
Fusion We Can Believe In?



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Working on a shoestring budget, researchers have found no reason why a [low-cost approach to nuclear fusion](#) won't work.

President-elect Barack Obama's [pick for energy secretary](#) has said he's aware of the approach, known as inertial electrostatic confinement fusion or Polywell fusion - and although it's probably not on his radar screen right now, it just might show up in the future.

For decades, scientists have been trying to figure out how to harness the power of the nuclear reaction that sets the sun ablaze. Fusion involves smashing the nuclei of lighter elements together to produce heavier elements, plus an excess burst of energy. The sun turns hydrogen into helium. Thermonuclear bombs do something similar with different isotopes of hydrogen.

The mainstream approaches to commercial fusion would involve heating up plasma inside a doughnut-shaped magnetic bottle known as a tokamak, or using lasers to blast tiny bits of deuterium and tritium. The former approach is being followed for the [\\$13 billion international ITER project](#), and the latter would be used by multibillion-dollar experiments such as the [National Ignition Facility](#) in the U.S. or [HiPER](#) in Britain.

Then there's the \$1.8 million (yes, million) project that's just been wrapped up at [EMC2 Fusion Development Corp.](#) in Santa Fe, NM. The experiment, funded by the U.S. Navy, was aimed at verifying some interesting results that the late physicist Robert Bussard coaxed out of a high-voltage inertial electrostatic contraption known as WB-6. (The "WB" stands for Wiffle Ball, which describes the shape of the device and its magnetic field.)

An EMC2 team headed by Los Alamos researcher Richard Nebel (who's on leave from his federal lab job) picked up the baton from Bussard and tried to duplicate the results. The team has turned in its final report, and it's been double-checked by a peer-review panel, Nebel

told me today. Although he couldn't go into the details, he said the verdict was positive.

"There's nothing in there that suggests this will not work," Nebel said. "That's a very different statement from saying that it will work."

By and large, the EMC2 results fit Bussard's theoretical predictions, Nebel said. That could mean Polywell fusion would actually lead to a power-generating reaction. But based on the 10-month, shoestring-budget experiment, the team can't rule out the possibility that a different phenomenon is causing the observed effects.

"If you want to say something absolutely, you have to say there's no other explanation," Nebel said. The review board agreed with that conservative assessment, he said.

The good news, from Nebel's standpoint, is that the WB-7 experiment hasn't ruled out the possibility that Polywell fusion could actually serve as a low-cost, long-term energy solution. "If this thing was absolutely dead in the water, we would have found out," he said.

If Polywell pans out, nuclear fusion could be done more cheaply and more safely than it could ever be done in a tokamak or a laser blaster. The process might be able to produce power [without throwing off loads of radioactive byproducts](#). It might even use helium-3 mined from the moon. "We don't want to oversell this," Nebel said, "but this is pretty interesting stuff, and if it works, it's huge."

The idea is still way out of the mainstream, however. In his new book about the frustrating fusion quest, "[Sun in a Bottle](#)," Charles Seife says that WB-7 and similar contraptions, known generically as fusors, aren't good candidates for power-generating fusion — even though they've attracted "something of a cult following."

"The equations of plasma physics strongly imply that fusorlike devices are very unlikely ever to produce more energy than they consume," Seife writes. "Nature's in-

exorable energy-draining powers are too hard to overcome.”

Nebel is well aware of the naysayers. In fact, that’s one reason why he’s being so circumspect about the results of the WB-7 experiment. When I mentioned that he’d probably like to avoid the kind of controversy and embarrassment that came in the wake of 1989’s notorious [cold-fusion claims](#), Nebel laughed and added, “That’s well-put.”

Despite the skepticism, Nebel and his colleagues have already drawn up a plan for the next step: an 18-month program to build and test a larger fusor prototype. “We’re shopping that around inside the DOD [Department of Defense], and we’ll see what happens,” he said.

Nebel said some private-sector ventures are also interested in what EMC2 is up to, and that may suggest a backup plan in case the Pentagon isn’t interesting in following up on WB-7.

For the time being, Nebel said his five-person team is getting by on some small-scale contracts from the Defense Department ([including these three](#)). “I’ve got enough to cover the people we’ve got, and that’s about it,” he said. “What we’re doing with these contracts is trying to get prepared for the next step.”

He’s also waiting to see what the Obama administration will bring. Will the White House support EMC2’s low-cost, under-the-radar fusion research program alongside ITER and the National Ignition Facility? “We just don’t know,” Nebel said.

Stephen Chu

Physicist Steven Chu discusses “The Energy Problem and What We Can Do to Solve It” in a Google Tech Talk on February 28, 2007. He was asked about Robert Bussard’s fusion research at the 1:01:30 mark. This month President-elect Barack Obama selected Chu to become energy secretary.

Obama’s team has at least one person who knows about Polywell fusion: Nobel-winning physicist Steven Chu, who will be taking over the Energy Department. A year and a half ago, Chu [gave a talk at Google](#) about future power sources and was asked about the technology (about 61 minutes into the YouTube video).

Chu responded that he had been discussing the concept with the folks at Google. “So far, there’s not enough information so [that] I can give an evaluation of the probability that it might work or not,” he said. “But I’m trying to get more information.”

If Chu is still interested in more information, Nebel is in a position to tell him about it.

Talk Polywell

For even more information, check out the [Talk-Polywell discussion forum](#) and Mark Simon’s [IEC Fusion Technology](#) blog. Special thanks to Simon and his Polywell pals for pointing to Chu’s YouTube video and the online book “[Amateur Nuclear Fusion](#).”

Previous Cosmic Log Fusion Items

Here are previous Cosmic Log items about the fusion quest:

- [February 17, 2004: The facts about fusion](#)
- [June 27, 2007: Inside fusion’s fortress](#)
- [June 28, 2007: How far away is fusion?](#)
- [January 9, 2008: Strange science takes time](#)
- [April 2, 2008: America’s fusion future](#)
- [May 2, 2008: The far-off fusion race](#)
- [June 12, 2008: Fusion quest goes forward](#)
- [August 28, 2008: Fusion effort in flux](#)
- [October 20, 2008: Fusion projects hang in limbo](#)