

## Air Force Unravels Rocket Mystery

Last April, a serious accident befell a key U.S. satellite 10,000 miles above the earth. A rocket transporting the satellite to a permanent station over the eastern tip of Brazil—where it would relay scientific data from experiments aboard Spacelab—veered wildly off course while traveling at enormous speed, dumped the satellite in the wrong spot, and bumped it once or twice before proceeding on its errant way.

On 12 July, a team of engineers impaneled by the U.S. Air Force said they had finally figured out why it happened, but they were not sure as yet how to keep it from happening again. The accident was apparently caused by the deflation of a rubber tube, about 1½ feet in diameter, three-quarters of the way through the rocket's normal burn period. The tube forms a flexible barrier between the engine and its nozzle, enabling the nozzle to move according to programmed instructions. When the tube was deflated, the engine's thrust jammed the nozzle into the wrong position, which in turn made the rocket veer off course.

The Air Force, which supervised the rocket's construction, is unsure whether the tube leaked because it got too hot, was poorly manufactured, or was poorly designed. The investigating team, which was directed by General Donald Henderson, the manager of test and launch activities at Vandenberg Air Force Base, recommended more study, as well as better quality control and more prelaunch testing for rockets to be used in future missions. The team also recommended that diagnostic instruments be added to the rockets, so future investigations will not be as arduous.

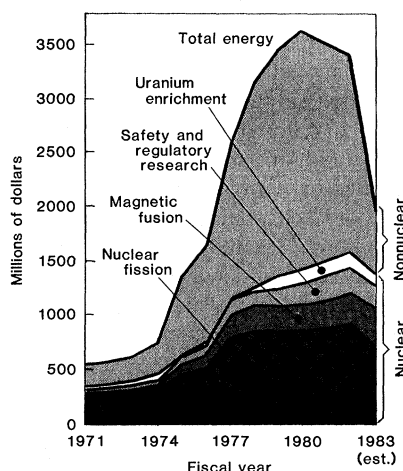
The Air Force predicts that the problem will be fixed by next summer, unless a major redesign is deemed necessary, which could require between 3 and 5 years. NASA has already postponed the launch of a second data relay satellite (*Science*, 20 May, p. 803), and the Air Force has delayed the launch of a secret defense satellite.

The original data relay satellite, meanwhile, has finally been maneu-

vered to the correct position over Brazil and will probably be available during the Spacelab flight now scheduled for late September.

—R. JEFFREY SMITH

## Boom and Bust in Energy



Few areas of federal R & D reflect the difference between the Carter and Reagan Administrations more dramatically than energy. The above chart, compiled by the National Science Foundation, shows the surge of funds that flowed into and out of non-nuclear research in the past 6 years. Since much of this surge went through the national labs, it is no surprise that a White House study has found that the labs are in a mess (see p. 438).

—COLIN NORMAN

## Smithsonian Inventory Turns Up Lots of Stuff

After a 5-year \$8-million investigation, the Smithsonian Institution in Washington, D.C., is at last able to answer a question posed repeatedly by its congressional overseers and by thousands of tourists: Exactly how many objects do the institution's nine museums have in their possession? The answer: 100 million, give or take a few million.

Seven million beetles, 8,000 turtles, 3,238 sea slugs, 1,782 algae specimens, 3,618 leeches, 114,429 bird eggs, 21,683 molluscs, 110,664 rocks, 6,282 marine sponges, 50,000

flies, and 35,594 skeletons are among the items discovered by the staff of the Natural History Museum alone. There also are 7,000 samples of wallpaper at the Cooper-Hewitt Museum in New York, as well as 283 planes, 125 missiles, and 63 satellites at the Air and Space Museum.

The Smithsonian reports that there were few sensational discoveries as employees wandered the halls with checklists, poking into corners and cabinets. "We have not found another Hope diamond, or another elephant," says Gary Gautier, a paleontologist who directs the data processing department at the Natural History Museum. But the auditors did encounter eight whale skeletons, a buffalo, and 75 reindeer skulls (complete with antlers), unexpectedly sequestered above display cases and inside a false dome above the main entranceway.

The audit has enabled the Smithsonian to transfer the record of its possessions from ledgers inscribed with such titles as "Skin and Bones, volume 26" to fully indexed and cross-referenced computer files. No longer will a researcher in search of particular specimens be required to interview various curators to ascertain their whereabouts. Priority was assigned to audits of minerals, gems, fossils, furs, and marine animals with significant commercial value, so as to aid in the detection and prevention of thefts.

But a major goal was apparently to satisfy congressional skepticism about the need for more space and expensive equipment in a new storage and conservation building in Suitland, Md. As Gautier explains, "the numbers are really a communications device, a way of explaining better what we are, a way of organizing a statement of needs" on Capitol Hill.

Gautier admits that there may be less here than meets the eye. "Knowing that you have 1.2 million specimens is not that meaningful if you are discussing, say worms," he notes. "A collection of that size can fit on a bookshelf. You can always say how many specimens you have but who cares? It's a bit like counting the number of blades of grass in your lawn." No one could say how many blades of grass the museum has, but one source disclosed that its holdings include several million specimens of dirt.—R. JEFFREY SMITH