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

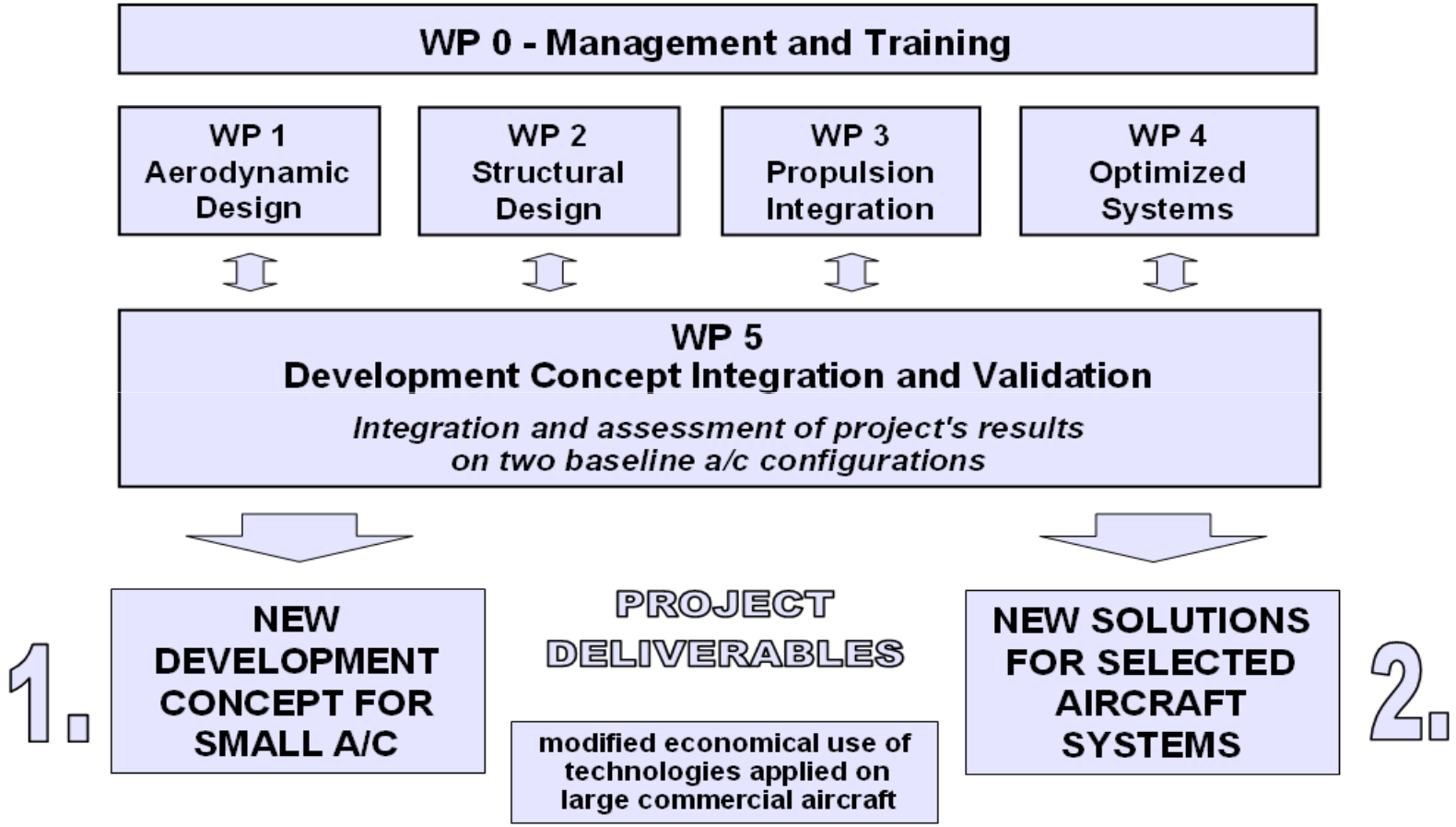
of these 8 SMEs

CESAR objectives

Increasing European competitiveness in the field of small commercial aircraft from 5 to15 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



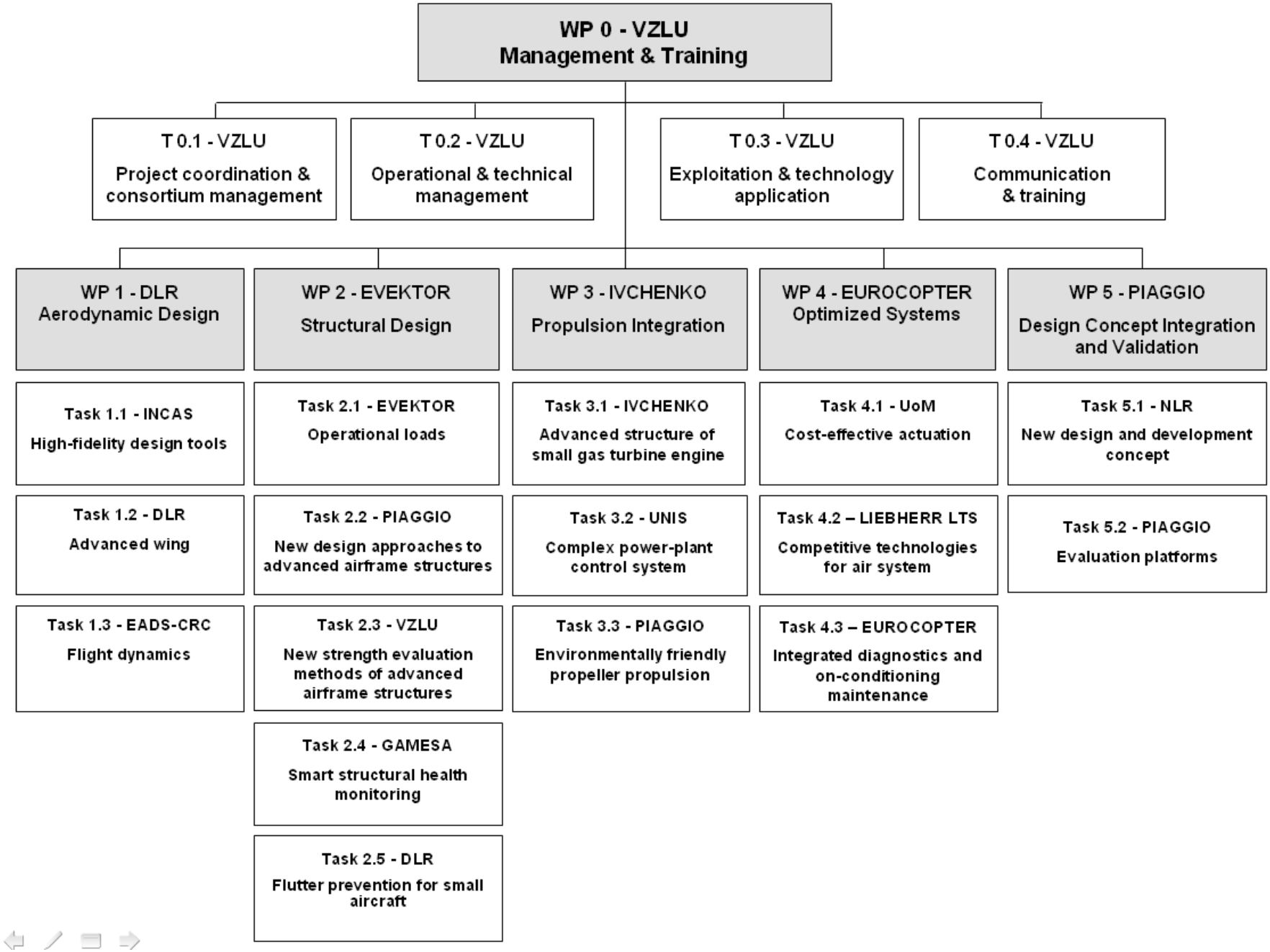
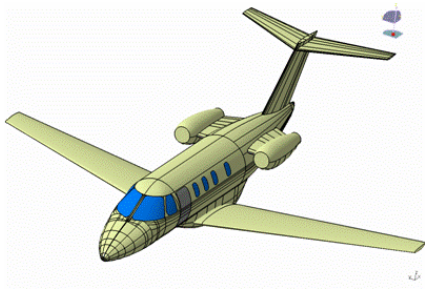

WP 0 - VZLU
Management & Training
T 0.1 - VZLU
Project coordination & consortium management
T 0.2 - VZLU
Operational & technical management
T 0.3 - VZLU
Exploitation & technology application
T 0.4 - VZLU
Communication & training
WP 1 - DLR
Aerodynamic Design
WP 2 - EVEKTOR
Structural Design
WP 3 - IVCHENKO
Propulsion Integration
WP 4 - EUROCOPTER
Optimized Systems
WP 5 - PIAGGIO
Design Concept Integration and Validation
Task 1.1 - INCAS
High-fidelity design tools
Task 1.2 - DLR
Advanced wing
Task 1.3 - EADS-CRC
Flight dynamics
Task 2.1 - EVEKTOR
Operational loads
Task 2.2 - PIAGGIO
New design approaches to advanced airframe structures
Task 2.3 - VZLU
New strength evaluation methods of advanced airframe structures
Task 2.4 - GAMESA
Smart structural health monitoring
Task 2.5 - DLR
Flutter prevention for small aircraft
Task 3.1 - IVCHENKO
Advanced structure of small gas turbine engine
Task 3.2 - UNIS
Complex power-plant control system
Task 3.3 - PIAGGIO
Environmentally friendly propeller propulsion
Task 4.1 - UoM
Cost-effective actuation
Task 4.2 – LIEBHERR LTS
Competitive technologies for air system
Task 4.3 – EUROCOPTER
Integrated diagnostics and on-conditioning maintenance
Task 5.1 - NLR
New design and development concept
Task 5.2 - PIAGGIO
Evaluation platforms

Table 2.3.1 - Matrix of RTD work and project objectives

Workpackages	RTD areas addressed by the proposal	Time to Market Reduction	Development Costs Reduction	Pax comfort, safety and environmental impacts	Propulsion unit and a/c system cost reduction	Reduction of Manufacture and Assembly Costs	Reduction of Operational Costs
WP 1 Aerodynamic Design	Task 1.1 - High fidelity design tools	***	***	*	**	***	**
	Task 1.2 - Advanced wing	***	***	**	*	**	**
	Task 1.3 - Flight dynamics	***	***	***	*	-	*
WP 2 Structural Design	Task 2.1 - Operational loads	***	***	-	-	-	*
	Task 2.2 - New design approaches to advanced airframe structures	**	***	**	-	***	*
	Task 2.3 - New strength evaluation methods of advanced airframe structures	**	**	**	-	-	**
	Task 2.4 -Smart structural health monitoring	*	*	***	**	-	**
	Task 2.5 - Flutter Prevention for small aircraft	**	**	**	-	-	-
WP 3 Propulsion Integration	Task 3.1 - Advanced structure of small gas turbine engine	***	**	**	**	***	**
	Task 3.2 - Complex power-plant control systems	**	**	***	**	**	**
	Task 3.3 - Environmentally friendly propeller propulsion	***	***	***	**	*	**
WP 4 Optimised Systems	Task 4.1 - Cost effective actuation	**	**	*	**	**	*
	Task 4.2 - Competitive technologies for air systems	*	**	***	***	*	**
	Task 4.3 - Integrated diagnostics & on-condition-maintenance	*	-	**	**	*	***
WP 5 Devel. Concept Integration and Validation	Task 5.1 - New design and development concept	***	**	-	-	*	*
	Task 5.2 - Validation platform	**	**	*	*	*	*

*** Very positive impact/effect
** Positive impact/effect
* Slightly positive impact/effect
- Indifferent



AERODYNAMIC DESIGN

WP 1 - DLR
Aerodynamic Design

Task 1.1 - INCAS
High-fidelity design tools

Task 1.2 - DLR
Advanced wing

Task 1.3 - EADS-CRC
Flight dynamics

EXPECTED RESULTS

T1.1 - High fidelity design tools

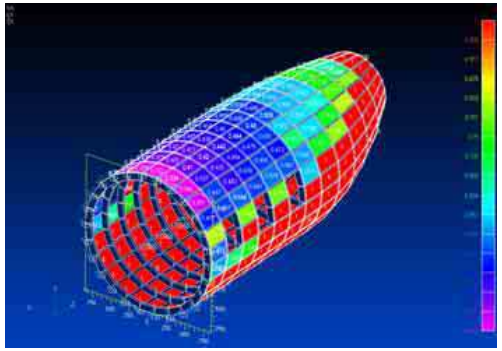
- Proved high fidelity aerodynamic tools customized for small aircraft development
- Adaptation and improvement of specific tools to be used for aerodynamic analysis
- Providing methods, tools, data and experience which allow accelerating the aerodynamic design

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



Task 2.1 - EVEKTOR
Operational loads

Task 2.2 - PIAGGIO
New design approaches to advanced airframe structures

Task 2.3 - VZLU
New strength evaluation methods of advanced airframe structures

Task 2.4 - GAMESA
Smart structural health monitoring

Task 2.5 - DLR
Flutter prevention for small aircraft

EXPECTED RESULTS

STRUCTURAL DESIGN

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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 advanc. airframe structures

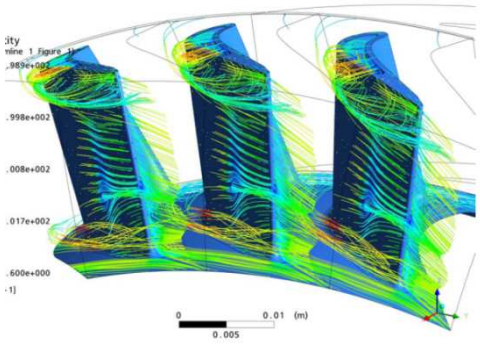
- Reliable and relatively fast methods and tools for strength evaluation for CS-23 aircraft
- Develop. of an effective tool able to analyze composite structures

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

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WP 3 - IVCHENKO
Propulsion Integration

Task 3.1 - IVCHENKO
Advanced structure of small gas turbine engine

Task 3.2 - UNIS
Complex power-plant control system

Task 3.3 - PIAGGIO
Environmentally friendly propeller propulsion

EXPECTED RESULTS

T3.1- Advanced structure of small gas turbine engine

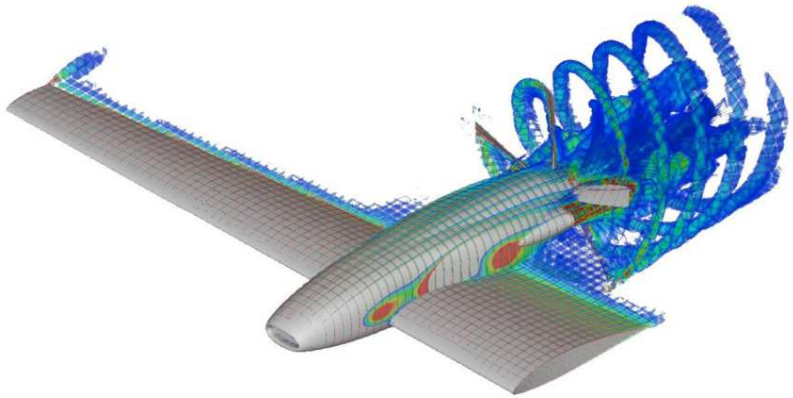
- Design tools and technologies for development of modern turboprop engine, incl. adv. design config. of the virtual engine
- Low weight centrifugal compressor and increased efficiency of thermodynamic cycle
- Cooled Small Turbine
- High reliability and efficient transmission

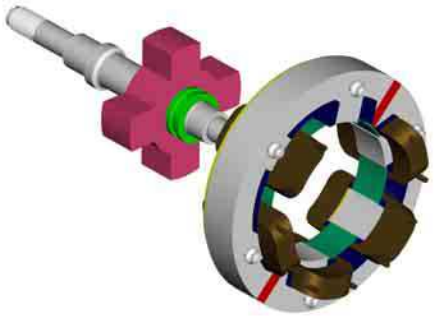
T3.2 - complex power-plant control system

- 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





WP 4 - EUROCOPTER
Optimized Systems

Task 4.1 - UoM
Cost-effective actuation

Task 4.2 – LIEBHERR LTS
Competitive technologies for air system

Task 4.3 – EUROCOPTER
Integrated diagnostics and on-conditioning maintenance

EXPECTED RESULTS

OPTIMIZED SYSTEMS

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T4.1 - Cost effective actuation

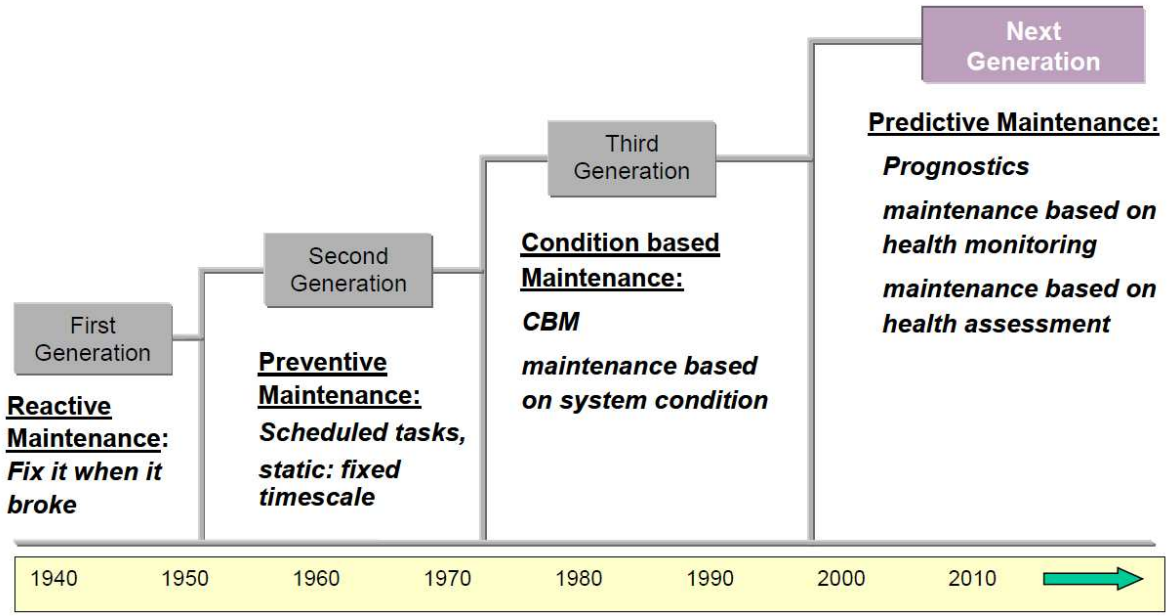
- Efficient and low weight electro-hydraulic actuation (EHA)
- Advanced concept for electro-mechanical actuation (EMA)

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

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WP 5 - PIAGGIO
Design Concept Integration and Validation

Task 5.1 - NLR
New design and development concept

Task 5.2 - PIAGGIO
Evaluation platforms

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

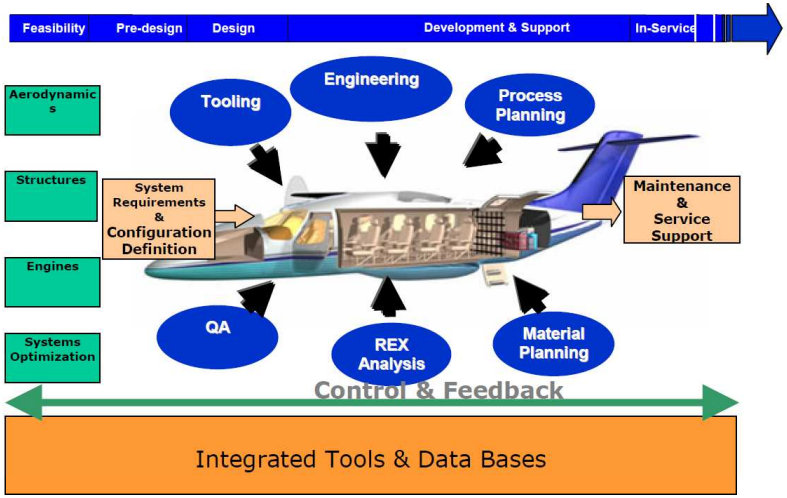

Figure 1 - IDS concept for small a/c

EXPECTED RESULTS

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