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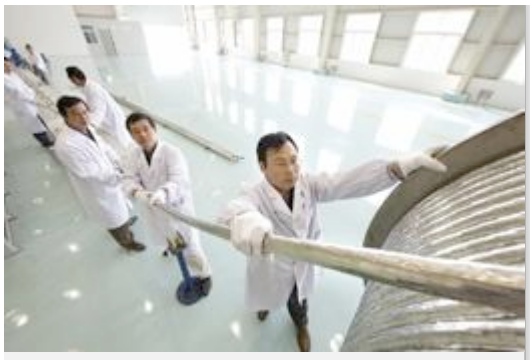
News

Fusion project looks for savings

Plans to scale down testing sparks concern.

Geoff Brumfiel

The world's most expensive science experiment is on the hunt for savings. ITER, a fusion test reactor under construction near Cadarache, France, is looking to trim around €500 million (US$688 million) from its massive construction budget — which informal estimates place as high as €15 billion.



The superconducting cable in ITER's magnets must be thoroughly tested. But how thoroughly? *P. Ginter/ITER*

At a council meeting next week, Osamu Motojima, the project's director-general, is planning to ask for approval of more than 20 cost-saving measures. The proposed savings are a fraction of what will ultimately be required and come amid enormous pressure from ITER's seven partners — the European Union, the United States, Russia, China, South Korea, India and Japan — to bring down the price of the machine.

The cuts include plans to consolidate contracts and reduce staff costs. But one proposal in particular — to reduce testing on critical superconducting magnets — has raised eyebrows outside the collaboration. "Saving in tests is the straight way to buy trouble later on," says Lucio Rossi, a physicist at CERN, Europe's particle-physics lab near Geneva, Switzerland. Rossi oversaw construction of superconducting magnets for the Large Hadron Collider, the world's most powerful particle accelerator.

ITER's goals are as sky-high as its price tag. The machine hopes to trap and squeeze hydrogen isotopes until they fuse together to form helium, releasing energy. If all goes to plan, ITER will release ten times the power it consumes, sometime after 2026.

Hot stuff

The endeavour hinges on the machine's ability to contain its hot hydrogen fuel, which can reach temperatures in excess of 150 million °C. To do this, ITER uses powerful magnetic fields generated by enormous superconducting magnets made of niobium-tin alloy. Such magnets carry current with no resistance, but they only work at a few degrees above absolute zero.

To save money, Motojima is proposing that not all the magnets need to be tested at the freezing temperatures at which they will operate. Only the machine's central solenoid, which has a crucial role in heating the

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machine's fuel, will be tested at operating temperatures and currents. The other magnets, which together create an invisible holding tank for the hydrogen fuel, will be tested at the temperature of liquid nitrogen, around 77 kelvin (–196 °C). That means some expensive cryogenic equipment and special test facilities won't be required. Motojima also says that fabrication techniques for the coils will be tested using copper, instead of costly niobium-tin.

> **on.”**

Some experts think that the revised tests will be adequate. Testing at 77 K will be enough to see how the magnets mechanically contract at low temperatures, says Lyn Evans, the former director of the LHC project. "The full cool-down is not essential," he says.

But Rossi, who was the person directly responsible for building the LHC's magnets, says that any reduction in testing could lead to trouble. The enormous electric fields inside these kinds of magnets can cause short circuits, and other problems can arise. When the LHC experienced a major accident in 2008, the part of the system that failed (the connections between magnets) hadn't been extensively tested, he points out. Moreover, Rossi says that copper tests alone will not be adequate to test coil fabrication. Some niobium-tin must be used to ensure that the techniques will work for the material, which is more brittle than copper.

Banking on experience

Motojima says he is aware of the risks, but thinks that careful quality control during production can eliminate the problems. A previous machine he oversaw, the Large Helical Device in Toki, Japan, was constructed without full tests, and scientists at the KSTAR tokamak in Daejon, South Korea, ran no tests at all on some coils. "We should make decisions based on successful experiences," he says.

On top of the proposed measures, Motojima wants industrial contractors in each of the seven partner states to find ways of trimming production costs, perhaps through minor changes in design. One way or another, he says, savings will need to be made: "Cost containment is a very, very important issue."

Others are sceptical that the €500 million target can be attained. "I think these cost savings are going to get lost in the escalations that are to come," says Stephen Dean, the president of Fusion Power Associates, a non-profit advocacy group based in Gaithersburg, Maryland.

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One place where savings will not be made is on the specialized coils that will control violent outbursts in the plasma, known as edge localized modes, that can damage the machine. Motojima was considering cutting these from the design, but he told *Nature* that he has now decided the coils

should stay.

Comments

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Although very much a lay man in relation to the science, physics and technology of such enormous and to my mind wonderful journeys into the future, I am so often dismayed at the lack of vision, intelligence and integrity of politicians; it is they who try to force the propagander of unproven science onto the masses via a manipulated media vis the destruction of the planrt by AGW, yet they stifle real scientific progress to minimise the alledged catastrophic damage of which they shrilly shreik by cutting the known cost of the project, which they themselves were aware of both in total and timescale spending because their social projects of population manipulation are failing and so they raid funds promised to scientific projects on the basis that other projects, which may be just as viable will not be funded because the ITER project is too expensive. Not so! When will there be a political policy that comprehends that ground breaking research IS expensive but that the longer term benefits for all of society will be far greater than the short term development costs and therefore an expansion in funding of big projects like ITER will ensure a cleaner, less polluted (by polluted I do not mean increases in CO2 but a reduction in harmful waste by more efficient application of technology, e.g. fusion reactors) future will come sooner when the scientists and engineers are left to do what they are good at rather than being stimied by ignorant meddlers. #15693

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Posted by: **John Leon** | 2010-11-15 06:22:46 AM

"I think these cost savings are going to get lost in the escalations that are to come," says Stephen Dean. #15743

This is but a foregone conclusion from the way earlier big-science projects have fared. Although this desire to trim cost is commendable and a relief to taxpayers, the funding agencies here would do even better to review a little more closely the tests conducted on tokomaks so far. For instance, in the JET report, http://www.iop.org/Jet/fulltext/JETP98010.PDF, one finds the sentence:
â€œIt will also be noted that the data in Fig. 2 shows an increase of sawtooth period with increasing tritium concentration. The reason for this is being investigated.â€
This would now beg the question: Has this since been investigated and the cause for this enigmatic sawtooth crash resolved?

This, in fact, was little surprise to me. It only clearly indicated that whatever fusion that takes place between deuterium and tritium (with the release of binding energy) to produce the alpha particle, the very stability of the fuel particles up to and around a 100 million C, where they are expected to fuse, and even of the alpha particle produced, are doubtful, to say the least. (Their nuclear splitting and the consequent and instantaneous re-absorption of binding energy are seen in the crashing of the sawtooth!)
For more, please see section 'The Hard Evidence' in: www.sittampalam.net/ITER.Test.htm
Thank you all, and Cheers!

Report this comment Posted by: **Eugene Sittampalam** | 2010-11-16 08:21:35 PM

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