Although the judicial route has now been blocked, disability rights groups have indicated they will continue to fight for more direct federal protection for handicapped infants through new legislation. ■

CONSTANCE HOLDEN

Feynman Issues His Own Shuttle Report, Attacking NASA's Risk Estimates

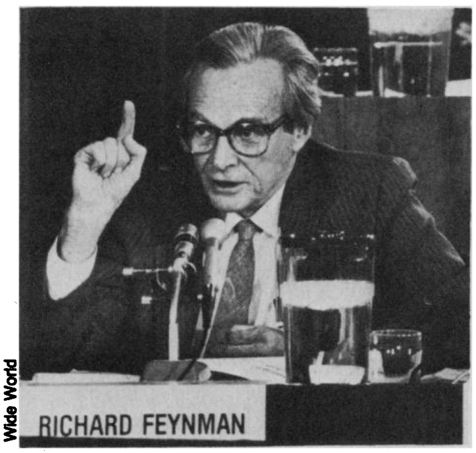
"When playing Russian roulette, the fact that the first shot got off safely is little comfort for the next," writes Richard Feynman in a scathing commentary he released on the space shuttle disaster.

Feynman, a Nobel prizewinning physicist at the California Institute of Technology, was best known—until recently—for the ingenious, cartoon-like diagrams he invented to illustrate the actions of basic particles. Now he is also famous as the independent voice on the Rogers Commission, the presidential team that investigated the shuttle accident. Feynman went his own way from the start. His impromptu experiment with a piece of "O-ring" dunked in ice water, aimed at challenging a witness as the witness spoke, was a memorable point in the hearings.

When it came time to write the conclusions, Feynman decided that his peers had gone mealymouthed. He lobbied for an evisceration of the bad logic used by the National Aeronautics and Space Administration (NASA). And he objected to an upbeat comment at the end of the report that "strongly recommended" more federal support for NASA and the space program. He noted that this issue had not been discussed. As a result, it was amended to a mere "urging." Although Feynman is not a dissenter, he wanted to add more definition to the report. So, on 9 June, he held a press conference and released his own "personal observations."

Feynman objects most strongly to NASA's way of calculating risks. Data collected since the early days of the space program, including records used by NASA's range safety officer, Louis Ullian, show that about one in every 25 solid rocket boosters has failed. About 2900 have been launched, with 121 losses. Feynman says it is reasonable to adjust the anticipated crash rate a bit lower (to 1 in 50) to take account of today's better technology. He would even permit a little more tinkering with the numbers (to 1 in 100), to take credit for exceptionally high standards of part selection and inspection. In this way, the Challenger accident, the first solid rocket failure in 25 shuttle launches (with two boosters each), fits perfectly into Feynman's adjusted rate of one crash per 50 to 100 rocket firings.

But Feynman was stunned to learn that NASA rejects the historical data and claims the actual risk of a crash is only 1 in 100,000. This is the official figure as published in "Space Shuttle Data for Planetary Mission RTG Safety Analysis" on 15 February 1985. It means NASA thinks it could launch the shuttle, as is, every day for the next 280 years and expect not one equipment-based disaster. Feynman searched for the origin of this optimism and found that it was "engineering judgment," pure and simple. Feynman concluded that NASA, "for whatever purpose . . . exaggerates the reliability of its product to the point of fantasy."



Wide World

NASA "exaggerates the reliability of its product to the point of fantasy."

It is not really as bad as that, according to Milton Silveira, NASA's chief engineer in Washington. "We don't use that number as a management tool," he said in a telephone interview. "We know that the probability of failure is always sitting there, and we are always looking for it and trying to prevent it." The 1 in 100,000 figure was hatched for the Department of Energy (DOE), he says, for use in a risk analysis DOE puts together on radioactive hazards on some devices carried aboard the shuttle. These are plutonium-driven power units for deep space probes, such as Galileo and Ulysses. To reassure the public, the government must certify that the shuttle can take off from Cape Canaveral without dumping plutonium on the beaches and orange groves of Florida.

DOE and General Electric, supplier of the power units, write up a detailed risk analysis before launch. They are accustomed to expressing risk in statistical terms. NASA is not, but it must help them prepare the analysis. To speak in DOE's language, NASA translates its "engineering judgment" into numbers. How does it do this? One NASA official said, "They get all the top engineers together down at Marshall Space Flight Center and ask them to give their best judgment of the reliability of all the components involved." The engineers' adjectival descriptions are then converted to numbers. For example, Silveira says, "frequent" equals 1 in 100; "reasonably probable" equals 1 in 1000; "occasional" equals 1 in 10,000; and "remote" equals 1 in 100,000.

When all the judgments were summed up and averaged, the risk of a shuttle booster explosion was found to be 1 in 100,000. That number was then handed over to DOE for further processing. To no one's surprise, the overall risk of a plutonium disaster was found to be terribly, almost inexpressibly low. That is, 1 in 10,000,000, give or take a syllable.

"The process," says one consultant who clashed with NASA, "is positively medieval." He thinks Feynman hit the nail exactly on the head. There are ways of taking experience into account while totting up the statistics, he added, but "once you divorce it from a scientific process, you make it susceptible to the whims of political necessity." Unless the risk estimates are based on some actual performance data, he says, "it's all tomfoolery." He also complained that NASA, because of its low opinion of the usefulness of such data, has been unwilling to pay for their collection.

Silveira says he views the entire field of statistical risk analysis with suspicion, precisely because he knows how much tomfoolery goes on. "I had some experience in this earlier," he says. "You tell me what you want to prove [with numbers] and I'll prove it." He learned his lesson with the Apollo program when the statisticians announced that there was less than a 1 in 20 chance of getting a man on the moon. After the moon landing, "We threw away all that data," and have not used the approach since.

NASA does give DOE the numbers it insists upon having, but pays little attention to them itself. Instead, NASA relies on its own system of component analysis, which is designed to keep track of all critical parts in the system and to isolate and fix every problem as it arises. Thus, in Silveira's view, the shuttle is always approaching infallibility. Historical rocket booster data are essentially irrelevant. The agency relies on experienced judgment, not the numbers game, in deciding where the risks lie. The reason for the Challenger disaster, in his view, is that those responsible for exercising their judgment on booster problems failed to do so. They "were operating outside the system" and let the situation get out of hand. ■

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