What a strange twist of fate events can take. I've been a space physicist at Caltech's Jet Propulsion Lab for over ten years and I'd sort of forgotten about 1972. Among other things, I've worked with the public affairs office to host visiting dignitaries during the various Voyager encounters with Jupiter, Saturn and Uranus. This is not part of the job description, but it's a nice perk. You get to meet all sorts of interesting people and JPL feeds you very expensive food for your trouble. On Saturday, 25 January 1986, three days before the Challenger blew up, JPL hosted the Voyager Uranus Encounter gala. I was stationed in the Gallery—an area that overlooks a science-fiction-like arena of mission operations activities and some wonderful big-screen displays of planetary images coming in from Voyager.

About 6 pm all the guests had left and I was cleaning up the area—mostly stuffing leftover fancy food into a giant plastic bag to bring to my friends in the science operations area one floor above. After ten hours I was tired, my feet ached from standing most of the time and I wanted to get home. Suddenly I heard voices coming up the stairs. I figured maybe it was some guest—or worse yet, Lou Allen, JPL's director. Whoever it was, I couldn't let them see me absconding with the food. But where do you hide an overstuffed Hefty Bag? I turned around to meet my fate and my eyes focused in the dim light on Dick Feynman himself, escorted by his sister Joan, a physicist in our section.

In my best adult voice I greeted them and asked if I could help them—or if they would like any food, since I just happened to have this big plastic bag full of all sorts of rich people's edibles. Joan said that they were just browsing around, looking at Voyager stuff. I offered to explain anything that they might want to know, and before I knew it I was involved in a multiplexed conversation with Dick on everything from Uranus pictures (how did the spacecraft do motion compensation?) to institutional parking scams [my 1979 JPL parking ticket record versus his Olympic-medal-winning (I believe this may even be a demonstration sport in Seoul this year) Los Alamos parking extravaganzas]. We also covered vast areas of physics as well as various and sundry stories about our respective youths. He seemed definitely impressed that I had read his book and knew so much about his life (I didn't tell him then, but I had read it twice and sent copies to several relatives and friends as well). The evening ended about two hours later when I brought Dick and Joan over to the science operations area to say hello to the MIT plasma team. By then my tired mind and aching feet had returned, and it was time to go.

Three days later the Challenger exploded and soon all the world got to know the man whom I had experienced in those two incredible hours. Feynman was a true kindred spirit, and his brief influence on me, as on so many others, will indelibly mark itself.

Two weeks ago, on the local evening news, I heard about his death. I cried that night, as I am sure many others did in Pasadena and around the world. The following day, on Caltech's Millikan Library tower, a banner reading, "WE LOVE YOU DICK!!" was hung across the top floors by Caltech students.

Wherever you are, Dick, I hope you have your bongos, 'cause we're going to have one hell of a jam session up there one of these days!

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Challenger's British Ancestor

We read with great interest Richard Feynman's February article (page 26) describing his experiences while serving on the Rogers Commission investigation into the Challenger accident. The insights that this remarkable man has provided into the implications of the Challenger disaster are pertinent whenever large governmental organizations engage in the advancement of technology. In particular, we were most taken by striking similarities between Feynman's descriptions of the failings in NASA's shuttle program and the history of another high-technology development program: that of rigid airships in England.

The development of rigid airships in Britain culminated with the construction and testing of the R100 and R101 airships during the period 1925–30. Those two airships were built to the same government-issued specifications, but one (the R100) was made by a private firm, while the other was undertaken by the Air Ministry organization at Cardington. In effect it was a competition between government and private industry. The R100 was successfully built and tested. The R101 was beset by both technical and political difficulties, and crashed with great loss of life during its first long-distance flight. The various technical difficulties suffered by the R101 have been described by Lord Ventry and Eugéne M. Kolesnik.[1] Among these difficulties was an inability to meet the specification for lift, which was solved by cutting the airship in half and inserting an extra hydrogen gas bag. Perhaps the most serious problem came about from the method of fastening the outer cover to the structural framework, which relied on "tapes fixed to the interior . . . with a rubber solution" that "reacted with the dope on the cover to make it very friable."[1] (It seems that the Challenger was not the first large technological undertaking to be compromised by a failure to understand a common material like rubber.) The program was further hampered by scheduling pressures related to the desire of Lord Thompson, the Secretary of State for Air, to use the R101 for an important official visit to India. Important flight tests were deferred because of this schedule pressure. Finally the "R101 slipped the mast . . . at 6:36 pm on 4 October 1930. Many of those responsible for the ship were concerned about her state of airworthiness, and yet a temporary Certificate of Airworthiness was handed to her captain just before the flight began."[1] The R101 crashed in France during that flight, with the loss of 48 out of a crew of 54.

Nevil Shute, the novelist, worked on the R100 as an aircraft design engineer. In his autobiography, written in 1953, some 25 years after his airship experiences, Shute assesses the technical and, with great astuteness, the human failings leading to the R101 disaster. His description of the pressures on the Cardington design staff is especially interesting. The Air Ministry press department's demands for favorable stories justifying the expenditure of public money ultimately had the effect that "the Cardington designers found themselves hemmed in behind a palisade of their own published statements which could not be broken through without some personal and public discredit, till one course only was left open to them, a course they never would have taken had they been free men, a course which was to lead to tragedy and death."[2] These views of Shute are incredibly similar to those expressed in the closing paragraphs of Feynman's article about another technical accident decades later.

We see two major points to be learned, which can be applied to a wide spectrum of endeavors. The first is the necessity for a well-defined and achievable objective, one that is not largely self-serving but can be judged in some greater context. Without a clear-cut objective there is the danger that the participants in an endeavor will substitute techniques and means in its place. The second is the recognition that a government's participation in such endeavors carries with it a natural conflict of interest. The organization charged with carrying the endeavor through to the end is often the very same organization charged with formulating the rules by which the success or failure of the endeavor is to be judged. It seems to us from the lessons of the R101 and the Challenger that a highly technical or innovative endeavor initiated without proper regard to these factors has a rather high probability for catastrophic (as opposed to graceful) failure.

References

1. Lord Ventry, E. M. Kolesnik, *Jane's Pocket Book of Airships*, Collier, New York (1976).
2. N. Shute, *Slide Rule*, William Heineman, London (1953).

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Coinage of the (Subatomic) Realm

Ah, the vagaries of trying to cope with the complexity of paleonumismatics without a thorough grounding in ancient Greek! Had Jonathan Kern advertised his wares correctly, selling *lepta*—which is the correct plural form of *lepto*, the ancient Greek one-hundredth of a drachma—rather than the grammatically incorrect *leptons*, Kenneth Jesse (October 1987, page 168) would not have despaired at the price of "leptons," a derivative of the Greek word meaning "thin and frail," and by extension "weak." The only solution is to reintroduce compulsory ancient Greek into the high schools.

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Corrections

March, pages 5 and 82—The item in the table of contents and the headline should have said that Robert A. Mendelson is the new vice president of the Society of Rheology.

September 1985, page 19—In the news story on chaotic orbits and spins in the Solar System, Douglas ReVelle's name was misspelled. ■