BRNO UNIVERSITY OF TECHNOLOGY

FACULTY OF MECHANICAL ENGINEERING

LETECKÝ ÚSTAV

Institute of Aerospace Engineering

www.lu.fme.vutbr.cz

BRNO UNIVERSITY OF TECHNOLOGY

FACULTY OF MECHANICAL ENGINEERING

INSTITUTE OF AEROSPACE ENGINEERING

BRNO UNIVERSITY OF TECHNOLOGY

- founded in **1899**
- **18 740** students
- **3 036** employees

FACULTY OF MECHANICAL ENGINEERING

- Biggest faculty of Mechanical Engineering in Czech Republic!
- **4 191** students
- **735** employees

INSTITUTE OF AEROSPACE ENGINEERING

Education at Institute of Aerospace Engineering

Study programme:

- **AEROSPACE TECHNOLOGY** in Czech language

  2 year master´s study programme

  - specialization **AIRCRAFT DESIGN**
  - specialization **AIRTRANSPORT AND AEROPORT TECHNOLOGY**

- **AEROSPACE TECHNOLOGY** **in English language**

  2 year master´s study programme

- **PROFESSIONAL PILOT**

  3 year bachelor´s study programme

- Ph.D. doctoral study programme
  Machines and equipment - Aircraft Design and Air Transport

Education in programme **AEROSPACE TECHNOLOGY**

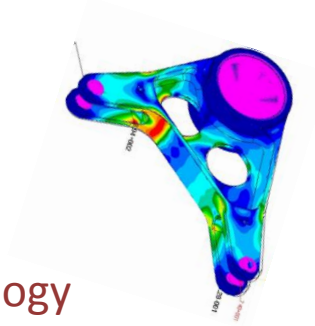
2 years title **Ing.** full-time study in **English language**

AEROSPACE TECHNOLOGY

The focus of the two-year follow-up Master's degree programme is on academic competences and students are provided with advanced education in the field of Aircraft Design, Space Technologies, Aerodynamics, Flight Mechanics, Design and Analyses of Aerospace Structures.

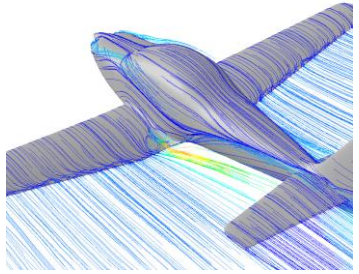
The field of Aviation is taught mainly in the first year and Space mainly in the second year.

1st year – List of courses



Winter semester

- Aerodynamics I
- Aircraft Structure
- Aircraft Materials and Technology
- Aircraft Propulsion
- Computer Aided Design and Manufacture
- English in Aviation



Summer semester

- Aerodynamics II
- Flight Mechanics I
- Aircraft On-Board Systems I
- Industrial Project
- Aircraft Manufacture
- Aerostructures Capability
- CFD for Aerospace

Details: www.fme.vutbr.cz/en/studenti/programy/program/7533

Education in programme **AEROSPACE TECHNOLOGY**

continuing

AEROSPACE TECHNOLOGY

Graduates can find a job in the aviation industry in companies Airbus Group, ESA, Boeing or Aero Vodochody, Aircraft Industries, Honeywell, GE Aviation Czech and other companies in aviation and space industry.

2nd year – List of courses

Winter semester

- Aircraft Composite Structures
- Space Structures Design
- Space Flight Mechanics
- Flight Mechanics II
- Aircraft Design
- Reliability and Maintainability of Aircraft
- Aeroelasticity
- Aircraft Testing

Summer semester

- Diploma project
- Diploma Seminar
- Spacecraft Technologies
- Aviation Law and Regulations
- Aircraft On-Board Systems II
- Fatigue of Aircraft Structures

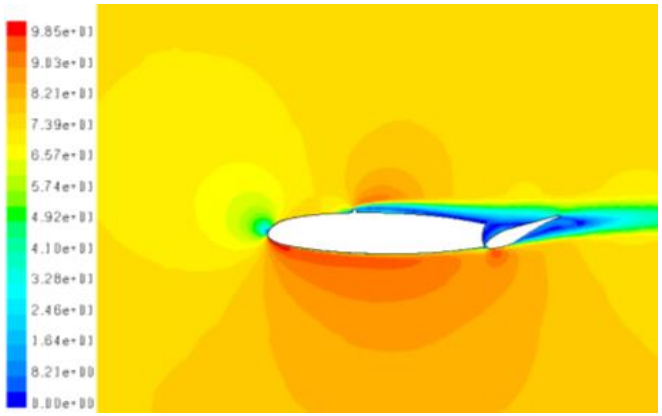
Examples of IAE courses

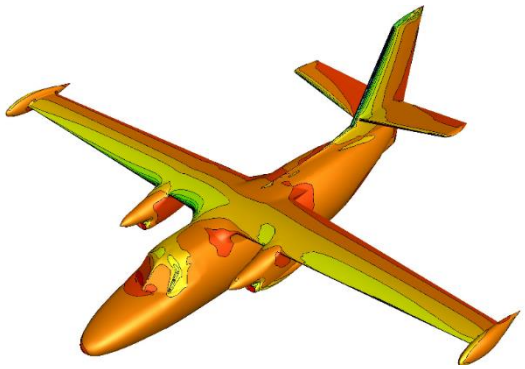
courses **Aerodynamics I and Aerodynamics II**

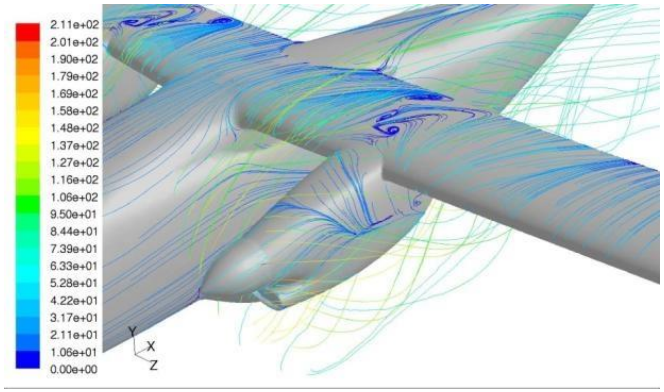
- Students will acquire the knowledge of aircraft aerodynamic analyses of flows around and inside of objects in subsonic and supersonic flights.

course **CFD for Aerospace**

- Computation with the use of Finite volume method in Computational Fluid Dynamics (CFD)
- Practical seminars are done in Ansys / Fluent software
- Student will learn how to do simulations of pressure distribution and flow visualizations







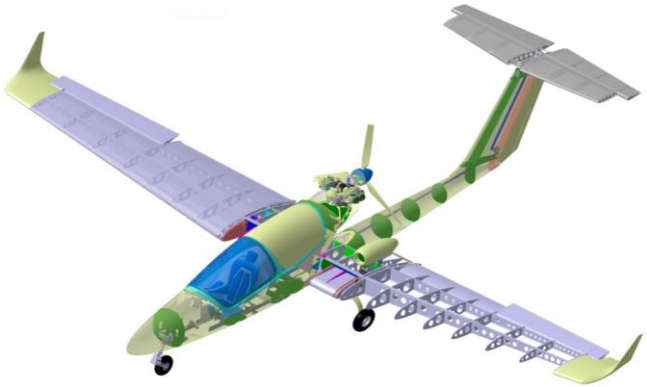
Examples of IAE courses

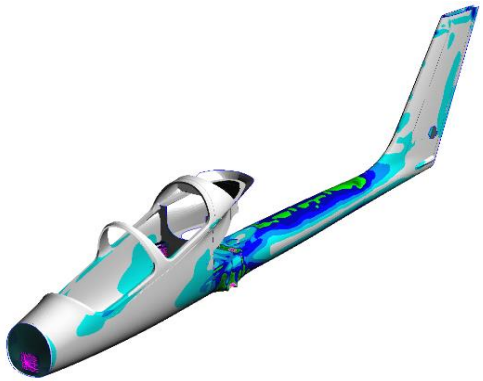
courses **Aircraft Structure, Aerostructures Capability**

- Students will acquire the knowledge of stress calculation, deformations and structural capability of thin-walled aircraft structures.

course **Computer Aided Design and Manufacturing**

- 2D and 3D CAD modelling with the use of CATIA V5 software
- Practical seminars are done also in specific aerospace modules (Generative Sheet Metal Design, DMU Kinematics, Machining, Generative Structural Analysis,...)
- Student will design a aircraft model





Examples of IAE courses

course **Space Structures Design**

- This course contain the introduction into space technologies, theory of rocket flight, rocket engines with solid or fluid propulsion mediums. Also spacecraft materials, rocket flight load estimation, subsonic and supersonic aerodynamics, structural designs, space stabilization systems, satellite systems, energy equipment, heat and radiation protection.

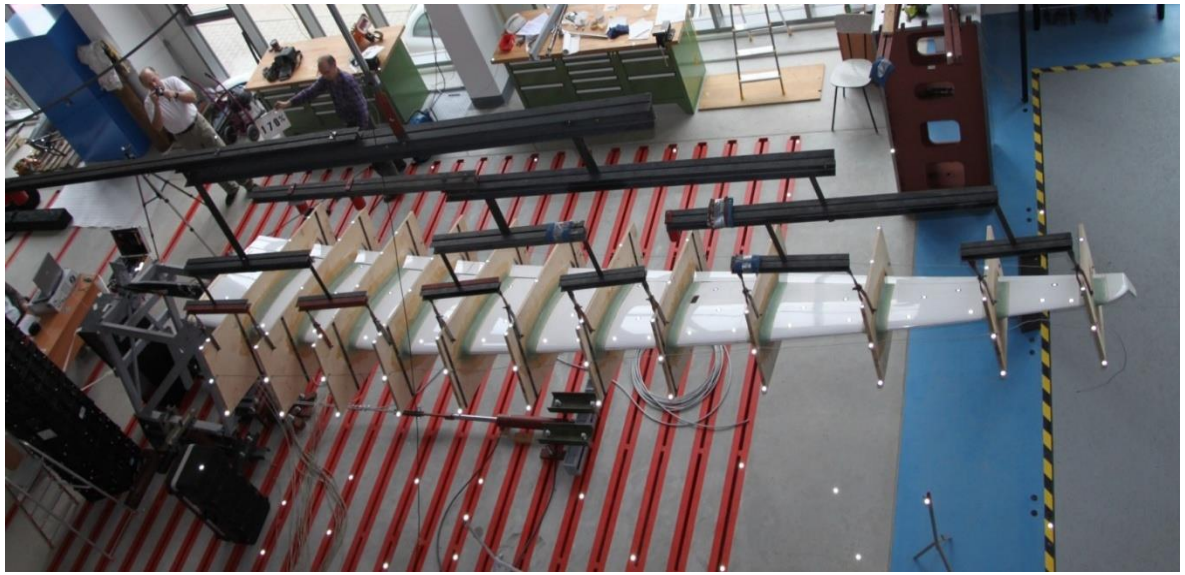
course **Space Flight Mechanics**

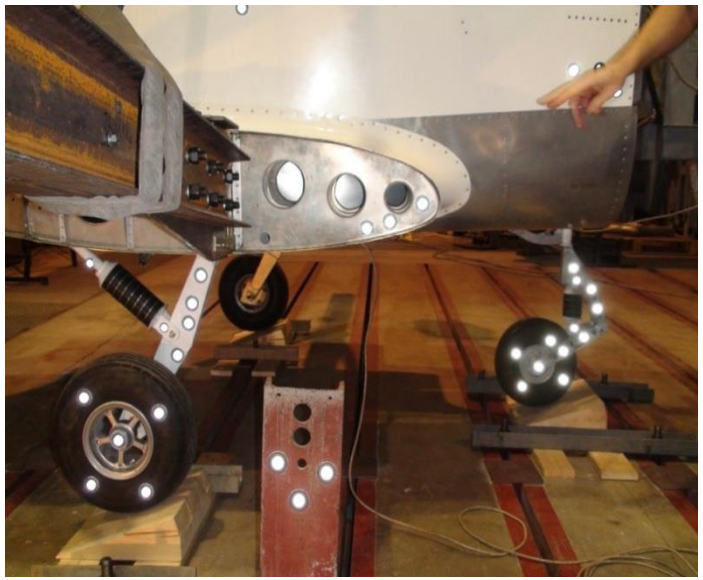
- Students will study the history of space flights, spacecraft type overview, basic problems of space flight and their technical solutions, passive propulsion in central gravity filed, Kepler´s laws, calculation of position and velocity of orbital objects, orbital trajectory. Also active motion of elements in space, rocket dynamics, flight characteristics and performance of rocket carrier, launch of artificial satellite, characteristic cosmic velocities, orbital maneuvering, active motion control, inter-planetary flights, return modules and transport vehicles for multiple utilization.

Examples of IAE courses

course **Aircraft Testing**

- Student will gain the knowledge of design of experimental verification of aircraft flight performance and characteristics. Also the knowledge of design and arrangement of strength tests, load distribution and test programmes.
- Presented are static, dynamic and fatigue tests of main aircraft parts. Students will do a practical design of loading system for the wing test, a preparation of strain gauge measurements and modern optic systems Aramis / Pontos.





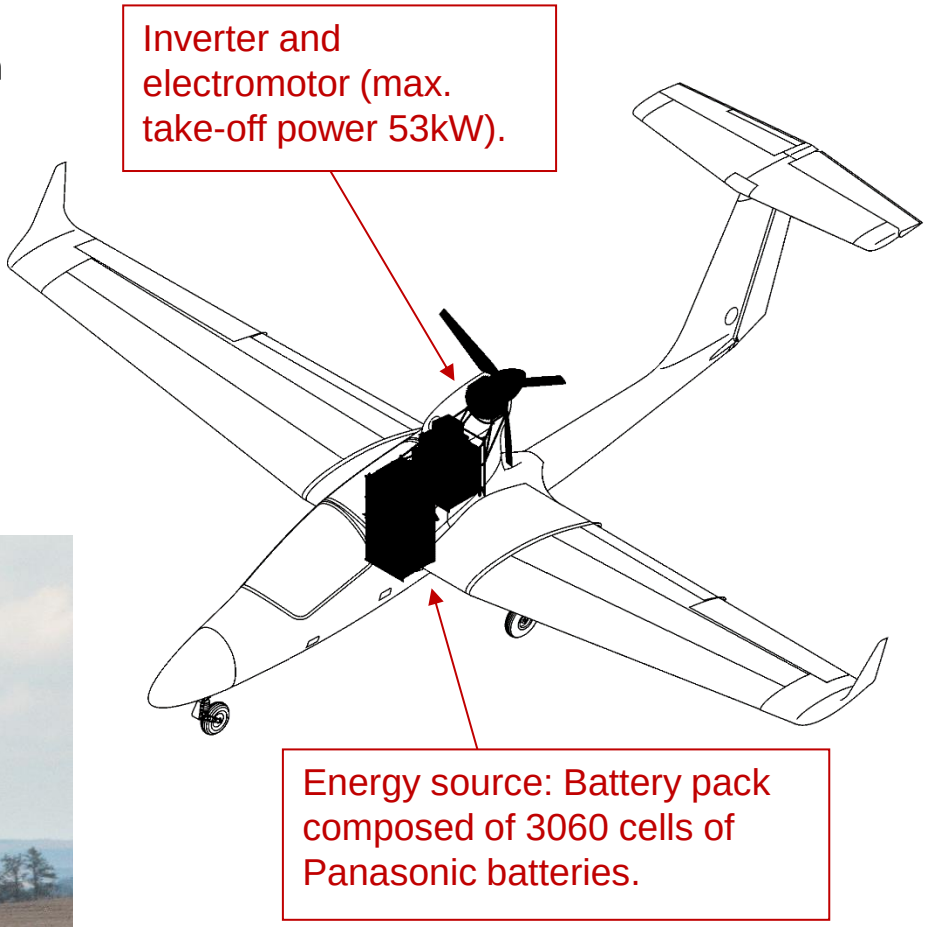
R&D of Institute of Aerospace Engineering

Designed and Built aircraft at IAE

VUT 051 RAY

Experimental aircraft with ELECTRIC propulsion

- Tested and evaluated were Battery packs and Hydrogen power units
- Design
- Permit to fly from Czech CAA
- Flight tests



R&D of Institute of Aerospace Engineering

Designed and Built aircraft at IAE

VUT 001 Marabu

Experimental aircraft with UAV systems

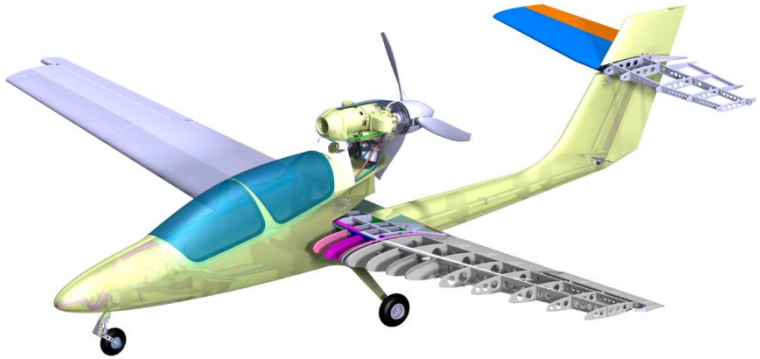
and Jet engine

R&D of Institute of Aerospace Engineering

Designed and Built aircraft at IAE

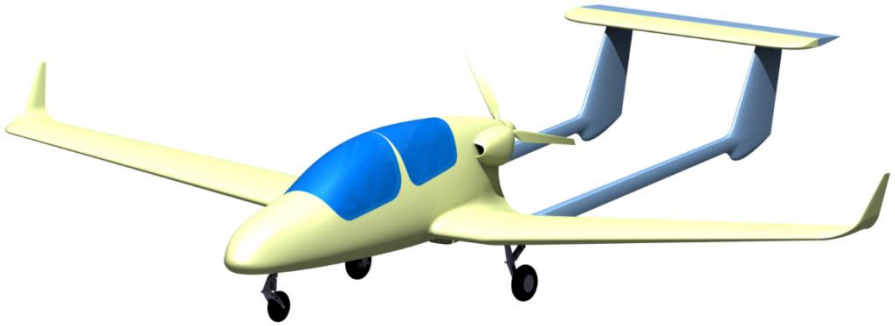
VUT 061 Turbo

- Experimental aircraft for development, testing and certification of turboprop engine



VUT 081 Kondor

- Prototype of aircraft with integration of advanced optical system for monitoring flights



R&D of Institute of Aerospace Engineering

Designed, developed or tested aircraft at IAE

Extreme XA42

Cessna 172 with turboprop engine TP100

R&D of Institute of Aerospace Engineering

Designed, developed or tested aircraft at IAE

HpH 304 Shark,

HpH TwinShark

L 410 NG

VUT 100

R&D of Institute of Aerospace Engineering

Space research

Project SPARTAN

SPAce exploration Research for Throatable Advanced eNgine

Development and production of the test module and hybrid rocket engines for controlled landing at Mars soil.

Space devices for space modules and satellites

Group of Aerodynamics and Space Technology performed tests of heat switches for space modules and satellites under extreme temperatures simulating the Mars atmosphere.

This project is guided by European Space Agency ESA.

R&D of Institute of Aerospace Engineering

Ballistic recovery systems

Design, development and testing of ballistic recovery systems for drones in cooperation with Galaxy GRS, RCE systems and Indet Safety Systems companies.

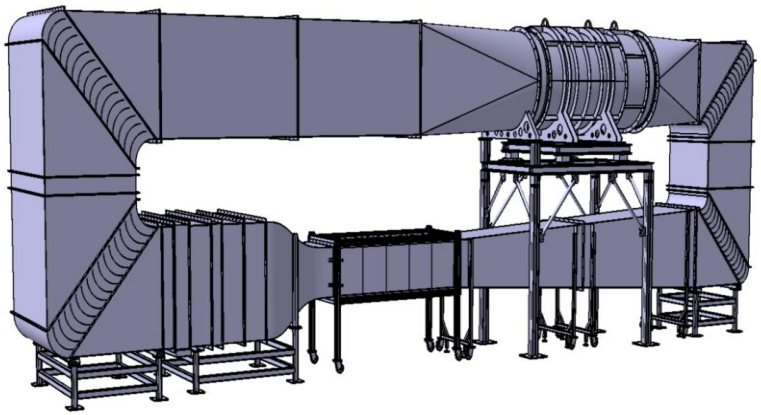
These unique parachute systems for UAVs were also patented.

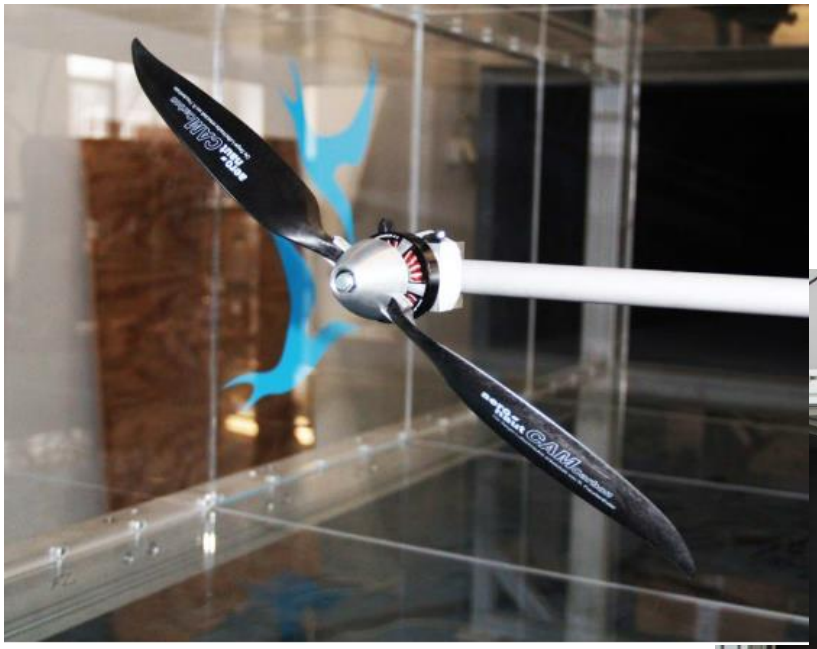
Nowadays are developed systems for aircraft with 5 passengers and mass up to 1900 kg.

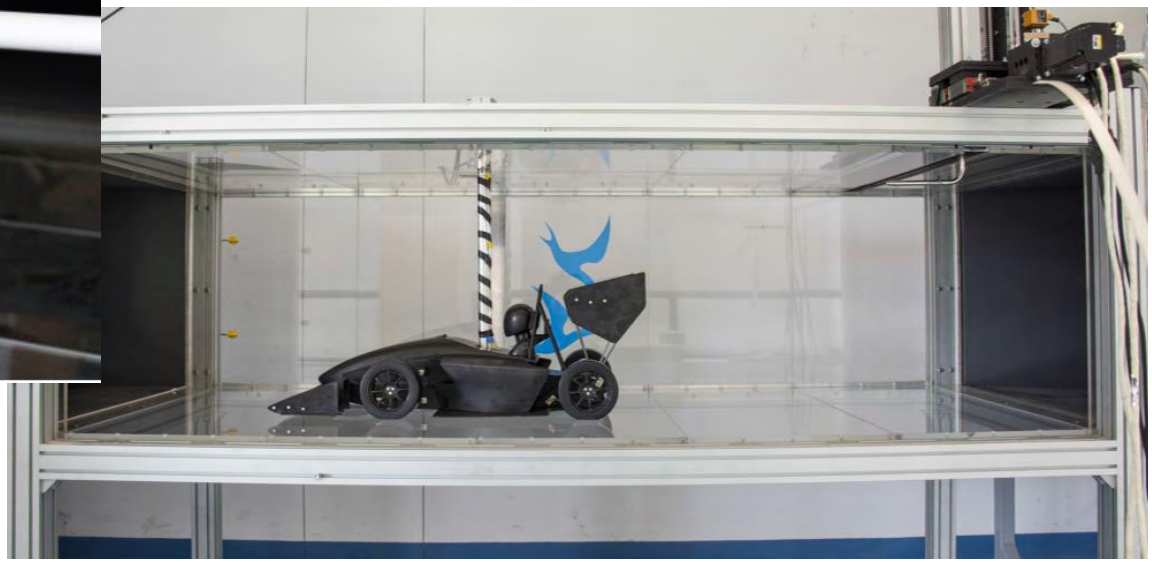
R&D of Institute of Aerospace Engineering

Aerodynamic Wind tunnel

For measurements of aerodynamic characteristi
of aircraft and automotive parts,
testing of heat exchangers, smart sensors, ...







R&D of Institute of Aerospace Engineering

R&D in Aircraft systems

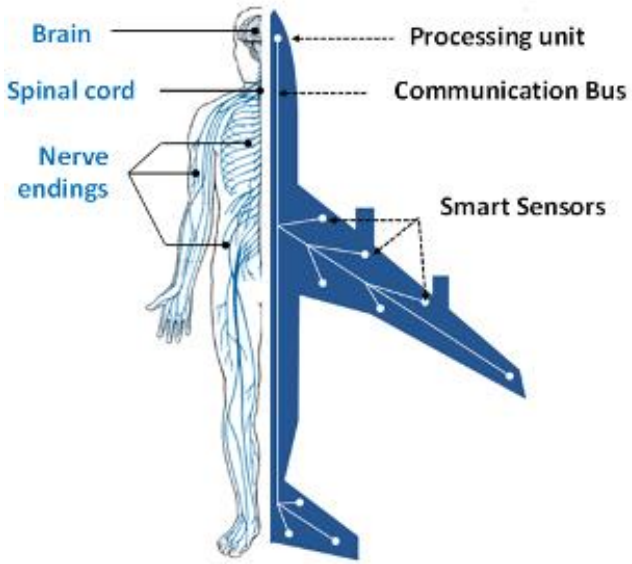
Structural Health monitoring

- Acoustic emission, Lamb waves
- *FE modelling of SHM signals in the structure*
- Optimization of sensor network (placement)

Structural Testing

Ballistic recovery systems

- UAVs
- *Small piloted aircraft*



Safety

- Assistant systems for small airplanes
- *Safety assessment for systems*
- Tests for AVIATION and SPACE

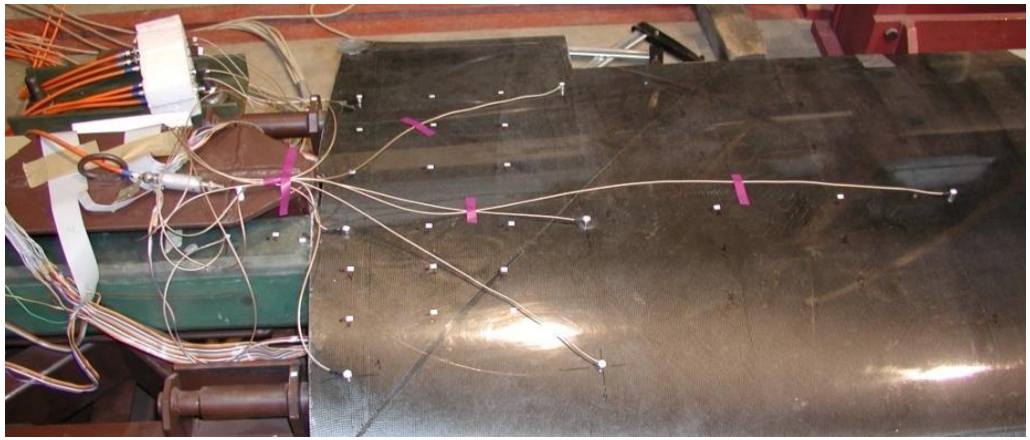
R&D of Institute of Aerospace Engineering

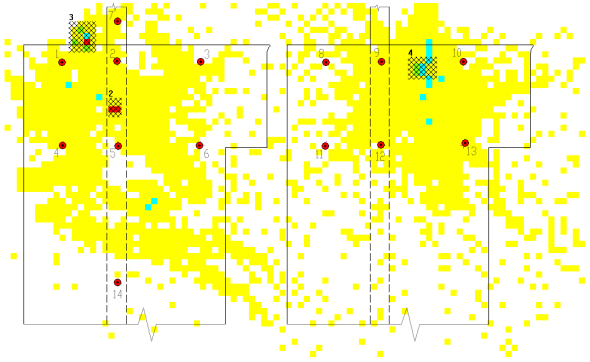
Structure Health Monitoring

in cooperation with Honeywell, Aircraft Industries and Aero Vodochody

- Experiments (within own testing facility)
- Optimization procedures for sensor placement

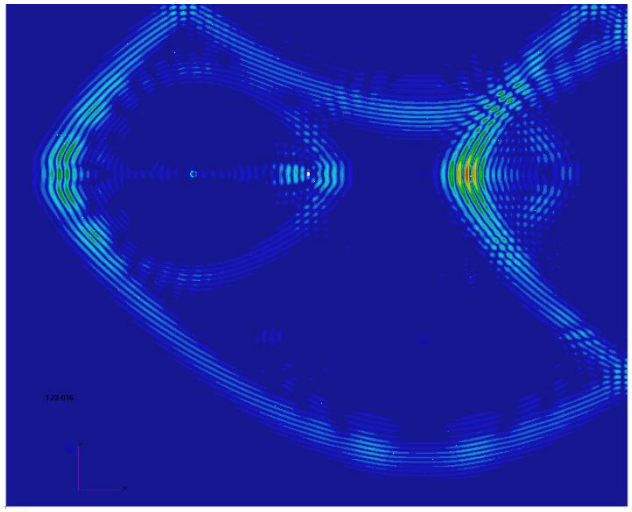
Acoustic emission





Modelling of signal processing

Ultrasonic Guided Waves signal propagation in thin-walled structures

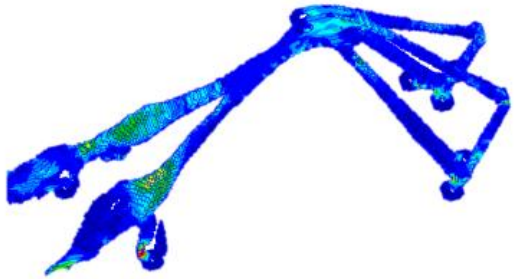


R&D of Institute of Aerospace Engineering

Additive Manufacturing for Aerospace Applications

Topology optimization, bionic design principles

Manufacturing process optimization for 3D ALM parts



Partners of Institute of Aerospace Engineering in CZ and EU

Awards of IAE students

3 innovative final theses of IAE students got Awards of Industrial Partners in 2020.

Bachelor´s thesis: **„Application of the 3D printing methods in the design of aerial elevated light fixtures and supporting structures“**

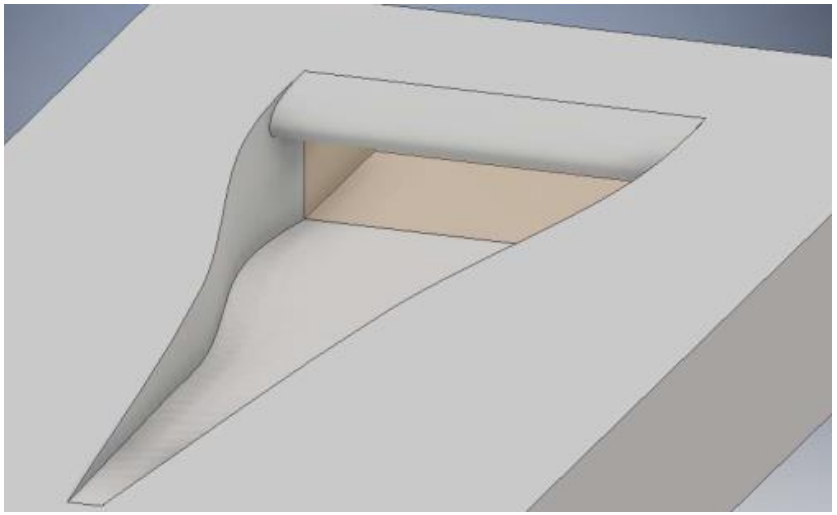
Master´s theses: **„Small satellite dispenser structural optimization“**

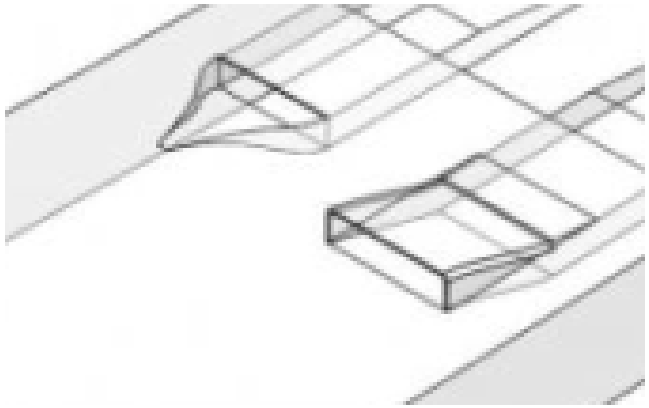
„Flexible structure development for efficient heat transfer“

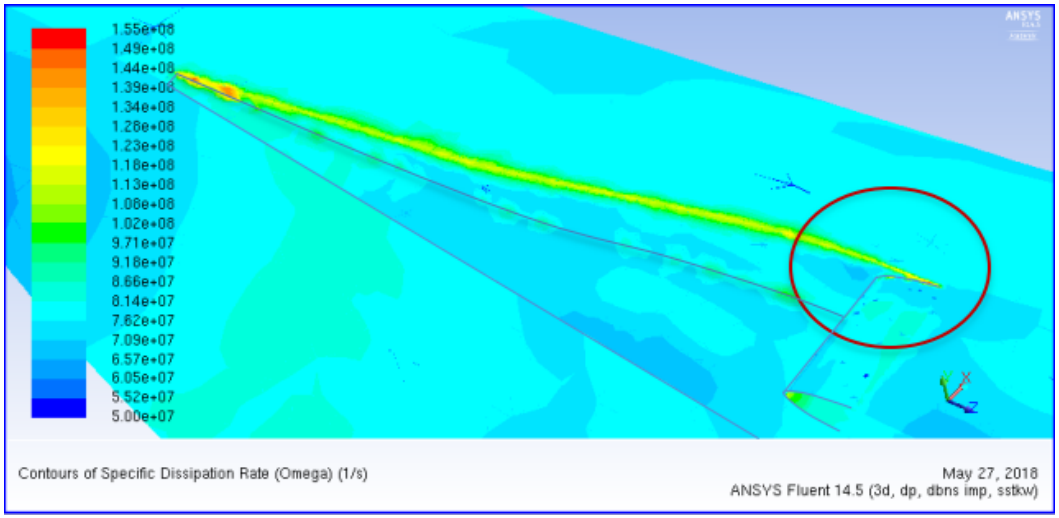
Partners:

Theses of IAE students

Design of air inlet for UAVs

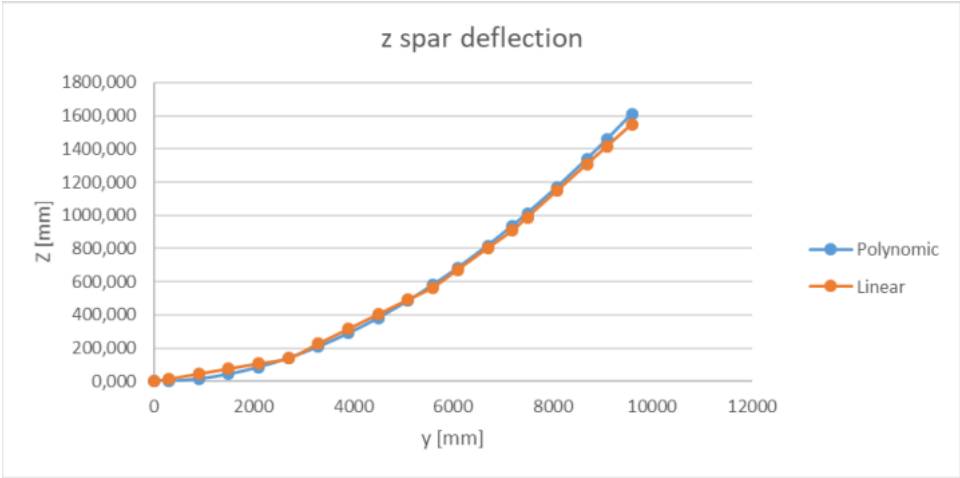






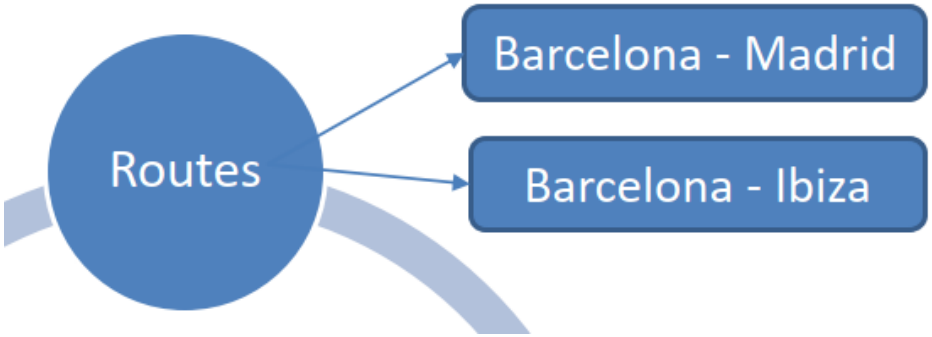
Theses of IAE students

Evaluation of stiffness characteristics of composite wing



Study of business jets in airlines

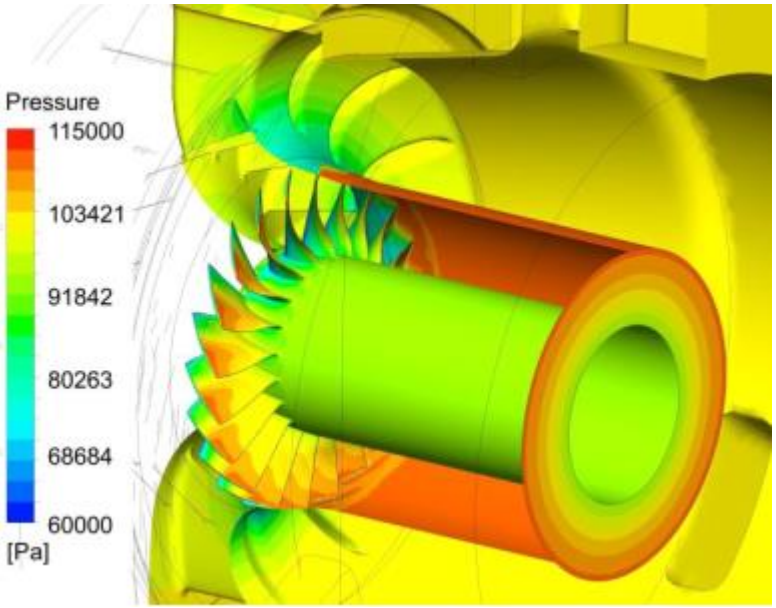
- cost estimations for 2 routes

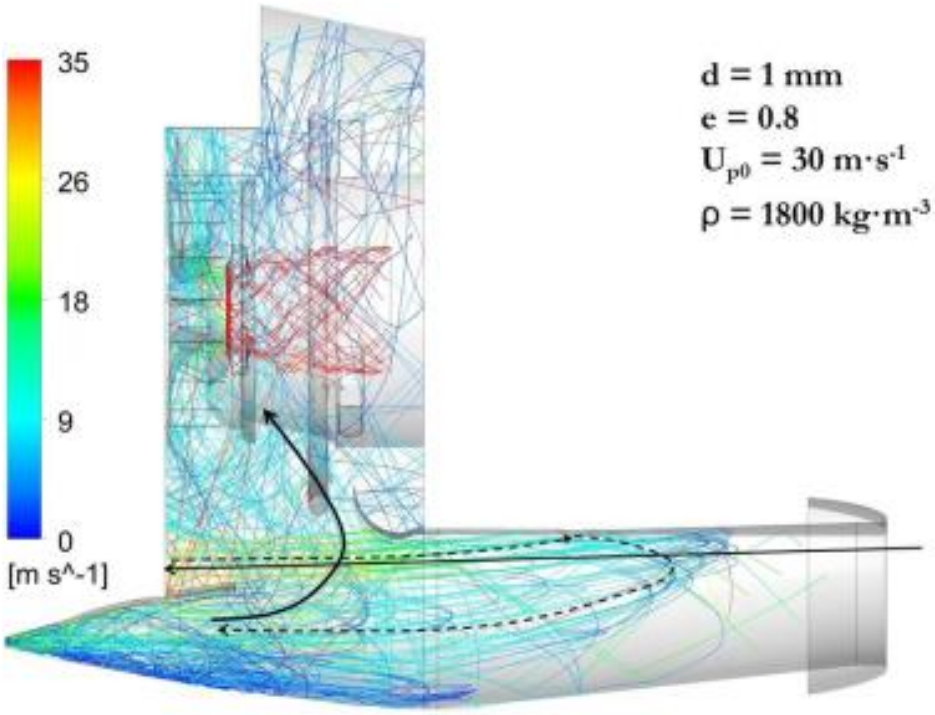


Theses of IAE students

Study of particle separator in turboprop engine

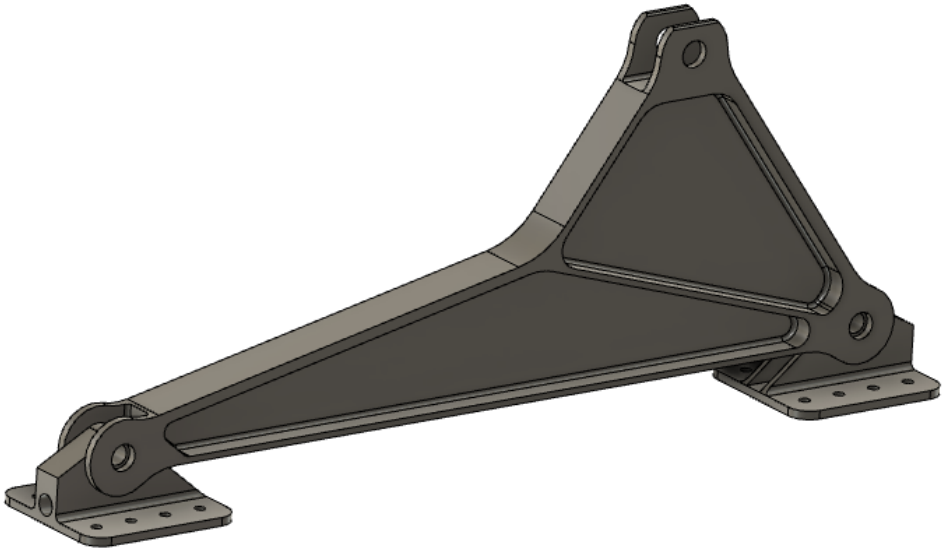
GE Aviation

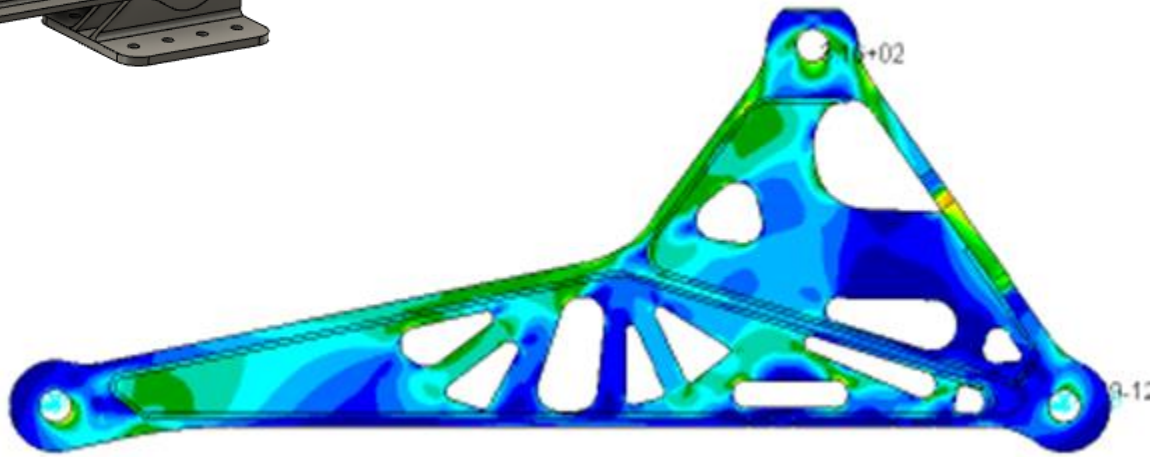




Theses of IAE students

Topology optimization of hinge on elastic base





Lower stress and mass reduction 13%.

Activities of IAE students

Students´ team CHICKEN WINGS

Our belongs into Top teams of international students competitions.

This year, they prepared the model for **SAE Aero Design 2020.**

Activities of IAE students

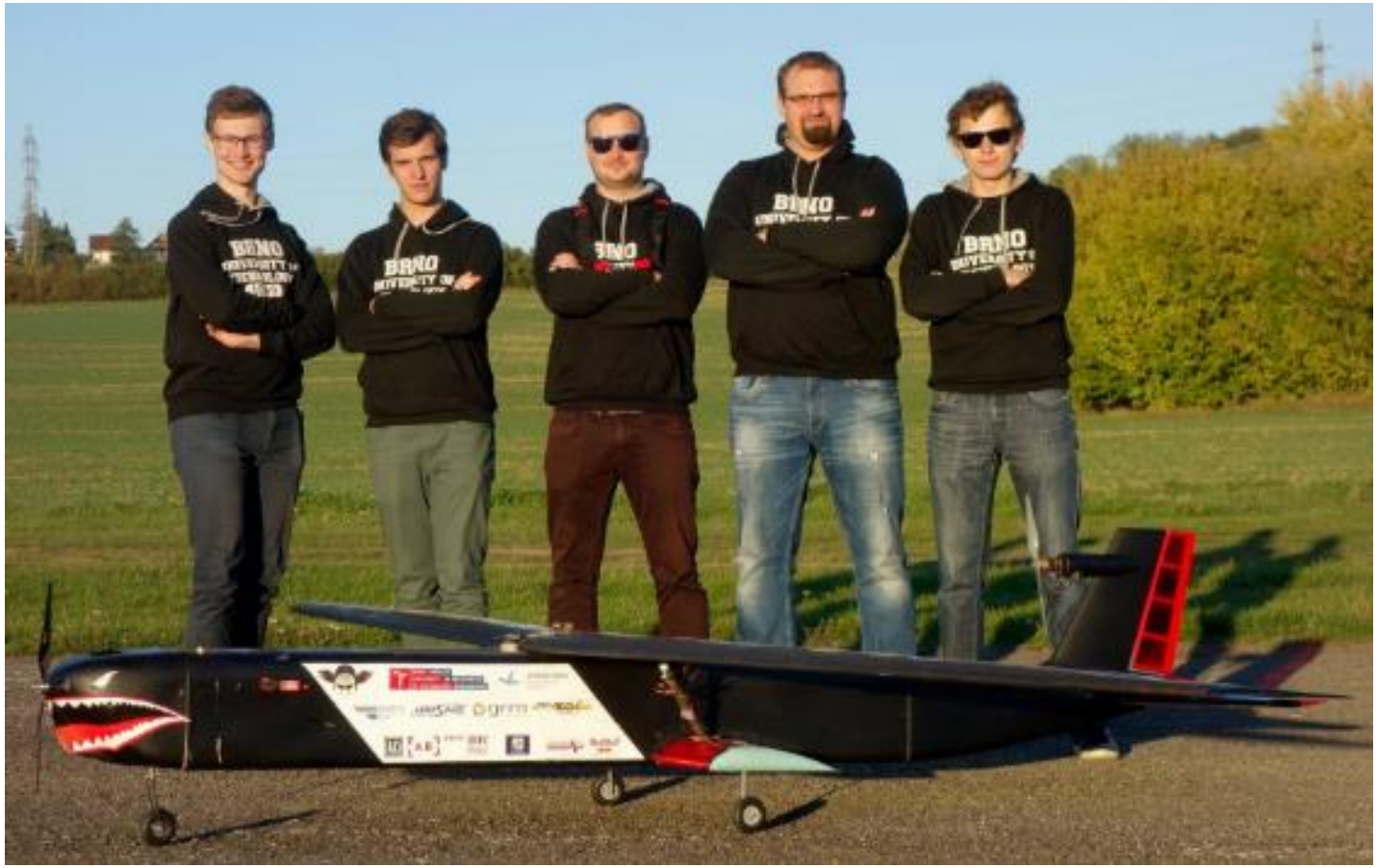
Students´ team CHICKEN WINGS

In **Air Cargo Challenge** competition in 2019 fought for great 7th place!

Activities of IAE students

Students´ team CHICKEN WINGS

Medal for the 1st place won in **New Flying Competition** in German Hamburk in 2018 !



Activities of IAE students

IAE together with SAB Aerospace organized the competition in ROCKET design!

www.sabaerospace.cz/cs/sab-rocket-challenge-2020

LETECKÝ ÚSTAV

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