

# FUEL CELLS FOR DRONES

# Longer-Lasting Drones Powered by Fuel Cells

**The enhanced Stalker XE 240 can stay in the air four times longer than its petroleum-burning counterpart, thanks to a small propane fuel cell.**

image

By [David Hambling](#)

image

**The small drone looks like an ordinary [Stalker](#)**, the 10-foot hand-launched craft by Lockheed Martin that Marines and Special Forces use for tactical reconnaissance. The difference is endurance. Where the conventional version can fly for 2 hours at a time, the enhanced Stalker XE 240 stays aloft for 8 hours at a stretch because it draws its power from a fuel cell—a major improvement that could pave the way for longer-lasting drones providing continual surveillance.

Michael Hansberry, unmanned-aircraft-systems engineer at [U.S. Marine Corps Warfighting Laboratory](#) (MCWL) in Quantico, Va., describes the Stalker as basically a powered glider, built for endurance rather than speed. The XE version includes improvements such as a bigger wingspan (12 feet) and a more aerodynamic fuselage. But the key to its extended endurance is replacing the lithium-ion batteries with a new fuel cell.

Fuel cells, which convert energy from a chemical reaction into electricity, can provide far more power than lithium-ion batteries. The beating heart of the enhanced drone is a D245XR solid-oxide fuel cell, made by AMI's Ultra Electronics in Ann Arbor, Mich., that uses the catalytic oxidation of propane fuel. It is one of the smallest fuel cells commercially available, weighing just over 5 pounds, and burning propane fuel at 800 degrees centigrade. The exhaust is warm, says Hansberry, but the fuel cell is so well-insulated that it does not heat the electronics around it.

The fuel cell has a nominal output of 245 watts when burning 112 grams of propane an hour. The Marines have a scrubber to remove the odor (added to domestic propane for safety reasons) and other contaminants from commercial-grade propane so they can use it. Dirty propane would gradually degrade the fuel cell and reduce its ability to generate power; the scrubber lets the Marines use propane from any source. And because countries around the world use propane for cooking and heating, DARPA figures supply should not be a problem.

The Stalker's two main missions are ISR (Intelligence, Surveillance, and Reconnaissance) and communications relay. In its ISR role, it typically flies at 1200 feet. That's high enough to be silent and difficult to spot from below, but low enough that its camera can see the ground in some detail. "At that altitude [1200 ft] you can tell a man carrying a rifle from a man carrying a broom," Hansberry says.

When acting as a relay, the Stalker can extend the range of tactical radios and other devices that may otherwise be limited to line-of-sight. Each drone is a node that has a range of about 4

miles to the next node, so with additional drones or ground stations, communications can travel greater distances.

The MCWL is also fitting the Stalker with a synthetic aperture radar. Previously, only a much larger aircraft such as the Predator could carry this tool, but the new miniature radar weighs just a couple of pounds. When matched with the endurance of the Stalker XE, this lightweight sensor can produce a map of the surface texture of the ground over a wide area. When the radar sweeps the same area a second time, change-detection software could determine whether anything is different; it could spot where dirt has been disturbed, the telltale sign of a newly buried IED.

## **Longer-Lasting Drones**

Endurance is currently a big limitation for small drones. But the Stalker is not the first fuel-cell drone. The U.S. Air Force has been experimenting with a Puma drone, similar in size to the Stalker, which uses a Protonex fuel cell that runs on hydrogen. It has achieved an endurance of 7 hours. Meanwhile the Navy has their own project called [Ion Tiger](#), which also uses a Protonex hydrogen fuel cell. In one test this custom-built drone flew for 23 hours.

Nor is the effort confined to the U.S. A company from Singapore, Horizon Energy Systems, has developed a hydrogen-fuel-cell power system called AEROPAK, specifically intended to replace batteries on small drones and quadruple their endurance. And last year Liaoning General Aviation Institute in China flew [Thunderbird](#), its first unmanned aircraft powered by a hydrogen fuel cell.

However, the fuel cell is not the only way to increase a drone's endurance. Last year [LaserMotive demonstrated](#) a Stalker fitted with a power system to recharge the battery using a laser on the ground. This allowed the Stalker to keep flying for 48 hours nonstop. Of course, it relies on having a ground station with a laser handy—but for communications relay or to provide aerial cover over a base, it has potential.

In the shorter term Hansberry says he hopes to have the Stalker XE in the hands of Marines next year for a series of exercises called the Advanced Warfighting Experiment. If it performs well, and if there is a demand, Stalker XE will then be able to move into the procurement process.

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But now manufacturers are getting ready to replace those with more efficient and longer-lasting hydrogen fuel cells in a bid to accelerate the mainstream commercial adoption of drones — also ...

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In an article titled “Longer-Lasting Drones Powered by Fuel Cells” , Popular Mechanics magazine talks about the military’s use of AMI’s fuel cells to power UAVs.

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### **[Popular Mechanics Reports on AMI fuel cell in Stalker XE ...](#)**

In an article titled “Longer-Lasting Drones Powered by Fuel Cells”, Popular Mechanics magazine talks about the military’s use of AMI’s fuel cells to power UAVs. The article says that thanks to the fuel cell, the Lockheed-Martin Stalker XE 240 “stays aloft for 8 hours at a stretch... a

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Likewise, a team of researchers at the University of Sydney have worked to improve the flexibility and robustness of hydrogen fuel cell-based hybrid power systems in drones. Lead researcher, Andrew Gong told DroneLife : “Hydrogen power provides much greater range and endurance compared to existing small electric unmanned aircraft.

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