PROJECT

WASIS

Composite fuselage section Wafer Design Approach for Safety Increasing in Worst Case Situations and Joints Minimizing

Funding: European (7th RTD Framework Programme)
Duration: Jan 2011 - Dec 2014
Status: Complete with results
Total project cost: €4,339,301
EU contribution: €3,239,763

Call for proposal: FP7-AAT-2010-RTD-1
CORDIS RCN: 97208

Background & policy context:

Aeronautics is a key asset for the future of Europe. However, nowadays the industry has to face the challenge of "More Affordable, Safer, Cleaner and Quieter" while at the same time accounting for a demand that will triple over the next 20 years.

Objectives:

The WASIS project aims to rise to this challenge with the development of a composite fuselage structure based on the lattice stiffening concept, optimizing geometrical and mass properties of transition zones of fuselage structural joints. Project overall concept is focused on simultaneous meeting environmental demands and rising safety, coupled with design and manufacturing cost-efficiency improvement.

Methodology:

The lattice approach allows composites to obtain more efficient mechanical behaviour, reducing weight and optimizing structure performance, which will be proved by comparative simulations against other approaches. This will be combined with specially designed semi-loop and micro-pin joining elements to provide the ability of innovative non-regular lattice structure manufacturing, save aircraft weight, avoid fuselage section weakening due to cutting reinforcement fibres.

Furthermore, the structure will also be developed to better withstand worst situation loadings, assessing safety through the large adoption of simulation and virtual testing from the very first design stages to analyse explosions and material damping. Developed innovative fuselage section design will be merged with high-productive filament winding technology to reduce manufacturing costs and time, and samples will be manufactured in order to prove how the different concepts fit together. Complete testing of the samples will be applied to prove the wafer approach. This integrated approach will result in sufficient fuselage weight savings, manufacturing cost/time efficiency and safety increase.

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:
Fundacion Cidaut

Address:
PLAZA VICENTE ALEIXANDRE CAMPOS 2 PQ TECNOLOGICO DE BOECILLO 209
47151 VALLADOLID
Spain

Organisation Website:
http://www.cidaut.es

EU Contribution: €463,607

Partner Organisations:

Institut Fuer Verbundwerkstoffe GmbH

Address:
ERWIN SCHRODINGER STRASSE GEB 58
67663 KAISERSLAUTERN
Germany

Organisation Website:
http://www.ivw.uni-kl.de

EU Contribution: €401,700

National Aerospace University "kharkiv Aviation Institute"

Address:
17 Chkalova St.
KHARKIV
61070
Ukraine

Organisation Website:
http://www.khai.edu

EU Contribution: €339,500

Comat Composite Materials GmbH

Address:
Marie Curie Strasse 1
67661 Kaiserslautern
Germany

EU Contribution: €0

Circomp GmbH

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67661 Kaiserslautern
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EU Contribution: €424,200

Materials Engineering Research Laboratory Limited

Address:
Wilbury Way
Hitchin - Herts
<table>
<thead>
<tr>
<th>Organisation Name</th>
<th>Address</th>
<th>EU Contribution</th>
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</thead>
<tbody>
<tr>
<td>Comite Europeen De Normalisation</td>
<td>Avenue Marnix 17, 1000 Bruxelles, Belgium</td>
<td>€13,600</td>
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<tr>
<td>Piaggio Aero Industries S.p.a</td>
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<td>€178,839</td>
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<tr>
<td>Netcomposites Limited</td>
<td>Bridge Way 4A Broom Business Park, Chesterfield, S41 9QG, United Kingdom</td>
<td>€236,510</td>
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<tr>
<td>Atg Europe Bv</td>
<td>Huygensstraat 34, 2201 DK Noordwijk, Netherlands</td>
<td>€136,108</td>
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<td>Element Materials Technology Hitchin Limited</td>
<td>Wilbury Way, Hitchin Herts, SG4 0TW, United Kingdom</td>
<td>€186,159</td>
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<td>Inegi - Instituto De Ciencia E Inovacao Em Engenharia Mecanica E Engenharia Industrial</td>
<td>Rua Dr Roberto Frias 400, 4200 465 Porto, Portugal</td>
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<td>Technologies:</td>
<td>Key Results:</td>
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<td>Composite materials</td>
<td>Stiffer fuselages, lighter planes</td>
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<td>Composite fuselage sections</td>
<td>A new design for stiffening aircraft bodies will make them lighter and consequently, more fuel efficient. The European concept depends on a composite lattice design.</td>
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<td>Development phase: Research/Invention</td>
<td>Fuel prices have greatly affected airline profitability and there is an urgent need for future aircraft to be cheaper and more fuel efficient. New designs will incorporate many cost-saving features, one of which will be aircraft-body (fuselage) stiffening.</td>
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This is the goal of the [http://www.wasis.eu](http://www.wasis.eu) (WASIS) project, a partnership among 11 European organisations from 10 countries. Their broad goal is to develop a stiffer fuselage based on an all-composite lattice design. The project focuses on making medium-sized aircraft greener, safer and more efficient.

Specifically, WASIS will focus on reducing fuselage weight via several means. These include optimising shape and weight properties of the transition zone of fuselage joints and replacing the joints with innovative micro-fasteners. The stiffer fuselage will be safer compared to conventional designs. The WASIS innovations will also reduce construction costs through automated manufacturing of wafer structures.

The project's first year saw the beginning of fuselage design that included all joints and openings so that manufacture would require fewer cuts. A wafer structure was designed using operational load scenarios, and then tested against conventional structures. All designs were simulated and refined during the project's second year.

Other work focused on the selection of materials suitable for the lattice design, from a list of candidates already used in aerospace. Chosen materials were tested during the second year.

Feasibility was assessed by manufacturing scaled demonstrators using different materials and techniques. These helped establish the feasibility of filament winding and tape placement as viable processes for the lattice structure. Other tests of manufacturing techniques are underway, including options for automation, combined with stress-testing of the resulting materials. Future work will merge fuselage design with filament-winding technology to reduce manufacturing costs.
WASIS offers a unique opportunity to combine modern composite materials with automated manufacturing, together leading to stronger and lighter aircraft frames. This will reduce fuel consumption and manufacturing wastage. Meanwhile, new designs will make repairs easier. These innovations will foster European industry.

**Documents:**
- Presentation (Project presentation)
- Final Report Summary - WASIS (Composite fuselage section Wafer Design Approach for Safety Increasing in Worst Case Situations and Joints Minimizing)

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