CESAR

Cost-Effective Small Aircraft

integrated project

3rd call of FP6 EU
CESAR Consortium

Total budget Euro 33,7 mil. EUR
EC contribution 18,1 mil. EUR
39 participants, 14 countries

7 a/c designers / manufacturers
Aero Vodochody, Piaggio Aero, Socata
EADS, Evektor, PZL, Eurocopter, INCAS;

12 a/c systems manufacturers
Liebherr LTS, Aernnova (former Gamesa),
HAI, Jihostroj, Technofan, Jihlavan, Mesit,
Hexagon, Merl, SRM, Speel, Unis

3 engine manufacturers
Turbomeca, Ivchenko, PBS

11 research establishments
EADS-CRC, DLR, NLR, ONERA, VZLU,
FOI, CIRA, ARC, IoA, Sicomp, CENAERO

6 universities
Universities of Manchester, Aachen, Brno,
Liege, Munich & Patras

of these 8 SMEs
CESAR objectives

*Increasing European competitiveness in the field of small commercial aircraft from 5 to 15 passengers*

- Time to market reduction by 2 years
- Development cost reduction by 20%
- Reduction of manufacturing and assembly costs by 16%
- **Propulsion unit efficiency and affordability** (to reduce fuel consumption by 5 to 15%, noise emissions by 3 to 6 dB(A), engine weight by 7-9%)
- **Optimization of selected aircraft systems** (health and usage monitoring system (HUMS), electro-hydraulic and electromechanical actuation technologies (EHA, EMA), air systems)
Project Structure

WP 0 - Management and Training

WP 1 - Aerodynamic Design
WP 2 - Structural Design
WP 3 - Propulsion Integration
WP 4 - Optimized Systems

WP 5 - Development Concept Integration and Validation

Integration and assessment of project's results on two baseline a/c configurations

1. NEW DEVELOPMENT CONCEPT FOR SMALL A/C
   modified economical use of technologies applied on large commercial aircraft

2. NEW SOLUTIONS FOR SELECTED AIRCRAFT SYSTEMS
<table>
<thead>
<tr>
<th>Workpackages</th>
<th>RTD areas addressed by the proposal</th>
<th>Time to Market Reduction</th>
<th>Development Costs Reduction</th>
<th>Pax comfort, safety and environmental impacts</th>
<th>Propulsion unit and a/c system cost reduction</th>
<th>Reduction of Manufacture and Assembly Costs</th>
<th>Reduction of Operational Costs</th>
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<td>WP 1 Aerodynamic Design</td>
<td>Task 1.1 - High fidelity design tools</td>
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<td>Task 1.2 - Advanced wing</td>
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<td>WP 2 Structural Design</td>
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<td>Task 2.2 - New design approaches to advanced airframe structures</td>
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<td>Task 2.3 - New strength evaluation methods of advanced airframe structures</td>
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<td>Task 2.5 - Flutter Prevention for small aircraft</td>
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<td>Task 3.2 - Complex power-plant control systems</td>
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<td>Task 3.3 - Environmentally friendly propeller propulsion</td>
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<td>Task 5.2 - Validation platform</td>
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*** Very positive impact/effect
** Positive impact/effect
* Slightly positive impact/effect
- Indifferent
AERODYNAMIC DESIGN

**T1.1 - High fidelity design tools**
- Proved high fidelity aerodynamic tools customized for small aircraft development
- Adaptation and improvement of specific tools to be used for aerodynamic analysis
- Providing methods, tools, data and experience which allow accelerating the aerodynamic design

**T1.2 - Advanced wing**
- Demonstration of the improvement of design process results by means of CFD methods in combination with optimization strategies
- Design with a higher degree of safety with respect to flow separation and icing
- Catalogue of advanced airfoils
- Wing design optimization
- Reliable tool for analysis of wing contamination

**T1.3 - Flight Dynamics**
- Development of more consistent chain of tools and database for flight dynamics analyses
- Proven flight dynamics testing procedures customized for general aviation
STRUCTURAL DESIGN

T2.1 - Operational loads
• Affordable tool for estimation of operational and fatigue load

T2.2 - New design approaches to advanced airframe structure
• Assessment of alternative design and manufacture technologies (welding, riveting, composite technologies)

T2.3 - New strength evaluation methods of advanced airframe structures
• Reliable and relatively fast methods and tools for strength evaluation for CS-23 aircraft
• Develop. of an effective tool able to analyze composite structures

T2.4 - Smart structural health monitoring
• Real-time structural health monitoring system resistant to harsh conditions

T2.5 - Flutter prevention for small aircraft
• Development of improved methods for reliable and fast prediction of aeroelastic stability
• Optimization of analytical and experimental approaches and methods to reduce time and costs of ground vibration tests and flutter certification process
PROPULSION INTEGRATION

T3.1 - Advanced structure of small gas turbine engine
- Design tools and technologies for development of modern turboprop engine, incl. adv. design config. of the virtual engine
- Low weight centrifugal compressor and increased efficiency of thermodynamic cycle
- Cooled Small Turbine
- High reliability and efficient transmission

T3.2 - complex power-plant control system
- Low cost “FADEC” with self-diagnostics, incl. propeller control for smaller engines
- Development of new storage and communication module for analytical technology with data downloads

T 3.3 - Environmentally friendly propeller propulsion
- Low-noise propeller design

EXPECTED RESULTS
OPTIMIZED SYSTEMS

T4.1 - Cost effective actuation
• Efficient and low weight electro-hydraulic actuation (EHA)
• Advanced concept for electro-mechanical actuation (EMA)

T4.2 - Competitive technologies for air systems
• Competitive integrated environmental control system and cabin pressure system

T4.3 - Integrated diagnostics and on-condition maintenance
• Reduction of delays and cancellations of flights due to unscheduled maintenance and repairs
DESIGN CONCEPT INTEGRATION AND VALIDATION

WP5 - New design and development concept
- Integrated computer environment for the design of small aircraft
- Optimized processes and knowledge management for design and development of small aircraft

Evaluation platforms

AC1 is a twin engine turboprop un-pressurized aircraft
AC2 is a twin engine Very Light Jet pressurized aircraft.
CESAR Outcomes:

✓ **Technical achievements** (knowledge, software/tools, methodologies, new technical solutions, technologies, new concepts, up to hardware validation/demonstration)

✓ Development of **international cooperation** in the GA sector with intensive participation of larger manufacturers, SMEs, research establishments and universities,

✓ Evidence of **long-term interest of GA industries** in participation in EC funded programmes

✓ **Increase of visibility** of GA, promotion towards European bodies and even on national level

✓ Demonstration of **organizational and managerial competence** of GA stakeholders to prepare and run RTD projects (even L2)

✓ Experience from CESAR project will enable to **better target specific research challenges of GA** within the next research projects
THANK YOU FOR YOUR ATTENTION

www.cesar-project.eu