

## Horizon Fuel Cell Powers New World Record in UAV Flight

- Small unmanned hydrogen fuel cell aircraft flies 78 miles, exceeding previous micro-UAV distance record by 50%
- Upcoming flight expected to set a new flight endurance world-record of 16 hours for small UAVs
- Horizon to incorporate Millennium Cell Hydrogen on Demand® in future UAV systems

**November 1, 2007**, [Horizon Fuel Cell Technologies](#) of Singapore announced today that a new hydrogen fuel cell propulsion system it designed enabled a small unmanned aerial vehicle (UAV) flight which was 50% longer than the previous distance record for micro UAV's. The fuel cell integrated micro UAV, which was designed by two leading U.S. aerospace research laboratories and supported by NASA, the Dryden Flight Research Center, the U.S. Air Force Office of Scientific Research and the National Science Foundation, set a new micro-UAV flight distance record of 78 miles (128 km) in Lancaster, California ([video](#)), exceeding by 28 miles (40 km) the previous record set in 2006 in Estonia. Even more significant is that this flight record was achieved using only 25% of the hydrogen tank capacity stored on-board the aircraft. On a full tank of fuel, the aircraft's flying range is 500 km (310 miles), enabling flights that are several times longer than previously recorded.

Horizon's new ultra-compact hydrogen fuel cell propulsion system creates high-efficiency electrical power by reacting hydrogen and oxygen from the air without combustion. Fuel cells enable longer flight times, quieter operation, less heat signature, and higher reliability than batteries or other methods of propulsion for many UAV's. So far however, very few fuel cell systems have been able to meet the extremely stringent size and weight requirements of UAVs. At over 480 Watt hours per kilogram, or 2.6 times the energy density of the best available batteries. Additionally, Horizon offers the best known system power and energy density specifications in a fuel cell based propulsion system, which can greatly extend the flight range of existing small UAV's.

The UAV project named "**Pterosoar**," was the result of a joint-effort led by Principal Investigators Dr. Maj Mirmirani, Dean of the Mechanical Engineering Department at California State University of Los Angeles (fuel cell system testing and integration); Dr Andy Arena of Oklahoma State University Aerospace Engineering Laboratory (fuel cell aircraft development); Horizon Fuel Cell Technologies (fuel cell system); and Temasek Polytechnic of Singapore (system control electronics). The name "Pterosoar" was adopted and adapted because the nose of the aircraft includes some fuel cell cooling scoops that make the airplane resemble a class of prehistoric creatures named Pterosaurs.

Members of the Pterosoar team included Christopher Herwerth of Calstate LA's Multidisciplinary Flight Dynamics Laboratory, who started working on fuel cell flight as early as 2005, and achieved a successful [Horizon-powered test-flight](#) as early as August 2006 ([video](#)). This time, the new distance record was achieved using a fully integrated fuel cell aircraft designed by the OSU Aerospace Engineering Laboratory, which presented the additional challenge of weighing 10.2 lbs (5kg), including hydrogen and fuel cells. In the next few weeks,



the same aircraft is expected to exceed 15.5 hours of flight, setting a new world endurance record for small-size unmanned planes.

Horizon's fuel cell capability was also demonstrated earlier this year as it powered the 200km/h [Hyfish jet-wing UAV](#) designed by [Smartfish GmbH](#) in Switzerland and integrated by the German Air & Space Institute (DLR) ([Video](#)). This program is unrelated to the micro-UAV flight discussed above, offered a glimpse of Horizon's potential to break new ground in the pioneering field of aerospace.

While these achievements are significant milestones for the aerospace sector, further performance improvements are on the way. George Gu, CEO of Horizon Fuel Cell comments "Due to our best in class fuel cell power density, we have been able to dedicate approximately 80% of the total power system volume to hydrogen storage using pre-filled pressurized hydrogen tanks to achieve record breaking results. However, we plan to employ more advanced forms of hydrogen storage based on [Millennium Cell's](#) (NASDAQ: MCEL) Hydrogen on Demand® technology." Using such novel fuel storage technology will significantly reduce the size of Horizon's current power system, while allowing best in class flight times for fuel cell powered small UAV's.

Recently, Horizon and Millennium Cell announced a [joint venture](#) to develop, manufacture and market a number of new products combining Millennium's ready-to-use Hydrogen on Demand® cartridges and Horizon's compact fuel cells. Unlike other developments in consumer and portable power markets (see [Horizon's new website](#)), both companies have so far been working separately to address the UAV market, which is estimated to reach \$54 Billion over the next 10 years, according to a [recent Teal Group report](#). Today, both companies believe the combination of these complementary high performance solutions will create the world's highest energy density, self-contained fuel cell power systems, able to meet the requirements of the most demanding UAVs.

***About Horizon Fuel Cell Technologies Pte Ltd [Visit our new website!](#)***

*Thinking big, yet starting small, Horizon was founded in Singapore in 2003. The award-winning company pioneered the sales of next-generation fuel cell power products starting with small consumer products, while developing larger-scale clean power solutions for larger-size applications such as portable power, transportation and aerospace. With comprehensive technological developments focused on enabling fuel cell commercialization, Horizon is the first company to bring advanced fuel cell technology out of the laboratories and into numerous commercial markets today. For more information, visit <http://www.horizonfuelcell.com>.*

***About Millennium Cell***

*Millennium Cell is a leader in the development of hydrogen battery technology used to power portable applications. Through its proprietary Hydrogen on Demand® fuel cartridges and PowerSkin™ fuel cell modules, the Company provides increased energy density resulting in longer runtime and lighter weight in a compact space. For more information, visit <http://www.millenniumcell.com>*