stretched and maintenance staffs undermanned as a result of FAA's "misdirected economizing." PATCO warns that catastrophes are inevitable if the schedule for putting in the new computers is not speeded up. Complained Leyden in his testimony, "The FAA's historical policy has been to react after, not before, a disastrous event." He cited the fact that radar was introduced after a midair collision in Arizona over the Grand Canyon in 1956, that the Minimum Safe Altitude Alert was required in airplanes following the crash of a jet approaching Dulles airport in 1974, and that intensive study of wind shear was stimulated by a crash at Kennedy airport in 1974.

The most vocal congressional critic has been Representative Bob Whittaker (R-Kans.) who, with Representative Sam Gibbons (D-Fla.), the oversight subcommittee chairman, accused FAA of covering up the extent and significance of computer outages.

The FAA's official term for a computer foul-up lasting less than 60 seconds is an "interruption"; anything longer than that, whether 2 minutes or, as recently happened in the New York ATRCC, 2½ days, is an "outage." The FAA regards many of the short interruptions as routine. They can occur when a component malfunctions and a backup takes its place or when the computer is temporarily saturated with incoming data. Some of these interruptions last only seconds, and since the narrowband system is updated in pulses, every 10 to 12 seconds, they may go unnoticed by the controller. In longer stoppages, the image on the screen may freeze, or the data may be lost altogether. According to FAA testimony, both outages and interruptions have decreased in the past 2 years. Last year the 20 centers experienced a weekly average of 8.15 interruptions, and this year the average was 7. Of these, 15 to 20 percent were outages with an average duration of 13.9 minutes.

FAA administrator Langhorne Bond defended his agency vigorously at the House hearings, asserting that the en route traffic control system is "safe and getting safer." He acknowledged that the equipment is well behind the state of the art, but pointed out that when new equipment is phased in it must be phased in "perfectly, without any failures. It's a problem for us to know when to freeze technology and move it into our system." But he insisted that instances when computers appeared to be saturated from heavy traffic were the result of adjustable "program anomalies" and that the current system can adequately handle the load until the new one is introduced.

To the accusations of Pass that maintenance was being given short shrift, he shot back that the organization had encouraged "shameful featherbedding" and that in fact the solid-state electronics that are replacing "tube-type" equipment in computers requires very little preventive maintenance. A Pass official counters that anyone who knows about solid-state equipment knows this contention is "ridiculous."

The dispute over the reliability of the computers should be seen in the overall context of the incidence of midair collisions. Since 1972 there has been only one involving a carrier, the San Diego disaster in which a Boeing 727 collided with a small plane in September 1978, and this occurred in terminal-controlled airspace. The statistics on near midair collisions (NMAC's) is more unsettling. The official FAA count for 1978 is 484, with 12 involving carriers. However, according to statistics collected for the FAA in a project conducted by the National Aeronautics and Space Administration, computer outages have played a neglible part in the near misses. In the past 2½ years, 90 percent of the NMAC's occurred at altitudes below 10,000 feet, and most of these were in terminal-controlled airspace.

It is not altogether clear who can be relied on to give a disinterested evaluation of the conflict between the FAA and the aviation groups. The FAA, which is subjected to intense pressures from the groups it regulates and is hampered by budgetary and procedural restrictions, is not renowned as an agency of swift and decisive action.

On the other hand, the critics may be exaggerating the computer problem as part of an effort to gain public prestige and leverage for future labor negotiations. (An official at the Leesburg center told *Science* that some of the controllers were "upset" at PATCO's statements, which seemed to imply that controllers were too rabbity and incompetent to perform their jobs effectively in case of an outage.) One thing is certain—all the groups that bear professional responsibility for air safety want a system in which that responsibility is minimized in the event of an accident.

Whether or not the aviation groups are crying wolf, the attention they have aroused in Congress and among the flying public should at least cause the FAA to take a harder look at its operations and to accelerate its programs for safety and upgrading of facilities.

—CONSTANCE HOLDEN

Appropriate Technology and the Too High Outhouse

Appropriate technology is more than just a pretty phrase—it's here to stay. Congress has written AT programs into the budgets of several agencies, and this month an AT research project won public recognition through receipt of the uncoveted Golden Fleece award.

Appropriate technology differs from he other kind in being labor-intensive, accessible to its users, frugal of scarce resources, unintrusive on the natural ambience, and manageable by the individual or small groups—an assembly of virtues epitomized by the bicycle as opposed to the Concorde, the windmill as against the nuclear power plant.

The National Science Foundation this month announced a $1.8 million program for grants in appropriate technology. The Department of Energy's AT program is running at $12 million in the current fiscal year, and the National Center for Appropriate Technology, located in Butte, Montana, has a budget of $3.7 million from the Community Services Administration.

It was the Department of Energy's program that attracted the attention of Senator Proxmire's argonaut-watchers. The Senator cited the department for its award of $1200 to a Missouri inventor who proposes to build an aboveground, aerobic, solar-assisted composting toilet. "Even with the energy shortage, the country isn't going back to the outhouse," steamed the Wisconsin senator.

Proxmire has nothing against appropriate technology as such. What helped the department win the Fleece was that it had overruled a committee of Missouri citizens who had turned down the composting toilet idea. The department seemed captive to a stereotype of Missourians as Ozark hillbillies who needed nothing more than a better outhouse, Proxmire's staff decided.

The department's regional office in Kansas City, which funded the project, is unrepentant. The composting toilet would indeed be suitable for rural Missouri, says a DOE official, because the state's 13 million private septic systems often contaminate drinking water supplies. A second

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committee of Missouri citizens advised the DOE Kansas City office that the concept had been unfairly overlooked.

Proxmire derided the project as an "outhouse elevated to a seat level of approximately five feet above the ground." The necessity for this unusual feature is simply that the composting process may profit from the advantage of sunlight. The inventor, H. Douglas Elley of Lupus, Missouri, a town of 50 souls, originally named his device "The Skycrapper," a title which the Department of Energy persuaded him to abandon. DOE officials deny that the reason for the change was to avoid attracting the attention of Senator Proxmire and his Golden Fleece award.

Scientists Favorable Toward Extrasensory Perception

Margaret Mead got the parapsychologists into the AAAS; physicist John Wheeler of the University of Texas wants to excommunicate them. While public debate continues, private belief in ESP among scientists seems constant at a surprisingly high level.

As many as 9 percent of natural scientists at American colleges consider that ESP "is an established fact" while another 45 percent believe it is "a likely possibility," according to a survey published in the *Zetetic Scholar*. This predominantly favorable attitude toward ESP is mirrored by the academic community as a whole, 16 percent of whom think ESP is an established fact and 50 percent that it is a likely possibility. Natural scientists were slightly more skeptical than average, and social scientists more doubtful still.

The survey, conducted by Mahlon Wagner and Mary Monnet, is based on questionnaires filled out in 1973. Wagner, a psychologist at the State University of New York in Oswego, says that he does not think attitudes have changed since then. He suspects that social scientists are more skeptical about ESP than natural scientists because of their familiarity with the way that experimenters can unconsciously influence the results of their experiments.

The questionnaire was sent to 2100 academics, with a return rate of 49 percent. Previous studies, including a Gallup poll of June 1978, have shown that a university education does not lead to a decline in belief in the paranormal. "It would certainly seem that college professors, as a group, have attitudes toward ESP that are much more positive than those of the American people as a whole," Wagner and Monnet conclude.

A Dearth of Phosphate?

The General Accounting Office, Congress's watchdog over the executive branch, has a bone to pick with the Office of Science and Technology Policy.

The GAO takes exception to the office's "negative attitude and abdication of responsibility."

The problem is that the GAO is concerned about future supplies of phosphate and the OSTP, by and large, is not.

The nation's richest reserves of phosphates are in the Bone Valley formation of Florida. They account for 75 percent of present production and are about to be depleted.

The GAO would like the government to make a precise estimate of phosphate reserves at home and abroad so that sensible plans can be made to ensure future supplies.

The Bureau of Mines is responsible for this chore, but its estimates are somewhat erratic. In 1972 it reckoned world phosphate reserves at 104 billion metric tons. In 1974 the estimate was revised to 5 billion tons. The in figure for 1979 is 27 billion.

Estimates of national phosphate reserves are not that much more reliable. The Export-Import Bank, in approving a $400 million deal for exporting phosphates to the Soviet Union, cited corporate data putting American phosphate reserves at 16 billion short tons, whereas the then current Bureau of Mines figures was 3.8 billion short tons.

The Export-Import Bank wrote to the GAO asking for that observation to be dropped from its report.

Phosphates do not seem to be in particularly short supply. There is enough for at least the next 20 years. But 20 years is not that long, and phosphates as fertilizers make an important difference to crop yields. The GAO would like the Secretary of Interior to conduct a careful survey of American and world phosphate reserves as a basis for future planning.

The Office of Science and Technology Policy disagrees on the grounds that a cabinet level committee is reviewing the situation on phosphates and 11 other mineral industries.

But the GAO has already reviewed the committee's work and finds it pays no serious attention to the phosphate problem.

GAO urges the OSTP to desist from its negative attitude and assume responsibility for formulating a comprehensive national R & D policy for phosphates.

When the German chemist Justus von Liebig discovered in 1800 that phosphates derived from bone made excellent fertilizer, the demand for bones was so great that there was a rush to mine the more sanguinary of Europe's many battlefields. Policymakers in Washington, if they can bury their differences, may come up with a phosphates policy that looks beyond the ossuary.

Agent Orange Again

Agent Orange just won't go away. The herbicide sprayed over South Vietnam from 1962 to 1970 contained a mere 368 pounds of dioxin, yet a decade later the issue of possible health effects from the dioxin contaminant is still unresolved.

A preliminary finding announced this month reported for the first time the presence of dioxin residues in the fat tissues of Vietnam veterans. Lyndon E. Lee, of the Veterans Administration in Washington, found traces ranging from 3 to 57 parts per trillion in samples from 10 out of 22 individuals. The significance of the findings is not yet clear.

Complaints of herbicide-related illnesses began to reach the Veterans Administration in late 1977. By September 30 of this year, some 4800 people had requested treatment and 750 had submitted compensation claims. The VA has allowed no claims based solely on exposure to herbicides in Vietnam because the role of dioxin has not yet been determined.

Nicholas Wade