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New ITER Chief Aims to Get Some Financial Wiggle Room

by Daniel Clery on 19 November 2010, 2:38 PM | Permanent Link | 0 Comments

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Cost cutting has been the name of the game for Osamu Motojima since he took the reins of the ITER fusion reactor project, the world's most expensive science experiment, in July. On Wednesday and Thursday, at the first ITER Council meeting under his leadership, Motojima outlined his plans for keeping the project's cost in check after several years during which every cost estimate seemed to be larger than the previous one. "My responsibility as director-general is to complete construction within the [now] capped cost," Motojima told *Science* after the meeting. "Cost saving is very important."

Motojima described to the council, made up of delegates from the seven members of the project (China, the European Union, India, Japan, South Korea, Russia, and the United States), his specific plans to cut the costs of the reactor's components and streamline the project's organization. His aim is to create a larger contingency to deal with unforeseen problems, without increasing the project's technical risk. "This strategy and activity was approved by the ITER Council," Motojima says. Now over the next few months, he and ITER headquarters staff members have to work out in detail how to do it.

The aim of ITER is to show that, in theory, nuclei of deuterium and tritium (isotopes of hydrogen) can be fused in a searingly hot plasma at the heart of the reactor, thereby releasing large quantities of heat that could be used to generate power. But replicating the power source of the sun and stars in this way is immensely difficult because of the very high temperatures involved—hundreds of millions of degrees. It has taken researchers 60 years to get to this proof-of-principle stage. The payoff, however, would be huge because fusion fuel is abundant in seawater and the reactor would produce minimal radioactive waste.

Since the partners formally decided to go ahead with the project in 2005, it has not all been clear sailing. In part this is because initial cost estimates proved inaccurate and the projected overall price tag more than doubled, to about €16 billion. In July, the partners finally agreed on the project's "baseline," a lengthy document outlining its detailed design, cost, and schedule. At the same time they hired Motojima to get the reactor built on time and within budget.

Motojima says that the baseline caps the construction cost of the reactor at €7.3 billion, and within that there is €395 million in contingency. "This is not enough. Further cost containment is necessary," he says. To create another €111 million in savings, Motojima proposed to the council changes to the "in-kind" components that are being built and paid for by each member and then delivered to the reactor site at Cadarache in France for assembly.

Much of the savings will be in the superconducting cables that are wound into enormous magnetic coils to produce the powerful fields that hold the reactor's superhot plasma in place. Each of the reactor's toroidal field coils weighs as much as a fully laden jumbo jet, and there are 18 of them in total. In order to operate, the superconducting magnetic coils have to be cooled to temperatures just above absolute zero with liquid helium. Some ITER members wanted to reduce the risk of a fault in the coils by cooling each one to its operating temperature and testing it. But that would be a lengthy and expensive process involving a purpose-built facility.

Motojima is proposing to simplify this process. Rather than testing whole finished coils—at which point a fault would mean rejecting the whole thing—he proposes beefing up quality control in the cable manufacturing and then testing selected batches of cable down to 77 kelvin, achievable with liquid nitrogen, which is cheaper than helium. "Most important is the everyday quality control," he says.

More savings will be achieved by simplifying ITER's control, data access and communications system—essentially the brain and senses of the reactor.

Another issue Motojima has had to grapple with is whether or not to add another set of magnetic coils to the interior walls of the reactor to help control disturbances in the plasma called edge-localized modes (ELMs) that can damage the inside of the plasma vessel. A gentle magnetic field from these so-called ELM coils can keep the disturbances under control, but this discovery was made too late for the coils to be included in the original design. ITER managers had decided to put off making a decision about installing the coils for a couple of years, but Motojima concluded earlier this month that the uncertainty was harming the project. "My job is to reduce ambiguity," he says. So the coils will be included, at a cost of €51 million, which will be taken from savings he is making in other areas.

Motojima also won approval from the council for organizational changes he planned to make, aiming for additional savings of €61 million. On arriving at ITER, Motojima divided the staff into three departments: one responsible for building the reactor; another in charge of safety, security, and quality control; and a third handling administration. Administration is key, he says, because of the complexity of the project, in which one central body interacts with an organization in each of the seven members that is responsible for contracting with companies to make components. "Interfaces matter with all seven parties making components and interacting with headquarters and each other," Motojima says.

Motojima also asked the council to free him from the necessity to hire an equal number of staff from each member country. "I need to hire people according to their excellence and professionalism to complete this task," he says. "I need all staff to have high motivation and morale."