JET: Uncertainty Follows Success

Europe is at the cutting edge of fusion research, but pressures to collaborate on a global program could cause delays

Culham, England

In the early 1970s, when a committee headed by French physicist Paul-Henri Rebut proposed that Europe should build the world's largest fusion reactor and operate it for less than a decade, "many of us thought the idea was crazy," recalls one of Rebut's colleagues. Few people now share that view.

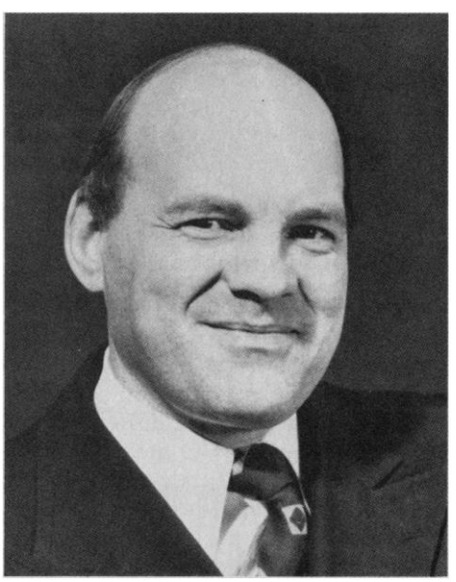
The European Economic Community (EEC) gave the go-ahead in 1977 to construct the machine, known as the Joint European Torus (JET), and it is now widely regarded as one of Europe's most fruitful collaborative research ventures. JET has been chalking up scientific successes since it began operating in 1983, and it has put Europe firmly in the vanguard of fusion research.

Yet, in spite of these achievements, Europe's fusion research community is facing the future somewhat nervously. JET is expected to complete operations in 1992, when a scheduled 18-month series of experiments with radioactive tritium will end the machine's useful lifetime. What will follow is far from certain.

Current plans call for a larger machine, dubbed the Next European Torus (NET), to be constructed by the European Community in the 1990s, followed by a prototype reactor early in the next century. Those plans will be hugely expensive, however, and in light of the perennial wrangling over the community's research budget, there is no guarantee that European governments will come through with the necessary cash.

In addition, further uncertainty has been introduced into Europe's plans by the proposal, first put forward at the 1985 summit meeting between President Ronald Reagan and Soviet leader Mikhail Gorbachev, that the superpowers should cooperate on fusion research. This idea has since evolved into discussions between the United States, the Soviet Union, Japan, and the European Community on potential collaboration on a "world" fusion machine, known as the International Thermonuclear Experimental Reactor (ITER). European physicists worry that this possibility will disrupt planning for their own program.

In the meantime, JET remains in many respects a model for European scientific cooperation. Situated alongside the U.K. Atomic Energy Authority's research establishment a few miles south of Oxford, it is midway through a planned series of experiments leading up to the final round involving tritium, scheduled to begin in mid-1991. This final series should demonstrate "break-even," when the energy generated by reactions in a hot deuterium-tritium plasma will equal the energy required to heat and contain the plasma. Already, according to JET researchers, the machine is outperforming its chief rival, the Tokamak Fusion Test Reactor in Princeton, New Jersey, although the two facilities are operating on somewhat different scientific tracks. JET, for example, is expected to provide longer pulses than the Princeton machine during the tritium experiments.



Paul-Henri Rebut. *Led design team for JET, now directs the project.*

JET is the centerpiece of the EEC's fusion research program, which pays 80% of the facility's budget of some $110 million. Britain directly contributes 10% of JET's budget, and the remaining 10% comes from associated fusion labs in other European countries. In addition to JET, the EEC funds about 25% of the work in the other fusion labs in Europe, plus the cost of priority programs. This gives it considerable leverage in shaping the total European fusion effort.

A team based at Garching in West Germany is now working on plans for NET, and the design phase is expected to begin around 1989. A draft report prepared by the U.S. Office of Technology Assessment (*Science*, 28 August, p. 966) notes that Europe, unlike the United States, "has a clear strategy for future fusion research, in which NET plays a vital role, and it appears committed to carrying this program out."

However, the ITER planning exercise could complicate matters. Since ITER and NET would be comparable in some respects, European researchers worry that NET could be sacrificed. Rebut, who is now the director of JET, talks, for example, of the "interference" of the ITER exercise, and says it "could well have a delaying effect on the European program." He also says he has problems with the notion of centering the world fusion program on one machine, since a single mistake could disrupt the entire fusion effort.

In any case, NET will require some hard political selling. Although its price tag is far from certain, it is expected to be at least twice the $450-million cost of JET. Since fusion research is currently one of the largest single items in the EEC's hard-pressed research budget, it will be a tempting source of funds for other politically popular programs. Choosing a site for NET could also be contentious. It took more than 2 years to decide on Culham as the site for JET; it could take 3 years to pick a site for NET and another 7 or 8 years to construct it.

Moreover, there are likely to be some tensions between national fusion programs and an increasingly expensive international effort. These tensions are already evident in Britain, for example, where the government recently cut some $1.5 million from the national fusion program to pay for an increase in its contribution to JET. Rebut himself says "I don't believe there is a future for national programs as such." He argues that they should be increasingly integrated into the European program, each taking the lead in a specific aspect such as blanket design or diagnostics.

Nevertheless, Rebut remains optimistic. "We live in a world of committees," he says, and "you have to press a project in such a way that the committee cannot refute your position. If they cannot reject it, they may well end up accepting it." That was what happened with JET, he says, and he hopes it will be repeated with NET. ■

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