



CLEAN AVIATION

Innovations and Challenges of the NGCTR-TD wing

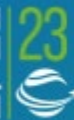


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AVIATION
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From Low Carbon to Zero-Emission Aviation

UNLEASHING DISRUPTION

22-23 March 2023

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Structures and Dynamics Dept - Head, T-WING Coordinator

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Research Directorate - Director



Centro Italiano Ricerche Aerospaziali

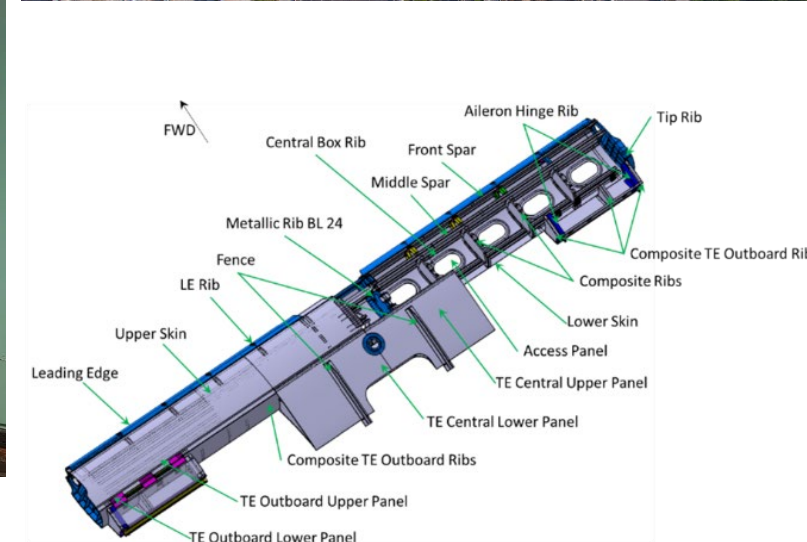
Italian Aerospace Research Center

23rd March 2023



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T-WING context



T-WING timeline

2018

Kick off

- System Requirements
- Review SRR
- System Functional
- Review SFR
- PDR entry

2020

CDR

- CDR Entry
- Joint integration DMU sessions
- CDR exit
- LLTI Tool chain Mfg

2022

Manufacturing

- Tools and Jigs Mfg
- Parts Mfg
- Assembly start

2019

PDR

- PDR Exit
- Joint integration DMU sessions
- CDR Readiness

2021

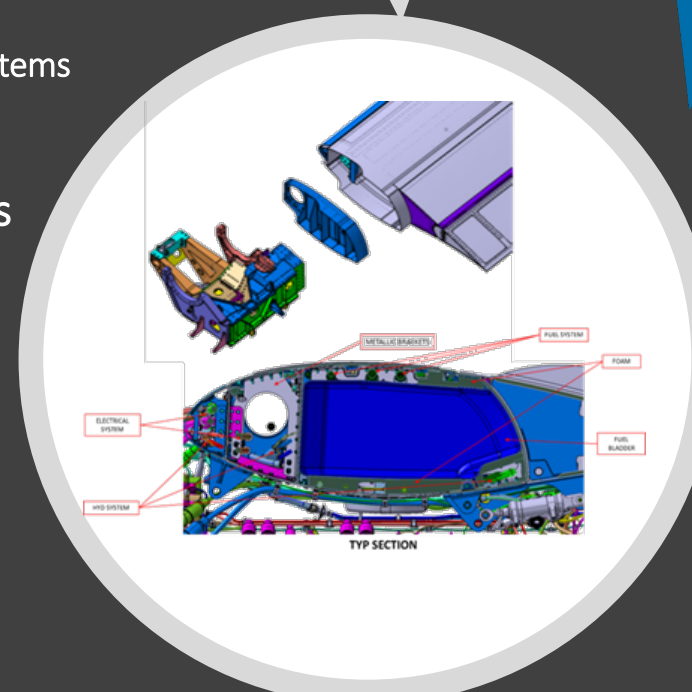
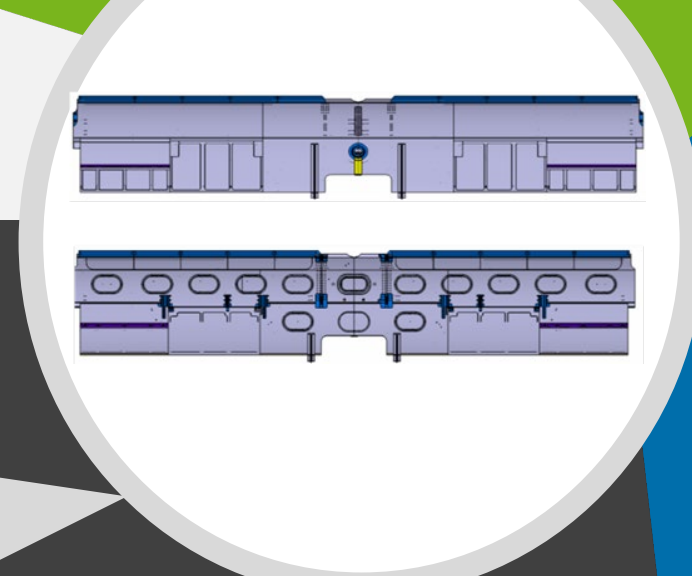
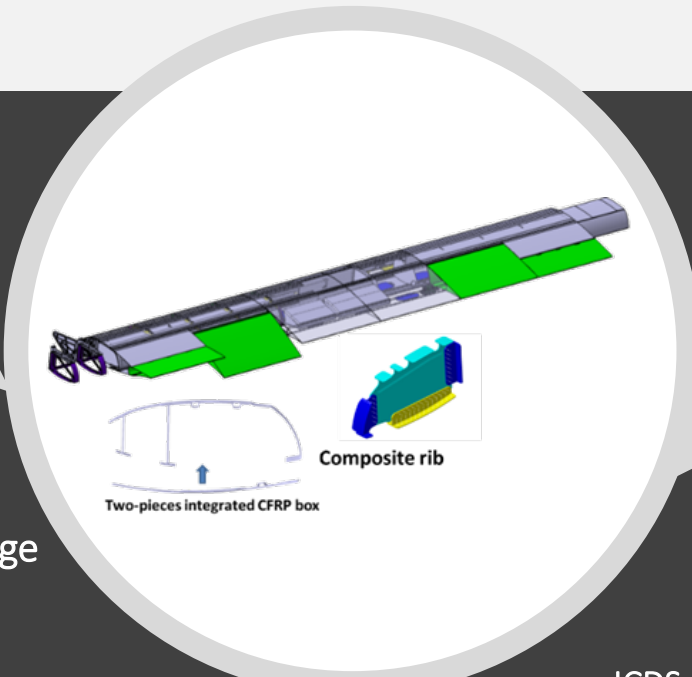
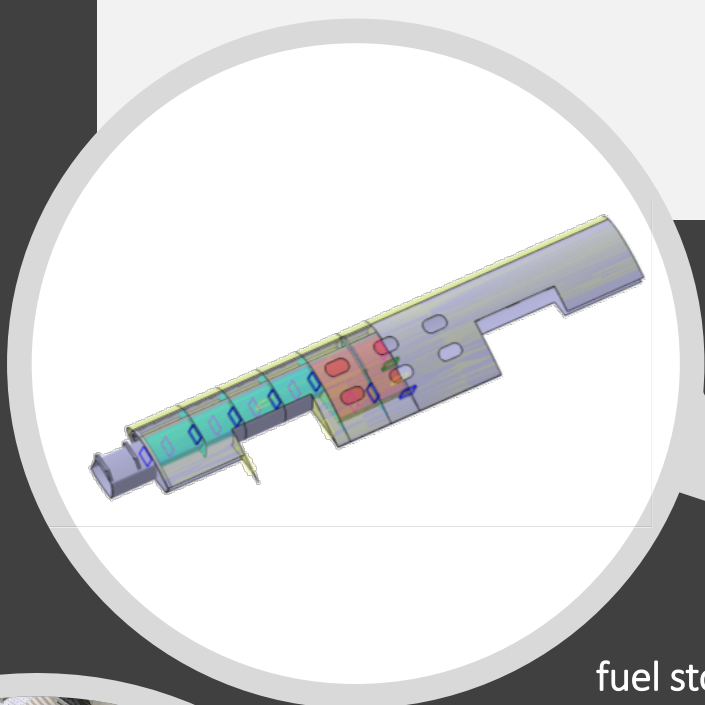
Mfg readiness

- Design refinement
- Drawings Release
- Joint Sessions for QTP
- Tools & Jigs design

2023

Flight

- Flight article delivery
- Ground qualification
- Permit to Flight
- Flight Test & TRL6



fuel storage
whirl flutter

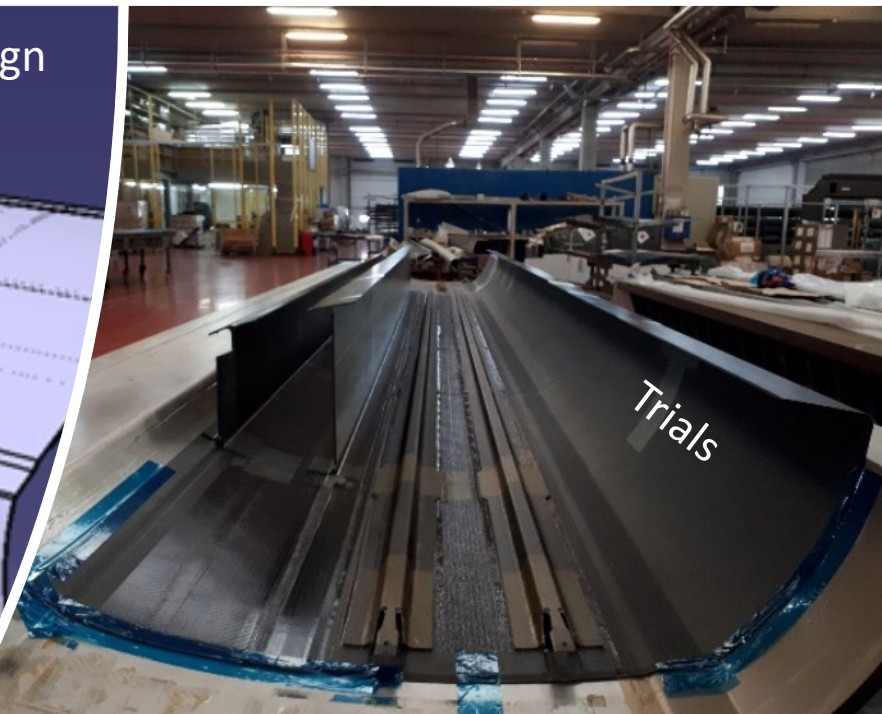
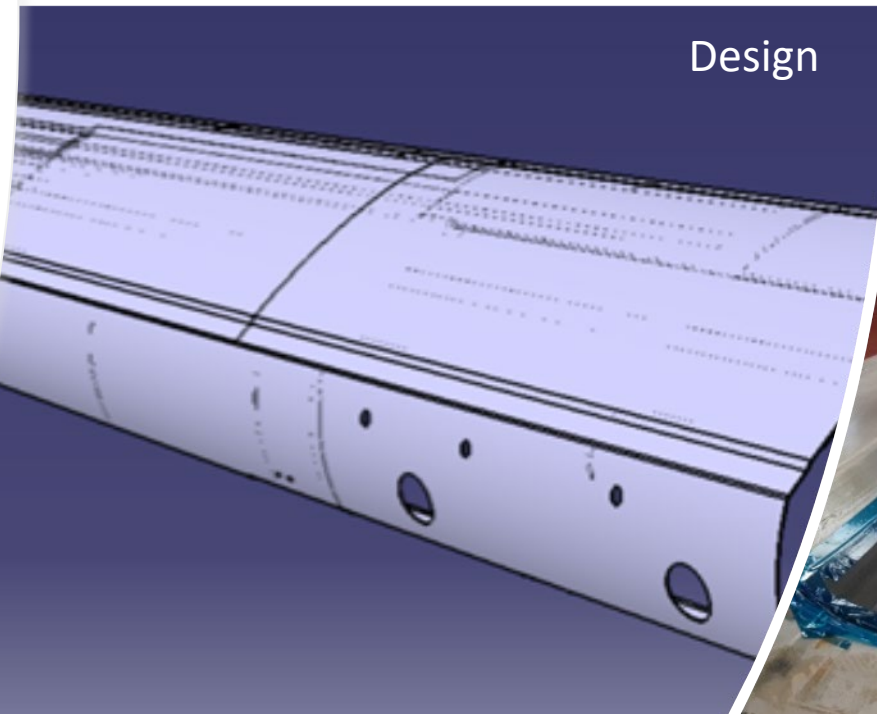
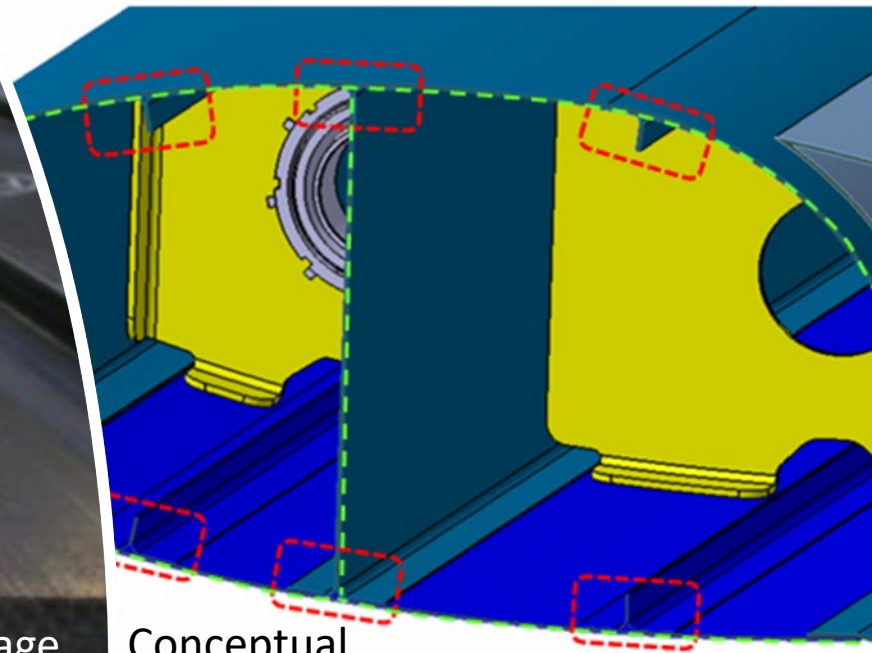
accessibility
Strength & buckling
airworthiness
crashworthiness

aeroelastic tailoring
weight
loads
environmental footprint

innovations
ICDS & systems
dynamics

From scratch to manufacturing

From scratch to manufacturing



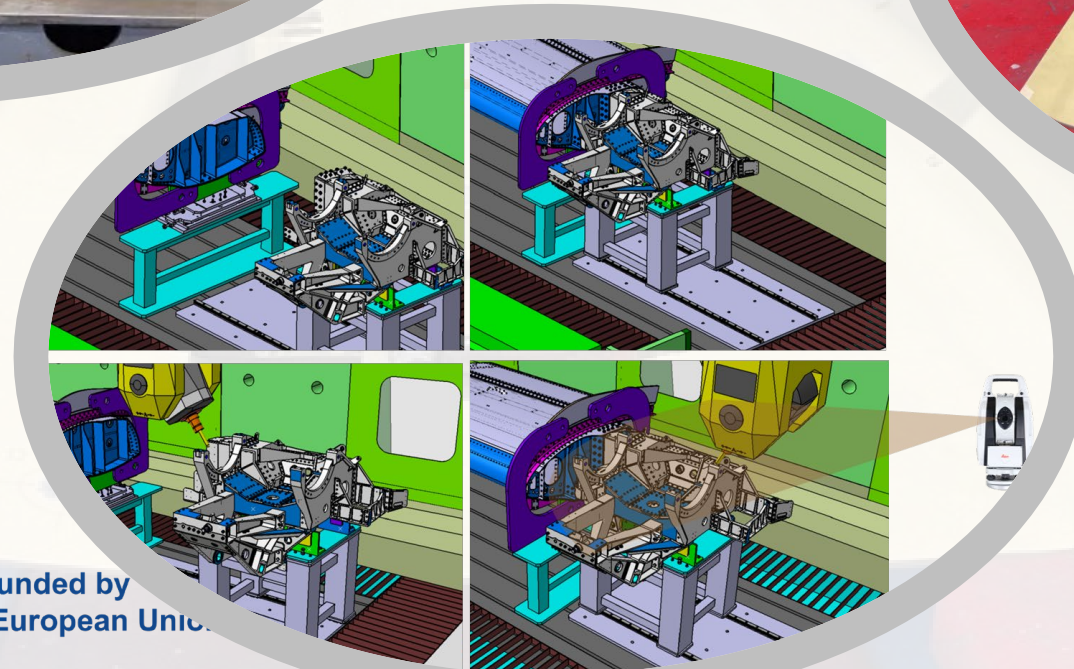
Innovations: Manufacturing & Assembly concepts



MODULAR TOOLING

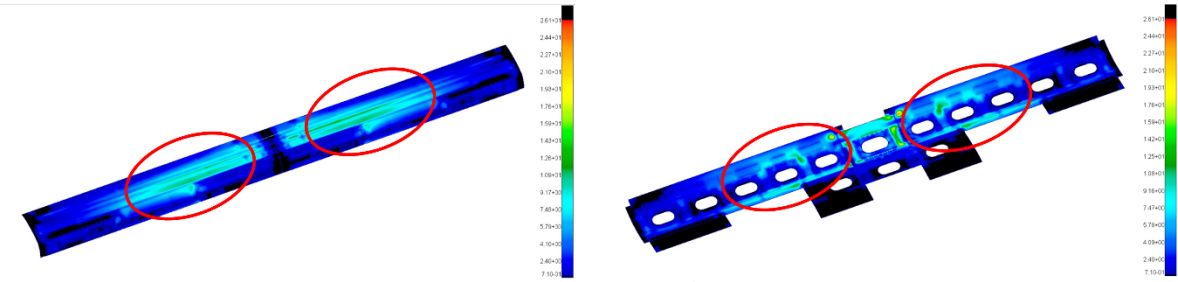


HIGHLY INTEGRATED
CFRP STRUCTURE



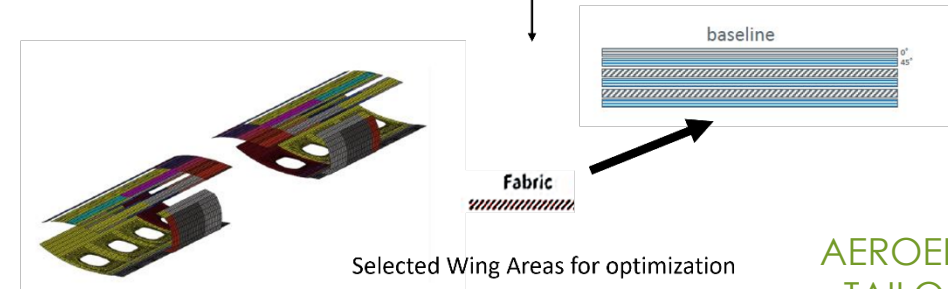
NO GAP APPROACH
FOR NPS INSTALLATION

Innovations: methodologies

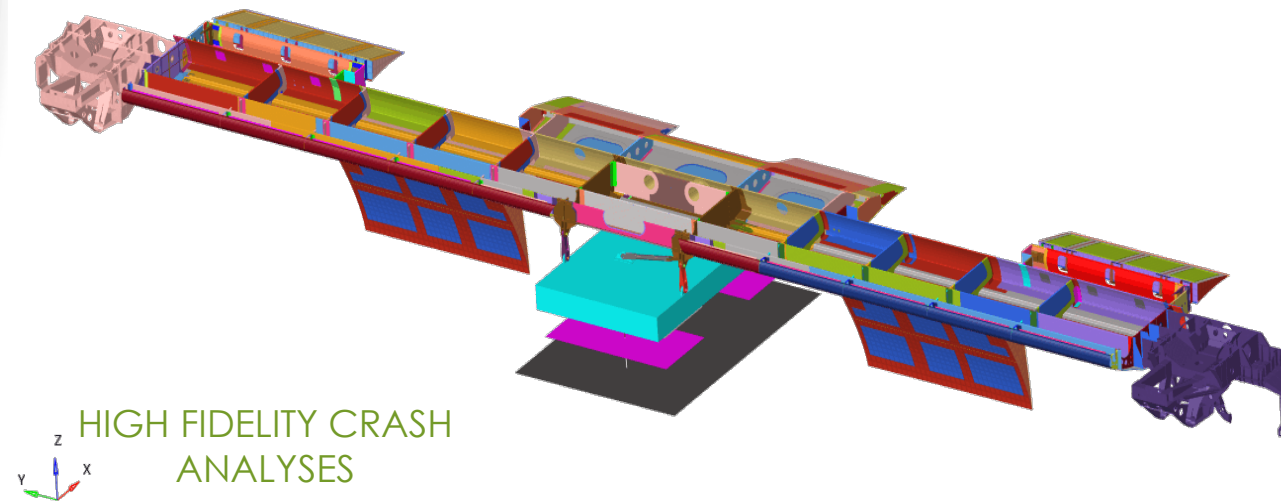


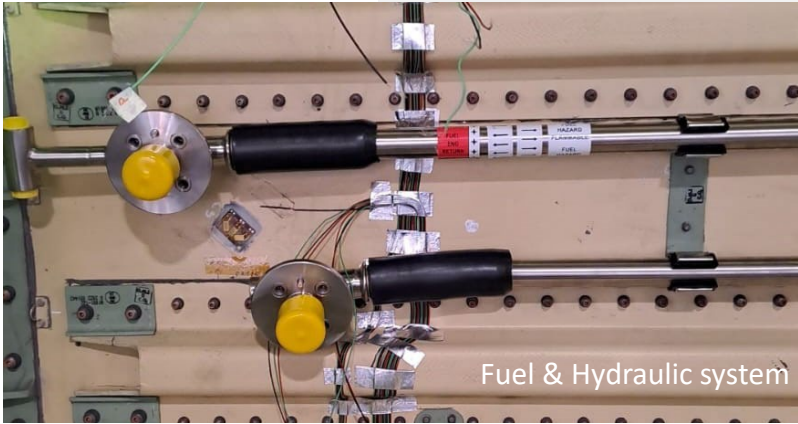
Strain Energy fringe plot – Upper Skin

Strain Energy fringe plot – Lower Skin



AEROELASTIC
TAILORING

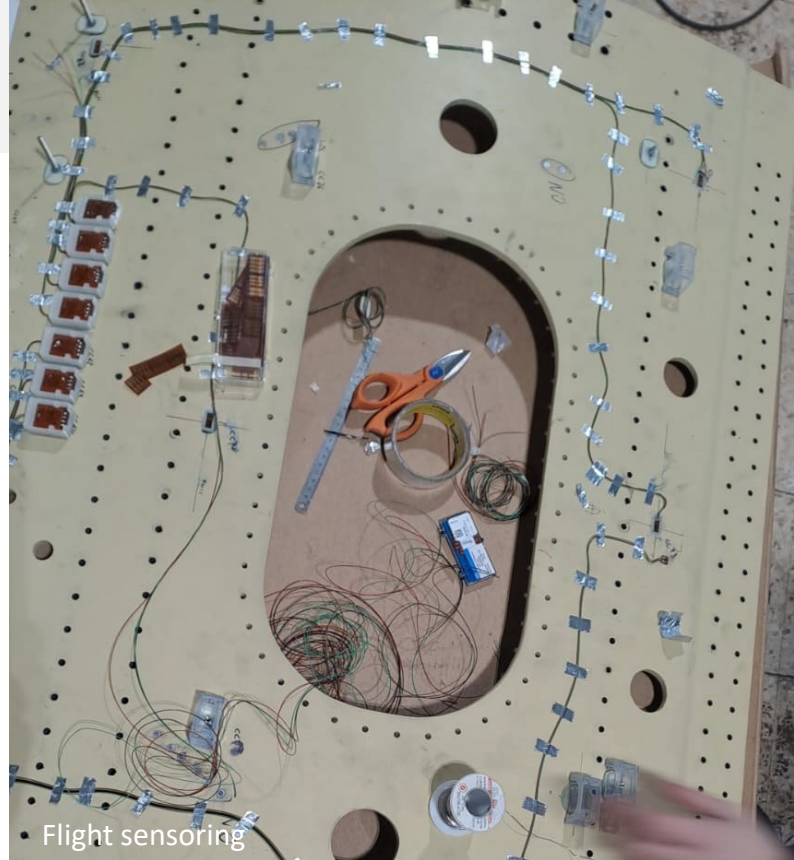




Fuel & Hydraulic system



ICDS



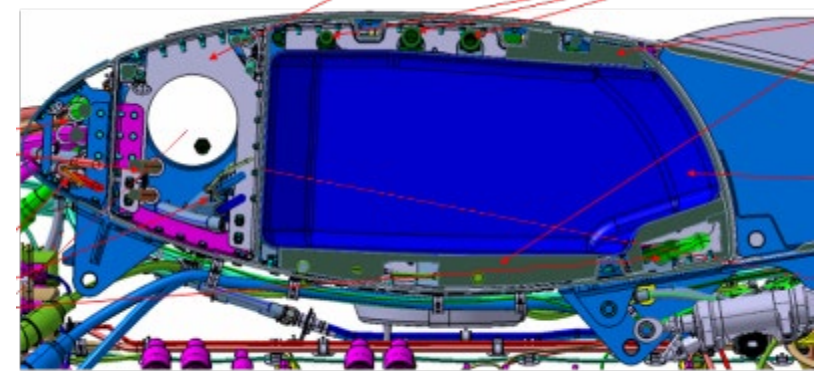
Flight sensing



ALM



Bladders



TYP SECTION



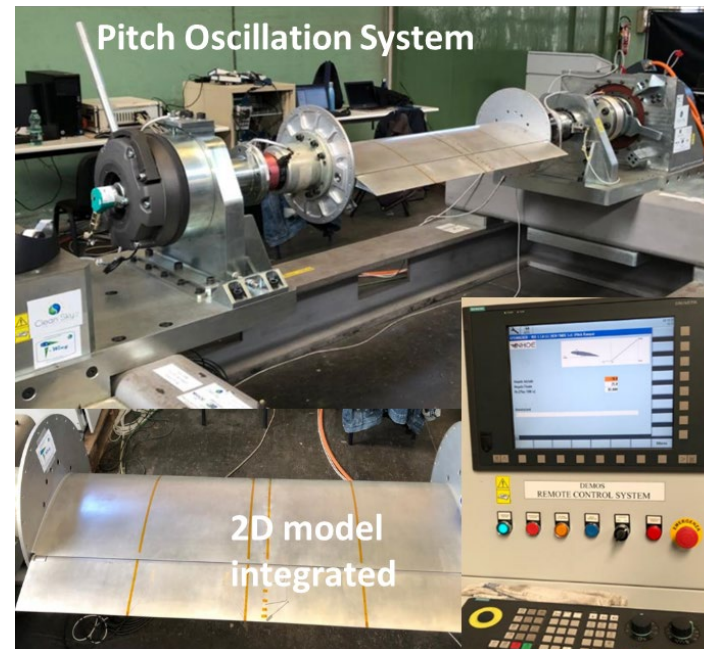
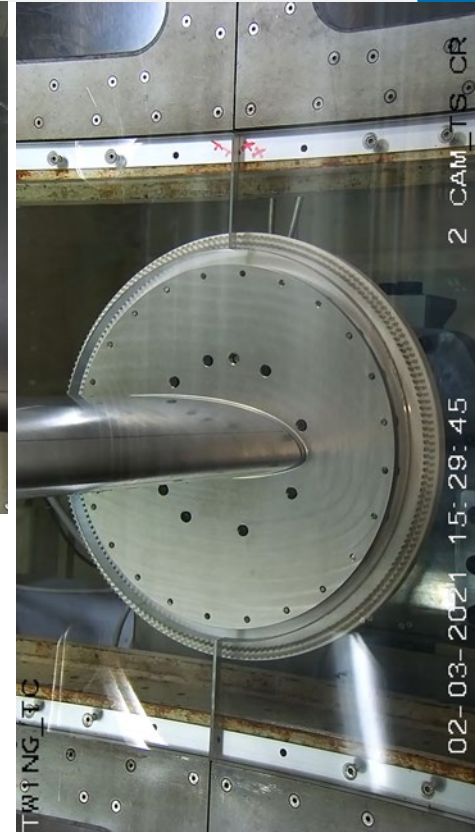
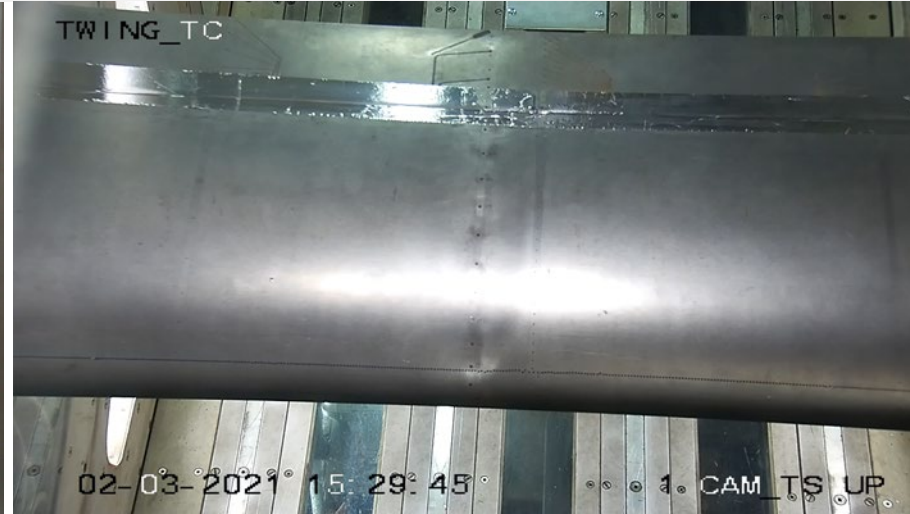
Electrical system

Systems integration

Close collaboration T-WING, Leonardo, DEFENDER, DIGIFUEL

Innovations: unique 2D unsteady tests

- Wing aerodynamic to simulate sudden pitch-up and -down maneuvers
- @ Mach=[0.2; 0.5]
- steady and unsteady pressure distribution
- force and moment



CIRA IWT



T-WING is also LCA

- Climate change [kg CO₂ eq] = -30%
- Ozone depletion [g CFC11 eq] = -26%
- Ionising radiation [kBq U-235 eq] = -24%
- Photochem. ozone formation [kg NMVOC eq] = -35%
- Particulate [disease incidence/thousand] = -63%

Impacts

T-WING is a huge knowledge increase for European industry

A **brand new supply chain** for the tiltrotor market was born

Enhancing mobility options within Europe

Strengthen European competitiveness within worldwide aeronautical arena

High level of innovation made possible by funding from **Clean Sky** and commitment of members



T-WING is a European partnership of LEONARDO, CIRA, MAGNAGHI, SALVER, OMI, MAREGROUP, IBK-INNOVATION, UNINA.
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