Germany Boosts Research Funds

Bonn

The West German government has decided to increase its spending on space research by 11.8% in 1989 to a total of 1.33 billion marks ($711 million) in order to meet its commitments to new European space projects. These include the new launcher Ariane V, the mini-spaceplane Hermès, and participation in the U.S. space station, all of which were approved at a joint ministerial meeting in The Hague last November.

Heinz Riesenhuber, the West German Minister for Research and Technology, said in Bonn last week that the government was also planning to increase spending by 5.8% on health research, and by 4.5% for large-scale research institutes, such as the Fraunhofer Society, in order to guarantee funding for areas of basic research neglected by industry.

Riesenhuber says his Ministry's budget plan for 1989 reflects a continued "change in profile" away from "market-oriented" research toward the support of basic research. According to Riesenhuber, the West Germany government has decreased funding of market-oriented technologies by 50% since 1982, and nongovernment research funding has become increasingly important for scientific research over this period.

Because of the long-term nature of space projects and their importance for developing new technologies, Riesenhuber called West Germany's interest in space "sensible and necessary." Europe "has taken on the challenge of international technological competition," Riesenhuber says, and consequently one-fifth of West Germany's total research budget will soon be devoted to space research.

At the same time Riesenhuber noted that the European Space Agency—at West Germany's insistence—is preparing a new budget plan for the European Space program which is to lower the costs compared with the existing plan.

Riesenhuber notes that basic research, which makes up 38% of overall research funding of 7.6 billion marks, will increase by about 4%. Its share of total R&D funds has grown from 26% in 1982. Areas of basic research strengthened by next year's budget include biotechnology (4.2%), polar research, and the Deutches Electron Synchrotron (DESY) and the heavy ion synchrotron SIS. After increasing the budget of the Max Planck Society last year by 5%, a more modest additional increase of 3.3% is called for in next year's budget.

Overall, federal funding for research and development will only grow by 2.9%, however. This is considerably below the increase in total government spending of 4.9%, partly accounted for by a significant growth in the defense budget.

Riesenhuber says he hopes regional governments in West German states will also increase funding for research. "The high quality of German research and the attractiveness of Germany as a center of research, depends on the regional government support." Universities in West Germany depend on regional governments for their funding. ■ DON KIRK

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Math Education: A Mixed Picture

A study involving some 28,000 students in the public schools of Montgomery County, Maryland, documents in sobering detail how black and Hispanic students on average fall behind their white and Asian counterparts in mathematics. But the study provides no firm answers to the question of why the disparities occur.

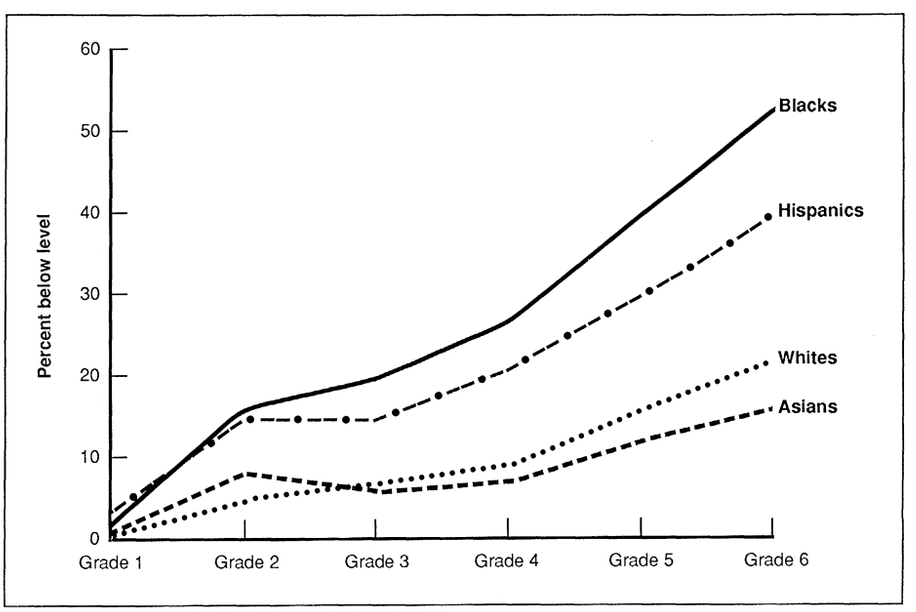
The study, which was sponsored by the National Science Foundation, also confirms findings from other surveys concerning gender differences in achievement in mathematics. Boys and girls perform equally well through the first years of high school, but in the final years, fewer girls than boys opt for more advanced mathematics courses and male students tend to score higher than females on the mathematics sections of the Scholastic Aptitude Test (SAT).

Racial and ethnic differences begin to show up as early as the first or second grade, and become more pronounced throughout the school years, the study found. By the eighth grade, almost half the black and Hispanic students in Montgomery County schools are performing below grade level. Moreover, "the evidence suggests that once a student falls below the standard level of performance in the curriculum for his/her grade level, he/she is not likely ever to catch up again."

These findings are particularly striking because Montgomery County, which is a mixed suburban and rural area bordering on Washington, D.C., is relatively affluent and puts substantial resources into education. "Montgomery County has one of the best school systems in the country, and when you find these differences there, it makes you wonder just how bad it is in other parts of the country," says William Schmidt, an NSF official who oversaw the project. Indeed, the report repeatedly notes that Montgomery County students perform above the national average in mathematics.

The study attempted to get a bearing on why students perform well or poorly by surveying the attitudes of parents, teachers, school counselors, and students themselves. What it found, not surprisingly, is that parental attitudes and encouragement have perhaps the strongest influence on a student's performance, followed closely by encouragement from teachers. A student's own liking for the subject is also an important factor in achievement.

Although the study found few differences



Falling behind. *Percentage of students in Montgomery County schools by racial/ethnic group and grade level who are working below the standard of performance for mathematics at each grade.*

among racial or ethnic groups in attitudes toward mathematics, an overwhelming majority of principals and school counselors "cited economic factors and fragmentation of families as reasons for the lack of motivation and interest in mathematics they felt was dominant among Hispanic and Black students," according to the final report of the study. Black students, even in the more advanced mathematics classes, also reported that they perceived differences in the way teachers regarded their abilities compared to those of other students.

Attitudes also appear to have an impact on the participation and performance of girls in mathematics, especially during the final years of high school. Although female students perform as well as males on standardized tests throughout the school years, they "seemed to be somewhat less confident in their abilities than their male counterparts."

Disparities in participation begin to show up after mathematics requirements for graduation and college entrance have been met, when fewer girls than boys take more advanced classes. Career aspirations may have something to do with this. According to the study, "males were more likely to aspire to careers in professional occupations utilizing mathematics or the physical sciences; females were more likely to want jobs that did not emphasize mathematics, and were more likely to view themselves as future managers."

The study did turn up one puzzling disparity in performance between boys and girls. Even in the advanced classes, male and female students perform equally well on two standardized tests, but on the SAT, boys tend to outperform girls. This may indicate that the disparity is unique to the SAT itself. Susan Gross, a Montgomery County Public Schools official who conducted the study, says the county has requested data from the Educational Testing Service, which administers the SAT, to determine whether there is a difference between male and female scores on specific items, or whether the differences are randomly distributed.

The report offers a sheaf of recommendations, including programs to bring those in danger of falling behind up to grade level; efforts to strengthen ties between school and home, such as the Family Math program developed at the University of California at Berkeley; and programs for training and retraining elementary school math teachers. The report points out that many of these approaches are already being tried in Montgomery County, but the persistence of the problems indicates they need to be stepped up and extended to other school districts.

■ COLIN NORMAN

B-1 Bombs on Capitol Hill

More bad news for the B-1 bomber, the Air Force's latest and most expensive flying machine. Last week, Representative Les Aspin (D–WI), the chairman of the House Armed Services Commitee, told his colleagues in an internal memorandum that a key element in the bomber's much-touted ability to penetrate Soviet air defenses is unlikely ever to work as intended. As a result, said Aspin, "the bomber won't be a match for the evolving threat it was supposed to handle over its useful lifetime."

The faulty system is the so-called electronic countermeasures, or ECM, system, a highly sophisticated and supersecret set of hardware that is supposed to provide protection against Soviet radar defenses, including radar-guided missiles. The ECM system is designed to detect radar signals, sort them out according to the level of threat they pose, jam them, and activate other countermeasures.

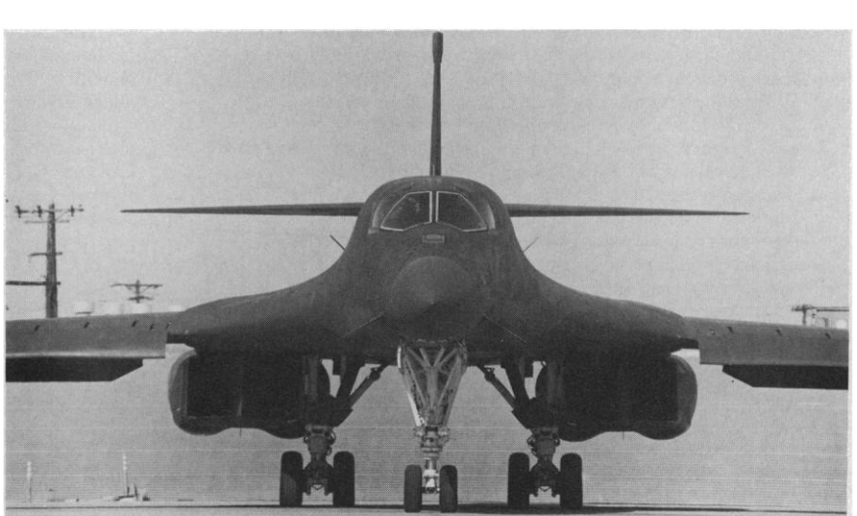
According to Aspin, Air Force officials admitted in a classified briefing for staff members of the Armed Services Committee that there is a fundamental design fault in the "architecture" of the ECM system. A source familiar with the system says that the problem is one of capacity. The system apparently has difficulty in handling a variety of threats simultaneously. This was confirmed last week by General Larry Welch, the Air Force chief of staff, in an interview with the *New York Times*.

The ECM system has long been a problem in the B-1 program. Last year, the Armed Services Committee released a highly critical report contending that the system's jammers interfere with other electronic systems on the aircraft and that it sends out a "beacon" that would attract defenses to the aircraft (*Science*, 29 January, p. 452). The new problem, which apparently only showed up during flight testing, "transcends the problems identified last year," according to one source.

Welch, in a statement released by the Air Force, argued that the flaws in the ECM system would not prevent the B-1 from penetrating existing Soviet air defenses because the bomber has other attributes, including the ability to fly fast and low; a low radar cross section, which makes it more difficult to detect; and high maneuverability. Moreover, said Welch, the ECM would be effective against the most serious threats, such as acquisition radars on fighter aircraft and antiaircraft missiles. Aspin said in his memo, however, that the B-1's ability to meet the current threat from air defenses is "still very much in question."

The Air Force is looking into a variety of options to mitigate the problem, including revamping the software. However, a committee staff member says the flaws in the system are fundamental and it will never have the capability it was originally designed for. Among the options the Air Force may have to consider, he says, are replacing the ECM entirely with a system now being used on the B-52 bomber, using the B-1 to fire air-to-surface missiles from outside Soviet air defenses, or confining it to a shallow penetration role.

■ COLIN NORMAN



U.S. Air Force

Faulty electronics. *Critics say a key system will never work as intended.*