DART

Development of an advanced rotor for tilt-rotor

Funding: European (5th RTD Framework Programme)
Duration: Mar 2002 - Jan 2006
Status: Complete with results

Background & policy context:
As the air passenger traffic continues to grow, by at least 5% per year, airport congestion becomes a mounting problem in Europe. Because of environmental constraints, airport extensions are more and more difficult to achieve and there is an increasing pressure for finding innovative solutions to cope with the air traffic growth expected within the next 20 years.

As already evidenced during the AIRPORT-IV study sponsored mid 90's by DG-VII, one of these innovative solutions could be the use of Rotorcraft for some of the hub-feeder missions which are today achieved with turboprop aircraft.

Indeed, thanks to their inherent Vertical Takeoff and Landing (VTOL) capability, Rotorcraft are able to reach airports without using the main runways which, in that case, could be reserved for large capacity medium/long haul jet airplanes.

The Tilt-Rotor is a relatively new configuration of Rotorcraft combining the operational capabilities and advantages of the propeller-driven airplane and of the helicopter.

Objectives:
The DART project goal was to significantly contribute to the development of a flying tilt-rotor demonstrator by achieving the following objectives:

- to define, design, manufacture and test an advanced rotor hub for future implementation on a tilt-rotor aircraft;
- to gain a better understanding of the technological issues associated with tilt-rotor rotor hub design;
- to bring significant improvements compared to existing design with respect to external noise, vibration, dynamic loads, safety and costs.

Methodology:
The design of such an advanced rotor hub for very unconventional operations has been possible thanks to the strong effort put on the calculations methods and methodology for loads and dynamic. The definition of the requirements, the Xcross correlations between several codes performed within this project and the method developments secure the hub concept definition. This effort provides a unique expertise for the partners and increase European knowledge. Next development phases towards serial product will start basically on those methodology.

Parent Programmes:
FP5-GROWTH KA4 (AERONAUTICS) - New Perspectives in Aeronautics

Institute type: Public institution
Institute name: European Commission, Directorate-General for Research (DG Research)
Funding type: Public (EU)

Partners:
France: Eurocopter S.A.S.; Office National d'Etude et de Recherches Aérospatiales; Paulstra

Germany: Eurocopter Deutschland GmbH

Italy: Agusta S.P.A.; Centro Italiano Ricerche Aerospaziali S.C.P.A.

Spain: Sener Ingenieria y Sitemas SA, Subcontratacion de Proyectos Aeronauticos S.A.

The Netherlands: Stichting Nationaal Lucht- en Ruimtevaart Laboratorium

United Kingdom: Westland Helicopters LTD.

Organisation: Eurocopter
City: MARIGNANE
Contact country: France

Key Results:
The main outcome of the project was the production of a full-scale rotor hub tested in laboratory to assess its functional and fatigue behaviour with the following results:

- full Scale rotor Hub architecture detailed design and manufacturing, for a tilt-rotor aircraft;
- improved load calculation methods for the different tilt-rotor operational modes;
- rotor hub architecture and detailed design for a tilt-rotor aircraft;
- identification of critical issues for the hub components of a rotor suitable to tilt-rotor aircraft;
- manufacturing process (for yoke);
- gained know-how and experience in the manufacturing of large elastomeric parts;
- results exploitation plan and recommendations for further research and development to support a future demonstrator aircraft.

Technical Implications
The trade-off studies have selected a four-bladed rotor as the best suited for the ERICA concept, bringing significant advantages in terms of external noise, performance, stability and vibration.

The full scale development helps validating the process and technologies to be implemented on full scale serial product. Production of this tested full-scale rotor hub for tilt-rotor will significantly lowered the risk for future activity.

STRIA Roadmaps: Vehicle design and manufacturing, Network and traffic management systems
Transport mode: Air transport
Transport sectors: Passenger transport, Freight transport
Geo-spatial type: Infrastructure Node