

Britain's Big Science in a Bind

The United Kingdom is spending the majority of its particle physics and astronomy budgets on subscriptions to CERN and the European Space Agency; other research in these fields is suffering

LONDON—When the British government introduced a sweeping reorganization of its science bureaucracy 3 years ago, most researchers welcomed one change with open arms: Particle physics and astronomy were separated from the rest of the science budget and put into a research council of their own. No longer would these scientific leviathans, with their voracious appetites, compete so directly with other fields for funds. And for high-energy physicists and astronomers, the new arrangement meant that they would be housed in an organization—the Particle Physics and Astronomy Research Council (PPARC, pronounced “pea-park”)—that would be more attuned to their needs. But although the new environment sounded promising, it has not been kind to these two fields. And the rest of British science has found that it is far from isolated from the budgetary woes of their beleaguered colleagues.

The new “big science” research council has been forced to live with a stagnant budget, less than half of which is under its control, a planning cycle ill-suited to its needs, and a domestic program too small to exploit international facilities effectively. As a result, domestic research programs in high-energy physics and astronomy have been cut to the bone and several prominent projects are now in jeopardy. “It’s a very difficult situation, and we are convinced there’s a better balance to be struck,” says PPARC’s chief executive, astronomer Ken Pounds.

PPARC’s plight is now being examined by the House of Commons select committee on science and technology as part of a review of the government’s 1994 science policy reforms. The committee began hearings on PPARC last month, but so far committee members have not shown much sympathy—and scientists from other disciplines have not rushed to PPARC’s defense either. “There’s always controversy over the budget for big science,” says Labour committee member Ann Campbell. And although the share of the total U.K. science budget spent on particle physics and astronomy has fallen by more

BIG SCIENCE

Most countries are having a tough time fitting big science projects into constrained research budgets. This week we look at the problems facing particle physics and astronomy in the United Kingdom. Next week, the other side of the coin: Japan’s plans for a string of cutting-edge large facilities.

than half—from 20% to 8% since the mid-1970s—“there’s a body of opinion amongst the scientific community that particle physics is very expensive,” says Campbell

Poor exchange

Two big-ticket items dominate PPARC’s budget: the membership fees for the European Space Agency (ESA) and CERN, the European particle physics laboratory in Geneva. Most other member countries pay their subscriptions to these bodies from the budgets of the ministries responsible for implementing the intergovernmental treaties that founded the organizations—generally the industry or foreign ministry. But the British government insists that the costs be borne by the U.K.’s science budget, and PPARC pays them both. As a result, more than half PPARC’s \$285 million annual budget is gobbled up by these subscriptions. “This is the key problem. Everything else stems from this,” says a senior particle physicist.

The burden this imposes on the U.K. science budget is made heavier by the vagaries of international finance: Although the CERN budget has been relatively constant in recent years, subscriptions are paid in Swiss francs, and the pound has declined in value by a factor of 4 against this currency since the mid-1970s. Over the past 2 years the decline has been dramatic: The U.K. subscription to CERN has climbed by 27%, from \$87 million to \$110 million. “It’s just bad management on the part of government that the jumps in exchange rates impact immediately on the support for science,” says Oxford University physicist John Mulvey. Britain has had more luck with its ESA subscription because it is

paid in European Currency Units, which have risen less rapidly against the pound.

Because of this long-standing problem, the former Science and Engineering Research Council’s Nuclear Physics Board, which used to pay CERN subscriptions before PPARC was set up in 1994, used reserve funds to cope with currency fluctuations. But eventually this did not prove to be enough: In 1991 the council announced that to meet the cost of the fluctuations, it would have to close the Nuclear Structure Facility at its Daresbury Laboratory in northwest England. This was a world-class machine that provided facilities for many U.K. and overseas researchers studying the properties of atomic nuclei.

This was followed in 1994 with a scheme to fund currency fluctuations from the entire science budget before allocating it to the research councils. “Without this we’d have been totally dead,” says another senior particle physicist. This arrangement was part of the reorganization that split particle physics and astronomy into PPARC and put other areas of physics, including nuclear structure research, and engineering into the Engineering and Physical Sciences Research Council. “We are delighted not to be in PPARC,” says nuclear structure researcher Brian Fulton at the University of Birmingham.

The reforms have created new problems, however; in particular, resentment from researchers in other disciplines at having to shoulder some of the costs of PPARC’s subscriptions. “There’s not a great deal of sympathy for us,” acknowledges Pounds. And this lack of sympathy means that PPARC gets scant support in its efforts to win increases in the rest of its domestic budget during the annual budget negotiations (see chart).

The pressure on PPARC’s domestic budget has been disastrous for the council’s support for research that makes use of the hardware provided by CERN and ESA. “PPARC is paying a fortune to be in a fancy golf club but has no money for golf balls,” says one particle physicist.

Pounds and other researchers argue that, to get full value from these international facilities, the government should spend as much on related domestic research as on the subscriptions themselves. But “at present the U.K. is spending less than half its subscriptions on domestic programs, which doesn’t make any sense from the U.K. point of view or from [CERN’s and ESA’s] point of view,” says Pounds.



Squeezed. PPARC’s chief executive, Ken Pounds.

And the U.K. expenditure on domestic particle physics research will make even less sense as CERN moves ahead with construction of its next big accelerator, the Large Hadron Collider (LHC). CERN will be able to build the machine without an increase in its subscriptions, but PPARC's domestic budget must pay for Britain's contribution to the instruments needed to exploit the LHC. In 1994, PPARC spent only \$37 million to support domestic high-energy physics research, while its subscription to CERN was \$87 million—well below the parity that PPARC believes is needed to fully exploit CERN.

This squeeze on domestic funds is making life hard for British physicists. Robin Marshall, a particle physicist at the University of Manchester who works at CERN and at DESY, Germany's particle physics lab in Hamburg, says that although the current financial year does not end until April, his group is already running out of this year's funds. "We don't have enough money to travel to experiments, and this is starting to affect the supervision of our students. We are literally broke on some projects," he says.

And these financial strictures do not leave any room for new initiatives. "The pressure to invest in new things is particularly acute now—we are doing good science on things built 10 years ago like the Large Electron Positron collider at CERN and the HERA collider at DESY," says one senior particle physicist. Pounds believes the council will need to find an extra \$12 million per year over the next few years for Britain's contribution to detectors for the LHC to make full use of the machine, but he sees little scope at present for finding anything like that amount.

On the brink

PPARC has also been forced to make major cuts in programs outside particle physics. Last year it decided it could not afford to participate fully in ESA's Integral gamma-ray observatory mission, due for launch in 2001, although several U.K. research groups had been planning an instrument for this mission for a decade. "It was a huge disappointment," says Gerry Skinner at Birmingham University, one of the researchers affected. "A number of Italian and French groups found a way of funding and building the same instrument, and those who build instruments are able to use them to best advantage," he says, adding: "We are hangers-on picking crumbs at the table. Our credibility is going to be rock bottom." For Pounds, pulling out of Integral was a tough move. "The decision was scientifically and politi-

cally damaging," he says.

And it's not just programs tied to the large international organizations that are at risk. Funds for a proposed U.K.–German gravitational wave experiment, for which the two countries were expected to split the \$12 million tab, have been squeezed. The United Kingdom will now contribute only \$1.5 million over 4 years, which means U.K. researchers will have a much smaller role in the project. "It's a very frustrating situation in the light of exciting and timely new opportunities," says Pounds.

Ground-based astronomers also worry about their funding and fear that the United Kingdom's participation in the major international Gemini project could be in jeopardy. The United Kingdom is a 25% partner in the \$176 million venture to build two 8-meter

1995, p. 26), but the weakening pound has continued to increase Britain's costs.

John Cadogan, director general of the research councils, says that the United Kingdom cannot afford to continue to pay increases of this magnitude, and he is trying to find some ways to limit the cost. Giving evidence to the select committee inquiry last month, he said he was preparing for informal negotiations with CERN. Although national contributions are fixed by treaty, there have been precedents for short-term reductions. Germany, for example, negotiated a

10% reduction in subscriptions between 1993 and 1998 because of the costs of reunification with the east and reorganization of its scientific infrastructure.

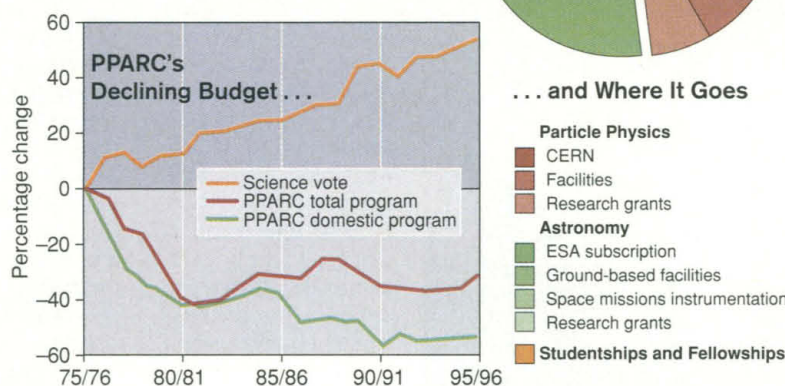
PPARC's problems have highlighted the widening perception among U.K. scientists that the country does not have an adequate mechanism for funding large items of research equipment in any field of science. "How will the U.K. find the means to make an investment for something like a new synchrotron which will be needed early in the next century at an estimated cost of \$200 million?" asks Pounds. In January the government announced a new \$55 million competitive scheme to fund equipment in priority areas. Although these funds are for comparatively small items of equipment, some researchers

see it as a potential model by which research councils can fund equipment outside the tight constraints of their annual budgets. "The new equipment initiative is welcome and starts to address the problem," says Pounds.

While this scheme may offer some hope, it will do little to relieve the competition for operating funds for big science. So far, however, the council has managed to prevent battles between the astronomy and particle physics communities within the council. "I think they both recognize the quality of each other's work and that there is nothing spare to trim off," says a PPARC official.

"The whole physics community has become isolated, but it is important not to develop a ghetto mentality on funding," says Pounds. Britain's once-buoyant physicists have learned the hard way to live within their means. Says one senior researcher: "The sums causing PPARC so many problems are actually not that large. With an upturn of 10%—\$30 million—we'd be in very good shape." But in today's harsh funding climate, even a \$30 million increase seems unlikely.

—Nigel Williams



Poor relation. Spending on programs covered by PPARC has declined in real terms over the past 20 years, while the total science budget has increased.

telescopes at Mauna Kea in Hawaii and Cerro Pachon in Chile. "The U.K. has a strong ground-based astronomy community, but it is particularly vulnerable," says Oxford University astronomer George Efstathiou. Another senior astronomer says: "If we accept the amount of money is not going to grow in real terms it means we do less science. It's not impossible, but it would be the ultimate tragedy if we had to pull out of the Gemini project."

Tough choices

This pressure on the domestic science budget has led the U.K. government to try to put the brakes on the CERN and ESA budgets. And it has had some success. The ESA council agreed last year to freeze its science budget in cash terms for the next 5 years and to get compensation for inflation only when it rises above 3% (*Science*, 27 October 1995, p. 571). As a result, it is expected that ESA will announce major cuts to its science program later this month, including the cancellation of one planned mission. Agreement was also reached at the end of 1994 to freeze the CERN budget until 1997 (*Science*, 6 January