DIPARTIMENTO DI
SCIENZE E TECNOLOGIE
AEROSPAZIALI

DEPARTMENT OF AEROSPACE SCIENCE AND TECHNOLOGY (DAER)

POLITECNICO MILANO 1863

DAER: the only university department in Italy entirely dedicated to aerospace studies

DIPARTIMENTO DI SCIENZE E TECNOLOGIE AEROSPAZIALI

The **community of the Department of Aerospace Science and Technology** (DAER) comprises more than 280 faculty, staff and PhD students.

62
Faculty members (professors and researchers)

31
Technical and administrative staff

195
PhD students, post-docs, adjunct researchers

DAER for EDUCATION

The educational offer of the BSc Degree in Aerospace Engineering and of the Master Degrees in Aeronautical Engineering and Space Engineering is highly connected with the **research activities carried out by DAER.**

250
MSc students in Space Engineering

250
MSc students in Aeronautical Engineering

600
BSc students in Aerospace Engineering

DAER
RESEARCH LINES

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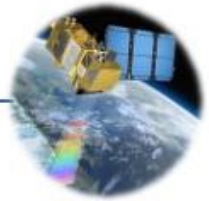
DIPARTIMENTO DI SCIENZE E TECNOLOGIE AEROSPAZIALI

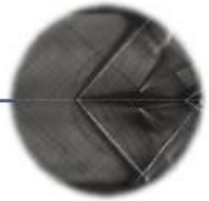
Research areas

Aircraft and rotorcraft design, aerodynamics, dynamics and control

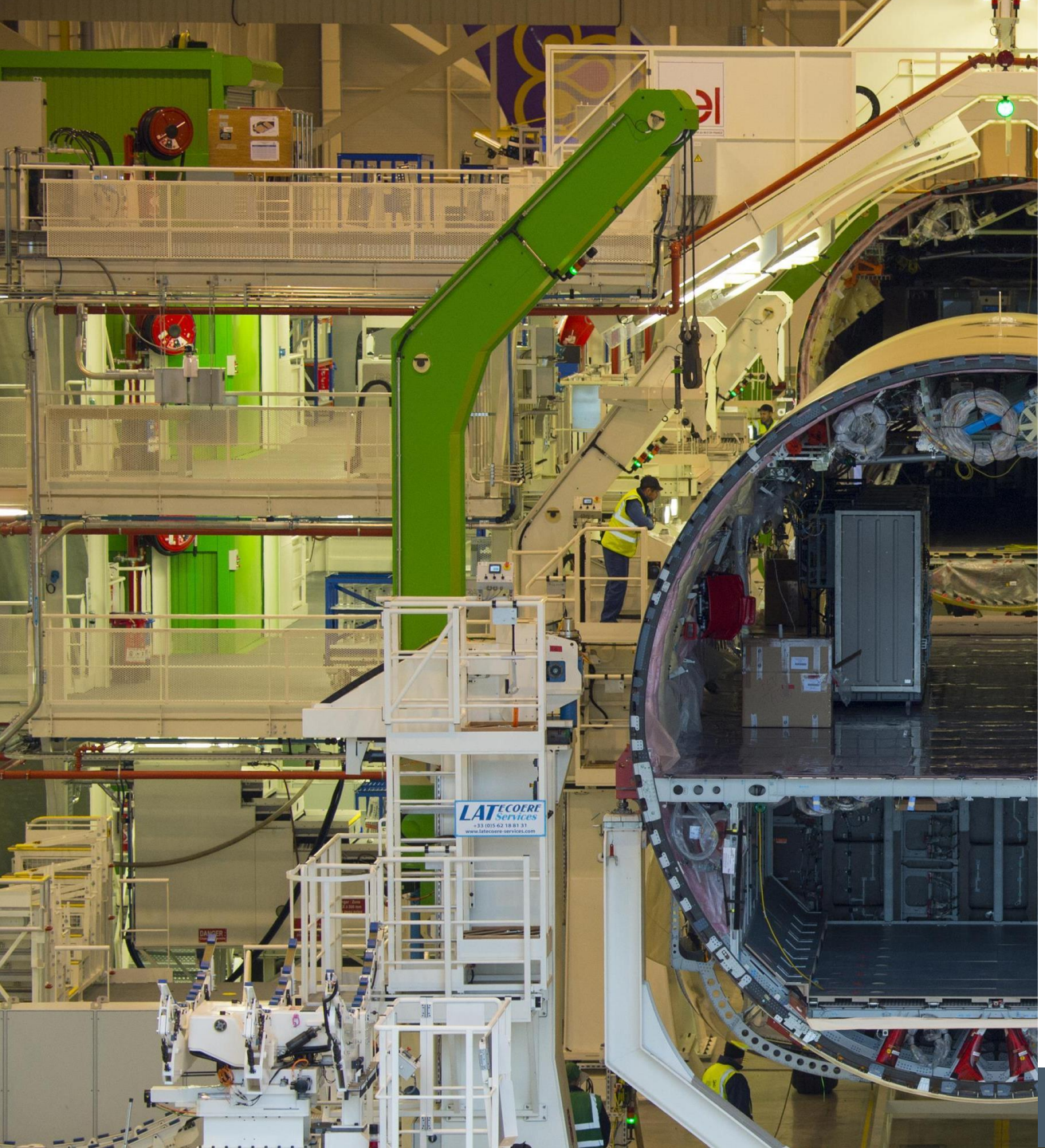
Aerospace structures, materials and technologies



Space science and engineering



Fluid dynamics, computational engineering, energy conversion



AEROSPACE STRUCTURES, MATERIALS AND TECHNOLOGIES

Multi-functional structures and MDO methodologies including AI-based approaches, high-velocity impacts and **crashes**, structural instabilities, **fatigue and damage-tolerant structures**, **advanced materials and manufacturing processes**, and **health monitoring** technologies.

NABUCCO (ERC Advanced Grant, PI: Chiara Bisagni)
New Adaptive and BUCkling-driven COmposite aerospace structures

Goal Develop new concepts of adaptive buckling-driven composite structures for next generation more efficient and sustainable aircraft

Results Adaptive structures for aircraft morphing wings

Impact Acting on two of the biggest levers for the future of clean aviation: reduced weight and increased efficiency

Traditional approach

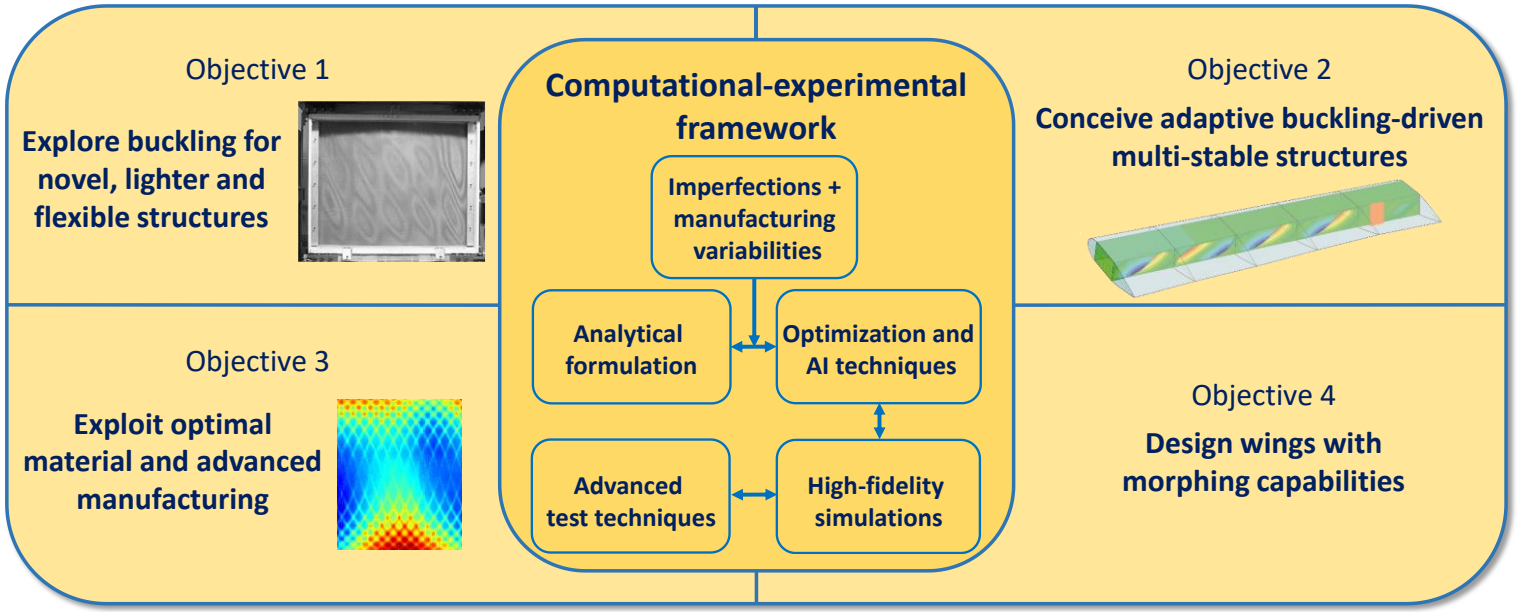
Buckling avoided:

- Stiffness reduction
- Nonlinear response
- Snap-through
- High variability (imperfections)

NABUCCO approach

Buckling exploited:

- Load redistribution
- Shape variation
- Fast response
- Large design space



AIRCRAFT AND ROTORCRAFT DESIGN, AERODYNAMICS, DYNAMICS AND CONTROL

Flight dynamics and performance, **unconventional configurations** and design methodologies, **UAVs and Advanced Air Mobility**, **active and adaptive control** systems, **autonomous guidance** and navigation systems, fluid-structure interactions, **structural dynamics and aeroelasticity**, **rotorcraft aerodynamics** and **aeroacoustics**.

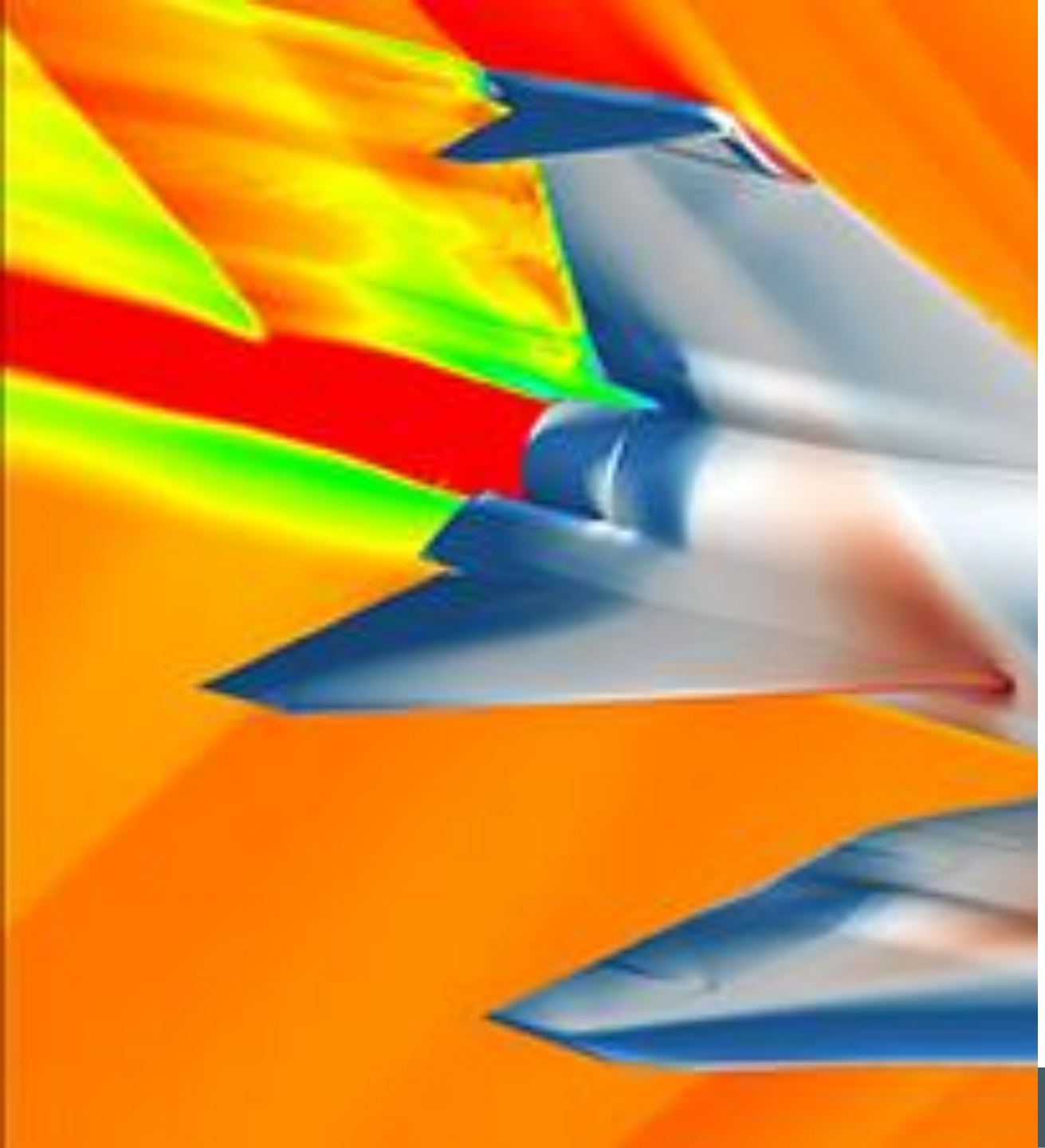
PNRR

MOST
CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

In the next decades the main challenge for the future mobility will be a **drastic reduction of emissions**, to reach the highest possible sustainability at a global level.

Technology transfer mechanisms will need to be strengthened to support an effective green transition, the achievement of carbon neutrality by 2050, and the digital transformation for efficient and inclusive mobility services.

DAER is a member of **SPOKE 1 Air Mobility** of **MOST**, the **National Center for Sustainable Mobility**, dedicated to the development of air mobility. In particular, DAER is the leader of **WP1 Sustainable design and social acceptance for Urban Air Mobility with demonstrator**



FLUID DYNAMICS, COMPUTATIONAL ENGINEERING, ENERGY CONVERSION

Aerodynamics, turbulence, spray and **combustion**, reacting flows, aeroacoustics, **computational fluid dynamics**, co-design methodologies using HPC, non-ideal flows for energy conversion systems, and **wind turbines**.

TRACES DOCTORAL NETWORK

TRACES

—

TRAining the next generation iCE researcherS

SPACE SCIENCE AND ENGINEERING

Mission analysis and design, **astrodynamics,** environmental impact of space missions, **space debris management**, trajectories optimization, **autonomous spacecraft guidance and navigation**, space surveillance & tracking, **interplanetary CubeSats**, primary and secondary **thermochemical propulsion**.

EXTREMA

Goal: To enable deep-space CubeSats with autonomous GNC capabilities

To what extent can we navigate the solar system free of human supervision?

The Engineering Extremely Rare Events in Astrodynamics for Deep-Space Missions in Autonomy (**EXTREMA**) project wants to **challenge** and **revolutionize** the current paradigm under which spacecraft are piloted in the interplanetary space.

Pillar 1
Autonomous Navigation

Pillar 2
Autonomous Guidance

Pillar 3
Autonomous Ballistic Capture

Experiment 1
EXTREMA Optical Facility

Experiment 2
EXTREMA Thrust Test Bench

Experiment 3
Ballistic Capture Corridors

EXTREMA Simulation Hub (ESH)

IMPACT

DAER
RESEARCH INFRASTRUCTURES

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Research infrastructures

DIPARTIMENTO DI SCIENZE E TECNOLOGIE AEROSPAZIALI

Galleria del Vento del Dipartimento di Scienze e Tecnologie Aerospaziali del Politecnico di Milano

- Laboratorio aerodinamico
- Laboratorio Prove Sperimentali
- Laboratorio Tecnologico
- Space Propulsion Lab
- Laboratorio Sicurezza Trasporti
- CREA Lab
- Laboratori Droni

EXPERIMENTAL AERODYNAMICS LABORATORY

The main plant is a **closed circuit wind tunnel** with a test section of **1,5m x 1m** and a maximum wind speed of **55 m/s**.
The experimental activity includes **measures of pressure and force, hot wire anemometry and particle injection velocimetry (PIV)**.
Tests are conducted in various research fields, from basic fluid dynamics to industrial applications.

STRUCTURAL TESTING LABORATORY

The laboratory performs several types of tests, including:

- ✓ Static, dynamics and fatigue characterization of materials
- ✓ Static, stability, modal and fatigue tests on mechanical components
- ✓ Thermomechanical analysis, dynamic analysis, viscometry measurements
- ✓ Support to a broad variety of tests involving mechanical and dynamic systems

TECHNOLOGICAL LABORATORY

Support to the design of components and complete systems, to the machining of **metallic materials** using CNC tools, to the realization of systems and components in **composite materials and advanced composites** using different production technologies including **additive manufacturing**.

LAST – TRANSPORTATION SAFETY LABORATORY

It features a sled for **crash tests**, several pieces of equipment for **drop tests**, launching machines for **high-speed impact testing**, and several devices and tools for **static tests**.

DRONE LABORATORY

Fly-ART arena for drone flight
12 m x 6 m x 4 m test volume equipped with a motion capture system and a rapid protoyping capability for guidance, navigation and control systems.

SPLAB – AEROSPACE PROPULSION LABORATORY

It operates in the field of space propulsion with reference to solid, liquid, and hybrid propellant systems, both from an experimental and numerical point of view.
The research group works at innovative solutions, including solid propellant formulations with low environmental impact and non-conventional hybrid engine confgurations for in-space applications.

DAER
OBSERVATORIES

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Space Economy Observatory Research

The **Space Economy Observatory Research** focuses on five main topics:

- map the **Space Economy ecosystem** in Italy;
- estimate the **Italian Space Economy market**;
- identify main **business services and applications of space technologies** at national and international level;
- analyze **technology trends**;
- analyze **private funding** opportunities.

Drones and Advanced Air Mobility

The **Drones and Advanced Air Mobility Observatory** aims for the following goals:

• Understand the features, trends and opportunities of the professional **drone market;**

• Study the introduction of **drone services** and identify the most promising innovative air services areas**;**

• Study the **level of operation** of some services at the base of drone use:

• Monitor the evolution of **international drone regulations**;

DAER

START UPs and SPIN OFFs

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START UPs and SPIN OFFs

esa BUSINESS INCUBATION CENTRE Milan

PoliHub
Innovation Park
Startup Accelerator

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Fondazione
Politecnico
di Milano

ESA BIC MILAN

PROGRAM (2023-2029)

For each startup ESA BIC provides

50.000 €
GRANT
EQUITY-FREE. FOR PRODUCT DEVELOPMENT AND IP RIGHTS

50 H
BUSINESS SUPPORT (COACHING AND MENTORING)

24 MONTHS
INCUBATION LENGTH

80 H
TECHNICAL SUPPORT

5
STARTUPS INCUBATED EACH YEAR

10 H
IPR AND LEGAL SUPPORT

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