anomaly," he agrees "it should never have happened."

Kizer is orchestrating a 150-person effort to nail down any loose ends that can be found on the issue of aging aircraft. In an unprecedented action, the airlines, the manufacturers, and the regulators are cooperating to identify all industry service directives and federal maintenance orders that have a bearing on cracking and corrosion, and to rank them in importance. This amounts to a major house cleaning; the recommendations, due by summer, will carry authority.

The FAA meanwhile has ordered inspections and rerivetting of hundreds of older 737s. This is a "change of philosophy," says McSweeny. It means that on these planes the FAA will no longer allow airlines to cope with problems through inspection and maintenance; they will have to carry out repairs that "terminate" the problem.

According to Bernard Loeb, aviation technology chief at the NTSB, another "open question" still under review is whether to give credit to the principle of "safe decompression" used by Boeing in earlier years to guard against catastrophic failure. Boeing's idea was to rely on designed-in stress patterns to steer dangerous longitudinal cracks, if they appeared, in a less threatening circumferential direction around the fuselage. The goal was to have these cracks announce their presence by creating a delta-shaped flap, which would let pressure out of the cabin, creating an attention-getting but not a catastrophic demand for action.

Swift of the FAA says that perhaps in older, fatigued aircraft with weak lap joints, cracks that start running longitudinally may continue to do so, because rivet holes may provide a path of lesser resistance. This result would defeat the "safe decompression" design, and the possibility deserves study, he says.

In Congress there has been talk of legislating the risks away. According to FAA officials, some are suggesting that planes more than 20 years old simply be forced into retirement. This idea finds no support whatever in the FAA or industry. It would create a severe shortage of vehicles, says McSweeny. Swift says that for air travelers, "The world would stop turning."

The industry points out that the risk of continuing to use aging aircraft is probably very small. During the jet age, fewer than 4% of the accidents in which a cause has been determined have been tied to faulty maintenance or structural failure. In view of these odds and the difficulty of finding a quick remedy to this problem, U.S. air travelers probably have no option but to continue riding on geriatric planes.

■ ELIOT MARSHALL

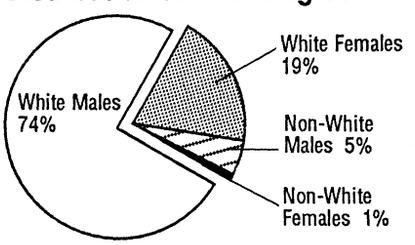
Overhaul Urged for Math Teaching

Most American students leave school with such a poor understanding of mathematics that they cannot adequately perform the vast majority of jobs, much less consider specialized careers in mathematics or science, an expert panel said last week. The villain, however, is not student laziness or the difficulty of the subject matter, but rather an approach to math teaching that is out of date and mired in pointless pencil-and-paper computation, rote memorization, and multiple-choice tests.

Women and minorities are particularly hard hit by poor math education, which keeps them from entering scientific professions, the report says. For example, white men earn 74% of the doctoral degrees in math each year (see figure).

But the number of white males entering the work force is now dwindling and the professions increasingly are looking to women and minorities for new employees. The disparity in math achievement portends a nation divided into a white, technologically astute elite and a largely minority underclass that finds "economic and political power beyond reach."

Distribution of Ph.D. Degrees



White males' province. *Three of every four Ph.D.'s in math awarded to U.S. citizens are earned by white males.* [*Source: NRC*]

"Unless corrected," the report says, "innumeracy and illiteracy will drive America apart."

The report, issued last week by the National Research Council, represents the consensus of 70 organizations and individuals concerned with math, science, and education. It calls for a radical overhaul of the way mathematics is taught in the United States. The changes outlined in the report—and to be further elaborated in March in a new set of national standards issued by the National Council of Teachers of Mathematics—would affect the way math is learned at every grade level, kindergarten through college.

The most prevalent method of math instruction today, teacher lecturing, has been proved the least effective, Shirley A. Hill, a professor at the University of Missouri and the panel's chairman, said at a news conference. Instead, in the math class of the future, teachers should act as facilitators who encourage students to solve realistic problems, explain their approaches, and work in teams to find their solutions. Calculators and computers should be used when appropriate to perform calculations. Studies have shown that use of calculators does not weaken students' understanding of the basic mathematical processes, Hill said.

Math classes should emphasize higher order processes—such as pattern recognition—and deemphasize mere computation. Curricula might also be rewritten to remove the traditional distinctions between arithmetic, algebra, geometry, and other math specialties, the report says.

But, Hill says, new reform does not mean a return to the "New Math" of the 1960s and 1970s, which frustrated teachers, students, and parents alike. The New Math was an attempt to transplant a fully developed math curriculum into a wide range of school systems. This "top down" approach is one favored by countries like Japan and West Germany for their school systems, and it allows students in those countries to consistently outscore students here in math and science.

But the American tradition of decentralized education calls for more of a grass-roots approach, the report says. Instead of setting a national curriculum, the report hopes to enlist public opinion in support of local curriculum revision based upon newly evolving standards such as the forthcoming ones from the national math teachers association.

Improved math education might even save money, the report says. About 60% of college math courses merely repeat material that was taught but unlearned in high school, said Philip A. Griffiths, a professor at Duke University and chair of the Research Council's Board on Mathematical Sciences. In addition, U.S. industry spends as much on remedial math education for employees as is spent on math education in schools, colleges, and universities combined each year.

■ GREGORY BYRNE