Kenyalang-1, the first fuel cell powered aircraft in Southeast Asia
Written by:
Prof Madya Dr. Thomas A. Ward, Kenyalang UAV Project Leader

Kenyalang-1 ("Hornbill-1") UiTM Fuel Cell Powered Aircraft

On 21 October 2009, our Kenyalang Fuel Cell Aircraft Research Team which is part of the Flight Technology and Test Center (FTTC) made history by flying the first hydrogen fuel cell airplane ever designed and built in Southeast Asia. In this first flight, the motor was powered by a 500 W Horizon polymer electrolyte membrane (PEM) hydrogen fuel cell. In subsequent flights we have been able to lift a modified (heavier) aircraft with a hybrid power system. In the hybrid system the fuel cell is boosted (7.4 volts) by a 2-cell lithium polymer (LiPo) battery during take-off. We have flown the aircraft many times now. Although our longest flight duration was 10 minutes (on 22 June 2010), we are capable of flying at full power for nearly one hour using our 1.1 liter (30 MPa) hydrogen tank.

Unmanned air vehicles (UAV) have proven themselves as reliable assets in accomplishing remote sensing, military reconnaissance, and telecommunication missions. Since their inception over thirty years ago, most UAVs rely on combustion engines. However, the harmful health and environmental effects of combustion emissions has created a global demand to transition to alternative “green” power sources. This has caused a great interest in PEM fuel cells because they exhaust only water vapor. Unlike a combustion engine, a fuel cell does not use chemical combustion of fuel to release heat. A fuel cell transforms the chemical energy stored
in a fuel into direct-current (DC) electricity by breaking molecular bonds. It does this in a single step without the need for moving parts (solid state), therefore it is very rugged and reliable. For these reasons, PEM fuel cells are attractive power generators for long-endurance UAV because of their high efficiency, high specific energy, quietness, reliability, low temperature, and ability to be recharged.

The Kenyalang-1 UAV was built as a technology demonstrator. It is fully telemetered with a GPS, pitot tube (velocity), altimeter, g-force sensors, temperature sensors (monitoring both the fuel cell and motor), electrical output (voltage and current), motor shaft rotational speed, and an onboard video camera. Analysis of this recorded flight data is enabling us to begin work on a more optimized future design. Our objective for this new Kenyalang-2 design is to create an operational prototype for commercial remote-sensing missions.
Onboard Video of Traffic on the ELITE Motorway – 22 June flight

[Kenyalang UAV faculty team members: (FKM) Prof Madya Dr. Thomas A. Ward, Datuk Prof Ir. Dr. Ow Chee Sheng, Prof. Dr. Wahyu Kuntjoro, Prof. Madya Nor’Aini Wahab, and Balijit Singh; (FKE) Prof Madya Ahmad Maliki and Syed Mutalib Aljunid; Postgraduate students: Norhisyam bin Jenal, Noor Idayu binta Mohd Tahir, and Mohd Izmir bin Yamin] *This work was originally funded by a research grant from the Malaysian Ministry of Science, Technology, and Innovation (MOSTI).*