ASTIB:
A research programme on innovative electro-mechanical actuators and iron bird within the Clean Sky 2 research initiative

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Framework

ASTIB: *Development of **A**dvanced **S**ystems **T**echnologies and hardware/software for the flight simulator and **I**ron **B**ird ground demonstrators for regional aircraft*

A research programme within Clean Sky 2 framework which falls in the Green Regional Aircraft research line and addresses the topics JTI-CS2-CPW-REG-01-01

Focus and Objectives

Focus ⇨ Contributing to generate technological advancements to be implemented in a future Green Regional Aircraft (GRA) by supporting the improvement of the TRL up to above 5 for a number of significant electrical equipments that are being considered of critical importance for the future GRA

Objectives ⇨ Develop technologies and prototype components integrating innovative features capable of making electrical actuation an accepted proposition for future flight controls and landing gears

➔ Present regional aircrafts are not provided with boosted flight controls

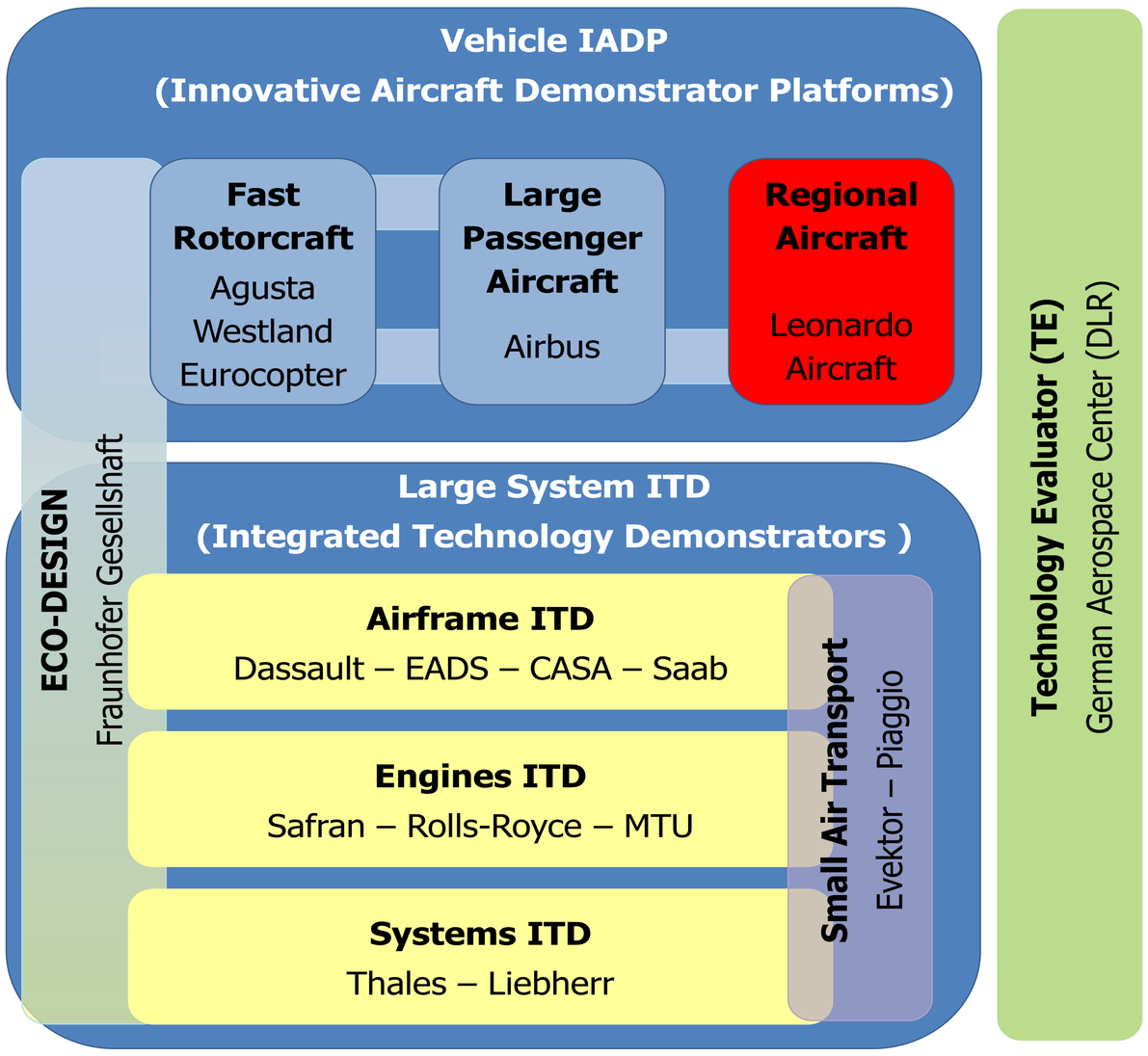
➔ Opportunity to freely explore design alternatives without being biased by existing solutions

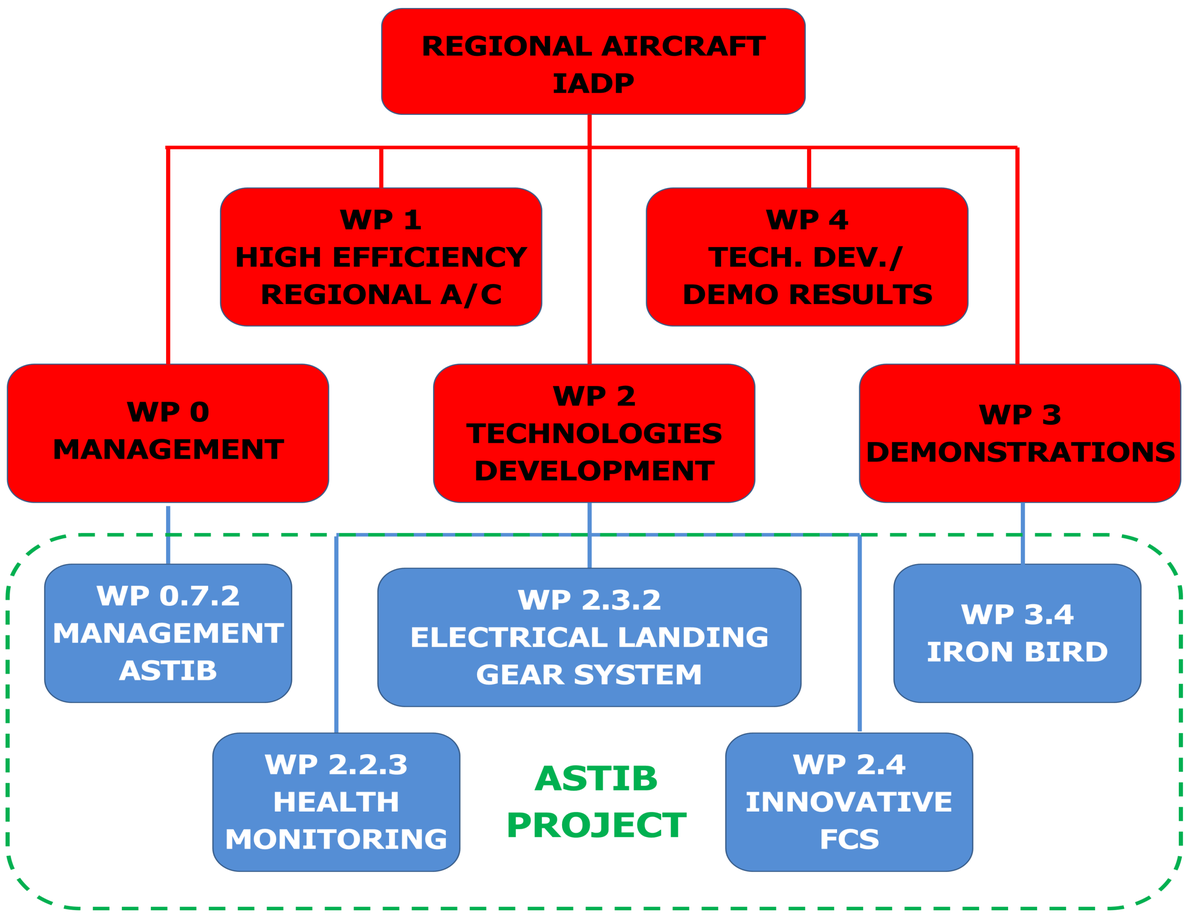
- ⇨ Electrically actuated ***movable winglet and wingtip*** for wing load reduction
- ⇨ Electrically actuated ***main and nose landing gear***
- ⇨ Contribution to developing an ***Integrated Vehicle Health Monitoring system***
- ⇨ ***Iron Bird*** provided of intelligent control for:
  - ➢ Testing new flight control system architectures and relevant electromechanical actuators for wing load alleviation
  - ➢ Testing electrically actuated landing gear
  - ➢ Accepting load banks simulating aircraft electrical loads to complete the global aircraft electrical system simulation
  - ➢ Performing real-time virtual flight execution
  - ➢ Assessing the effectiveness of prognostics and health management solutions for the electromechanical actuators

Consortium

- ➢ Umbra Cuscinetti
- ➢ CERTIA
- ➢ Institut National de Sciences Appliquées (INSA)
- ➢ Magnaghi Aeronautica
- ➢ Politecnico di Torino
- ➢ Viola Consulting

Project integration within Clean Sky 2





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ELECTROMECHANICAL ACTUATION

Research action

- Actuators architectures with reduced number of components and new design
- New materials
- Robust non-linear control
- High-fidelity physics based models
- Real-time models

Actuator

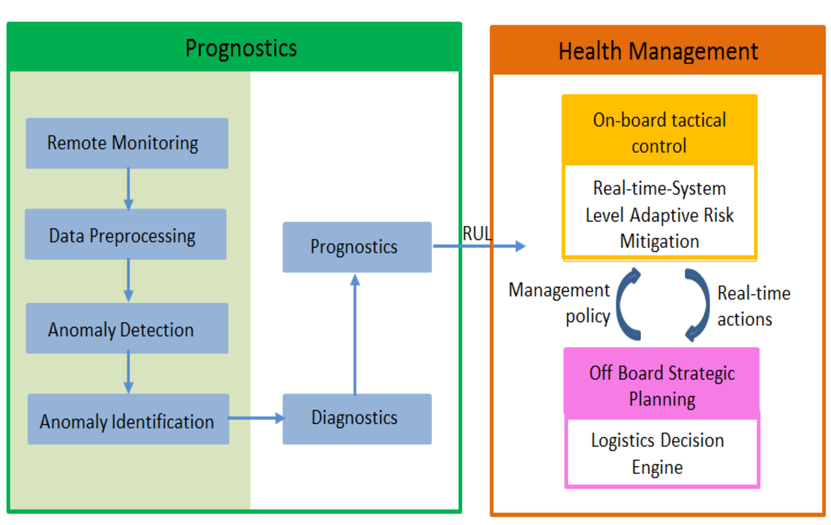
- Reduce envelope and weight
- Augmented power-to-weight ratio
- Improved reliability
- Optimize dynamic response
  Minimize disturbance after failure
- Execution of hardware-in-the-loop and software-in-the-loop tests

Aircraft

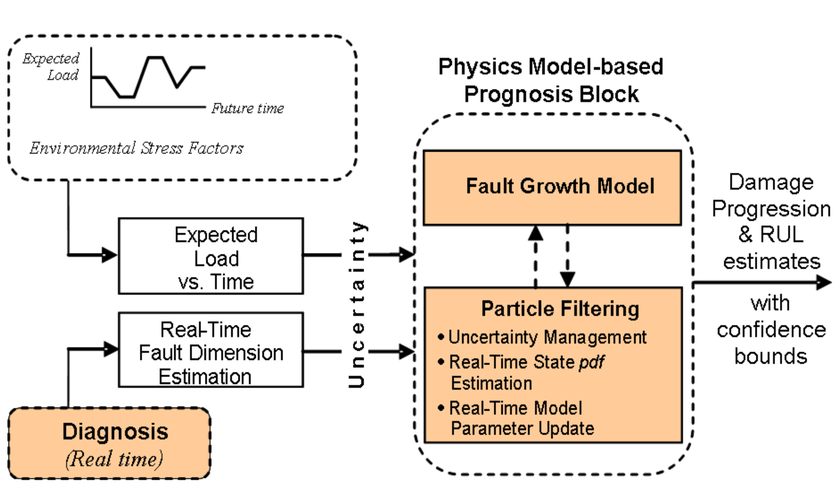
- Installation in thin wings
- Electrically actuated landing gear
- Improved flight quality
- Increased confidence level

HEALTH MONITORING

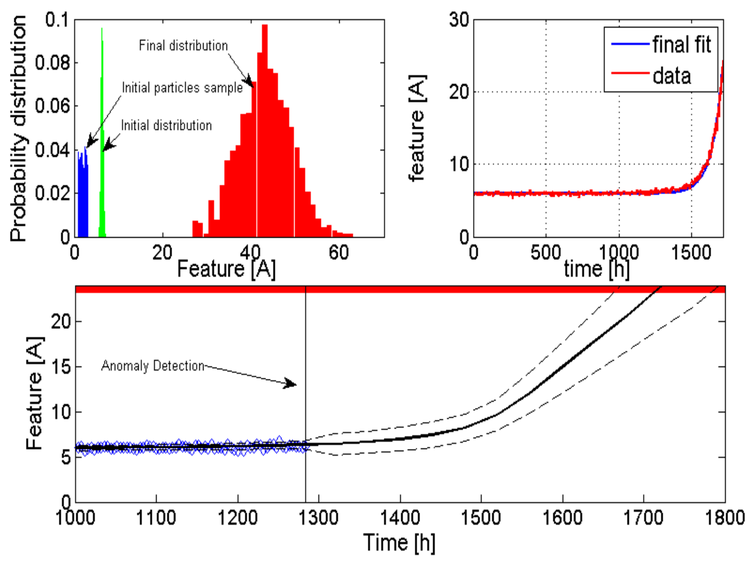
Prognostics and Health Monitoring framework



Prognostics methodology



Prognosis results



IRON BIRD

- Testing of new flight control system architectures
- Accept the installation of the electrical power distribution system and the associated electrical loads
- Reproduce the aircraft installation of the electrical landing gear system
- Reproduce the aircraft installation of flight control surfaces with their EMAs
- Install programmable load banks simulating aircraft electrical loads
- Aircraft model to allow virtual flight with pilot-in-the-loop
- Real-time generation of aerodynamic loads
- Replaceability of real actuators with their real-time models
- Faults injection to assess health monitoring algorithms