a serious setback to its weather-observing satellite system. GOES-7 would have enabled NOAA to monitor weather patterns over the entire United States for the first time in two years. Coast-to-coast coverage of the nation—which normally requires two satellites, one situated over the Atlantic and one over the Pacific — was lost when GOES-5, monitoring the East, failed on July 29, 1984. Since then meteorologists have been making do with GOES-6 by relocating it over the center of the United States and then shifting it east in the summer and west in the winter to focus on meteorological trouble spots. This has produced incomplete and sometimes distorted weather data.

According to NOAA, the remaining GOES-6 will have enough fuel for two more years of operation, and if the instruments continue to perform the satellite could possibly provide some coverage for two years after that. Weather observations will also be supplemented by the polar-orbiting NOAA-9 satellite, the European Space Agency's Meteosat and the Japanese National Space Agency's GMS satellite. NOAA is hoping that it will be possible to launch GOES-H later this year. The next series of satellites, GOES-I through -M, will begin to come off the assembly line in 1989 or 1990, so far planned for launch by shuttle.

—J. Eberhart and S. Weisburd

Chernobyl: Emerging data on accident

As low-level radioactive fallout from the catastrophic accident at the Chernobyl Nuclear Power Station began wafting over the West Coast of the United States on Monday, the Soviets began releasing their first, brief descriptions of what crippled a reactor in the Ukraine one week earlier. The accident began at 1:23 a.m. on Saturday, April 26, when a chemical explosion ripped apart structural elements in the building housing the reactor, said Soviet officials this week. At a press conference in Moscow on Tuesday, those officials said the accident, which occurred during a planned shutdown in the plant, was a result of "several highly improbable and therefore unforeseen failures."

No mention was made of what caused the initial explosion or of the status of a graphite fire, which Western scientists suspect is still burning in the damaged number-4 reactor's core. Although the Soviets reported on Monday that some 26,000 Chernobyl-area residents had been evacuated "in a strict and organized fashion," taking only four hours, they added at the Moscow press conference the following day that the evacuation did not begin until about 36 hours after the accident. That is long after many would have sustained substantial and potentially lethal radiation doses, Western scientists believe. First Deputy Health Minister Yevgeny Vorobyev told reporters on Tuesday that 204 had been hospitalized for "radiation disease" — 18 suffering from "extreme radiation exposure." In addition, Soviet officials reported that by May 5, radiation levels at Chernobyl had been reduced "by two- to three-fold" since April 27, to 10 to 15 milliroentgens per hour—an hourly exposure that would be equivalent to one-half to two-thirds of a chest X-ray.

Sources outside the Soviet Union continue to accumulate data on the Chernobyl accident, and last week the White House established a U.S. government interagency task force to analyze the growing body of information. Extrapolating radiation-monitoring data collected in the Stockholm area by the Swedish government, for example, the task force estimates that the whole-body radiation doses that might have been absorbed by persons in the immediate area of the plant range from 20 to hundreds of rems during the two days when radiation releases were likely highest. (A rem is a unit of absorbed radiation dose that takes into account the type of radiation.) The task force says these doses are "sufficient to produce severe physical trauma, including death."

Atomic bomb and laboratory data have indicated that thousands of rems cause the central nervous system to fail, killing within hours or days. No treatment is possible at such doses. According to radiation expert Herbert L. Abrams of Stanford University, at 700 to 1,200 rems death comes within days to weeks as a result of gastrointestinal damage. From a few hundred to 700 rems, the first medical intervention—in the form of bone marrow transplantation — is possible. Without successful transplantation, death could come within a month, usually from the destruction of the blood-

cell-forming bone marrow. Exposures of 200 to 400 rems kill half the people exposed within a month, by Abrams's estimate; 100 to 200 rems injure the immune system and carry a long-term risk of cancer. Fewer than 100 rems can cause nausea and vomiting, with the cancer risk decreasing as the exposure decreases.

The immediate medical recommendation for people exposed to radioactive particles is to shed contaminated clothing, wash their skin and avoid ingesting anything radioactive. In terms of intervention, at the low end of the exposure scale iodide can be ingested to prevent the body from incorporating radioactive iodine. But neither iodide nor bone marrow transplantation is a panacea. Iodide can cause side effects ranging from allergy to thyroid problems, and pregnant women taking iodide can harm their fetuses. Though iodide was distributed in Poland after the accident, several U.S. experts told SCIENCE NEWS that, at least from the data they saw in the press, the action was not warranted. And bone marrow transplantation is a complex, difficult and risky procedure. Bone marrow transplant specialist Robert Gale, of the University of California at Los Angeles, went to the USSR a week after the accident and, joined later by several colleagues, was reported to have begun performing transplants there. Such a procedure needs to be done within one to two weeks after exposure, notes Andrew Yeager, a bone marrow transplant specialist at Johns Hopkins University in Baltimore. Following the transplant, the patient has to be completely isolated from infection while the new marrow takes root.

Knowing which radioisotopes contributed to the dose is important in estimating the severity of exposure because certain isotopes, such as krypton, aren't absorbed by the body. With so few data available on the exposure levels within the USSR, calculating the long-term health effects is guesswork at best. At the moment, says H. Jack Geiger of the City University of New York and president of Physicians for Social Responsibility, "the major long-term meaning of this event is the need for international cooperation."

For the United States, the international aspect of the accident became more immediate on Monday, when the National Oceanic and Atmospheric Administration reported its first measurements of very dilute Chernobyl fallout in the U.S. atmosphere – above the Oregon-Washington coast and the Gulf of Alaska. There is no danger within the United States from these near-background levels of radiation entering the atmosphere via the jet stream, according to U.S. radiation-health experts. Some of that fallout was also detected at ground level in rain. The 500 picocuries per liter of iodine-131 measured in Washington state "pose no danger," the task force reported Tuesday.

However, health experts recommend that Europeans nearer Chernobyl avoid food and water contaminated by radioactivity. U.S. radiation-monitoring teams were dispatched last week to Moscow, Bucharest and Warsaw to measure possible radiation exposures that the U.S. diplomatic corps might receive. According to the State Department, initial readings indicate "there is no reason for significant health concerns."

The State Department and the interagency task force both noted early this week that the raging graphite fire at Chernobyl's unit-4 reactor, detected in aerial photos last week, may still be burning. The task force said it could not confirm news reports – generated by Swedish analysis of commercial-satellite survey photos – that a second reactor might be burning. However, at a task force briefing this week, Harold Denton, director of the Nuclear Regulatory Commission's office of reactor regulation, did report indications that a second reactor at the Chernobyl complex might be having trouble cooling – a suggestion that it might not proceed safely to full, "cold" shutdown.

Many Western scientists expect that a better picture of the accident may be forthcoming now that three members of the International Atomic Energy Agency – a Swedish, a Soviet and a U.S. nuclear scientist – have been invited to discuss the accident with Soviet officials.

– J. Raloff and J. Silberner

Commentary

The 'white overalls' of overconfidence

After so many years of accident-free, "nominal" technological performances, the timing of the Chernobyl nuclear disaster, amidst three U.S. space program failures, reminds us of something we tend to forget: Even the highest technology is operated by human beings. And it appears there was a similar, tragic behavior pattern of overconfidence, even arrogance, on the part of those who operate and oversee these systems in both countries.

It is clear now that some officials within NASA were aware of potential problems that could occur if the Challenger were launched in cold weather. Nevertheless, the launch took place and the "unthinkable" happened. The loss of Challenger, coupled with the failure last month of a Titan 34D and last week's explosion of an unmanned Delta rocket, is a blow from which NASA may not fully recover for decades. It will also take a long time to completely unravel the reasons why Challenger was launched that day, but among them almost certainly are the false sense of security and the disdain for public scrutiny that can come with success.

This attitude is also chillingly evident in a feature article on the Chernobyl plant in the February 1986 SOVIET LIFE magazine, a USSR-sponsored publication. In it, the Soviets took a carefree, whistling-past-the-graveyard look at the plant and the town of Pripyat, which was born with the startup of Chernobyl in 1977. In what may have been history's worst-timed piece of public relations, the Soviet publication quoted Pyotr Bondarenko, a shift superintendent specializing in safety review, as saying "that working at the [Chernobyl] station is safer than driving a car."

Twenty-nine-year-old Boris Chernov, a Chernobyl steam turbine operator, told SOVIET LIFE, "I wasn't afraid to take a job at a nuclear power plant. There is more emotion in fear of nuclear power plants than real danger. I work in white overalls. The air is clean and fresh; it's filtered most carefully. My workplace is checked by the radiation control service. If there is the slightest deviation from the norm, the sensors will set off an alarm on the central control panel."

One can only wonder about the physical conditions of these two men today. The Soviet government – to its own detriment, as well as to that of surrounding countries experiencing higher-than-normal radiation levels – has carried its charade over into the weeks following the accident, maintaining that death, injury and harm to the environment have been relatively minimal.

The Soviet stonewalling contrasts greatly, of course, with the widespread and continuing public inquiry of NASA in the wake of the shuttle disaster and the Titan and Delta failures. What has been exposed, however, is a similar – albeit more subtle – attitude on the part of some of those charged with the safety and performance of the shuttle. The public trust gained through the successful Apollo, Skylab and Viking programs was abused by those who would cut corners for time, money or other reasons. This may not have been totally intentional. Such people may have actually come to believe what many of us did: that NASA was indeed invincible, that everything, no matter what, would always be "nominal." But the NASA and Chernobyl tragedies dictate a new attitude, a new caution, a new attention to detail regarding high technology.

One wishes that the words of Pripyat Mayor Vladimir Voloshko in SOVIET LIFE did not bear such sorrowful irony. The only problems in a town surrounding a nuclear reactor, he said, were "teething problems. Pripyat is currently experiencing a baby boom. [The] day-care centers and nursery schools . . . can't cope with the demand." *– J. Greenberg*