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Fuel cells in unmanned aircraft

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Fuel Cells in Unmanned Aircraft



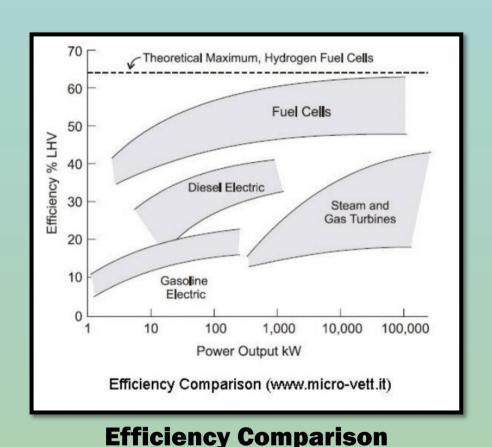
Overview:

This project investigates the implementation of a fuel cell into a small unmanned aerial vehicle. Small model aircraft are used around the world by hobbyists for pleasure and creating home videos. Currently these aircraft are a excellent solution for many commercial

applications; land surveying, search and rescue, police surveillance, border control and recently in the news for the Army. However, these aircraft can only fly for a fraction of an hour, and then require a length battery recharge, or for many spare batteries to be carried.

A fuel cell offers a far greater endurance than any battery whilst still maintaining low weight. It is anticipated that a fuel cell for the aircraft in this project will last for six to ten hours, and is very quick and easy to refuel, and requires no recharging at all.

- A typical commercial off the shelf remote controlled plane, running on a lithium polymer battery, has an endurance of 20mins.
- Mounting a downwards facing camera gives a surveying potential of 0.26km².
- A very small fuel cell may be capable of operating for 2 hours. This would increase this effective area to 2.74km².



Traighuain

Survey Area at 52mph at 200ft, 2cm Resolution

The Problem

Platform

Testing

- Several aircraft have been tested for suitability and power consumption.
- The Squall, high performance advanced aerobat in cruise has a power to weight of 245 Wkg⁻¹.
- The F-27Q Stryker, good all-round aerobat, 175 Wkg⁻¹.
- The Skywalker X8 has a large payload with large internal volume, 642 Wkg⁻¹.





Squall Ducted Fan

F-27Q Stryker



Skywalker X8 (LU-X8SH)

The Aircraft



Field Testing LU-X8SH

 SIMULINK and MATLAB allow the system to be fully modelled on a computer (eventually!)

algorithms Control can



Scan to watch



the flight

Doctoral Training Centre for Hydrogen Fuel Cells and their Applications

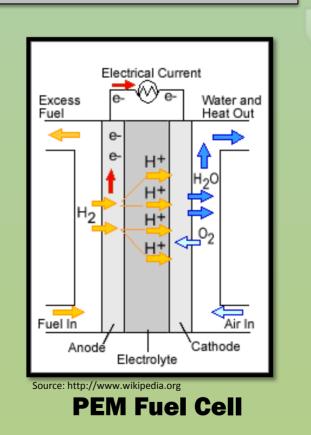
designed and tested on the PC.

- A fuel cell doesn't provide enough burst power for take-off or go-arounds. (1.8kW)
- Combining a small battery with the fuel cell solves this problem.
- Using the battery for take-off, the fuel cell for cruise. (~120W)
- The battery can be recharged in flight by the fuel cell.



Horizon H-100 PEM Fuel Cell Installed

The Fuel Cell



CO2 & H20 Fuel In H20 Annode Electrolyte Current Cathode Oxygen Excess Air Out

> • Proton Exchange Membrane Fuel Cells run on pure hydrogen.

Solid Oxide Fuel Cell



SOFC Micro Tubes

- Solid Oxide Fuel Cells can light any hydrocarbon (e.g. propane).
- A SOFC with low pressure propane (e.g. camping gas) will be implemented into platform aircraft.

Future:

- Obtain a Solid Oxide micro tubular fuel cell from the University of Birmingham
- Complete a full power system model on SIMULINK.
- Develop a plug-and-play hardware platform to accept different fuel cell types to test a multitude of hardware.
- Develop control algorithms for power switching and monitoring using autopilot information for optimisation.
- · Fly Loughborough's first ever fuel cell unmanned aircraft!

