

## INFORMATION

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## RAPID 200-FC.

**The first Italian and European Commission funded Aircraft powered by a Hydrogen Fuel Cell is ready for flight.**

The first high speed taxiing tests were successfully carried out on the *Rapid 200-FC* "zero emission" aircraft between 10 and 18 December of last year. The next step for the European team, coordinated by Professor Giulio Romeo of the Department of Aerospace Engineering at the Politecnico di Torino, will involve obtaining the flight permit from the aeronautical authorities and then conducting the first test flight. The aircraft has an entirely electric 40 kW propeller: power is supplied to the propeller through 20 kW hydrogen gas fuel cells. In order to guarantee absolute safety of the operations, the aeroplane also has a second source of energy that consists of a set of 20 kW lithium polymer batteries which are able to guarantee alternative or supplementary power during take off and initial climbing.

The electric engine is fed through the generation of high energy currents in an ionization and hydrogen re-combination system (PEM) which has a final product of 100-110 Amps of electrical current at 200-240 V, plus air and water vapours emitted at environmental temperature.

The aircraft and the electric and energy system have been developed, according to a design by Professor Romeo, and tuned by the team which consists of the 10 companies and enterprises involved in the European Community "ENFICA-FC" project (**Environmentally Friendly Inter City Aircraft powered by Fuel Cells**). The team is made up of the Politecnico di Torino (IT) (Design of the modified aircraft and experimental test flights), Skyleader (CZ) (constructor of the aircraft), Intelligent Energy (UK) (designer and constructor of the hydrogen fuel cells), APL (UK) (in charge of the tanks and supply of the high pressure hydrogen), Mavel Elettronica (IT) (designer and constructor of the inverter and electronic control of the power) and the University of Pisa (IT) (laboratory tests on the electric system).



The exceptional and sophisticated power electronics system was specifically developed by Mavel to guarantee the supply of the 40 kW of power necessary for take off while satisfying the difficult requirement of limiting weights (less than 15kg) and encumbrance so that it could be installed on the airplane.

The ENFICA-FC project was chosen by the aeronautical and space planning committee from among hundreds of other programmes presented. The overall cost of the project is 4.5 million Euros of which 2.9 million Euros is financed, for the first time in Europe, with public funds allocated by the European Commission.

Summarising, Romeo says that "... the objective is that of building an aeroplane that works on hydrogen, taking advantage of the "fuel cell" technology at present available to create a demonstrator aircraft that is able to connect cities through flights while totally eliminating the environmental impact. The work plan financed by the EC is divided into two stages: modification of a light-weight two-seater airplane with an electric engine completely supplied by hydrogen; the test flights on this are aimed at identifying the technical advantages and improvements in performance obtained with

the new generation electrical energy. At the same time, more theoretical type studies have been carried out (in collaboration with the Israel Aircraft Industry, Université Libre de Bruxelles and Evektor (CZ) partners). These will not have an immediate practical application in the initial stages because of the present technological limits, but have the aim of using zero emission propellers in the future to equip aircraft for 20-30 passengers in the regional and intercity sector”.

Commander Marco Locatelli, to whom the test flights have been entrusted, has underlined that a maximum velocity of 120 km/h has been reached, that the maximum internal temperatures of the electric system do not reach 60° C at maximum power and that the only fluid in the fuel cell supply circuit are the 8 litres of distilled water contained in the tank on the right wing.

The   <sup>FC</sup> project, which began in 2006, foresees finishing positively with the final test flights in the months of February and March 2010; for this reason, the Politecnico di Torino research group, headed by Professor Romeo (Engineers Fabio Borrello, Gabriel Correa and Marco Pacino), has been offered hospitality at the Reggio Emilio airport.

The entire electric and energy system underwent intensive laboratory testing on a bench model in the first six months of 2009, in collaboration with the Department of Electrical Systems and Automation at the University of Pisa. The starting up, functioning under power and taxiing tests of the aircraft with its definitive propeller have instead been carried out along the 1400 metre runway at the Reggio Emilia airport over the last few weeks. The hydrogen at high pressure (350 bar), the 20 kW LiPo battery set and the electric engine have proved to be reliable and offer continuity of supply of the more than 40 kW power necessary for take off. The sophisticated electronic control system ensures redundancy and makes both sources of energy available to the pilot in order to guarantee the safe functioning of the single propeller, even in the case of breakdown of the hydrogen current generators.

The airplane (whose final lay-out was achieved with the technical assistance of the Italian Skyleader importer – T&T Ultralight) has a wing opening of about 10 metres; with the systems at present available, the airplane has autonomy of 1 hour and can reach a cruising speed of 150-180 km/h, thanks to the hydrogen alone.

If this objective is reached during the next tests, the aircraft will establish the world speed and flight duration record.

Among the advantages of an aircraft of this type, mention can be made of its remarkable silence: a characteristic that can greatly improve the quality of life around city airports.

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**Rapid 200-FC – Aircraft breaking test**



**Rapid 200-FC – Taxiing test**

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**Rapid 200-FC – Taxiing test at take off speed**

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