It's not over yet

It would be unfortunate to be forced to discuss the demise of the International Thermonuclear Experimental Reactor in the editorial of a special issue on fusion. This would seem to be the case. The US, one of four partners in the project to build the world's first power station-sized fusion reactor, pulled out in early October. All US researchers who were working on ITER abroad were ordered home. Among them was the author of one of the articles in this issue, Deputy Director of ITER, Ron Parker, who will be leaving his office at the ITER site in Garching in Germany and returning to MIT in the US in December.

The end of ITER has been announced by *Science* magazine ('the ITER's over' October 9th) among others, and by newspapers the world over. The ITER partnership always depended on all four partners being involved. However, as *Europhysics News* goes to press the pull-out of the US appears to be just that: the pull-out of the US. The other three partners—the EU, Japan and Russia—are still firm in their commitment to ITER. So why has the US withdrawn?

ITER—the tokamak designed to harness fusion energy in a magnetic doughnut—reached the end of a six-year design stage this year. In the summer it suffered a reduction in size as a smaller ITER experiment was considered. But, according to Miklos Porkolab, Chair-Elect of the Plasma Physics group of the American Physical Society, it had been clear for some time that the US Congress would be unimpressed if no one put up the money and moved ahead with construction of ITER. Cancellation came when Congress ordered the Department of Energy to discontinue its contributions to ITER.

Fusion research in the US suffered severe cuts in funding in 1995 when research spending was slashed by a third. According to Porkolab, this has already led to restructuring to concentrate on innovative concepts and on improving the tokamak principle. No further budget cuts are expected but more of the same restructuring will be needed now that ITER is not there. And, says Porkolab, 'we are hoping that we will keep collaborating with the rest of the world, Europe and Japan in particular.'

Officially, US involvement in ITER continues until July 1999 but without any funding to speak of. The EU, Japan and Russia have signed-up for three years. In Japan fusion research is very important—Japan has little access to energy resources of its own. Akio Kitsunezaki, Director of Japan's ITER efforts, told *Europhysics News* in an impassioned email that fusion research in Japan is an attempt to rescue the Earth from rising CO_2 emissions, from the rising world population and even from possible wars that may result from a dearth of energy in the future.

The US is very different from Japan. Simply put, land and oil are cheap, which makes the US and its Congress less concerned about the population explosion and gradual loss of energy resources. As Parker points out, fusion research in the US no longer has a definite schedule or time frame, in other words, no *urgency*. Lack of concern is one reason why US-withdrawal from ITER was possible.

One other reason is the flexibility (or lack of stability, depending on your point of view) of US science funding. Such a hasty retreat as the one the US has made would not be possible in Europe (or Japan) where funding arrangements are more lengthy. US funding for ITER was cancelled during annual spending decisions. In Europe funding is linked to a five-year Framework programme (for which funding was still being discussed as this issue was being prepared).

So what will the next step be? In late October the two-year fusion Olympiad took place in Yokohama in Japan. The mood there was said to be a mixture: those involved in ITER experienced a mixture of horror faced with the possible end to their work and of elation at the progress that fusion research is making. Those not directly involved in ITER may have seen for the first time the impressive achievements of ITER R&D, and may have found it hard to believe that all this work could soon be lost. Fans of the stellarator concept, a lesser-developed rival to the ITER tokamak, can look forward to a large device that will come on line next millennium at Greifswald in Northern Germany. But stellerator fans are worried: if a decision to build a full-sized tokamak is never made, where would the willingness to build a full-sized stellarator come from?

One thing that appears to unite tokamak physicists the world over is the opinion that if the EU and Japan do move ahead with definite plans to construct ITER, then the US will follow, much like they have done with their investment in CERN's Large Hadron Collider. So which nation would be willing to become the host for a full-sized tokamak? If it were a European nation, it would be an opportunity to forge links with Japan and industry the world over (*see page 192*), and ultimately with the US. Alternatively, there is enthusiasm for building (a reduced cost) ITER in Japan, but the financial unsteadiness in Asia makes this uncertain. A definite signal that the EU would participate in a Japan-lead project would be needed first. But can the EU provide such a signal when many of its politicians are uncertain about fusion themselves?

Any lack of firm decisions on the goals of ITER research will surely kill the project as only definite aims will attract US participation. Of course, no single nation could handle on its own what is the world's biggest-ever technological challenge. It would at least be reassuring to see the EU and Japan forge strong links over the next three years (and perhaps build joint institutes). Otherwise, ITER research looks set to burn-up post 2001.

European Physical Society
EPS Secretariat, 34 rue Marc Seguin
BP 2136, F-68060 Mulhouse Cedex, France
phone +33 3 89 32 94 40; *fax* +33 3 89 32 94 49
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Managing Editor
Toby Chapman
email eneditor@univ-mulhouse.fr

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