Fusion Quest Goes Forward

EMC2 Fusion's Richard Nebel says that after months of tweaking, the WB-7 device "runs like a top" - and he's hoping to get definitive answers about a technology that has tantalized grass-roots fusion fans for years.

by Alan Boyle, Cosmic Log, MSNBC, June 12, 2008

EMC2 Fusion's Richard Nebel can't say yet whether his team's garage-shop plasma experiment will lead to cheap, abundant fusion power. But he can say that after months of tweaking, the WB-7 device "runs like a top" - and he's hoping to get definitive answers about a technology that has tantalized grass-roots fusion fans for years.

With $1.8 million in backing from the U.S. Navy, Nebel and a handful of other researchers have been following up on studies conducted by the late physicist Robert Bussard before his death last October - studies that Bussard said promised a breakthrough in fusion energy.

Nebel, who is on leave from Los Alamos National Laboratory, picked up Bussard's mantle at Emc2 Fusion Development Corp. in Santa Fe, N.M., and is trying to duplicate the results that were reported from the last machine Bussard built. The WB-6 device supposedly worked by setting up a high-voltage electrical field that was configured in just the right way to get ions slamming into each other, creating a fusion-fueled plasma.

Unfortunately, WB-6 was destroyed during one of its last scheduled test runs in 2005, and Bussard was never able to build another device. Fortunately, Nebel's five-person team has succeeded in building a new, improved device on a shoestring budget.

A test plasma using helium glows inside the WB-7.

"We're kind of a combination of high tech and Home Depot, because a lot of this stuff we make ourselves," Nebel told me today. "We're operating out of a glorified garage, but it's appropriate for what we're doing."

The Emc2 team has been ramping up its tests over the past few months, with the aim of using WB-7 to verify Bussard's WB-6 results. Today, Nebel said he's confident that the answers will be forthcoming, one way or the other.

"We're fully operational and we're getting data," Nebel said. "The machine runs like a top. You can just sit there and take data all afternoon."

So was Bussard correct? Will it be worth putting hundreds of millions of dollars into a larger-scale demonstration project, to show that Bussard's Polywell concept could be a viable route to fusion power?

No Answers Just Yet

Nebel said it's way too early to talk about the answers to those questions. For one thing, it's up to the project's funders to assess the data. Toward that end, an independent panel of experts will be coming to Santa Fe this summer to review the WB-7 experiment, Nebel said.

"We're going to show them the whole thing, warts and all," he said.

Because of the complexity, it will take some interpretation to determine exactly how the experiment is turning out. "The answers are going to be kind of nuanced," Nebel said.

The experts' assessment will feed into the decision on whether to move forward with larger-scale tests. Nebel said he won't discuss the data publicly until his funders have made that decision.

For now, Nebel doesn't want to make a big deal out of what he and his colleagues are finding. He still remembers the controversy and the embarrassments that were generated by cold-fusion claims in 1989.

"All of us went through the cold-fusion experiences, and before we say too much about this, we want to have it peer-reviewed," he said.

At the same time, he can't resist talking about how well WB-7 is operating. "I've been very pleased, frankly, with the sorts of things we've been getting out of it," Nebel said.

High hopes for low-cost fusion
Nebel may be low-key about the experiment, but he has high hopes for Bussard's Polywell fusion concept. If it works the way Nebel hopes, the system could open the way for larger-scale, commercially viable fusion reactors and even new types of space propulsion systems.

"We're looking at power generation with this machine," Nebel said. "This machine is so inexpensive going into the 100-megawatt range that there's no compelling reason for not just doing it. We're trying to take bigger steps than you would with a conventional fusion machine."

Over the next decade, billions of dollars are due to be spent on the most conventional approach to nuclear fusion, which is based on a magnetic confinement device known as a tokamak. The $13 billion ITER experimental plasma project is just starting to take shape in France, and there's already talk that bigger budgets and longer timetables will be required.

If the Polywell system's worth is proven, that could provide a cheaper, faster route to the same goal - and that's why there's a groundswell of grass-roots interest in Nebel's progress. What's more, a large-scale Polywell device could use cleaner fusion fuels - for example, lunar helium-3, or hydrogen and boron ions. Nebel eventually hopes to make use of the hydrogen-boron combination, known as pB11 fusion.

"The reason that advanced fuels are so hard for conventional fusion machines is that you have to go to high temperatures," Nebel explained. "High temperatures are difficult on a conventional fusion machine. ... If you look at electrostatics, high temperatures aren't hard. High temperatures are high voltage."

Most researchers would see conventional tokamak machines as the safer route to commercial fusion power. There's a chance that Bussard's Polywell dream will prove illusory, due to scientific or engineering bugaboos yet to be revealed. But even though Nebel can't yet talk about the data, he's proud that he and his colleagues at Emc2 have gotten so far so quickly.

"By God, we built a laboratory and an experiment in nine months," he said, "and we're getting data out of it."