GLAMOUR

Gust Load Alleviation techniques assessment on wind tunnel MOdel of advanced Regional aircraft

**Funding:** European (7th RTD Framework Programme)

**Duration:** Feb 2014 - Nov 2016

**Status:** Complete with results

**Total project cost:** €2,323,861

**EU contribution:** €1,742,896

**Call for proposal:** SP1-JTI-CS-2013-01

**CORDIS RCN:** 185697

**Objectives:**

The aim of Gust Load Alleviation techniques assessment on wind tunnel MOdel of advanced Regional aircraft (GLAMOUR) proposal was a technological optimisation and experimental validation through an aero-servo-elastic innovative WT model of gust load alleviation control systems for advanced Green Regional Aircraft. The expected benefits of such technologies were mainly the mitigation of gust load responses, the reduction of peak stresses so to potentially decrease sizing loads and consequently increase the weight saving. Most generally, the capability to control the load distribution spanwise could contribute to other global targets such as fatigue lifetime as well aeroelastic and aerodynamic performances.

GLAMOUR project had these main objectives:

- Validate the Load Alleviation techniques based on control architectures defined by ITD member.
- Develop of alternative control schemes.
- Design and manufacturing of a wind tunnel model representing half GRA aircraft dynamically scaled so to be used for experimental validation purpose. The model will be equipped with active split ailerons and elevator to be used for active control.
- Perform wind tunnel test with and without LA controls to validate both the proposed control schemes and the new ones developed by the consortium. To this aim, the wind tunnel proposed for experimental activity will be equipped with an ad hoc developed gust generator so to inspect the whole flight envelope and frequency bandwidth typical of the considered aircraft.
- Draw a final assessment on the global benefits achievable using LA technologies in both design and off-design flight conditions.

Apart from the Project management work package (WP0), that includes exploitation and dissemination, the tasks to be done inside of the project are included in six work packages.

**Parent Programmes:**
**FP7-JTI - Specific Programme "Cooperation": Joint Technology Initiatives**

**Institute type:** Public institution

**Institute name:** European Commission

**Funding type:** Public (EU)

**Other programmes:** JTI-CS-2013-1-GRA-02-022 Experimental investigation of advanced load control/alleviation technology in a regional a/c

**Lead Organisation:**

**Politecnico Di Milano**

**Address:**
Piazza Leonardo Da Vinci 32
<table>
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<tr>
<th>Partner Organisations</th>
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<tr>
<td><strong>Ibk-Innovation Gmbh &amp; Co. Kg</strong></td>
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<tr>
<td><strong>Address:</strong> BUTENDEICHSWEG 2 21129 HAMBURG Germany</td>
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<td><strong>Organisation Website:</strong> <a href="http://www.ibk-innovation.de">http://www.ibk-innovation.de</a></td>
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<td><strong>EU Contribution:</strong> €432,300</td>
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| **Revoind Industriale** |
| **Address:** VIA CASALE MARCANGELI 13 67063 ORICOLA Italy |
| **Organisation Website:** [http://www.revoind.it](http://www.revoind.it) |
| **EU Contribution:** €511,098 |

| **University Of Bristol** |
| **Address:** BEACON HOUSE QUEENS ROAD BRISTOL BS8 1QU United Kingdom |
| **Organisation Website:** [http://www.bristol.ac.uk](http://www.bristol.ac.uk) |
| **EU Contribution:** €146,896 |

| **Technion - Israel Institute Of Technology** |
| **Address:** Senate Building Technion City Haifa 32000 Israel |
| **EU Contribution:** €186,570 |

**Technologies:**
- Computer-aided design and engineering
- CFD and FEA modelling of gust loads

**Development phase:** Validation

**Key Results:**
Executive Summary:

The need for more efficient aircraft able to meet the new challenging requirements defined by ACARE with its strategic road map stated in the Vision 2020 forces the researchers to look for more advanced aircraft configurations, based on more efficient aerodynamics and structures together with more sophisticated flight control systems. Aircraft industry has to be able to deliver new significantly greener aircraft with a substantial reduction of fuel consumption, emissions and perceived noise levels. One of the most promising concepts regarding more environmentally friendly aircraft concerns Natural Laminar Flow (NLF) wing. This concept required a fully multidisciplinary approach due to the counteracting role of main aircraft parameters such as wing sweep, wing thickness and cruise speed, so to minimize the potential structural wing penalty. Looking for this global target, a possible solution was based on combining Natural Laminar Flow (NLF) with an aggressive use of manoeuvre (MLA) and gust load alleviation (GLA) technologies that offer the potential to greatly improve both the weight and aerodynamic terms in the classical Breguet equation. For all these reasons the interest in the development, implementation and experimental verification of MLA and GLA technologies is becoming a key topic in the development of the next generation transport aircraft.

The GLAMOUR project, in response to the SP1-JTI-CS-2013-01-GRA-02-022 call under the JTI-Cleansky 1 initiative, tackled this topic in two different ways. At first, having the Green Regional Aircraft as reference, starting from the active control laws proposed by a ITD member of Cleansky program, it tried to deeply explore their validity over the entire flight envelope, and to extend them with new control strategies based on alternative approaches, such as the Neural Networks, as well as based on Robust Model Predictive Control techniques.

Finally, an extended experimental validation campaign was conducted at Wind Tunnel available at Politecnico di Milano. To this scope, a large wind tunnel half aircraft model, properly scaled, was manufactured and tested in a free-free configuration allowing to validate the most promising GLA techniques. Aiming at this goal, a dedicated gust generator has been designed, installed and tested into the wind tunnel.

Documents:
Final Report Summary - GLAMOUR (Gust Load Alleviation techniques assessment on wind tUnnel MOdels of advanced Regional aircraft)

STRIA Roadmaps: Vehicle design and manufacturing
Transport mode: Air transport
Transport policies: Safety/Security
Geo-spatial type: Other