



## INFORMATION

# **ENvironmentally Friendly Inter City Aircraft powered by Fuel Cells (ENFICA-FC).**

The **ENFICA-FC** project led by Politecnico di Torino and comprising 11 partners has been selected for co-funding by the European Commission in the Aeronautics and Space priority of the Sixth Framework Programme (FP6).

The main objective of the **ENFICA-FC** project is to **develop and validate the use of a fuel cell based power system for the propulsion of more/all electric aircraft**. The fuel cell system will be installed in a selected aircraft which will be flight and performance tested as a proof of functionality and future applicability for inter city aircraft.

**Through this project, the research and industrial Consortium partners will focus on developing and providing operational zero-pollution solutions to the immediate needs of aircraft services.**

**The project will bring together key industrial and academic players in the design and development and validation of intercity aircraft together with fuel cell expertise for propulsion systems and hydrogen storage. The overall budget is 4.5 M€, of which 2.9 M€ will be funded by the European Commission.**

Hydrogen and fuel cell power technologies have now reached the point where they can be exploited to initiate a new era of propulsion systems for **light aircraft** and **small commuter aircraft**. In addition, these technologies can also be developed for the future replacement of on-board electrical systems in larger 'more-electric' or 'all-electric' aircraft.

The primary advantages of deploying these technologies are **low noise and low emissions** – features which are particularly important for commuter airplanes that usually takeoff and land from urban areas. The possibility to takeoff and land without contravening the **noise abatement regulations** set for small airfields, in urban areas and near population centres, will allow the use of these airfields during the late night hours when the noise abatement regulations are even more stringent.

**No other Project funded by The European Commission** promises such ambitious results which will be presented at both an on-ground public event and at an in-flight public event within the scheduled time.

Within the course of the 3 years **ENFICA-FC** project, which was launched on the 1st of October 2006, two key objectives will be realised:

**1) A feasibility study** will be carried out to provide a preliminary definition of new forms of aircraft power systems that can be provided by fuel cell technologies (Auxiliar Power Unit, Primary electrical generation supply, Emergency electrical power supply, Landing gear, De-



icing system, etc); also Safety, certification & maintenance concepts shall be defined as well as a Life Cycle Cost evaluation.

In defining the Inter-City aircraft systems that can be powered by fuel cell technologies, the feasibility study will take into account the performance improvements of future generation fuel-cells and will thereby show the technical (and performance) advantages that could be obtained in contrast to existing conventional systems.

In addition, the feasibility of an **all-electric propulsion inter-city aircraft** (10-15 seat), completely powered by fuel cells, will be studied in order to assess the impact that a more silent and less polluting aircraft will have in being able to takeoff and land from congested urban areas using short airfields.

**2) By the end of the project an electric-motor-driven two-seat airplane powered by fuel cells will be developed and validated by flight-test at a public event.**

An existing and certified high efficiency two-seat aircraft design will be used. The fuel cell system and the electric motor will be integrated on board; the flight control system will also be converted into an electric system.

- A fuel cell unit and a high efficiency brushless electric motors and power electronics apparatus for their control shall be designed, built and tested in laboratory prior to installation on board for flight;
- Efficiency greater than 90% would be obtained by an optimised aerodynamic propeller design and the flight mechanics study of the new aircraft will be carried out to verify the new flight performance.
- Flight testing of the aircraft capable of remaining aloft for one hour will be a major goal of the project to validate the overall high performance of an all electric aircraft system.

The ENFICA-FC consortium, led and coordinated by Politecnico di Torino, consists of 11 partners representing the whole value chain with Aircraft manufacturers (IAI, Evекtor and Jihlavan Airplanes), Fuel cells Power system producer (Intelligent Energy), Hydrogen distribution (Air Product), Research Institutes (Brno University of Technology, Politecnico di Torino and Université Libre de Bruxelles) as well as Small Medium Enterprise in the field of electric and electronic equipment (Enigmatec and Infocosmos).

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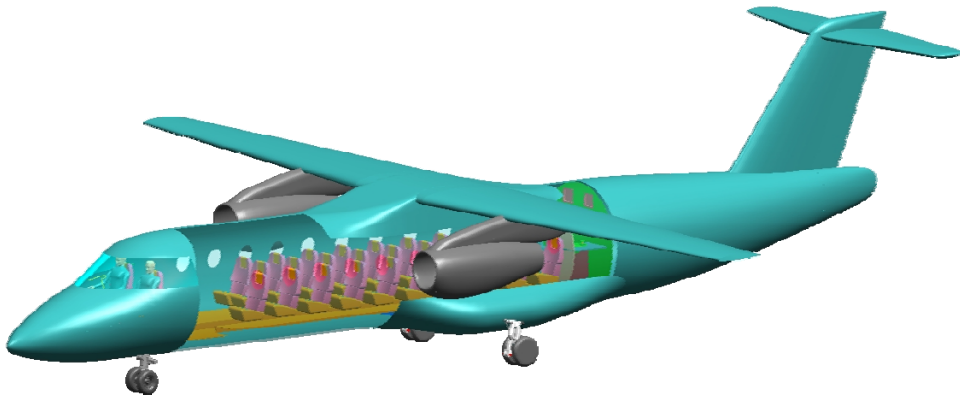
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### ENFICA-FC consortium

| Participant name   | Country        | Domain of activity  |
|--|----------------|---|
| <b>Politecnico di Torino</b><br>(Turin Polytechnic University) | Italy          | Design of Airplane, Aerodynamics and Structural Analysis, Manufacturing of Solar powered UAV. Study of electric machines and power electronics devices. Fuel Cell Energy system   |
| <b>METEC</b>   | Italy          | Service and Engineering Company specialized in the management and coordination of R&D Projects  |
| <b>Israel Aircraft Industries (IAI)</b>                        | Israel         | Design, integration, manufacturing and certification of family of business jet.   |
| <b>Intelligent Energy (IE)</b>                                 | United Kingdom | Design, development, and systems engineering of PEM fuel cell power systems, including fuel cell stacks and the associated balance of plant, for stationary, portable and motive applications; plus the production of fuel processing, desulphurisation and hydrogen generation technologies. |
| <b>Brno University of Technology (BUT)</b>                     | Czech Republic | Design of Airplane, Aerodynamics and Structural Analysis (especially FEM stress calculations for design and optimization). Flight and ground tests of aircraft structures.  |
| <b>Evektor (EVE)</b>   | Czech Republic | Design of aeroplanes and their systems, production of General Aviation airplanes  |
| <b>Jihlavan Airplane (JA)</b>                                  | Czech Republic | Production of small General Aviation airplanes. Producer of aircraft systems.   |
| <b>UNIV. PISA</b>  | Italy          | Management of activity.. Design of. power management unit , electrical system and actuators.  |
| <b>Air Products (APL)</b>                                      | United Kingdom | Global leader in hydrogen production, distribution and supply   |
| <b>Université Libre de Bruxelles (ULB)</b>                     | Belgium        | Aircraft and UAV propulsion - System studies on integration of propulsion and energy storage elements in the vehicles - PEM Fuel Cells  |

## IAI Small Commuter Jet (20 PAX)



## EVEKTOR EV55



## JIHLAVAN Airplanes RAPID 200 (RAPID KP-2U)



## JHLAVAN Airplanes RAPID 200 (RAPID KP-2U)



## Intelligent Energy - PEM fuel cell stack

