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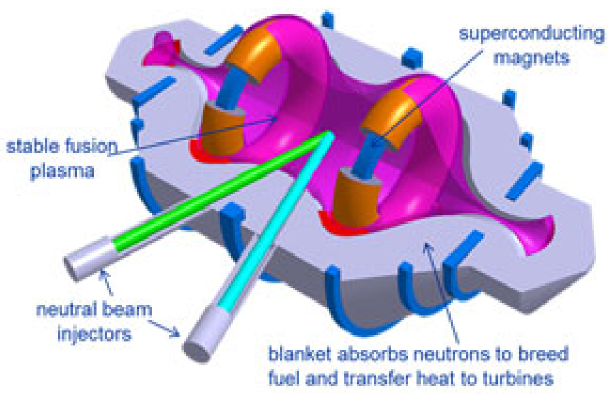
Lockheed Martin Claims Sustainable Fusion Is Within Its Grasp

By **Wayne Rash** | Posted 2015-03-04



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Imagine a source of electrical power that uses water for fuel, produces byproducts that are totally safe and releases no air pollution.

Then imagine that once it's up and running, it'll be so portable that an entire power plant could fit into the cargo hold of an airplane. Now, imagine that it'll be running in prototype form in five years and operating commercially in ten.

It sounds like science fiction, but it's not. However, it is being built by a group of scientists and engineers in a place that's legendary for doing what was thought to be impossible in a remarkably short amount of time. This place, which is part of Lockheed Martin's aeronautics business, is popularly known as the Skunk Works.

This is the same Skunk Works created by the near-mythical Kelly Johnson, an aerospace engineer able to head teams that built the SR-71 Blackbird reconnaissance jet years before any other organization even thought Mach-3 flight was possible.

The Skunk Works, which was started during World War II, has created some of the most iconic aircraft ever built, ranging from the then-revolutionary P-38 fighter to the high-altitude U2 reconnaissance. Current projects include the Falcon HTV-2 hypersonic aircraft, which flies at a top speed of 13,000 miles per hour, fast enough to take it from New York to Los Angeles in 12 minutes.

The Skunk Works is able to create its ground-breaking technological advances through a combination of rapid prototyping, appropriate scalability, and a management environment that fosters innovation without traditional limits. One other feature of the Skunk Works is its practice of being very quiet about its work until it reaches a point at which the group is certain that its project actually works.

This is why the Skunk Works and its new Compact Fusion project have the potential to be so revolutionary—by succeeding where so many other efforts have fallen short after more than a half-century of research.

Yes it's true that such claims have been made and debunked before. Many people remember when a pair of electrochemists, Martin Fleischmann and Stanly Pons claimed in 1989 that they had discovered "cold fusion," a way to make hydrogen atoms fuse at room temperatures and pressures. The researchers' claims were soon rejected by other scientists who couldn't repeat the experimental results that Fleischmann and Pons reported.

The U.S. government has funded fusion research projects for decades without producing the design of an economical fusion reactor.

Unlike earlier fusion projects, this effort has the results of all that research behind it as well as the Skunk Works' physics and engineering know-how to create a working prototype. The Lockheed Martin project is designed to take advantage of the practice of rapid prototyping that the Skunk Works pioneered by building relatively small, easily improved incremental projects that lead to a finished product that actually works.

Those relatively small projects also mean that each iteration is built quickly by relatively few people. Because it can be done quickly, the rapid development also means that choices can be less conservative; they can cost less and alternatives are easier to develop. This rapid progress provides a sort of developmental momentum that helps propel innovation.

The Compact Fusion reactor makes use of a magnetic bottle created by superconducting magnets to contain the temperatures that can reach hundreds of millions of degrees. This magnetic bottle can then release some of the heat so that it can be used for power generation.

Editor's Note: This article was updated to reflect that the U2 reconnaissance aircraft, not the B2 "flying Wing" bomber, was developed by Lockheed.

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The fusion is powered by a combination of two isotopes of Hydrogen, Deuterium and Tritium, both of which occur in nature and which can be extracted from water. "Our studies show that a 100 MW system would only burn less than 20 kg of fuel in an entire year of operation," a Lockheed Martin spokesperson told *eWEEK*. "Tritium fuel is continually bred within the reactor wall and fed back into the reactor along with deuterium gas to sustain the reactions."

In other words, the fusion reactor creates most of its own fuel as part of its operation. The Deuterium gas is simply a normal hydrogen atom with an extra neutron, creating what is sometimes called "heavy hydrogen." Deuterium can be extracted from the hydrogen obtained from electrolysis of water. This may sound complicated, but it's a process that has been routinely performed in college physics projects.

While the fusion reactor does create a radioactive byproduct, it's recycled for use in the reactor itself.

There is no radioactive waste problem such as exists with nuclear fission power plants. "The waste footprint is orders of magnitude less than coal plants which require huge landfills to contain the toxic ash and sludge wastes," the spokesperson said in an email.

"A typical coal plant generates over 100,000 tons of ash and sludge containing toxic metals and chemicals each year. The first generation of fusion reactors will run on Deuterium-Tritium fuel, but successive generations would use fuels that could eliminate the radioactivity altogether," she said.

Currently Lockheed Martin is in the process of testing a magnetic confinement bottle, where the Skunk Works team has apparently made significant progress. In terms of how a fusion reactor would be created, the magnetic bottle is the primary hurdle.

If that's accomplished successfully most of the science and engineering is known. However, that doesn't mean that building the prototype fusion reactor is a done deal. Lockheed Martin is looking for industry partners to help develop the Compact Fusion reactor into a real product.

The goal is to create a fusion reactor that can generate heat to use in existing power plants, where the reactor would replace existing fossil fuel combustion. This means that existing power generation and distribution infrastructure would be retained, which will dramatically reduce the cost of implementation and dramatically speed up deployment.

The existence of cheap, portable power will transform the world in many ways. A statement from the company envisions ships and aircraft with unlimited range, spacecraft that could reduce the travel time to Mars to less than a month.

Perhaps most important to the most people, it could bring vast amounts of power to anywhere on earth, providing among other things economical water desalination to developing regions of the globe, which are not only poor, but short of clean water, by removing energy scarcity as an insurmountable problem.

If Lockheed Martin can pull this off, and given the reputation of the Skunk Works for routinely doing the impossible, I suspect it will, the results will be transformative.

While it doesn't mean free energy, it does mean that the cost of nearly unlimited energy is very low, and with unlimited energy, there's no end to what can be accomplished. To say that the Skunk Works is on the verge of changing the world is an understatement. This development could well define the future.