DEPARTEMENT OF MECHANICAL ENGINEERING
LT-COL PROF BENOÎT MARINUS – HEAD OF DEPARTMENT

DEFENCE

12 September 2025

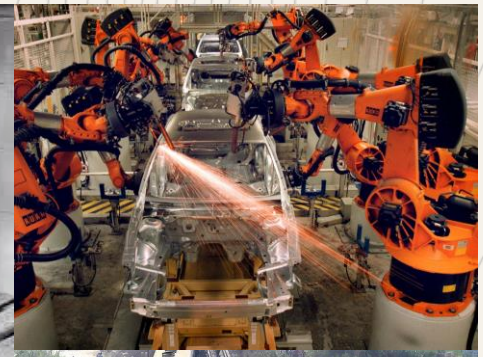
MECA - Engineering Military Mobility for Complex Environments

RMA .be Brussels
Royal Military Academy

Mechanics is everywhere around you!
Land-Sea-Air-Life & even Cyber (HVAC, cooling) 🤓







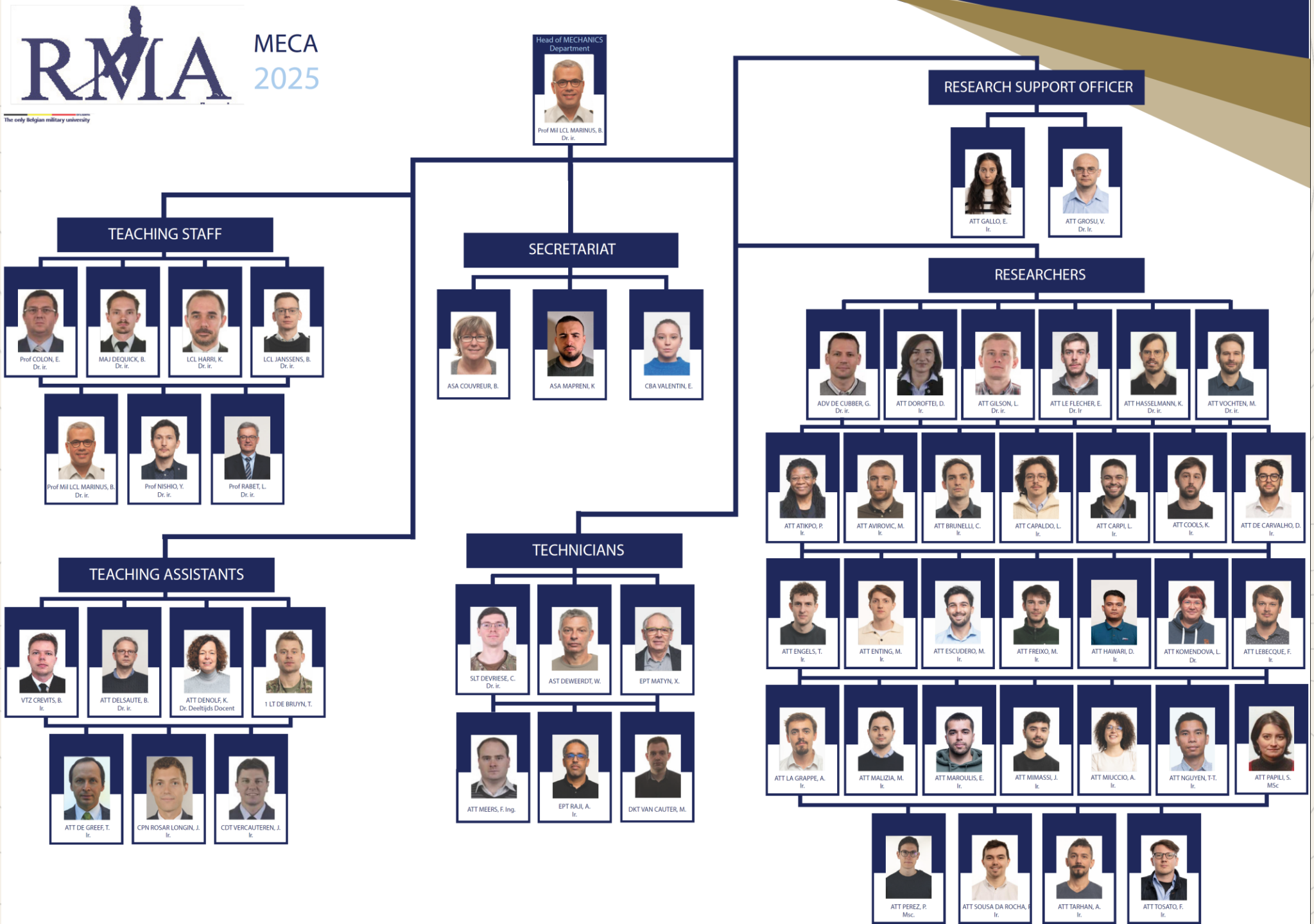






RMA
The only Belgian military university

MECA
2025



Research Topics

EMMA F
Environmental Mechanics and Mobility Applications

ROBOTICS & AUTONOMOUS SYSTEMS

1

on the relation between **mechanical devices** and the **environment**

- materials,
- vibrations & ageing,
- acoustics,
- fluid dynamics & air quality,
- sensing.

2

on the performance, stability and technology of **mobility platforms** (air-land-sea)

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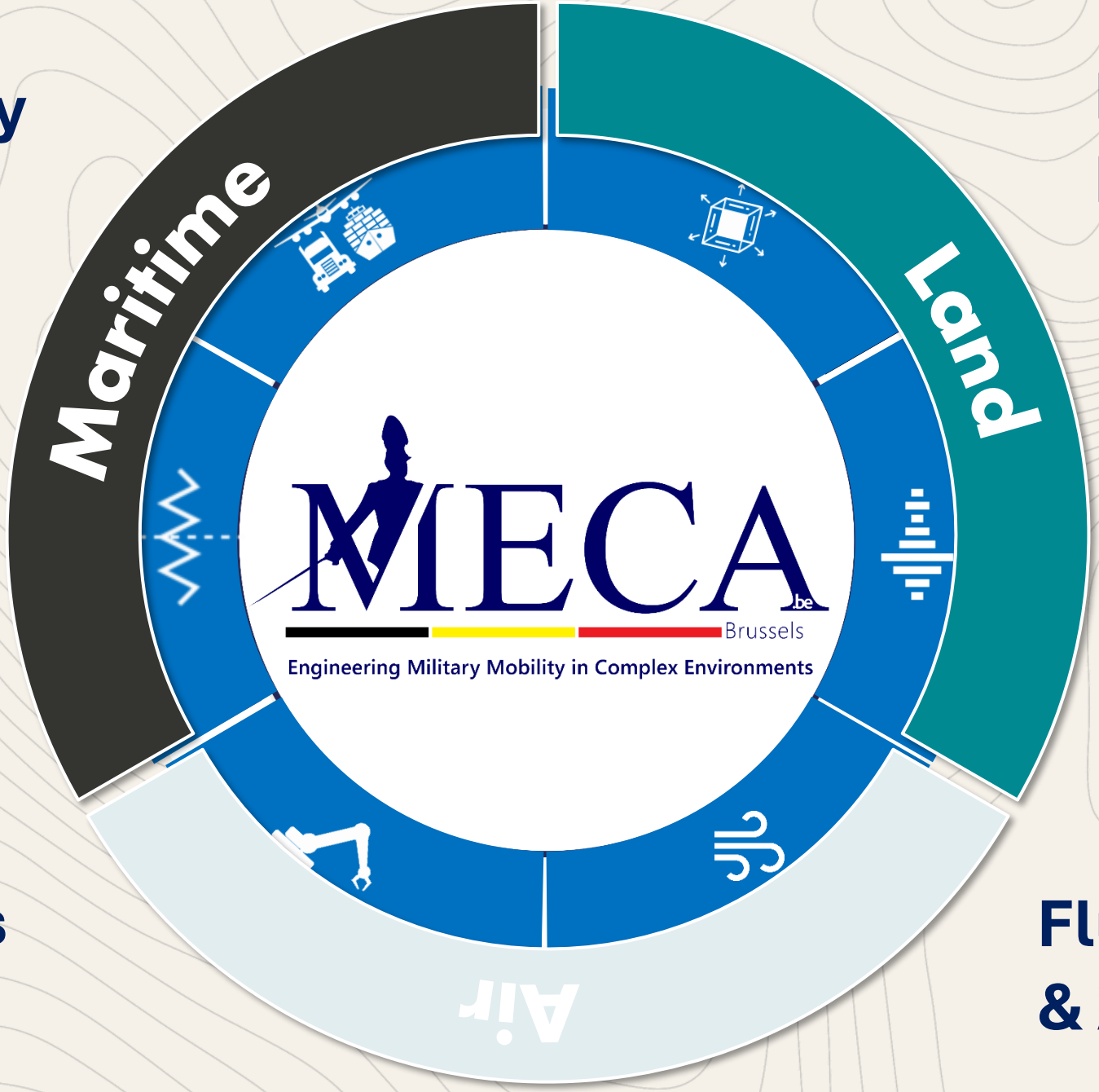
Mobility

Materials Engineering



Vibrations

Acoustics

Robotics & Autonomous Systems

Fluid Dynamics & Air Quality

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Vibrations Laboratory

- LDMS has an accreditation ISO/IEC 17025
- 20kN Electrodynamic shaker
- Vertical & Horizontal
- Climatic chamber (-50°C --> +100°C)

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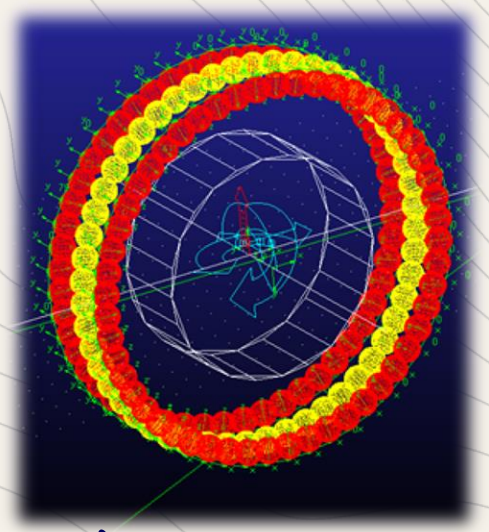
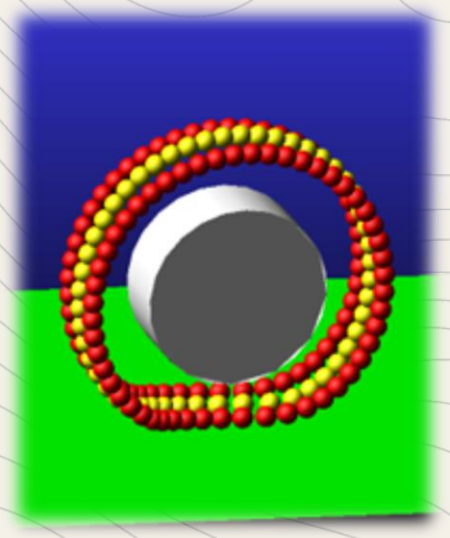
Vehicle Dynamics

Better modelling of **land vehicle ground contact to complex terrain** to improve the ride quality for both the personnel and the vehicle. (Defence)

Collaborating with Belgian civilian corporations to provide a European expertise while contributing to NATO activities. (Society)





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Complex Environments

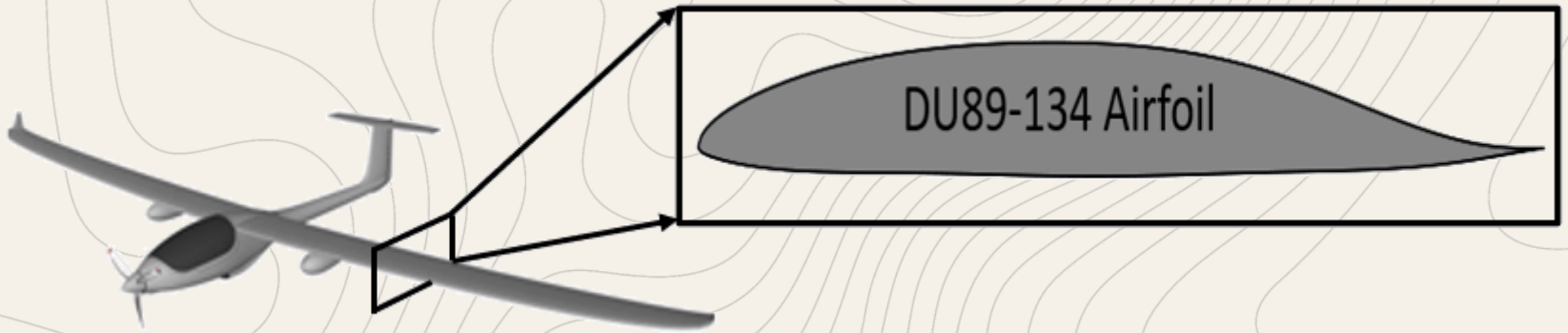
SOURSE
Insight from earth

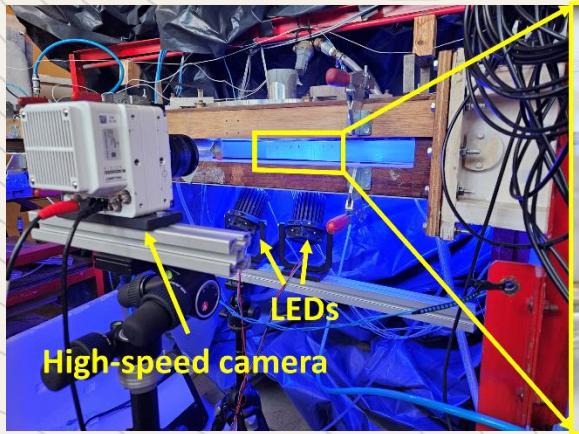
von KARMAN INSTITUTE FOR FLUID DYNAMICS

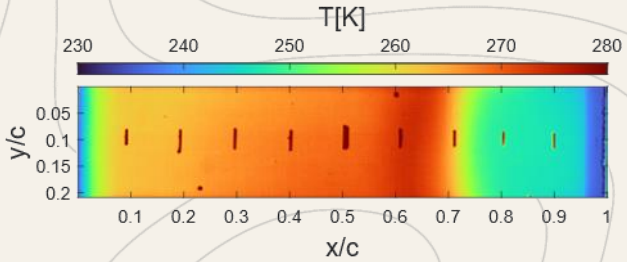
GHENT UNIVERSITY

VUB VRIJE UNIVERSITEIT BRUSSEL

From **Laboratory** and **Numerical Simulations** to **Real-life**







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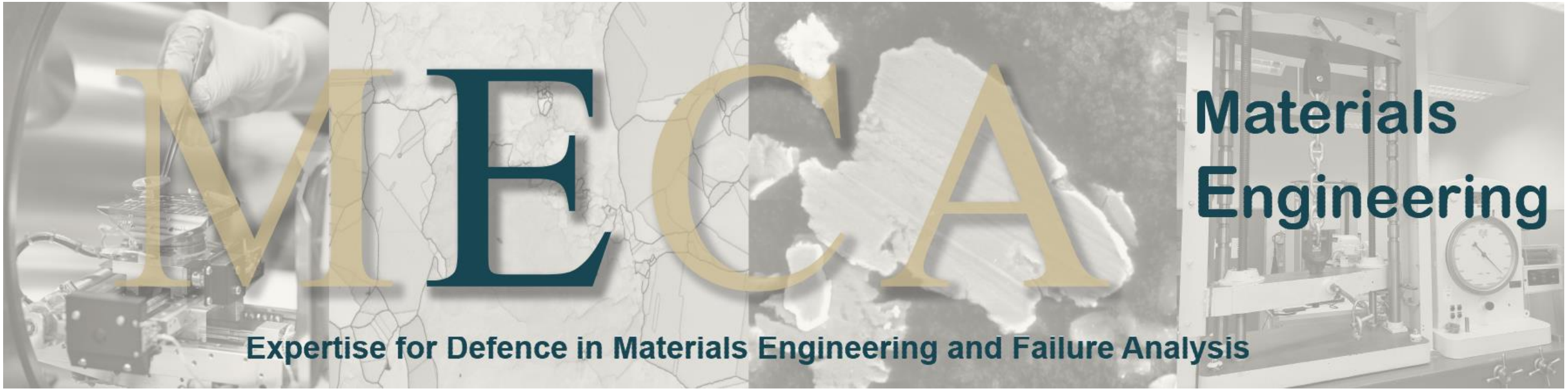

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Materials Laboratory

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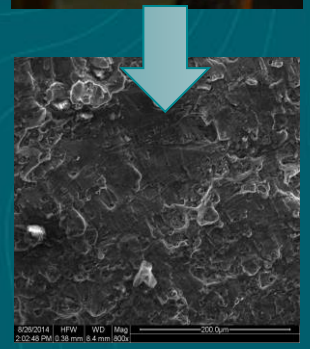
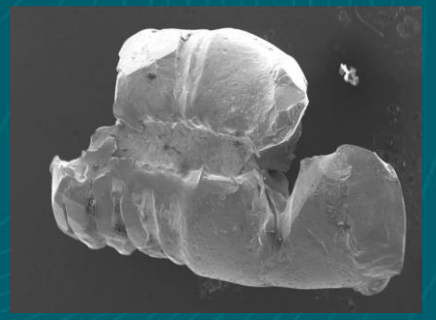
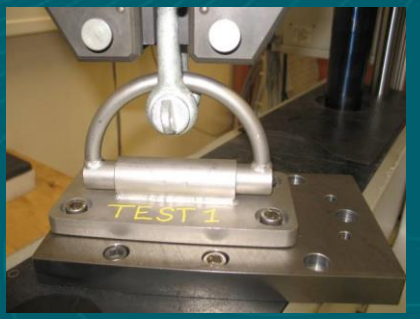
- Metallography
- Optical & Scanning Electron Microscopy
- Tensile, Bending & Torsion Benches
- Hopkinson bars
  (dynamics of materials = high deformation speed events)
- Charpy V-notch Impact Test
- Fatigue Test Bench





F-16 FOD screw

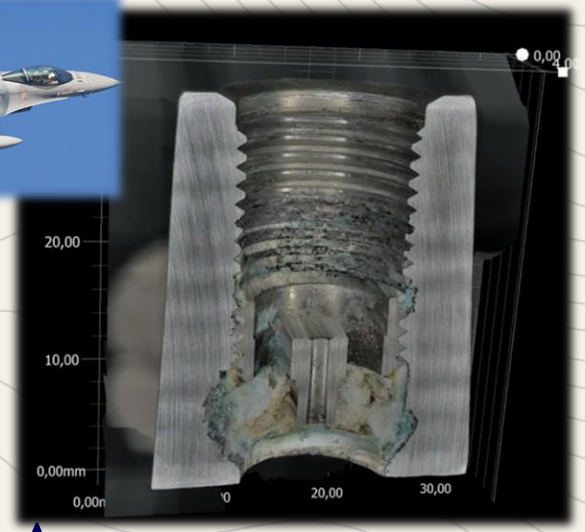


Clogged hydrazine valve

Materials Laboratory: Failure Analysis

Expertise for safety in the Air Force

Hydrazine is an emergency fuel on the F-16. The origin of the clogging of the hydrazine valve was unknown → determination of contaminant to find the cause and avoid malfunction in flight.



… in the Navy

Discovery of cracks on the anchoring chains of the Lobelia led to some worries. Testing in the Lab certified their usage with the required loads.

…. in the Army

How many jumps can a Jungle Line sustain before we need to replace it? First tests concluded on their initial strengths. Testing for fatigue to be con't.

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Robotics & Autonomous Systems Laboratory

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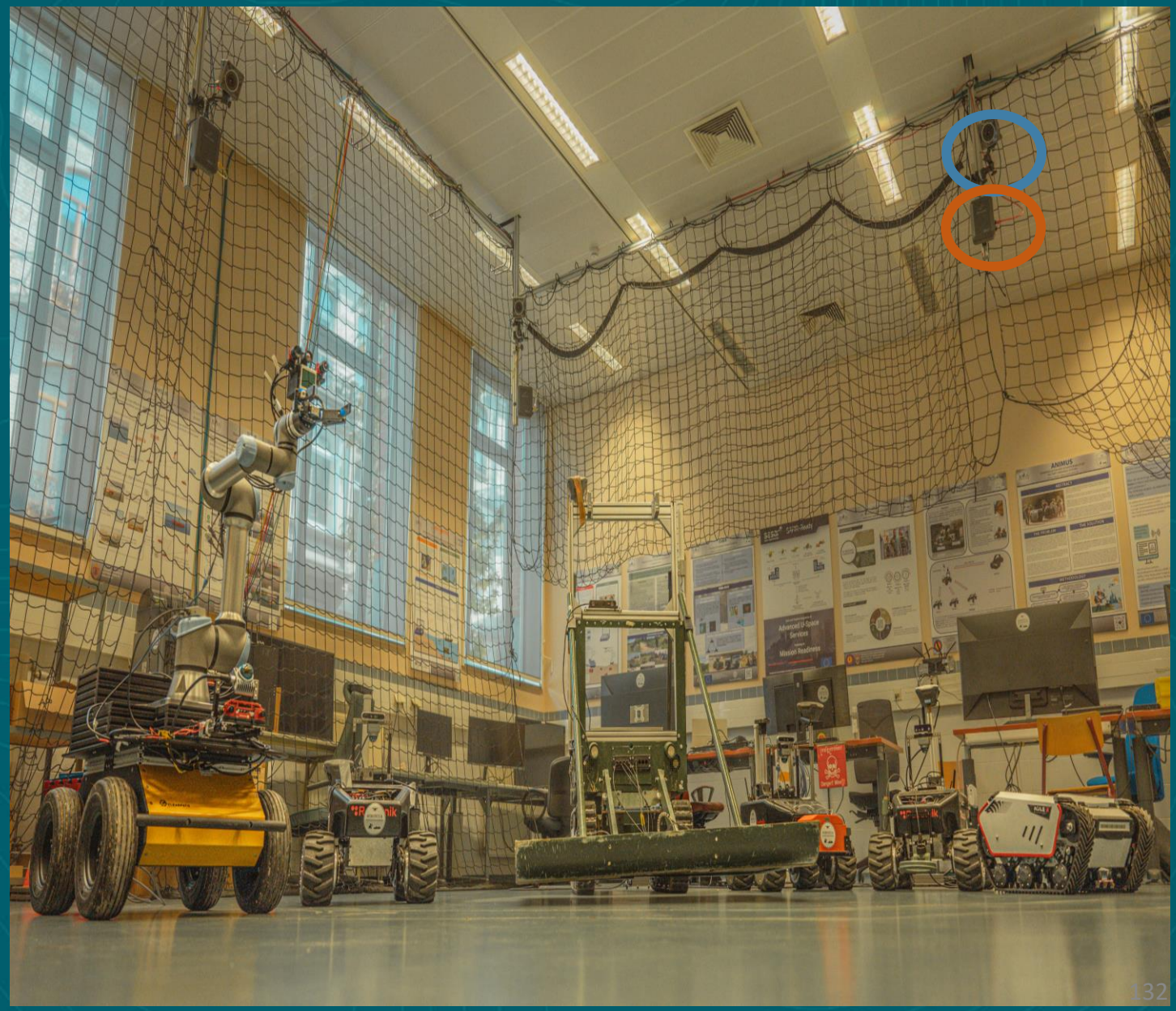
- 9m x 9m x 3m **drone cage** for safe indoor experimentation and validation
- Unique **dual positioning system**, consisting of:
  - 8-camera Optitrack
  - motion tracking system
  - 8 beacon Agilica UWB positioning system
  - Result: positioning accuracy up to 0,2 mm



2020

Development of swarm coordination strategies for military UGS

2022

Validation of swarm coordination strategies with end users and porting them to real military UGS, like the Milrem Themis

2024

Operational deployment of the Themis in Ukraine for CASEVAC, resupply, demining & logistics

2018

Development of a drone detection system without relying on RADAR

2024

Release of a **world-first** pre-standard test method for assessing the performance of drone detection systems

2025

Development of a full EN-standard. Development of a harmonized drone incident database

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Fluid Dynamics Laboratory

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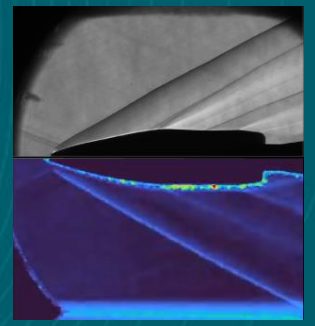
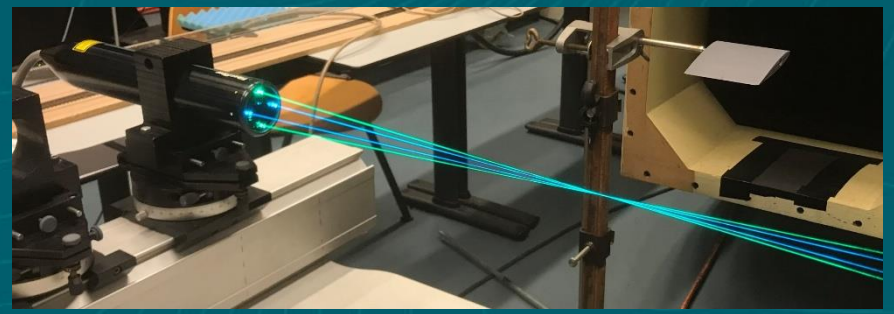
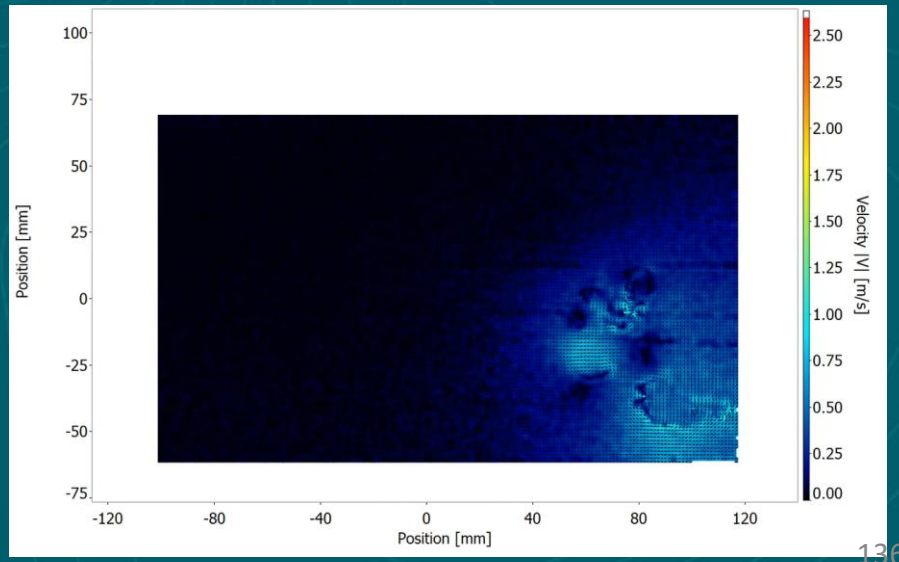


- 60x60cm low-turbulence wind tunnel (up to 40m/s);
- 40x40cm wind tunnel (up to 30m/s);
- 6x5cm supersonic wind tunnel (from Mach 1.2 to Mach 3);
- Particle Image Velocimetry system, a Laser-Doppler Anemometer, Hot-Wire anemometers, aerodynamic balances (3- and 6-components), pressure scanners, infrared camera;
- Sound signal acquisition system (28 microphones, 36-174dB, 20Hz-70kHz);
- High Performance Computing installation and CFD/Acoustics software: Ansys Mechanical, StarCCM+, PowerFlow, Cadence, OpenFoam, SoundPLAN.

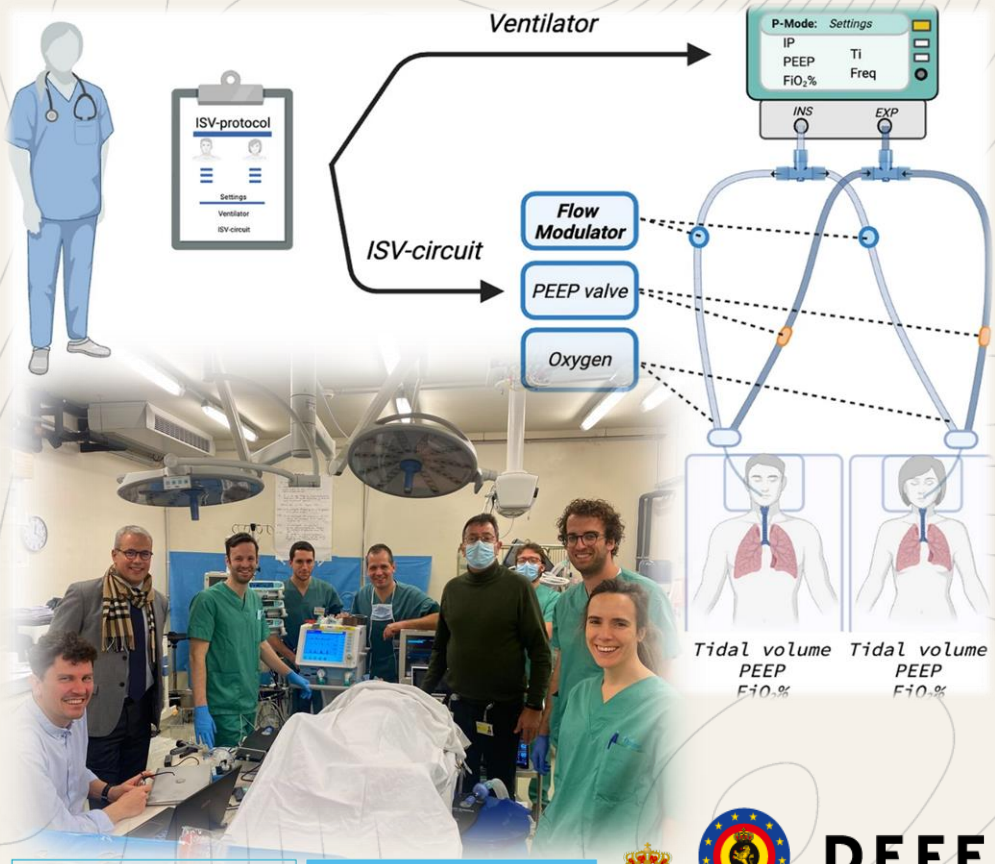




Practical solutions with real impact for Defence and society.

Better modelling of non-linear propagation for better mitigation for the impact of military jet noise on personnel and communities. (Defence)

Tackling a ventilator surge capacity problem by developing an AI based protocol for Individualized Shared Ventilation. (Society)



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Reach out!

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DEPARTEMENT OF CHEMISTRY
BART SIMOENS

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Research @ CHCH

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