CROP

Cycloidal Rotor Optimized for Propulsion

Funding: European (7th RTD Framework Programme)
Duration: Jan 2013 - Dec 2014
Status: Complete with results
Total project cost: €780,846
EU contribution: €599,993

Call for proposal: FP7-AAT-2012-RTD-L0
CORDIS RCN: 106045

Objectives:
The CROP project introduces an innovative propulsion system for aircraft based on the cycloidal rotor concept, using an integrated approach that includes the electric drive train, airframe integration and an environmental friendly energy source.

Methodology:
The CROP system is supported on a multi-physics approach:

- The high thrust is obtained by unsteady-based cycloidal rotor operation;
- The development of low-weight electric power drives for the system;
- Airframe re-design to accomplish optimum integration of the cycloidal propulsor;
- Environmental friendly energy source based on hydrogen and photovoltaic cells.

The strengths of the CROP concept are:

- High thrust levels: by using unsteady airflows
- Low weight: using an integrated design approach between airframe and cycloidal propulsor
- Environmental friendly: because it is based on green energy power sources.

The revolutionary CROP propulsion concept will introduce new air-vehicle concepts, overcoming traditional limitation on short take-off and landing, including hovering capability.

Parent Programmes:
FP7-TRANSPORT - Transport (Including Aeronautics) - Horizontal activities for implementation of the transport programme (TPT)
Institute type: Public institution
Institute name: The European Commission
Funding type: Public (EU)

Lead Organisation:

Universidade Da Beira Interior

Address:
Convento De Santo Antonio
6201 001 Covilha
Portugal

EU Contribution: €162,250

Partner Organisations:
<table>
<thead>
<tr>
<th>Organisation Name</th>
<th>Address</th>
<th>EU Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The University Of Sheffield</td>
<td>Address: Firth Court Western Bank Sheffield S10 2TN United Kingdom</td>
<td>€79,640</td>
</tr>
<tr>
<td>Organisation Website:</td>
<td><a href="http://www.sheffield.ac.uk">http://www.sheffield.ac.uk</a></td>
<td></td>
</tr>
<tr>
<td>IAT 21 Innovative Aeronautics Technologies GmbH</td>
<td>Address: LEITENBAUERSTRASSE 10 4040 LINZ Austria</td>
<td>€89,014</td>
</tr>
<tr>
<td>Organisation Website:</td>
<td><a href="http://www.d-dalus.com">http://www.d-dalus.com</a></td>
<td></td>
</tr>
<tr>
<td>Grob Aircraft Ag</td>
<td>Address: Lettenbachstrasse 9 86874 Tussenhausen Mattsies Germany</td>
<td>€83,390</td>
</tr>
<tr>
<td>Organisation Website:</td>
<td><a href="http://www.polimi.it">http://www.polimi.it</a></td>
<td></td>
</tr>
<tr>
<td>Politecnico Di Milano</td>
<td>Address: Piazza Leonardo Da Vinci 32 20133 Milano Italy</td>
<td>€88,340</td>
</tr>
<tr>
<td>Organisation Website:</td>
<td><a href="http://www.unimore.it">http://www.unimore.it</a></td>
<td></td>
</tr>
<tr>
<td>Universita Degli Studi Di Modena E Reggio Emilia</td>
<td>Address: VIA UNIVERSITA 4 41121 MODENA Italy</td>
<td>€97,359</td>
</tr>
<tr>
<td>Organisation Website:</td>
<td><a href="http://www.unimore.it">http://www.unimore.it</a></td>
<td></td>
</tr>
</tbody>
</table>

Technologies:
Aircraft design and manufacturing
Electric aircraft

Development phase: Research/Invention
**Key Results:**

**Novel propulsion system for aircraft**

EU-funded scientists are designing an innovative cycloidal rotor for both lift and thrust that is a radical alternative concept, revolutionising aircraft flight.

European transport policies aim to foster integrated, safer, greener and smarter pan-European transport systems benefiting all citizens and the environment. Novel AeroSystems, such as those being developed in the EU-funded project 'Cycloidal rotor optimized for propulsion' can optimise operations and performances.

Scientists are working on a cycloidal rotor propulsor that creates lift in the event of engine failure, thus making the aircraft hover just like a helicopter. This novel propulsion system is based on a cycloidal device — plasma-enhanced cycloidal thruster — that has thrust effects due to strong unsteady flows. To achieve a lower weight-to-power ratio, a low-weight electric drivetrain will be integrated into the system. Furthermore, scientists will re-design the airframe to achieve optimum integration of the cycloidal propulsor.

CROP's breakthrough concept is leading to novel air vehicle designs with improved performances and reduced environmental impact. The system is minimising fuel consumption, reducing take-off and landing spaces, and increasing aircraft manoeuvrability.

Scientists have examined different rotor assemblies and aerial vehicle configurations, with a six-bladed configuration achieving the greatest efficiency. Furthermore, they have constructed a rotor assembly that allows integrating a plasma actuator. The weight of the carbon fibre wings has been decreased by 40%, while their strength has been increased. New component designs, manufacturing techniques and aerofoil shapes have also been developed to minimise stresses and increase power-to-weight ratio.

Another task has been electronics and software development to control the system during the flight and drive it from a vertical to a stable forward flight. The four-rotor lab model for vertical launch has been optimised and a proof-of-concept electrically driven cyclogyro has been demonstrated.

Society towards 2050 will need more long-range transport. CROP is laying the foundations for greener transport by 2050, and its activities are in line with the objectives set by the Advisory Council for Aviation Research and Innovation in Europe (ACARE).

**Documents:**
- [Final Report Summary - CROP (Cycloidal Rotor Optimized for Propulsion)]

**STRIA Roadmaps:** Vehicle design and manufacturing

**Transport mode:** Air transport

**Transport sectors:** Passenger transport, Freight transport

**Transport policies:** Decarbonisation

**Geo-spatial type:** Other