eCon Engineering

Boundless Innovation
Unique Technologies
Solutions Tailored To Your Demand

Intro & Business Model

eCon Engineering is a cooperative engineering partner engaged in consultation-, cutting edge CAE services and special purpose machine design. Through high-added value simulation technologies, we offer faster and more reliable product development for our industry partners.

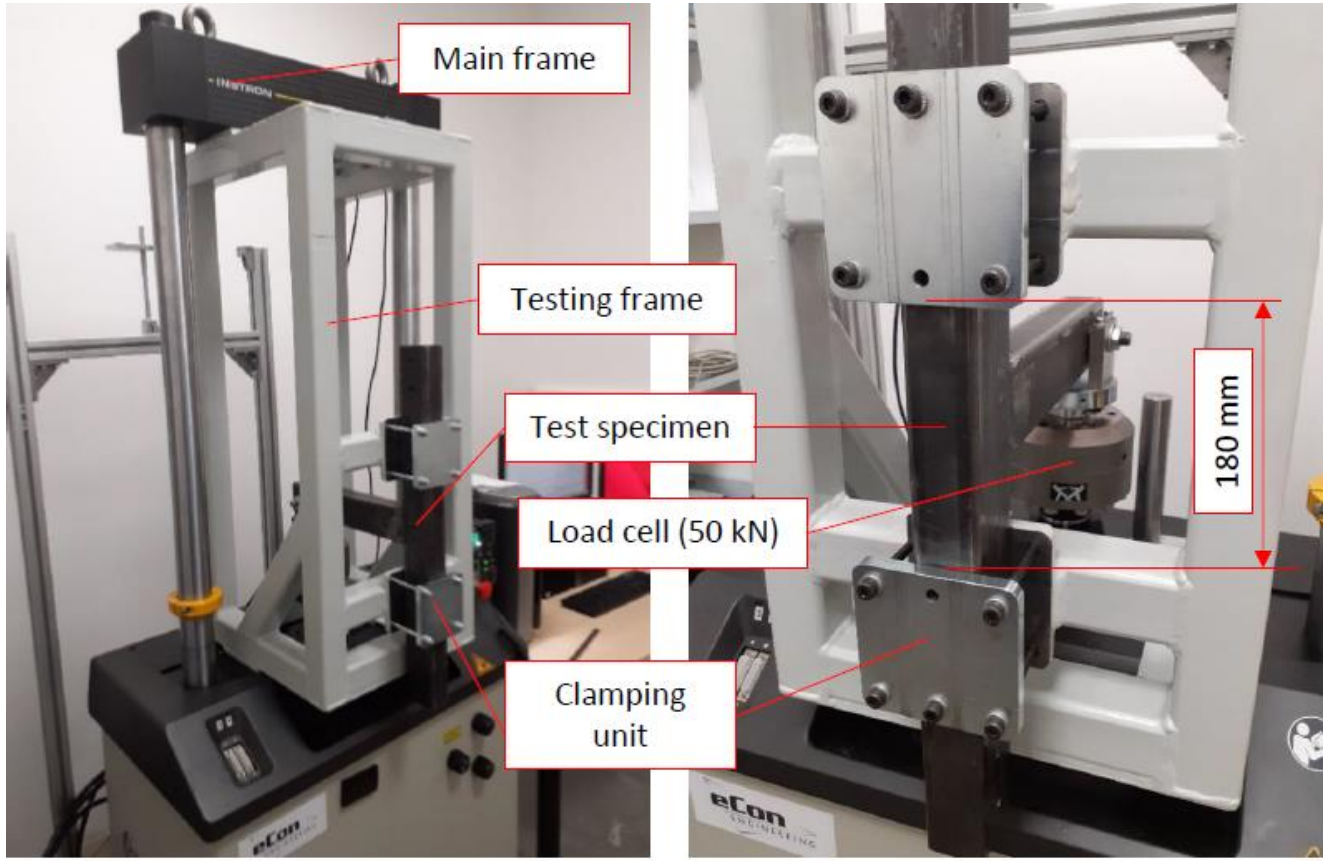
- Founded in 2002, 80+ employees
- Independent engineering consulting company
- Turnover (estimated) for 2021: 7.0+ M€
- Business fields – Automotive, Aerospace, Composite, Military, Healthcare, Energy industry, Agriculture
- Certifications – ISO9001, ISO27001, TISAX Level3
- Certified Channel Partner of Ansys and Moldex3D

Our offer: flexibility, high-added value support, outstanding quality and reliability

- Structural mechanics & dynamics
  - Thermo-mechanical investigation, vibration (modal, harmonic, PSD etc.), multibody simulation, topology optimisation
- Fatigue simulations
- CFD, aerodynamic design
- Electromagnetic design challenges
  - LF, HF, Thermal management, HFSS
- Optimisations
- Cutting edge composite knowledge
- Method developments, using AI and machine learning
- Automation solutions & production technology

Fatigue Testing, Material Characterisation

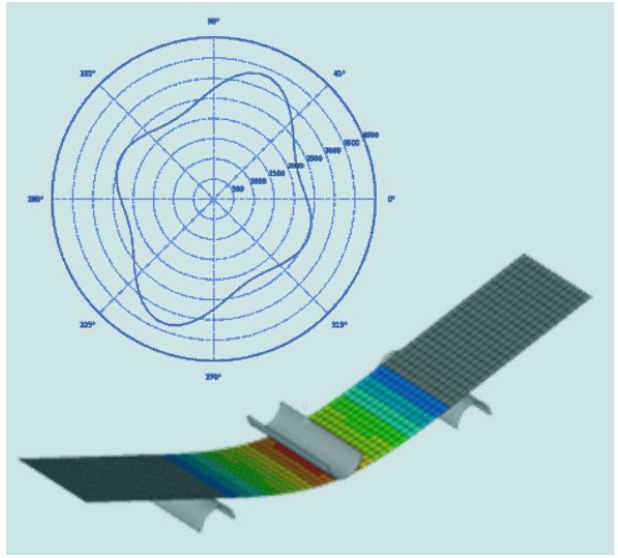
Testing capabilities



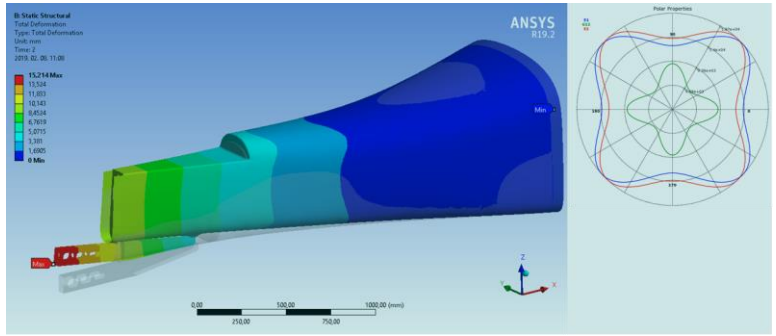
Test equipment / Software
Instron 8801
Servo-hydraulic fatigue testing system
Capacity +/- 100kN (dynamic load)
WaveMatrix 2 Dynamic Testing Software
Instron 8800MT digital controller

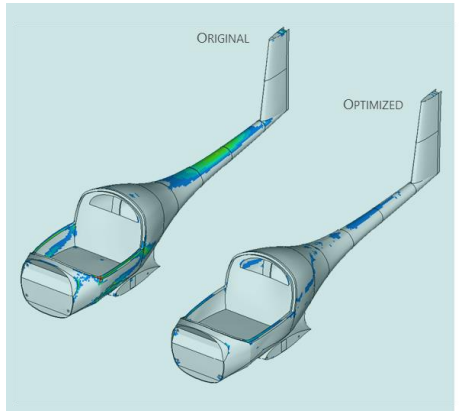
Composites Design General

Light-weight structures

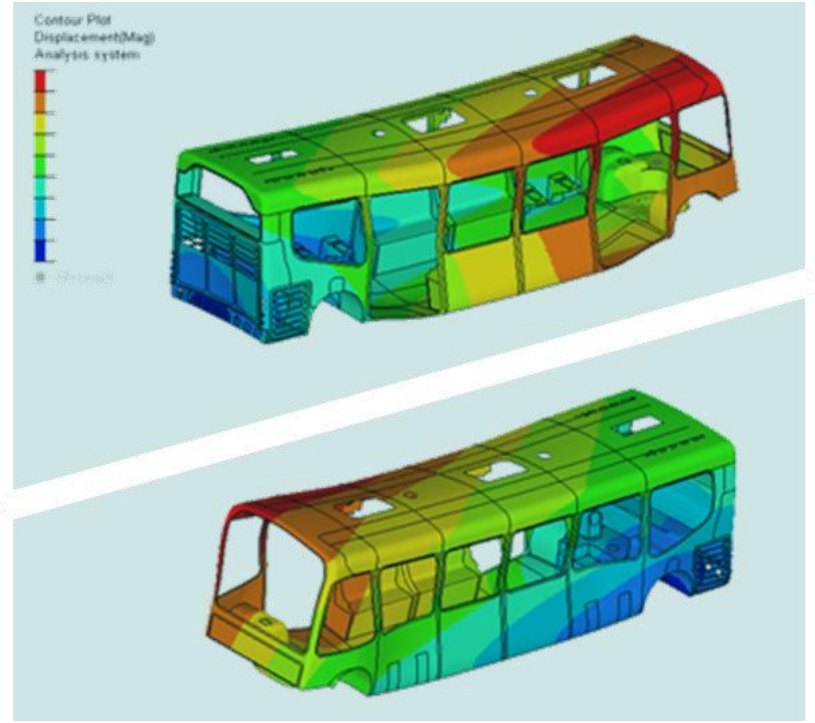


Finite element analyses of the composite structure of a modular, sandwich composite material. The material model setup was based on in-house and external measurement results.





Modular composite bus

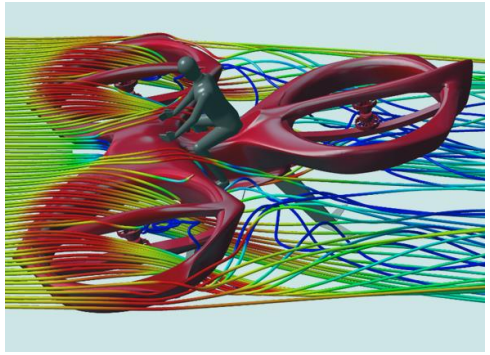


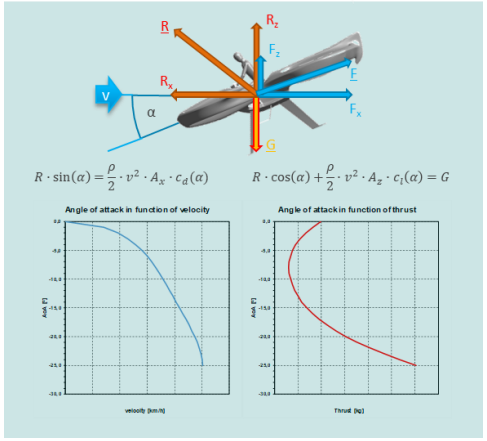
FEA of the composite structure of a modular, sandwich composite autobus. The material model setup was based on in-house and external measurement data.

Aerodynamic Design Challenges

Drone – Flike

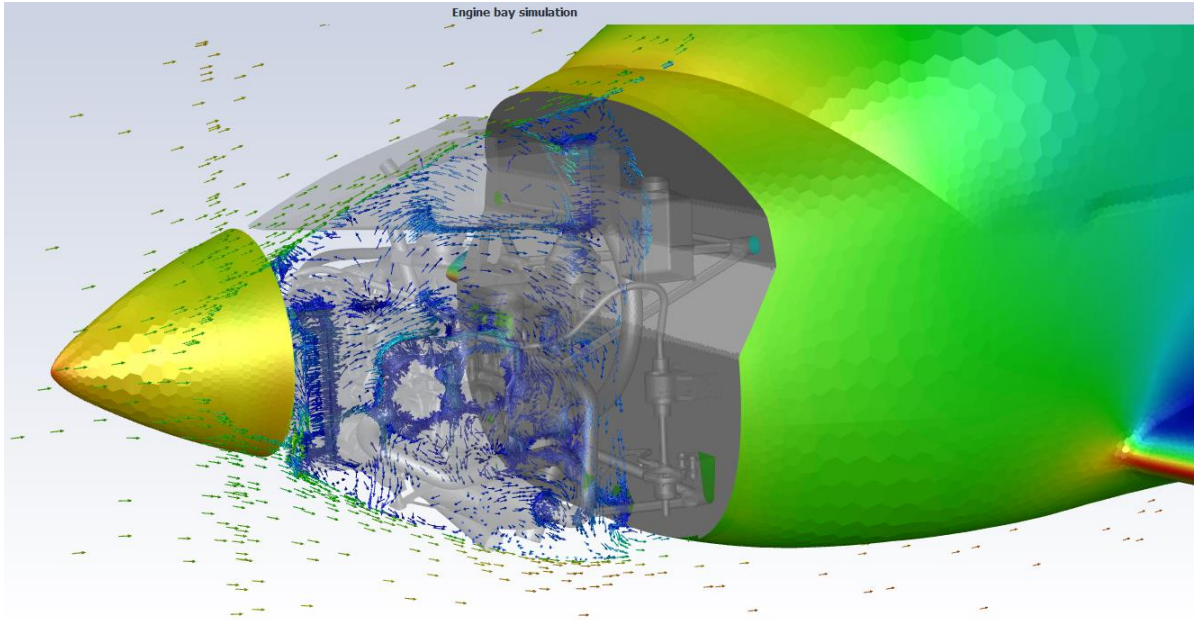
Aerodynamic performance analysis of FLIKE – a manned drone – was worked out at different angle of attacks in order to determine maximum and optimal flight speed, and associated thrust.





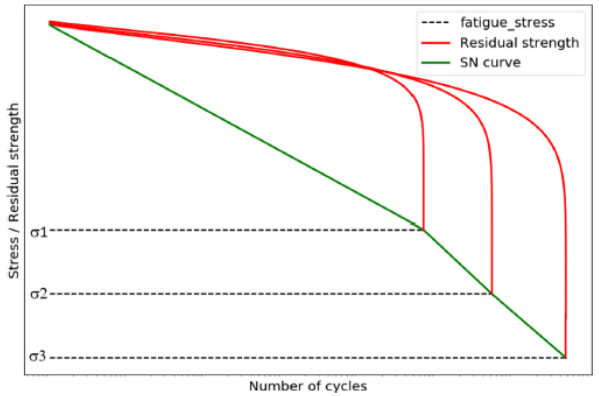
Engine bay simulation

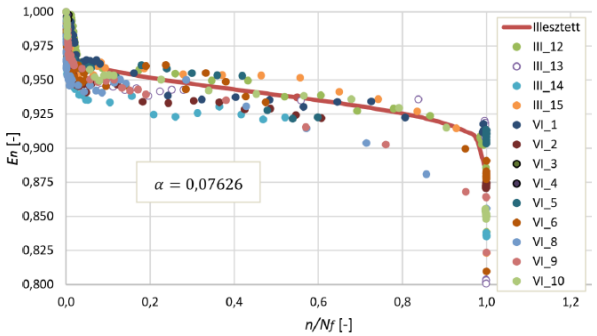
Detailed engine bay and air intake simulation was carried out incorporating the 3D corrected Virtual Blade Model to assess internal flow patterns and determine engine cooling efficacy.

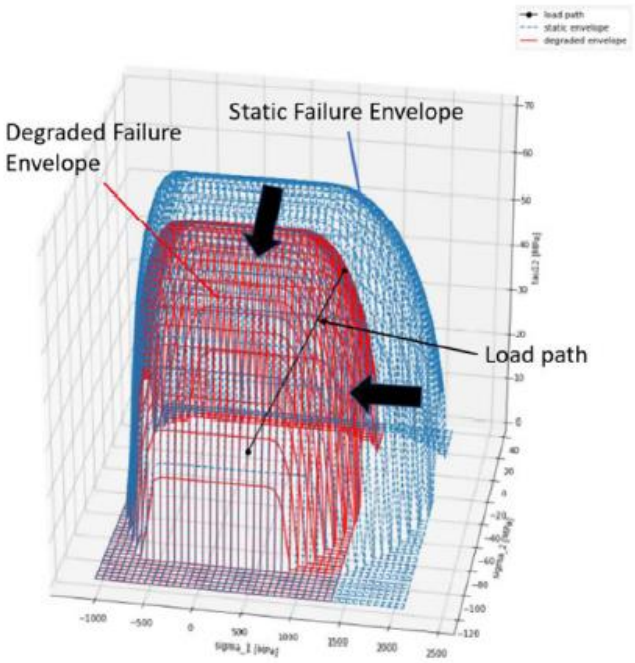


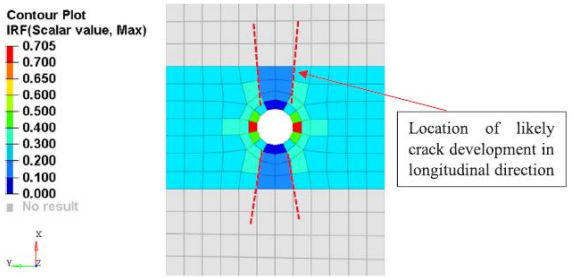
Method Development
Service Life Evaluation Method for Composites

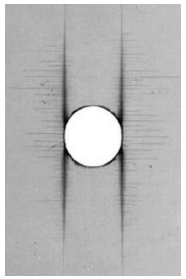
- **Calculation of composite fatigue life in FE environment – no similar solution available on the market**
  - Treats stiffness and strength as characteristics degrading with cycles → fatigue = progressive degradation
  - Combines methods from literature developed for unidirectional loads with a complex failure theory → innovation
  - Complex failure theory and FE based ply stress calculation ensures usability on ANY ply stackups and geometries

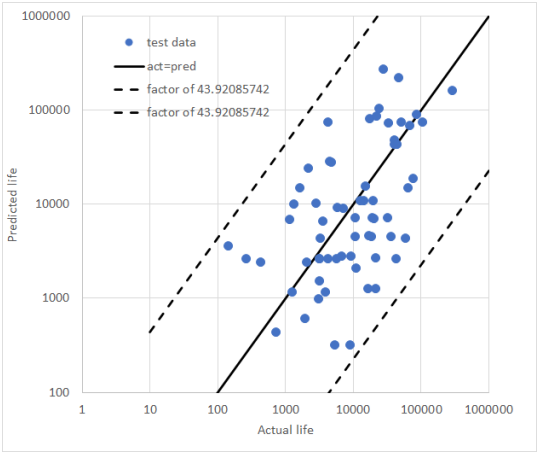


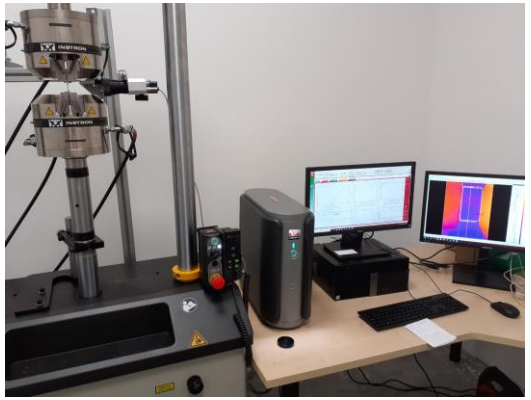






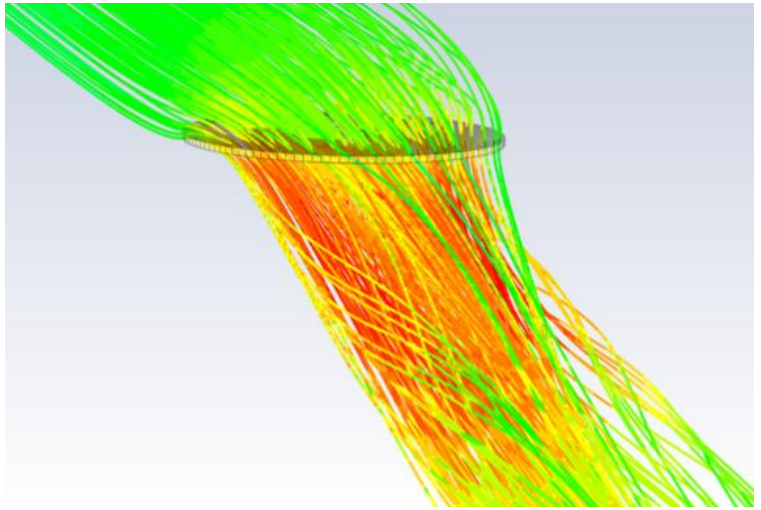




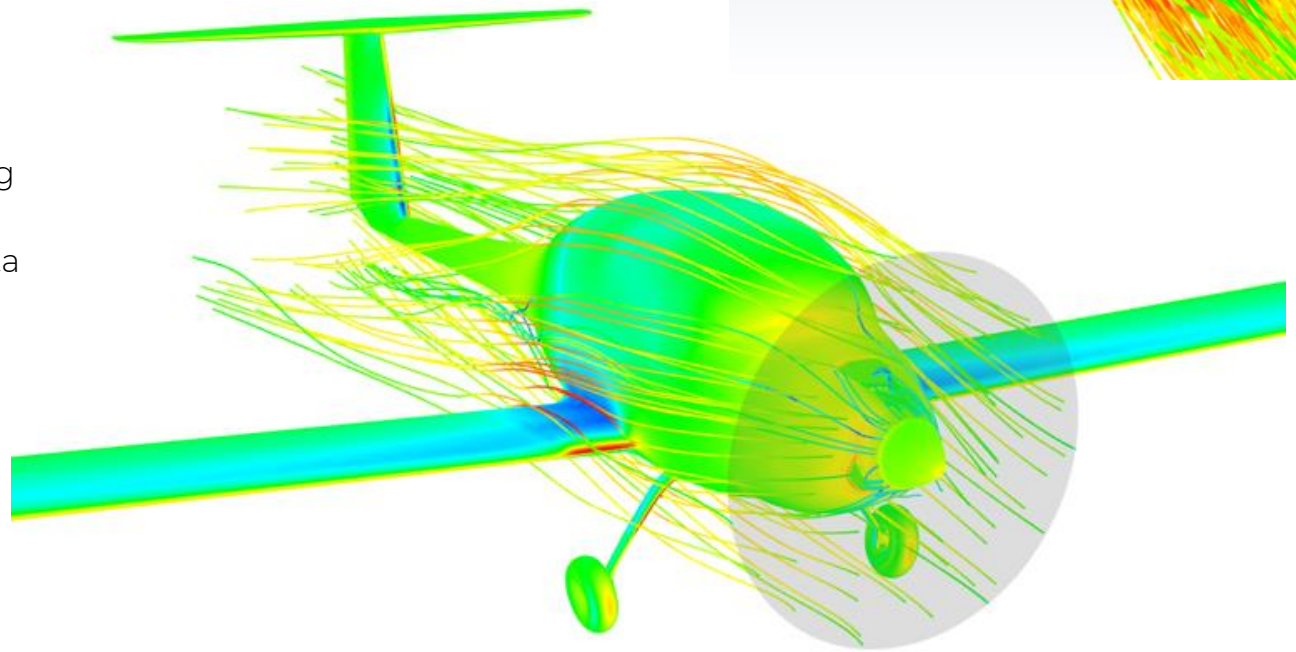


Method Development
Development of 3D corrected Virtual Blade Model

- **Development of Virtual Blade Model** (VBM) with built-in 3D aerodynamic correction using artificial intelligence
  - 3-year R&D project funded by the Hungarian government
  - Substitution of explicit propeller models in CFD with VBM to speed up simulations without loosing flow characteristics induced by blades' spanwise 3D load distribution
  - Optimisation of features washed by the propellers' wake becomes feasible



- **3D-VBM: 3D corrected Virtual Blade Model**
  - Virtual Blade Model (VBM) substitute costly explicit blade modelling
  - Accounts for 3D aerodynamic effects by utilizing special AI model
  - AI is trained based on 3D explicit blade CFD data

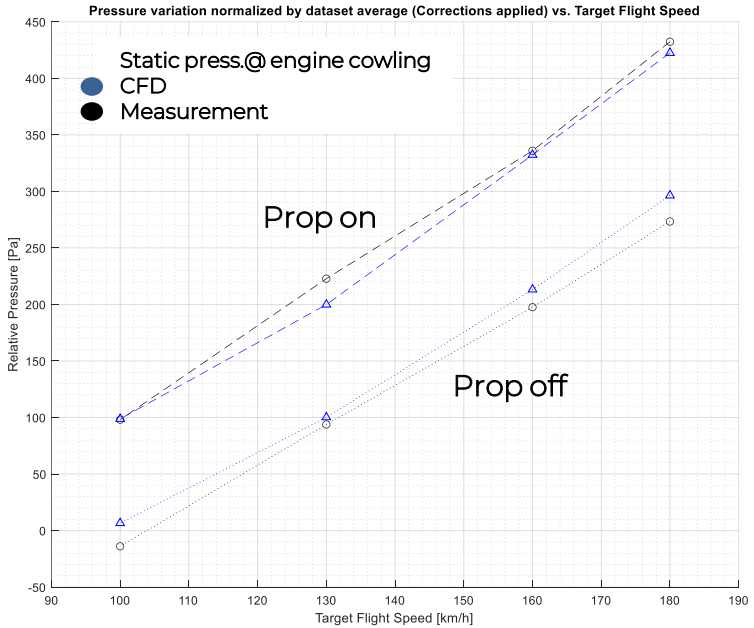


- **Enables affordable optimisation of multi-rotor systems**
  - Drones
  - Conventional aircraft
  - Wind turbines and wind turbine farms

Experience in In-flight Testing

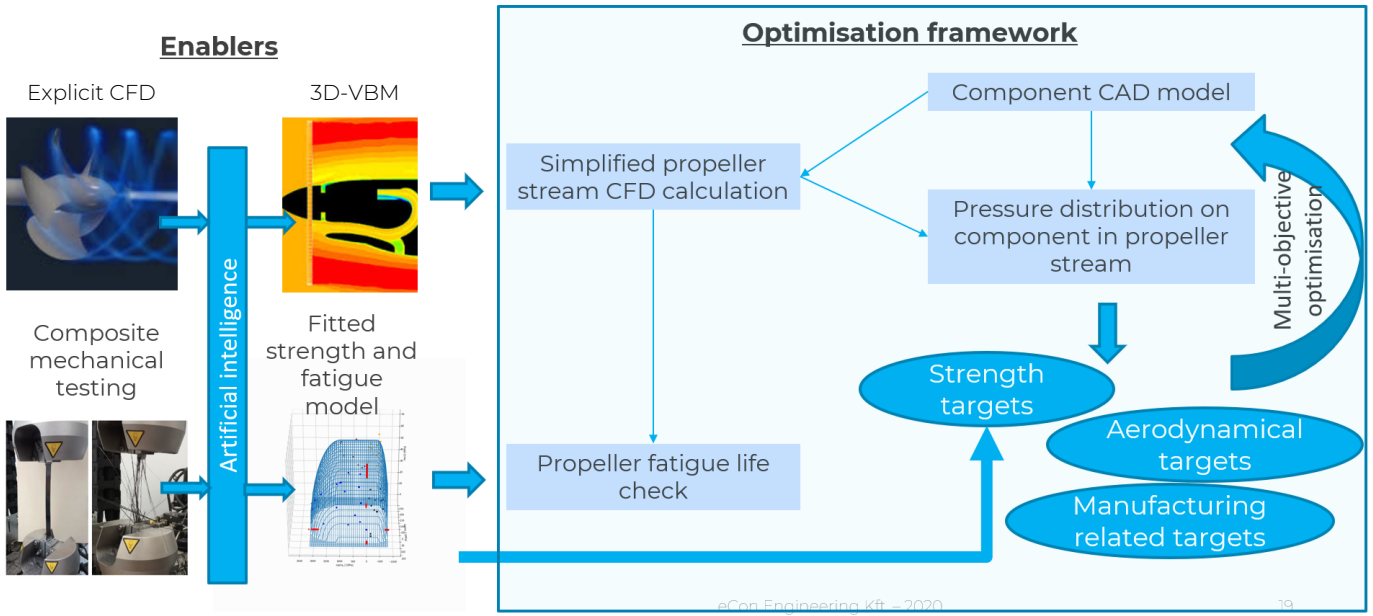
Use Case: Motor-glider and autogyro flight tests

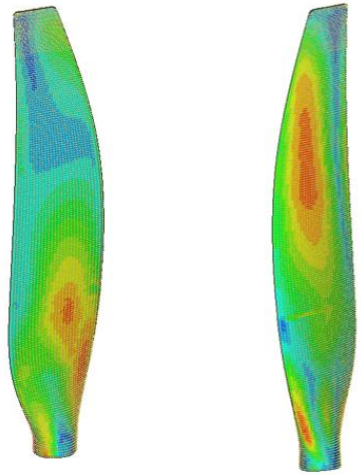
- Proved and robust method for pressure data acquisition
  - Robust surface and total-pressure sampling system
  - Wind tunnel calibrated static pressure sensors
  - Calibrated 3D printed Kiel-probes for total-pressure sensing
  - Allows quick verification of CFD models and flow field assessments of aircraft, drones, ground-vehicles or wind turbines

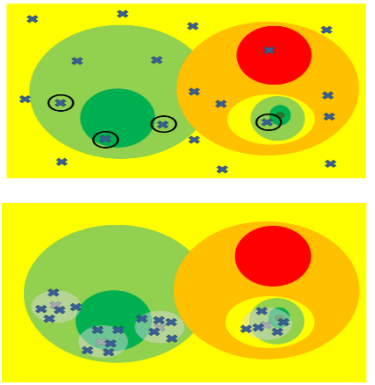


Method development
AI in Engineering Applications

- Hungarian government funded domestic R&D project
- Exploiting AI in propeller optimisation from CFD and strength POV
- Two main subprojects:
  - CFD project aims developing 2D to 3D blade correction for 2D based virtual blade modelling
  - FEM project aims developing intelligent composite material parameter fitting methods including static and cyclic strength
- Side project: development of a virtual (numerical) predictive model for the fatigue behaviour of TP matrix based continuous fibre reinforced composites
- All models integrated in an optimisation workflow







Cooperation Opportunities

- RDI activities in cooperation with regional Multinational partners and SME's

- High added value
  - Preparation of concepts and feasibility studies
  - Process/method development for FEA, CFD and composite technology simulations
  - Application of artificial intelligence and machine learning in engineering simulations
  - Composite technology; development of new processes, optimization, and production technology,
  - Mechanical and fluid dynamics engineering improvements
  - Drone technology developments
  - Verification of various simulation methods
  - Development of combat vehicles, small arms, protective clothing and lightweight protective equipment
  - Electromechanical developments; HFSS, radar technology
  - Virtual simulation of high velocity impacts
  - Process/method development; promoting virtual development, developing validation procedures, applying artificial intelligence and machine learning
  - Education, training

Thank you for your attention!

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