DRESS

Distributed and Redundant Electro-mechanical nose wheel Steering System

Funding: European (6th RTD Framework Programme)
Duration: Jun 2006 - Dec 2009
Status: Complete with results
Total project cost: €4,040,786
EU contribution: €2,460,892

Background & policy context:
In the large commercial aircraft market, landing gear systems are currently operated using hydraulic power. It has been widely recognised that there is a need from a social and environmental impact point of view, to improve the efficiency of aircraft and their associated systems. Alternative power source (electric) strategies are considered for aircraft systems, which are traditionally hydraulically powered. Several research programmes, currently underway, are taking more electric aircraft technologies through the final validation phase prior to deployment on aircraft programmes. Continuous efforts are also being made by the aircraft manufacturers and the air traffic control sector to fully automate the aircraft approach, landing, ground manoeuvres and take-off. This will increase the air transport system efficiency by allowing the aircraft to operate in all weather conditions. Due to the current aircraft steering system loss objective, airworthiness regulations impose a minimum visibility that would allow the pilots to safely regain manual control in case of steering system loss.

Objectives:
The goal of this project was to research, develop and validate a distributed and redundant electrical steering system technology for an aircraft nose landing gear that would provide improved competitiveness and improved aircraft safety.

- Reduced system weight at the aircraft level, replacing the current hydraulic actuation by electrical actuation.
- Improved aircraft safety provided by the higher reliability, the higher levels of safety objectives with associated redundancies that will be imposed to the new system, beyond the current technology capabilities.
- Subsequent ability of the steering system, with its improvements on safety, to be integrated in a future fully automated aircraft ground guidance system providing the aircraft with a true all-weather (true zero visibility) capability, hence offering significant aircraft operation gains and enabling a more efficient Air Transport System.

Methodology:
DRESS was composed of the following work packages:

- The 'Specifications and assessment criteria' work package identifying all the requirements, providing a base on which high-level as well as detailed specifications for this new steering system shall be established. Assessment criteria were defined to assess the final validation results in an easier and better way.
- The 'Research on optimised system architecture' work package concerned modular and redundant open control system architecture studies, and also addressed the complex nose landing gear oscillations damping control.
- The 'Electromechanical technologies' work package concerned the electromechanical actuator, a
new electric motor architecture, and a safe and segregated power electronics control system

- The ‘Components manufacture’ and ‘Technology Integration’ work packages covered the manufacture and then the assembly of various components with first sub-assembly tests.
- ‘Technology evaluation’: the main components and then the complete validation prototype of the new steering system were tested against the specifications. An evaluation of this new technology regarding its integration in a production aircraft system was provided.

DRESS achieved this technological breakthrough, investigating in both fields of system architecture and electro-mechanical actuation, by bringing together 13 actors of the European aeronautics industry including an aircraft manufacturer (Airbus UK), a landing gear manufacturer (Messier-Bugatti-Dowty), two Systems and Equipment manufacturers (SAAB, Messier-Bugatti-Dowty), a Research Institute (IA), five universities (INSA, UHA, UCL, UCV, BUTE), and three SMEs (TTTech, EAT, SPAB) with their own specific expertise. DRESS was a 3-year STREP led by Messier-Bugatti-Dowty with an overall budget of 4M.

**Parent Programmes:**
**FP6-AEROSPACE - Aeronautics and Space - Priority Thematic Area 4 (PTA4)**

**Institute type:** Public institution

**Institute name:** European Commission

**Funding type:** Public (EU)

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**EU Contribution:** €0

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Key Results:

DRESS was a successful project that enabled the participants to significantly increase their knowledge in many areas, for instance, distributed architecture, control of a redundant actuator, worm gear and cyclo reducer technology, steering control, the safety issues, the shimmy behavior of an electrical steering system, the integration of an electrical actuator on a landing gear.

The DRESS project has proven the feasibility of an electrically driven steering, demonstrated the advantages of a distributed architecture and validated the principle of driving a redundant actuator to
significantly increase safety. It has enabled demonstrating potential benefits compared to the classical hydraulic steering in terms of power consumption, operability, maintenance, flexibility. Nevertheless, the system weight is significantly higher than a current one and further work is needed on shimmy phenomenon. Therefore, it cannot be implemented on an aircraft immediately.

To conclude, the DRESS prototype is not sufficiently optimised to be competitive with an hydraulic system yet but gives a really good basis for future development and will enable to build an optimised design system and make the right choices.

Documents:
- Project Presentation - Paris Air Show 2009

STRIA Roadmaps: Transport electrification, Vehicle design and manufacturing
Transport mode: Air transport
Transport sectors: Passenger transport, Freight transport
Transport policies: Safety/Security
Geo-spatial type: Infrastructure Node