# Technical University of Liberec

# Cooperation Workshop with Czech Republic: Automated Driving 29. - 30. April 2021

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**Project: MODULAR PLATFORM FOR AUTONOMOUS CHASSIS OF SPECIALIZED ELECTRIC VEHICLES FOR FREIGHT AND EQUIPMENT TRANSPORTATION**
**This project | Reg. No. CZ.02.1.01/0.0/0.0/16_025/0007293| is financially supported by the Ministry of Education, Youth and Sports of the Czech Republic and the European Union (European Structural and Investment Funds - Operational Programme Research, Development and Education)**

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# Technical University of Liberec (TUL)

Established in 1953 (High School of Engineering and Textile)

Bachelor, Master and Ph.D. study programmes

Over 1 300 employees, over 7 000 students – 500 international


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# Technical University of Liberec (TUL)

**Faculty of Mechanical Engineering**

**Faculty of Mechatronics, Informatics and Interdisciplinary Studies**

**Institute for Nanomaterials, Advanced Technologies and Innovation (cxi)**

Faculty of Textile Engineering

Faculty of Science, Humanitites and Education

Faculty of Economics

Faculty of Arts and Architecture

Faculty of Health Studies

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# Project:
# Reg. No. CZ.02.1.01/0.0/0.0/16_025/0007293
# “Modular platform for autonomous chassis of specialized electric vehicles for freight and equipment transportation“

**This project is financially supported by the European Union**

# TUL expertise related to automated driving

1. Current project “Modular platform for autonomous chassis of specialized electric vehicles for freight and equipment transportation”
2. Equipped laboratories for technical development and experiments
3. Research projects

**Project: MODULAR PLATFORM FOR AUTONOMOUS CHASSIS OF SPECIALIZED ELECTRIC VEHICLES FOR FREIGHT AND EQUIPMENT TRANSPORTATION**
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# Modular platform for autonomous chassis of specialized electric vehicles for the transport of freight and equipment

- Project duration in years 2018 - 2022
- Project budget 3.4 mil. EUR
- Potential for use in collaboration

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# Modular platform for autonomous chassis of specialized electric vehicles for the transport of freight and equipment

## Research intentions

- N.1: **Light structures** for autonomous electric utility vehicles
- N.2: **Electric drives** for controls autonomous electric utility vehicles
- N.3: **Batteries** for autonomous electric utility vehicles
- N.4: **Information system, mixed reality and automated driving** for autonomous electric utility vehicles

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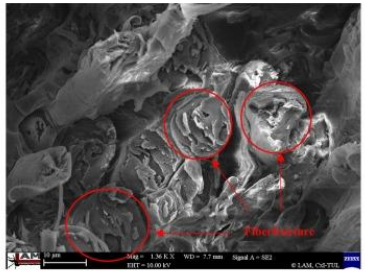
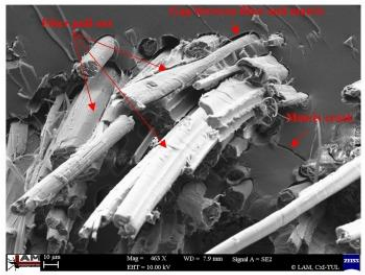
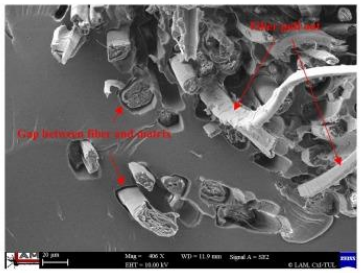


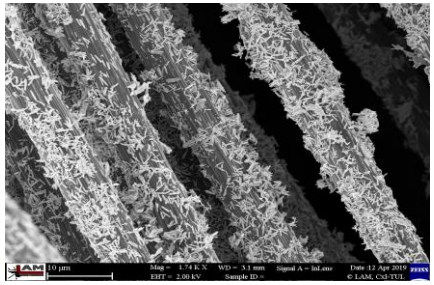
(a) Reference specimen

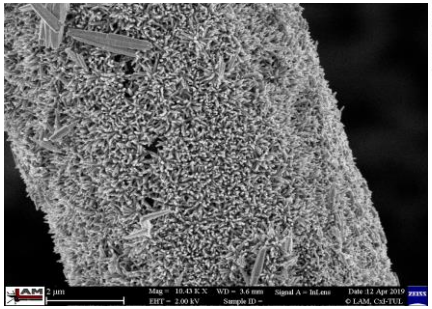


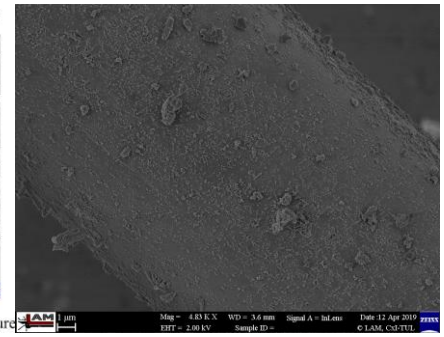
(b) Nature aging specimen after 180 days of exposure



(c) Hygrothermal aging specimen after 167.9 *h* of exposure







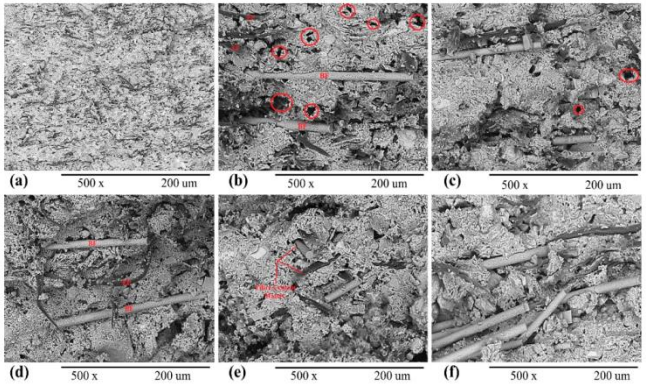
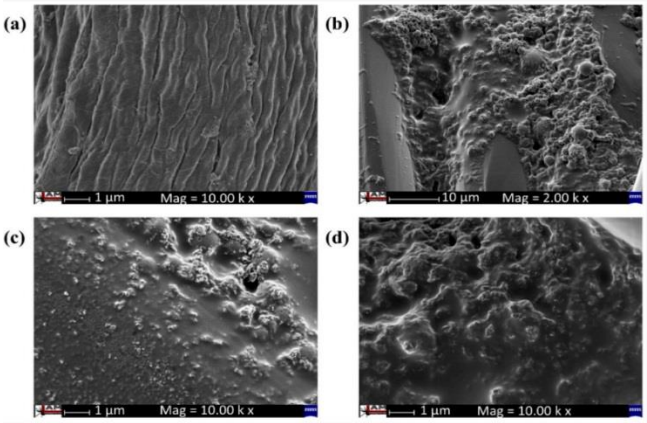



**Figure 7.** SEM analysis of EB-HRCC samples: (**a**) reference sample (without BFW), (**b**) 0.5% BFW + 4% eucalyptus pulp (EP), (**c**) 1% BFW + 4% EP, (**d**) 1.5% BFW + 4% EP, (**e**,**f**) 2% BFW + 4% EP from different samples respectively.

**Figure 2.** UHR-SEM analysis of (**a**) untreated sample, (**b**) sample C-nZnO 3, (**c**) sample C-nZnO 5, and (**d**) sample C-nZnO 7.




# 1. LIGHTWEIGHT STRUCTURES AND NEW COMPOSITES

- **Research to improve the interfacial behavior of organic and inorganic fiber / resin systems = improvement of mechanical properties of the resulting composite structure**
- Controlled growth of ZnO nano particles on the surface of carbon fibers
- **R&D of composite constructions: samples, parts, prototypes, assemblies**
- **R&D of new technologies for manufacturing of composite constructions**

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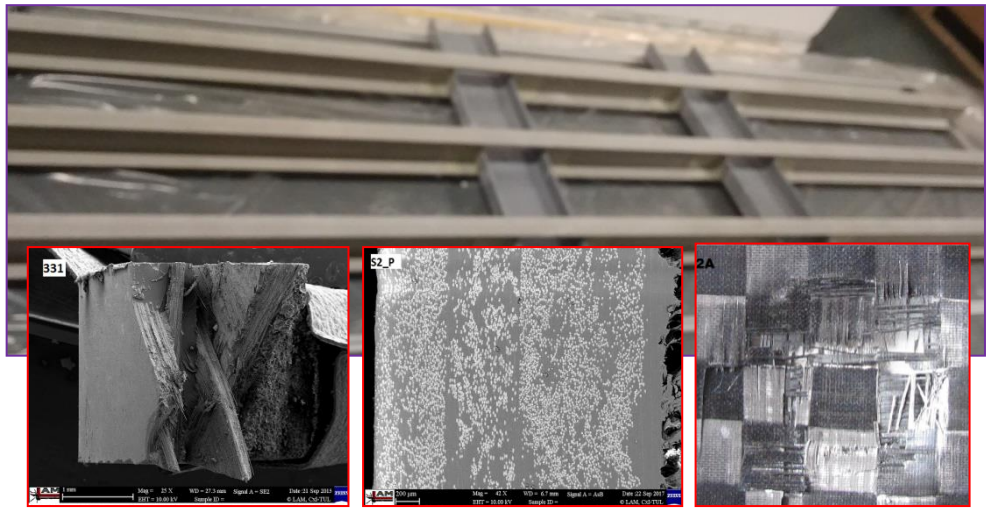
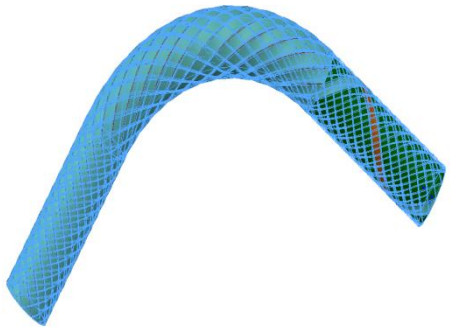
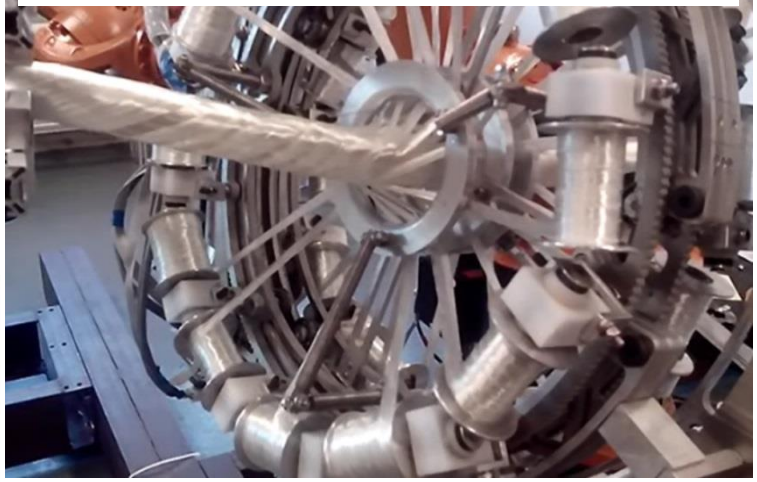
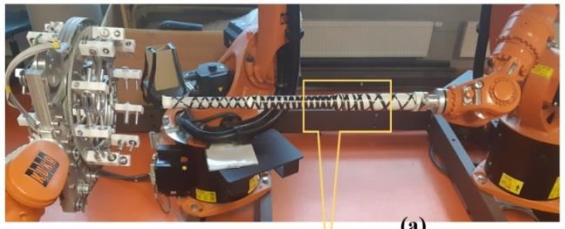
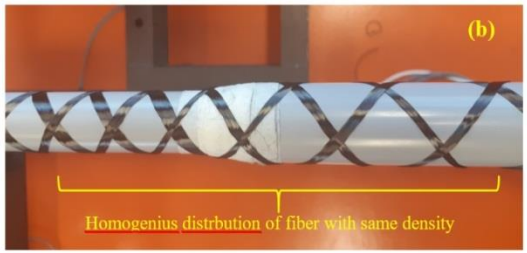


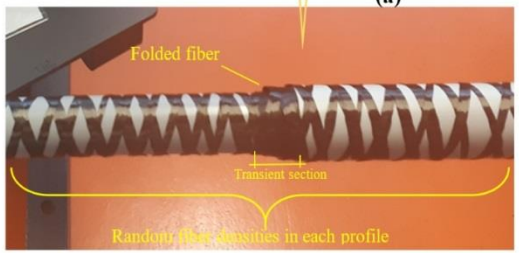



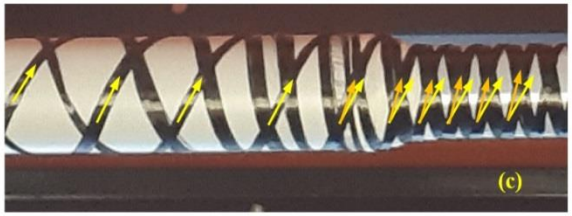
# Lightweight structures and new composite constructions at TUL



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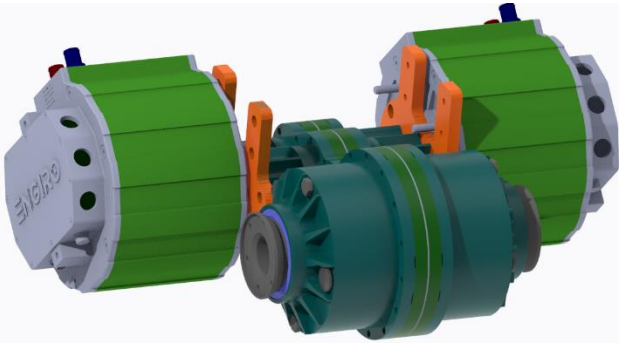
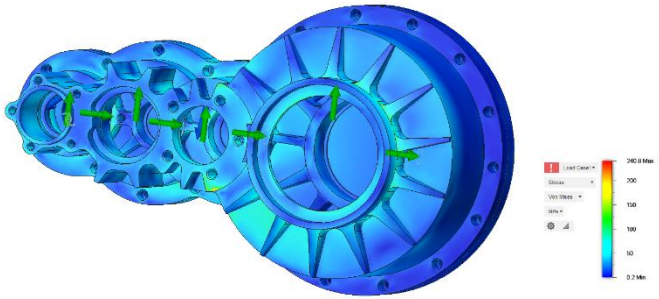
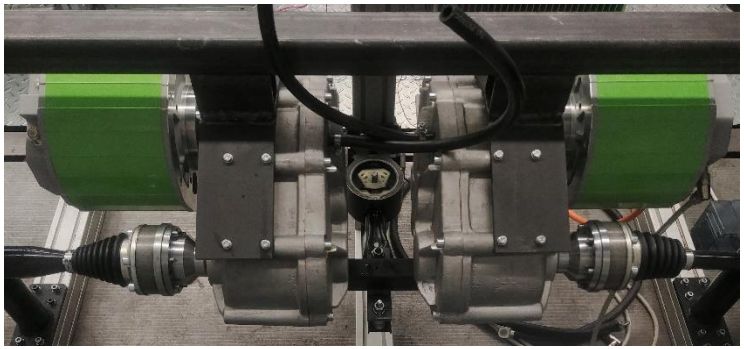
# 2. Electric drives







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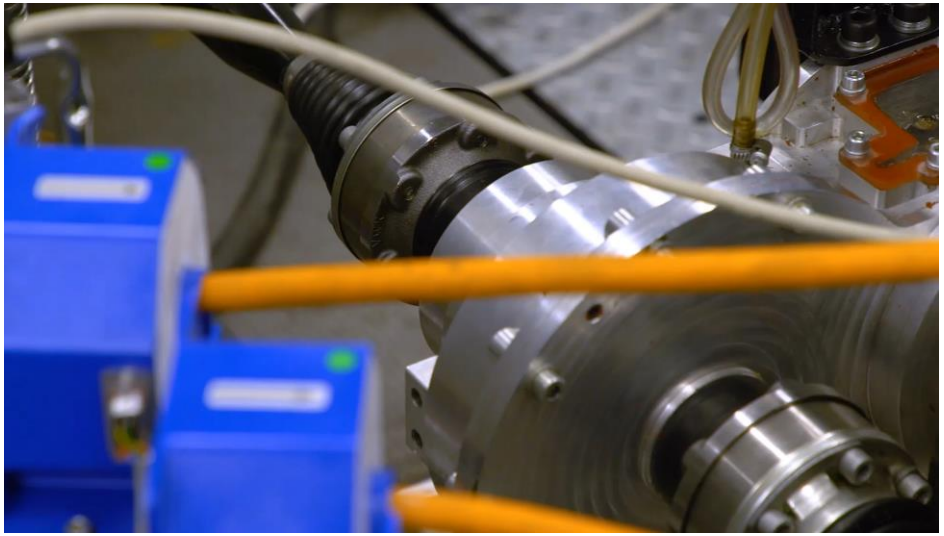

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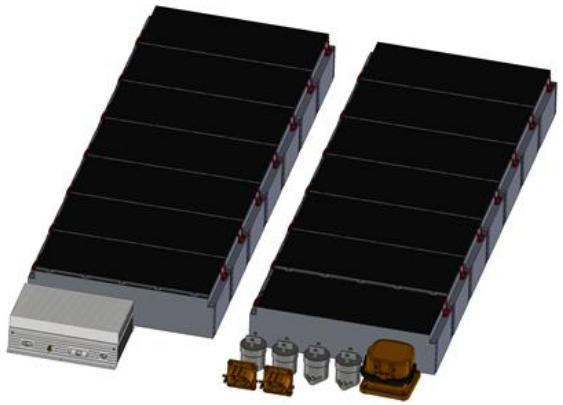
# 3. Battery design & charging system design

First battery

- Prismatic lithium cells
- Total nominal battery energy 36 kWh



Second battery

- 21700 nominal size cylindrical cells
- Thermal management system and advanced battery management system

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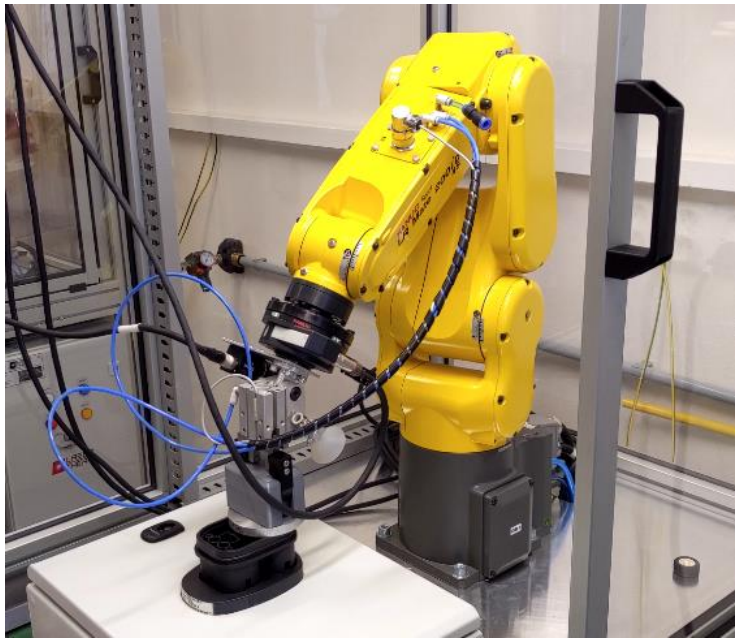
# Charging system design



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# 4. Information system, mixed reality and automated driving

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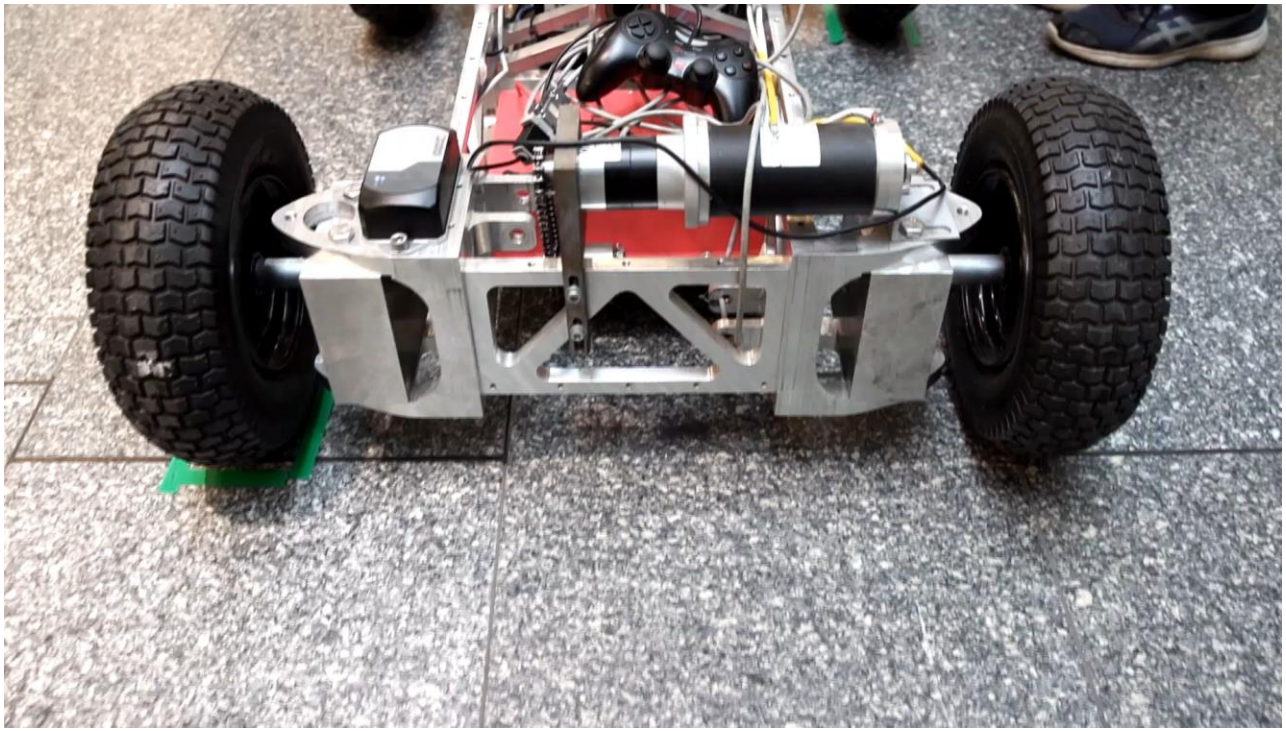
# 4. Information system, mixed reality and automated driving



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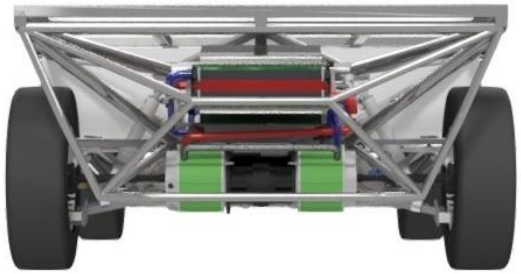
# TUL platform



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# Well-equipped laboratories for technical development and experiments

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# TUL research projects

**Distributed Artificial Intelligent Systems (49 partners, EU), 2021-2024**

- Reg. No. 101007273-1: H2020-ECSEL-2020-2-RIA-two-stage

**Networking For Research And Development Of Human Interactive And Sensitive Robotics Taking Advantage Of Additive Manufacturing, (5 partners, EU), 2020-2022**

- Reg. No. 857061: H2020-WIDESPREAD-2018-03

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# TUL research projects

**Modular platform for autonomous chassis of specialized electric vehicles for freight and equipment transportation, TUL, 2018 – 2022**

- Reg. No. CZ.02.1.01/0.0/0.0/16_025/0007293, Project European Structural and Investment Funds - Operational Programme R&D and Education

**Development and Industrialization of Light-weight and High-strength Glass Fiber-reinforced Composite Fabric, (4 partners, EU, China), 2018-2020**

- Reg. No. TF06000036: TAČR Delta

**Development of technology and production of one-piece GFRP blades for wind turbines, (5 partners, EU, China), 2016-2018**

- Reg. No. TF0200051: TAČR Delta

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# TUL cxi international research projects

**Project coordinator LIFE** - Innovative technology based on constructed wetlands for treatment of pesticide contaminated waters

**Project coordinator Twinning** - Networking for Research and Development of Human Interactive and Sensitive Robotics Taking Advantage of Additive Manufacturing

**Project participant** - H2020 Eurat - European Joint Programme on Radioactive Waste Management

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# TUL websites & Contact

**Technical University of Liberec (TUL)**
- tul.cz/en/

**Institute for Nanomaterials, Advanced Technologies and Innovation (cxi)**
- cxi.tul.cz/en/

**Faculty of Mechanical Engineering**
- fs.tul.cz/en/

**Faculty of Mechatronics, Informatics and Interdisciplinary Studies**
- fm.tul.cz/en/

**Josef Brousek, josef.brousek@tul.cz & Jindrich Cyrus, jindrich.cyrus@tul.cz**
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Department of vehicles and engines
Studentska 1402/02, 461 17 Liberec 1, Czech Republic

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