probably have enough money to begin half that number of new centers.

In its report on the 1969 defense appropriations bill, the House Appropriations Committee commented that, although the United States had been successful in retaining technical military superiority in all respects, "the level of productivity of the research, development, test, and evaluation effort of the Department of Defense is not commensurate with the level of expenditures in support of the program." The committee argued that the DOD had created a very large "R&D Establishment" composed of in-house government laboratories, industrial contractors, colleges and universities and nonprofit organizations, all of which lived permanently off DOD spending. The committee specially singled out the Federal Contract Research Centers as one of the "several areas in research and development in which unnecessarily high costs are incurred."

In the Senate, the Appropriations Committee on several occasions in its report on military appropriations recommended cuts in "social science studies, behavioral science studies, foreign policy research, research conducted in foreign institutions, and life sciences technology." In making this recommendation, the Senate Appropriations Committee seemed to be reflecting a more general congressional questioning of DOD sponsored social sciences research and of DOD's foreign research.

All in all, the Congress approved defense appropriations for fiscal 1969 of almost $72 billion, the largest appropriations bill ever passed by Congress. The Congress cut slightly more than $5 billion from the Administration military request, but will doubtless be required to pass supplemental defense appropriations if the Vietnam war continues at its present intensity.

Especially in the Senate, there was some hope that more extensive cuts could be made in military spending this year. This hope was chilled however, after the Soviet occupation of Czechoslovakia, which aroused the Cold War fears and concerns of many senators. On 2 October, the Senate rejected by a 45 to 25 vote an amendment to block procurement, personnel and operating funds for the Sentinel ABM system, which marked the fourth time this session that the ABM system had been upheld in a Senate vote. The Senate fight against immediate deployment of the ABM was led by Philip A. Hart (D–Mich.) and John Sherman Cooper (R–Ky.). On 2 October, Cooper inserted a letter signed by four scientists —Hans A. Bethe, George B. Kistiakowsy, Jerome B. Wiesner, and Herbert F. York—supporting the position that ABM deployment should be delayed by a year or more.

The Senate also turned back Senator Joseph S. Clark's (D–Pa.) one-man fight to cut defense appropriations by a further $8 billion to eliminate part of the "open, conspicuous, notorious, demonstrable waste" which Clark said was contained in the defense budget. Even though Clark is busy running in an uphill battle for reelection to the Senate this November, he took time out to sponsor these amendments and attack "the weapons cult" which he called "The Golden Calf of our nationhood." For the most part his amendments were crushed by substantial margins, including an amendment which would have kept military research, development, test, and evaluation at the 1968 level. That amendment was defeated 54 to 13. Clark was successful in gaining Senate acceptance of an amendment which would have required semiannual reports to Congress on the amounts spent on chemical and biological weapons, including those used for defoliation and other military operations. This amendment was, however, eliminated in the House-Senate conference.

When the massive defense appropriations bill was passed by the Senate on 3 October there were only two votes cast against it. But it would be wrong to believe that all those Senators who voted for it did so with an untroubled conscience. Immediately before he cast his "aye," Thomas J. McIntyre (D–N.H.) told the Senate: "Our priorities are sometimes puzzling. We spend billions on weapons to maintain the strategic balance of terror, yet we are losing the war against fear and terror in our cities. It is important to realize that a battle in one of our major cities threatens the nation's security at least as much as a battle in a Vietnamese hamlet does.

"We can no longer afford to increase defense spending at the expense of our domestic programs."

McIntyre is a "solid" member of the Armed Services Committee. Attitudes toward the sanctity of military spending may indeed be changing if solid Armed Services Committee members feel compelled to utter such heresies on the Senate floor.—BRYCE NELSON

Budget Paradox: Spending Holds Even, Yet Researchers Are Hurt

Budget cuts imposed on the scientific community this year have produced a seeming paradox. On the one hand, federal budget experts are predicting that, despite the cuts, the amount of federal money spent on research and development, and on academic science, during the current fiscal year will about equal the amount spent the previous year. On the other hand, many academic scientists are screaming that deep budget cuts have undermined their ability to do effective research. Can both views be right? Oddly enough, the answer appears to be yes.

The explanation of how a level budget can cause problems lies partly in the fact that the cost of research keeps going up and therefore more money is needed just to keep even, and partly in the fact that this year's budget crunch has fallen much more heavily on some agencies and scientists than others. Big agencies such as the Defense Department and Atomic Energy Commission have been able to protect their research budgets by making cuts in other programs—both expect to boost their spending and new commitments for basic research this year. The National Aeronautics and Space Administration, on the other hand, has suffered another in a series of bad budget years and is reducing its assistance to universities. Meanwhile, the National Science Foundation (NSF) and the National Institutes of Health (NIH), where research is the prime activity, have both had to scram-

ble hard to implement cuts without paralyzing the scientific community.

Though NSF and NIH have employed different methods, both have taken the radical step of telling grantees they can't spend money previously committed to them. These "Indian Giver" cuts have not fallen equally on all grantees, so the budget squeeze appears a catastrophe to some, and a mild annoyance to others.

This year's budget stringencies stem from the fact that Congress, as the price for approving a tax increase sought by the Johnson administration, required deep cuts in the President's proposed budget for fiscal year 1969, the current year. The cuts applied to expenditures (the amount of money that will actually be spent during the year), as well as to new obligations (the amount of money that will be committed to projects, though not necessarily spent within the current year). Congress traditionally cuts the President's budget, but the unusual thing this year was that Congress, in effect, required the administration to make stiff cuts beyond those imposed by the traditional congressional appropriations action. (In using the word "cuts," one should remember that these are reductions from the level of support proposed for fiscal 1969, not from the level actually maintained the previous year.) In order to comply with the congressional mandate, the Bureau of the Budget has been assigning ceilings to the various federal agencies limiting the amount of money they can spend or commit.

NSF Anguish

The restraints on current-year expenditures are causing considerable anguish, as can be seen by examining the experience of NSF. The Foundation, surprisingly enough, will probably spend more money this year than last, yet its grantees will clearly be hurting. In fiscal 1968, a tight budget year, NSF expenditures totaled $450 million. For fiscal 1969, the President's budget estimated a jump to $480 million. But, in the eyes of NSF officials, this estimate was unduly modest, partly because expenditure estimates are always conservative, partly because the estimate did not reflect a deferral of expenditures to 1969 from the previous years. A more realistic estimate of 1969 spending needs, according to NSF, would have been $518 million, or even higher. Yet the Foundation, at this writing, has been given an expenditure ceiling of $462.5 million—a slight boost over last year's spending total, but well below the amount NSF has counted on.

This expenditure ceiling posed certain problems for NSF, for the rate at which the Foundation's money is spent is almost entirely under the control of its grantees. In any given fiscal year, about 80 percent of NSF's expenditures result from obligations made to grantees in previous years, and only 20 percent from those made in the current year. Thus NSF could not make a major reduction in expenditures simply by reducing the level of new grants. It had to force its old grantees to curb the spending they had already planned.

NSF did this by assigning expenditure ceilings to some 500 academic institutions and nonprofit organizations that use about 80 percent of the funds provided by the Foundation. The institutions, in turn, have the task of deciding how to apportion the required cuts among the various NSF grantees, old and new, on campus. NSF stresses that "no grants will be cancelled nor will the amount of any award be reduced; rather, the intent is to extend the time for completion of the work supported by grants."

The spending ceilings, according to NSF, will "force an overall reduction of about 20 percent in the level of expenditures that would normally have been incurred in the conduct of research and education programs" at the 500 institutions. This is bad enough, according to NSF, but the situation is made worse by the fact that the institutions have many commitments that can't be reduced. These include construction work already contracted for; equipment ordered before the imposition of the ceiling; prior commitments made to faculty, professional personnel and graduate students; and various fixed costs. The situation is further aggravated by the fact that the ceilings were not imposed until 14 August, when NSF's numerous summer programs were already funded. The net effect was that institutions were able to absorb their cuts only in activities where some spending flexibility remained—and these activities have had to absorb much more than a 20 percent cut.

Research Hit Hard

Ongoing research has been particularly hard hit. Leland J. Haworth, NSF director, warned Congress last month that "substantial reductions in total research effort may be necessary" at the 500 institutions assigned ceilings. Haworth predicted a "quite severe" impact on developing institutions, the National Sea Grant program, and programs to develop the uses of computers in science education. The seriousness of the situation is reflected in the fact that NSF has been flooded with hundreds of letters and calls of protest. One researcher complained that he was not able to spend a single penny of his grant money.

NSF did not apply expenditure ceilings to some 800 to 900 institutions which spend less than $50,000 a year of NSF funds, largely because the potential savings were not worth the administrative effort. Nor did NSF reduce the stipends on fellowships it has granted directly to individuals. However, the Foundation has cut its own administrative costs, as well as expenditures at its three contract research centers.

In addition to the restraints on current-year expenditures, NSF has suffered a sharp drop in its ability to make new grants and commitments. Last year NSF received $495 million in new obligational authority. This year it sought $500 million, but Congress chopped this drastically to $400 million, and the Budget Bureau may chop it down still further.

NIH Problems

At NIH, the picture is also gloomy. At this writing NIH has not been given a precise ceiling for new expenditures and new obligations, but Ronald W. Lamont-Havers, associate director for extramural programs, says there is no question that "the amount of money we give to the academic community during fiscal year 1969 will be less than we gave them in fiscal 1968."

Like NSF, NIH has had to renege on money that had already been virtually promised to researchers. Though NIH only parcels out its money on a yearly basis, it makes long-term agreements with grantees—known as noncompeting grants—that have always been considered virtual assurance of continued support at the agreed-upon level. This year, however, NIH realized it would have to reduce its new and competing continuation grants by a whopping 1,200 (against a base of 11,000 total grants) unless the noncompeting grants were made to absorb some of the required budget cut. NIH has therefore negotiated reductions with its old grantees on a grant-by-grant basis. The cuts have ranged from zero to more than 25 percent, and have averaged 14 percent. Thus far negotiations have involved only grants whose anniversaries fall between July and De-

cember, and the cuts have applied only to funds for the current year. But NIH is predicting that all noncompeting grants will have to be renegotiated this year, and that such negotiations will probably be necessary next year as well. Meanwhile, NIH expects to make roughly 400 fewer competing grants this year—a big decline but not the precipitous drop that would have been necessary had NIH not reneged on its old grantees.

The extent of the damage caused by all these budgetary ups and downs is not yet known. Federal science officials say they have no idea whether certain fields of science are suffering more than others, or whether certain institutions have been badly hurt by the cumulative impact of cuts from several agencies. Efforts are now being made to pinpoint problem areas, and, in cases of dire need, some budget adjustments may be made. It is clearly not a happy year for science—even if total federal expenditures for R&D do end up equaling last year's figures.—PHILIP M. BOFFEY

Trained Manpower: British Find Too Much Stress on Pure Science

London. To the detriment of industry and education, too many of Britain's brightest young scientists are pursuing basic research careers in university and government laboratories.

American statesmen of science would probably ascribe such sentiments to a Neanderthal legislative body, but, in fact, it is one of the main conclusions in a unanimous report issued last month by an eight-man committee of British scientific leaders, including five who are members of that immutable bastion of pure research, the Royal Society. Chaired by Michael Swann, principal and vice chancellor of Edinburgh University, the committee concludes that "a positively dangerous situation" has developed from "a concentration of scientific talent in the fundamental research sector (particularly in universities) and a very significant movement abroad, with a consequent starving of industry and schools." To deal with the situation, the committee recommends a variety of steps, but central among them is a shake-up of many aspects of higher education so as to put more emphasis on preparation for careers in industry rather than in basic research. At the same time, the committee also stresses the need for better pay to attract more scientifically trained persons into secondary school teaching as part of an effort to reverse the "swing from science" in the school-age population.

Titled, "The Flow into Employment of Scientists, Engineers, and Technologists,"* the Swann report is the latest in a series of high-level studies that, over the past few years, have been looking into the development and employment of Britain's scientific and technological resources. Though the report mainly provides statistical substantiation for an interim report issued 2 years ago, it nevertheless has drawn a great deal of attention in this country that is so introspective about its sickly economy.

The report skirts around the fundamental question of whether industry could make profitable use of more scientifically trained persons, but it leaves no doubt that higher education and industry are far from intimate in Great Britain. Thus, it notes that in recent years only 9 percent of first class honor graduates in science took jobs with industry; 72 percent chose to continue their studies or to go into research. Industry did get 40 percent of the "firsts" in technology, but at the higher degree levels it got only 31 percent of the technology graduates and only 10 percent of the science graduates.

Noting that early specialization raises the likelihood of early obsolescence, the report points out that 65 to 75 percent of American science and engineering students receive "generalist" training as undergraduates, compared with no more than 20 percent in Britain. And it also points out that, while the school-age population is rapidly rising, there is an inadequate supply of replacements for the large number of teachers nearing retirement, and that, among these replacements, the proportion with outstanding academic records is declining.

The report repeatedly plays on the theme that Britain has gone overboard on preparation for careers in academic research. Thus it points out that, while employment of scientists and technologists at universities increased by 40 percent between 1961 and 1966, rapid expansion of the universities is now more or less completed, and current planning provides no place for a major portion of those who are training for careers in basic research. Citing "a strong preference for research training on a scale unlikely to be satisfied by employment opportunities over the next five years," it warns that this could lead "to increased emigration and dissatisfaction with careers in science and technology." And, in turn, this could affect "disproportionately the career decisions of the next generation." The solution, it says, is to steer these bright young people into industry and teaching so that they will not be frustrated by lack of opportunity in basic research and, also, so that they can be more directly involved in helping their country earn its way.

For pure scientists to advocate anything less than expansion of their ranks is not unlike the Pope's calling for fewer converts, and naturally, this departure from form has evoked a number of less-than-charitable interpretations among some who are beyond the inner circle of Britain's tightly run scientific community. Prominent among these is the view that the panel is not enamored of what has happened to the quality of scientific research during the rapid expansion of recent years, and that, at a time when money is tight, the cry of industrial need is a politically palatable one for warding off pressures to spread the wealth to second-rank centers. Interestingly, the panel does not call for spending less on basic research; rather, it comes out for channeling more scientifically talented students into programs that will prepare them for industrial and teaching careers. Clearly, this would be beneficial for industry and teaching, as well as for those who remain in the ranks of pure research.—D. S. GREENBERG

*Available from Her Majesty's Stationery Office, London; 7s 6d. Issued in conjunction with the Swann report was a separate study. "The employment of highly specialized graduates: A comparative study in the U.K. and the U.S.A.," also available from Her Majesty's Stationery Office; 4s 6d.