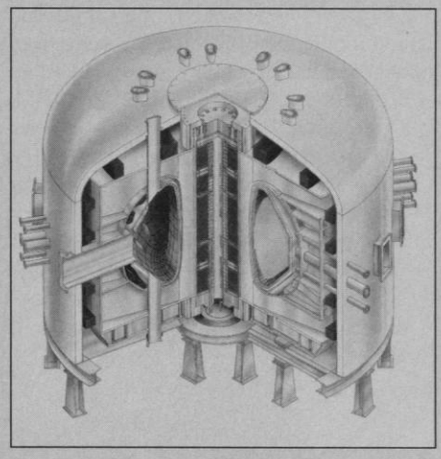
U.S. Fusion Program: Struggling to Stay in the Game

As Europe considers its next move in fusion energy research, the U.S. program is retrenching. This fall, Congress unexpectedly slashed almost $50 million from the budget for magnetic confinement fusion and, as a result, the Department of Energy is being forced to abandon portions of its research program and lay off hundreds of researchers and engineers.

The department's plans were revealed to laboratory directors at a closed meeting on 6 December. *Science* has learned that major facilities and research programs at Los Alamos and Oak Ridge National Laboratories are on the chopping block. The aim is to focus efforts on tokamaks—the leading magnetic fusion technology—and to keep the next big machine on track. This is the $1-billion Burning Plasma Experiment, formerly called the Compact Ignition Tokamak, construction of which is currently set to begin around 1993.



Top priority. *The Burning Plasma Experiment, a.k.a. the Compact Ignition Tokamak.*

All this is having a devastating effect on morale, and some researchers are laying the blame at the door of Energy Secretary James Watkins. They are claiming that he allowed the program to drift for 2 years and that he has failed to make a strong case for fusion to Congress. "Watkins has got to give fusion the kind of backing in the department that programs like the SSC [Superconducting Super Collider] get," says David Overskei, a physicist at General Atomics, which operates the nation's second largest tokamak research reactor, DIII-D.

The retrenchment comes just as Watkins was planning a new strategy for U.S. fusion R&D that was meant to stabilize the program and restore congressional confidence in it. In September, his hand-picked Fusion Policy Advisory Committee urged DOE to mount an aggressive program to develop fusion power reactors—and to boost funding next year to as much as $420 million. Instead, Congress cut the budget from $323 million in fiscal year 1990 to $275 million in 1991. Now, even physicists and engineers who have survived the cutbacks wonder whether the program can recover.

One indication will come early next year when Congress considers a plan drafted by DOE to shift $16 million in fiscal year 1991 (which began on 1 October) from other programs to the hemorrhaging fusion program. More telling, perhaps, will be how legislators will view a request for $360 million in fusion funding that is expected to be part of DOE's budget proposal for fiscal year 1992.

DOE's priority on tokamaks is relatively good news for the Princeton Plasma Physics Laboratory, the Massachusetts Institute of Technology, General Atomics, and Lawrence Livermore National Laboratory. These institutions could receive full funding this year for key tokamak physics experiments leading up to the Burning Plasma Experiment, which will study the physics of plasmas much hotter than can be achieved in existing machines. The only casualty at these labs appears to be a small experimental machine at Princeton, the PBX tokamak, which will be mothballed. But even these programs will be facing slowdowns and layoffs if Congress does not approve DOE's plan to shift money to the fusion program from other department activities.

Other labs will not be so fortunate. According to plans outlined to the directors last week, the department aims to close the Confinement Physics Research Facility, the Reverse Field Pinch, and the compact toroid research programs at Los Alamos. A similar fate awaits the Advanced Toroidal Facility at Oak Ridge. These experimental devices, and much of the fusion research at these laboratories, are considered expendable by DOE officials because they do not directly support the tokamak program. They focus on alternative approaches to confining hot plasmas. Los Alamos has 140 people involved in fusion research and Oak Ridge has 300. A large number of people at these facilities will be let go.

The decision to close Oak Ridge's Advanced Toroidal Facility was particularly controversial when it was presented to the lab directors last week. The 2-year-old ATF is the world's most advanced stellarator, a fusion device that outwardly is very similar to the donut shaped tokamak but that, unlike today's tokamaks, can be run at a steady state rather than in short pulses. For studying plasma physics, it has some advantages over tokamaks. "It does not make sense to get rid of a machine like this when it can explore fundamental physics in ways that tokamaks can't," argues John Sheffield, director of Oak Ridge's fusion program.

DOE program officials say privately that they would prefer to ax the Microwave Tokamak Experiment at Lawrence Livermore National Laboratory. It is set to shut down in mid 1992, but it has been spared from immediate closure because it is being partly backed by Japanese funds. DOE officials are concerned, sources say, that dropping the project could scuttle Japanese participation in the Superconducting Super Collider and the International Thermonuclear Energy Reactor (ITER).

Watkins is said to be especially keen to keep ITER on track. A $6-billion tokamak being planned as a joint venture involving Europe and the Soviet Union in addition to the United States and Japan, the machine would be a forerunner of a prototype fusion power plant. According to current plans, ITER would follow the Burning Plasma Experiment. Watkins regards ITER as the only "cost-effective" option for commercializing fusion, and early next year he is expected to approve U.S. participation in the second phase of the design for the machine.

Even if the United States does continue with the Burning Plasma Experiment and, later, participates in ITER, the next few years could be difficult ones for U.S. fusion R&D. In October, Watkins warned researchers attending the International Atomic Energy Agency's fusion conference that the budget would be tight. "We will have to do the best we can," said Watkins, "and make some hard choices." Indeed, with the United States now in a recession and with greater demands on federal resources, DOE and fusion laboratory leaders fear there may be even harder times ahead. ■ MARK CRAWFORD

Mark Crawford is a free-lance science writer.