Tough Questions for ITER's New Director General, Bernard Bigot

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When ITER, the International Thermonuclear Experimental Reactor project, was launched in 1985, the plans called for a huge reactor that would demonstrate that the fusion of hydrogen atoms into helium atoms would be a source of unlimited energy. Its founding nations (Russia, the United States, Japan, and the EU (China and Korea subsequently joined the project in 2003, and India in 2005)) also hoped it would reduce drastically the problem of nuclear waste that plagues fission reactor projects.

The design approved in 1988 featured a tokamak in which huge superconducting magnets would trap an extremely hot plasma made of hydrogen atoms inside a toroidal steel vessel. Because of the vessel's size, scientists would be able to induce a fusion reaction that would yield up to 10 times as much energy as is injected in order to heat the plasma.

But that early promise quickly hit the cold reality that large-scale projects frequently encounter large-scale problems. The ITER project never enjoyed an easy life, especially when the United States withdrew its support in 1998, hopped in again in 2005, then drastically reduced its outlays for the project in 2008 (http://spectrum.ieee.org/energy/nuclear/does-fusion-have-a-future).

An external report in 2013 blamed a series of missed deadlines and cost overruns on the ITER organization's weak management of a decentralized organization. The total estimated cost for the project is now at €15 billion (about $16.5 billion), which is almost double the cost of CERN's Large Hadron Collider. Despite that level of government largesse, recent plans to achieve "first plasma" by 2020, and the first demonstration of energy production by 2027, are now being revised. A new schedule should be finalized by the end of the year.

So, what happens if the sponsors of the reactor, located in Cadarache in Southern France, decide to pull the plug? Contracts totaling €6.5 billion (about $7 billion)— €3.5 billion of which are for completing construction on the site—would be in limbo. The 500 contractors who now work on the building site would be out of work. So might the 600 staffers employed directly by ITER organization with its €275 million annual budget. According to ITER, 72 percent of these employees are engineers and scientists.

On 5 March, the ITER Council, in an extraordinary session, confirmed the appointment of Bernard Bigot as the Director General of ITER (http://www.iter.org/org/io/dg). Bigot, a physicist and chemist by training, has had a long career in research, but also as Chairman and CEO of the French Alternative Energies and Atomic Energy Commission (CEA) (http://www.cea.fr/english-portal). He takes over from Osamu Motojima, who started his term as head of ITER in July 2010. Bigot spoke to *IEEE Spectrum* last week; his comments have been abridged.

Spectrum: **On 5 March, you presented an action plan, proposing changes to the management of ITER. What are the specific problems that you are addressing?**

Bigot: What has plagued the ITER project so far is that we had no efficient decision process, caused by the fact that the ITER Organization and the seven domestic agencies did not operate as an integrated team. We have to make decisions every day, take financial decisions; we need to learn to work together. The question is not to 'control,' but the capacity to work together.

Spectrum: **What are the changes you proposed?**

Bigot: There are three important points. The first one is that the members, represented by the domestic agencies they have established, must consider it fully legitimate that the Director General is fully empowered to take any decision with eventual implications to the main interest of the project. The domestic agencies and the Central Team, here in France, worked quite independently, and I strongly believe that they should work closely together and be placed on an equal footing, and that we need someone who can arbitrate.

Secondly, we need to set up an organization in such a way that people feel associated with the decisions taken. We will set up an Executive Project Board that will be chaired by the DG, and in which the seven domestic agencies will be represented by their heads. In this way we can discuss issues and take decisions. Previously, representatives of the domestic agencies had also the rank of Deputy-Director General, confusing the technical role they had in the ITER Central Team and their responsibility in representing their own country. Now the Central team consists only of technical people, that way we simplify the process of diffusion and discussion.

My last point is that I will ask the ITER Council to provide the DG with a reserve fund that will be fully available to implement the technical decisions taken by the Executive Project Board. We are now in a new phase, starting with the assembly of the test reactor, and we have to operate as a single organization, despite the fact that the domestic agencies will continue as legally separate organizations.

Spectrum: **Past delays and mistrust of the technology have sometimes resulted in funding problems. Is outreach sufficient?**

Bigot: The questions are legitimate, and that is why we have to communicate. We have to answer these questions, and not only from the general public. A large part of my duties will be to keep in close touch with the members, with political leaders, congressmen, in such a way that they feel fully associated, fully understanding how we work, and what the possibilities of this technology are.

We have to demonstrate that we can deliver. ITER is not just a nice research project, it has to fulfill the expectation that in the long term fusion will be a reliable, sustainable, and environmentally friendly way to supply energy.

Spectrum: **What makes you optimistic that the ITER project will succeed in demonstrating this?**

Bigot: I have now visited several of the members, and I realize there are many issues to be addressed. So far we are moving in the right direction. The more we advance with the project, the more we see what the difficulties are and we address them, and we find solutions. For example, a few years ago we did not master the technology for producing superconducting coils required for the large magnets. We are now proceeding with the manufacture, and we're satisfied with the results.

And it is encouraging that some members are considering the next step, after ITER. China, with its large population, expects that fusion technology will be able to provide a share of their energy supplies some time this century. We view their own plans for fusion energy as an endorsement of ITER.

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