swiss space center

# MEMBERS' PROFILES

September 2020

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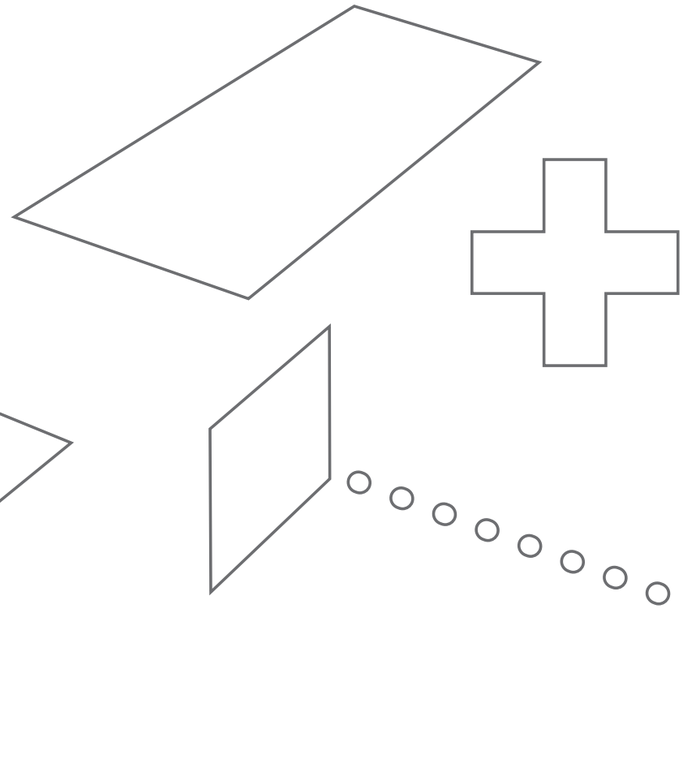

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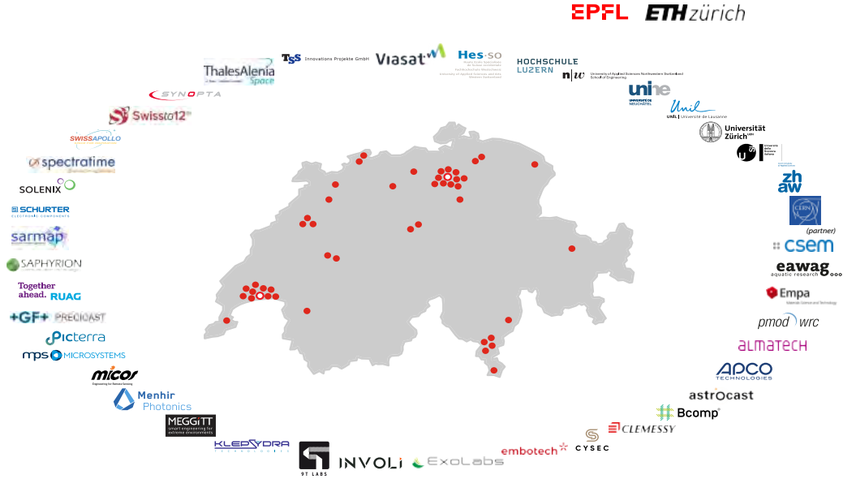
# INTRODUCTION

You have in your hands the third edition of the brochure presenting the capabilities and competences of the Swiss Space Center (SSC) members. Officially recognized as a truly national entity in 2012 by the Swiss Space Office from the State Secretariat for Education, Research and Innovation (SERI / SSO), the Swiss Space Center supports the SERI / SSO in the implementation of the Swiss Space Policy on specific tasks by :

- networking Swiss actors at national and international level,
- facilitating access to space projects for established actors and for newcomers,
- providing education and training,
- promoting public awareness of space.

At the time of this third edition (September 2020) the SSC has 44 members throughout Switzerland, among which 29 industries, 10 universities and 4 Research and Technology Organisations (RTO). In addition, the European Center for Nuclear Research (CERN) based in Geneva signed a partnership agreement with the SSC in 2016.

Board of Directors




We hope you will discover in more details what our members have to offer you in terms of expertise, products and potential collaborations. You may contact them directly or via the Swiss Space Center. Please note that all the information within this brochure were provided by the entities and reflect the situation in 2020.

# INDUSTRY

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | | |
| Instruments and Payloads | | | ✓ |
| Spacecraft and on-board Equipment | | | ✓ |
| Ground Segment | | | |
| Materials and Processes | | | ✓ |
| Structures | | | ✓ |
| Electronic Components | | | |
| Software | | | ✓ |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | ✓ |

## 9T Labs

### “All-in Solution for Digital Composite Production”

**References**

9T Labs’ Technology has already been tested in aerospace, automotive, medtech, sports, and luxury. Among these users, following applications can be mentioned:

- Helicopter door hinge - University of Applied Sciences Northwestern Switzerland
- Automotive bracket - SetForge/ Renault

**Profile**

Founded in 2018 by by a team of pioneers, passionate about bringing the next generation of high performance manufacturing, we aspire to mass produce high performance composites as easily as metals. We do this by automating and digitizing the production workflow of composite production at the most innovative companies.

Therefore, we built a software as a service suite, powered by integrated FEA simulation tools, that allows to quickly find the most optimal designs. Then we combined state of the art additive manufacturing equipment with advanced post processing technology to enable serial manufacturing of structural composite parts.

**Field of Expertise**

We are at the forefront of digital composite production with our all-in-one Red Series technology. To offer this level of technology to our customers, we developed a unique expertise in the production value chain of load-carrying composite structure from design toconsolidated serial parts.

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| Ground Segment | | ✓ | ✓ |
| Materials and Processes | ✓ | ✓ | ✓ |
| Structures | ✓ | ✓ | ✓ |
| Electronic Components | | | |
| Software | | | |
| Basic Research for Space Technology | ✓ | ✓ | ✓ |
| Small Satellite Activities | ✓ | ✓ | |

## ALMATECH

### “Space and Naval Engineering”

**Profile**

Almatech is a privately-held Swiss SME specialized in the design, engineering and MAIT of ultra-stable structures, high-precision mechanisms and thermo-optical hardware for the European space market.

Since its inception in 2009, Almatech contributed to multiple ESA missions such as PREMIER, Bepi Colombo, Solar Orbiter, Sentinel-5, CHEOPS, Exomars 2020 and Metop-SG including numerous successful hardware deliveries.

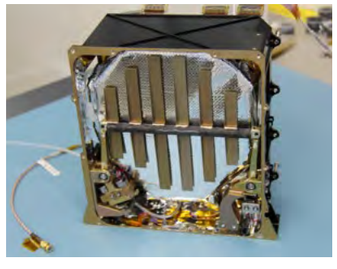
Almatech engineering competencies range from inventive concept definition through top-notch structural and thermal analyses to the final delivery of fully-tested flight hardware.

**Field of Expertise**

- Structural and thermal analysis
- High-precision mechanisms
- Compliant systems
- Lightweight Structures
- Ultra-stable CFRP Structures
- Exotic materials and processes
- Multi-layer insulation (MLI)
- Thermo-optical coatings

**References**

- FLEX Calibration Unit
- SVOM MXT Instrument Structure
- CHEOPS Telescope Optical Structure
- Sentinel-5 instrument Structure and Radiators
- Solar Orbiter Slit Change Mechanism (SCM) of the SPICE instrument
- Solar Orbiter Attenuator Mechanism (ATM) of the STIX instrument
- Exomars 2020 Carrier Module MLI and its support structure
- Metop-SG SAS MLI and MLI fixation
- Etc



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# INDUSTRY

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| Electronic Components | | | |
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| Small Satellite Activities | ✓ | ✓ | ✓ |

## APCO Technologies

"We take up technical challenges."

**References**

- Galileo, Sentinel-1/2/3/4/5/6, Bepi-Colombo, Exomars, IXV, Solar Orbiter, Eurostar, MTG, Euclid, CSO, MPCV, MetOp-SG MGSE
- Ariane 6 MGSE Center of Excellence
- Ariane 6 Boosters Upper & Lower Attachments
- Soyuz and Ariane 5 Transfer Systems
- Smart-1, Proba-2, Sentinel-5 P, MTG and Triton S/C Structures
- Sentinel-2 MSI, -3 OLCI and SLSTR Instr. Structure, Harness & Thermal S/S

**Profile**

APCO Technologies is specialized in the development of high quality mechanical and electro-mechanical equipment for the Space (Satellites and Launchers), Energy and Industry domains including project management, design, production, testing, installation, operation and on-site support.

APCO Technologies is certified EN 9100, ISO 9001, ISO 14001, ISO 27001, OSHAS 18001. APCO Technologies is employing more than 350 highly qualified people in Switzerland, France and French Guiana.

**Field of Expertise**

- Launcher and Spacecraft Structures (metallic and composite)
- Spacecraft Instrument Structures and Mechanisms
- Spacecraft Instruments
- Launcher and Spacecraft Mechanical Ground Support Equipment for Integration, Positioning, Hoisting, Handling and Testing
- Launcher and Spacecraft containers
- Infrastructures and Transfer Utilities
- Services at the European Space Port in French Guiana (Operations and maintenance of the Payload Preparation Facilities, Mechanical Group within the Technical Office and responsible of the Individual Protection Equipment)


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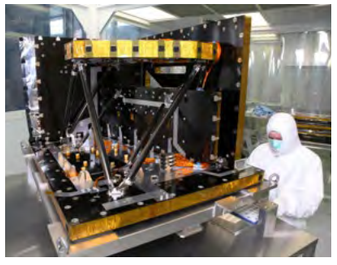

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## Astrocast

"Global low-cost connectivity for IoT applications"

**Profile**

Astrocast, in partnership with the European Space Agency, Airbus and Thuraya, is developing an advanced Nanosatellite network for the Internet of Things (IoT).

Airbus and Astrocast have developed a low-cost ASIC and module that provide the most power efficient satellite modem for IoT applications.

Thuraya has provided L-band spectrum and a global network of distributors and integrators for sales and support of our service.

The constellation will consist of 64 CubeSat in Low Earth Orbit (LEO) and will provide low latency global coverage.

**Field of Expertise**

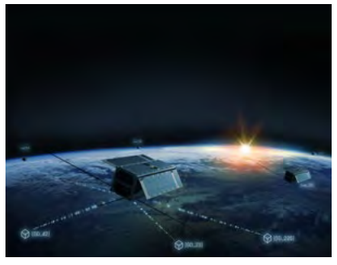
ESA's Advanced Research in Telecommunications Systems (ARTES) funding to develop an IoT nanosatellite network;

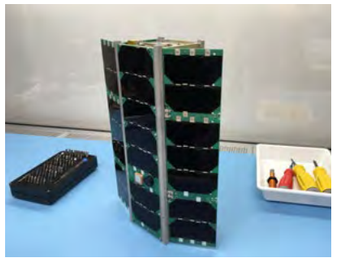
- DARA instrument digital board: Development and Manufacturing of the processing unit onboard Proba3
- Development of a CubeSat High-speed Communication System
- CHEOPS: Supporting the development of ground segment software
- xTerm (MdP): Advancements in L-band terminal up to TRL4 in partnership with IICT, Yverdon
- CTI – Antennas for CubeSat Communica tions in partnership with EPFL-MAG

**References**

Astrocast engineers have expertise in Space electronics, IoT applications and CubeSat development that include:

- Space electronics design (ECSS standard)
- Orbit analysis
- Attitude control systems design
- Communication system design
- Satellite operations
- Space and ground software development
- Mechanical design and analysis
- Testing and qualification of COTS components for space applications



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| Small Satellite Activities | ✓ | ✓ | |

## Bcomp

"Superior composite materials from natural fibres"

**References**

- Swiss Space Center mandate to develop novel lightweight composite structures for space applications for ESA.
- SSO MDP 2014 in collaboration with FHNW. In depth damping characterization of natural fiber composite structures for space applications.
- Development of interior automotive parts with several automotive brands
- Car body parts for Electric GT Championship

**Profile**

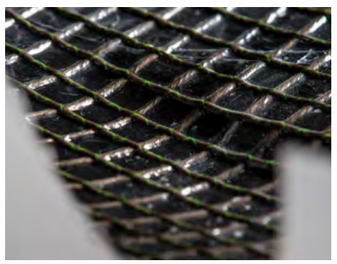
Bcomp develops natural fibre composite solutions, substituting existing engineering materials (carbon fibre composites, glass fibre composites, but also aluminium or wood), cutting weight and cost.

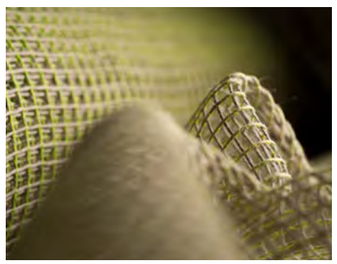
In only 5 years, Bcomp has established itself as a renowned supplier of high-performance, sustainable materials supplier in the Sports & Leisure industry, developing proprietary lightweight solutions made from renewable materials.

Thanks to its innovative products and strong brands, the company has built a large international customer portfolio in the Sports & Leisure industry, and more recently in the Mobility, Design and Aerospace industries.

**Field of Expertise**

- Design, fabrication and testing of composite structures, with natural and/or synthetic fibers
- Bcomp offers technology to build thin shell structures with unrivaled flexural stiffness to weight ratio and high vibration damping





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## Clemessy Switzerland

"Custom-made simulators and EGSE for spacecraft builders"

**Profile**

Clemessy Switzerland designs, integrates, develops and delivers electrical ground support equipment for monitoring and control systems, for aeronautics and space, transport infrastructures, scientific end environment.

**Field of Expertise**

- Electrical ground support system: Solar array simulator, battery simulation and load simulation
- Monitoring and control system
- Test stands
- Maintenance and operations

**References**

- MeteoSat Third Generation: EGSE for platform validation, for FCI instrument validation and IA-DEA instrument validation
- ExoMars: EGSE for 2016 and 2020 missions, covering platform of the spacecrafts, Rover Module and Carrier Module

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| Software | | ✓ | ✓ |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | ✓ | ✓ |

## CYSEC

### “Cybersecurity for satellite communications”

**References**

- Satellite operators, including Astrocast
- Ground segment providers

**Profile**

Cysec SA is a cybersecurity company based on the EPFL Innovation Park offering end-to-end protection of satellite communications.

Cysec commercializes ARCA, a secured server that is used on ground by satellite operators and ground segment providers to run the mission control software.

ARCA includes all cryptographic functionalities and key management system to perform security-related operations such as encryption-decryption, authentication and digital signature.

ARCA on ground is completed by a security module on board the satellite to provide the first end-to-end protection of satellite communications.

**Field of Expertise**

- Cybersecurity
- Cryptography
- Key management
- Software development
- Software Integration
- Cloud computing
- IT infrastructure

CYSEC

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| Segment | Research | Development | Production |
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| Software | ✓ | ✓ | ✓ |
| Basic Research for Space Technology | ✓ | ✓ | |
| Small Satellite Activities | | | |

## Embotech

### “Empowering Autonomous Systems to Make Better Decisions”

**Profile**

Real-time decision-making software for industrial machines, spacecrafts and autonomous cars.

Embotech is a leading developer of cutting-edge decision-making software. Our embeddable code empowers autonomous systems to make decisions by solving complex optimization problems in milliseconds, bringing significant improvements in safety, productivity and energy efficiency.

We create guidance & control (G&C) algorithms based on deterministic models with the ability to react in real-time to uncertainties and unforeseen events, increasing performance, reliability, and autonomy of the overall system.

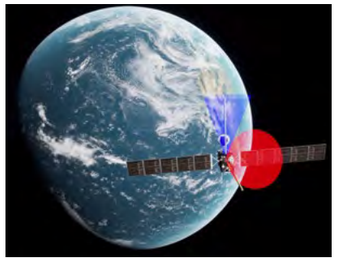
**Field of Expertise**

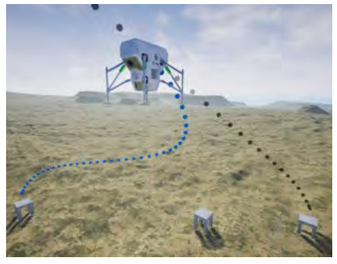
Our G&C software’s numerical core is based on Embotech’s proprietary and best-in-class FORCES PRO® mathematical optimization solver technology. Our solvers are designed with embedded hardware in mind and are the fastest solvers available on the market. We do G&C for:

- reusable space transportation systems
- satellites
- robotic arms
- autonomous vehicles

**References**

- On-board and real-time attitude guidance and control of satellites (ESA-FLPP)
- On-board and real-time guidance and control for space transportation systems (ESA)
- On-board and real-time guidance and control for VTOL vehicles (ESA-FLPP)
- On-board and real-time guidance and control for ADRIOS missions





embotech

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## Exolabs

### “Earth Observation as a Service”

**References**

- Spin-off from the University of Zurich, member of the UZH Space Hub & the Swiss Alliance for Data-Intensive Services, supported by Innosuisse
- Research projects with ESA, SSC, federal agencies, universities, industry
- National and international customers from the tourism, energy and natural resources sectors
- Global near real-time monitoring of snow characteristics (COSMOS, ExoSnow App)

**Profile**

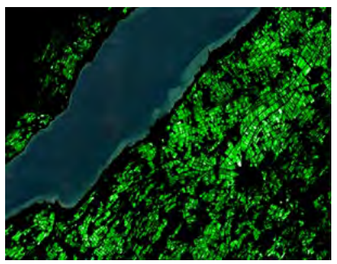
ExoLabs is a spin-off from the University of Zurich, founded in 2017 and registered in Zurich, Switzerland.

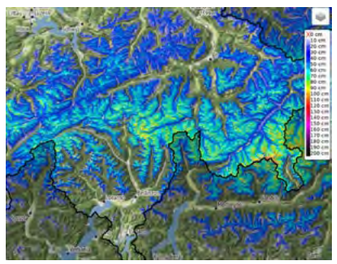
In the context of climate change and the associated changes in environmental conditions, ExoLabs enables businesses to better apply insights from Earth Observation data across sectors ranging from energy, insurance, tourism, commodity trading or agriculture to research and government.

We ensure that cutting-edge scientific research finds a direct implementation in user-defined applications by providing unique data products and by building customized solutions for our clients that deliver financial and operational advantages.

**Field of Expertise**

- Earth system science
- Multi-sensor Earth Observation image processing (satellite, airborne, drone)
- Global near real-time monitoring of environmental variables
- Land use/land cover classification and change detection
- Machine learning and big data handling
- Cloud computing
- Software development (SaaS)





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## INVOLI

### “Safely integrating Drones into the Air Traffic”

**References**

- ESA BIC Switzerland
- Swiss U-Space Implementation, alongside with FOCA and skyguide
- Armasuisse
- Meteomatics
- Swisscom

**Profile**

INVOLI enables the safe integration of drones into the air traffic to avoid collisions with aircraft. INVOLI provides unique air traffic data to drones, data gathered through a ground network of in-house developed sensors and satellite information/imagery.

Currently, the patented system is deployed throughout all of Switzerland and is a part of the Swiss U-Space Implementation (SUSI), providing surveillance data to the aerospace sector.

The system detects all cooperative aircraft in real-time, especially the ones flying low and at risk of hitting drones.

**Field of Expertise**

- Surveillance data for aerospace applications with focus on drones
- Software and hardware development of SSR
- Mechanical design and analysis
- Multilateration
- Algorithms & AI

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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | ✓ | |
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| Basic Research for Space Technology | | ✓ | |
| Small Satellite Activities | | ✓ | |

## Klepsydra Technologies

"Edge computing software for today's data hungry world"

**References**

- High-throughput Earth Observation paper, co-authored with LuxSpace for ESA OBDP2019
- Presentations and papers for ESA CANInSpace2019 and ESA GNC 2020
- Benchmarks for Space computers from Xilinx and Cobham.
- References from existing clients can be provided upon request.
- Klepsydra Community Edition, tutorials demos available via our website.

**Profile**

In today's increasingly data-hungry world, the bottleneck preventing the large-scale adoption of IoT solutions is the processing of large data volumes on resource-limited devices.

Inspired by the fastest software technologies in the world: high frequency trading, Klepsydra has developed, a lightweight, platform-agnostic software development toolset for embedded systems. As usability and interoperability is embedded by design, Klepsydra's platform is an easy-to-use, accessible framework aimed at enabling the next generation of high-performance space, smart mobility, robotics and IoT embedded applications.

**Field of Expertise**

We are experts in embedded software development, and in particular, we have expertise in:

- Space robotics
- Vision based navigation
- Precision control for landing and docking.

Our core skills are in parallel data processing including sensor fusion and image processing.

Our technical skills are:

- Flight software development.
- Real-time operating systems.
- FPGA, MATLAB, RTMES, FreeRTOS
- Machine Learning

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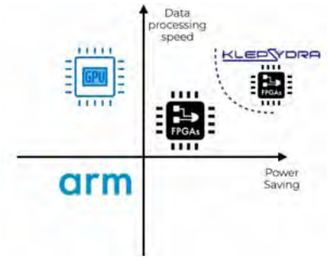




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## MEGGITT

"Smart engineering for extreme environments"

**Profile**

Meggitt PLC is an international group operating in North America, Europe and Asia. Known for its specialised extreme environment engineering, Meggitt is a world leader in aerospace, defence and energy. Meggitt employs approximately 12,000 people at over 40 manufacturing facilities and regional offices worldwide. Meggitt SA – trading as Meggitt Sensing Systems Switzerland – has become worldwide recognised as a leading supplier of high-performance and high reliability sensing and monitoring systems measuring physical parameters in the extreme environments.

**Field of Expertise**

- Piezo-electric transducers
- Vibration and dynamic pressure transducers
- Our systems measure displacement, relative and absolute vibration, rotational speed and dynamic pressure for space applications
- Meggitt's sensors withstand temperatures from -253°C to +780°C, pressures up to 350 bar and vibration up to 10,000g
- Meggitt's sensors use the eddy current measurement principle

**References**

Meggitt has been designing systems for space applications since the early 1970s, including high-performance vibration and dynamic pressure transducers and electronics for launchers and satellites. Meggitt's instrumentation further supported the development of the Vulcain and Vulcain 2 engines of the Ariane 5 launcher. Many of Meggitt's systems are flight qualified for Ariane 5.

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www.vibro-meter.com

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | ✓ | ✓ | |
| Satellite-based Applications | | | |
| Instruments and Payloads | | | |
| Spacecraft and on-board Equipment | ✓ | | |
| Ground Segment | | | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | | | |
| Software | | | |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

## Menhir Photonics

### “Laser precise and reliable as a Swiss timepiece”

**References**

- LIDAR wavelength calibration unit for space applications.
- Ultra-low noise RF signal generation for areospace applications.
- Lasers for frequency-comb and timing-distribution.

**Profile**

Menhir Photonics is a worldwide supplier of ultrafast lasers (femtosecond lasers) and related photonics solutions. We focus on customer satisfaction and industrial-grade quality, by placing the emphasis on the reliability and robustness of our products.
Thanks to innovative technology and design, we have developed a unique high-repetition rate (GHz) laser platform with ultra-low noise performances at 1550 nm. Our lasers are used in numerous applications including synchronization electronics, microwave generation or telecommunication.

**Field of Expertise**

- Ultrafast lasers design, production and testing
- Ultra-low noise RF signal generation using photonics solutions
- Timing-distribution with pulsed lasers

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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | ✓ | ✓ |
| Life and Physical Sciences | | ✓ | ✓ |
| Satellite-based Applications | | | |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | ✓ | ✓ | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | | | |
| Software | ✓ | | |
| Basic Research for Space Technology | ✓ | ✓ | |
| Small Satellite Activities | | ✓ | |

## Micos Engineering

### “Engineering for Remote Sensing”

**Profile**

Micos Engineering GmbH is an independent system engineering SME that focuses on optical instrumentation for the European space market. Micos serves its customers with design, engineering and AIT of ground support equipment and flight hardware.
Micos facilities dedicated to integration and testing account for ISO5, ISO6 and ISO7 clean-room areas equipped with quality and metrology instrumentation to support opto-mechanical integration and verification; TVAC facility with double cooling circuit; optical laboratory for breadboarding activities; thermometry calibration and vibration monitoring equipment are also in-house.

**Field of Expertise**

Our multi-disciplinary team runs projects with a professional network of industrial and institutional partners. Micos key competences:

- Optical, Opto-Mechanical Design and AIT
- Characterization & Calibration Systems and GSEs
- Optical fibre based Metrology Systems
- Spectroscopic and Interferometric Systems
- Prototype Processing and Algorithms
- Project and Subcontractor Management, Product Assurance

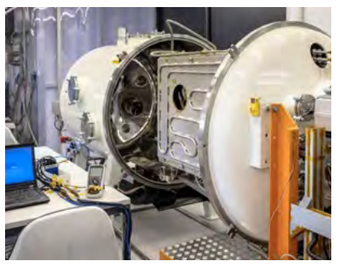
**References**

Contribution to European programmes:

- MTG Calibration Black Bodies and IRS Spectral Calibration Algorithm
- Sentinel-4 AIT-OGSE
- Sentinel-5 Calibration Subsystem
- Proba-3 FFLS Opto-Mechanical Subsystem
- MetOp 3MI Calibration M- and EGSE, METImage ReImager

Products development:

- Miniaturized Aerosols Monitoring Nephelometers
- High Accuracy Optical Encoders
- Waveguide based High Resolution Spectrometers



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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | ✓ | ✓ |
| Instruments and Payloads | | ✓ | ✓ |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | | | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | | | |
| Software | | | |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

## MPS

### “Solutions in microspace”

**Profile**

MPS Microsystems develops and manufactures high-precision, high-performance and very low-friction electro-mechanical microsystems.

Managing the miniaturisation and integration of functions in small spaces, MPS Microsystems provides solutions that meet specific customer requirements. MPS Microsystems also offers a standard range of products, such as linear bearings and ball screws under the “microlinea” trademark. Located in Bienne, Switzerland, in a modern and well equipped facility MPS Microsystems provides customers with unique capabilities that are perfectly suited to the requirements of the high-tech sectors.

**Field of Expertise**

- Miniature highly accurate ballscrews
- Miniature linear ball bearings
- Custom made complex and highly accurate electromechanical systems
- Miniature active optical systems such as zoom and laser focus mechanisms

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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | ✓ |
| Life and Physical Sciences | | | |
| Satellite-based Applications | ✓ | ✓ | ✓ |
| Instruments and Payloads | | | |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | | | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | | | |
| Software | | ✓ | ✓ |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

## Picterra

### “User-Sourced Artificial Intelligence For Earth Imaging”

**Profile**

Picterra develop Artificial Intelligence (AI) systems dedicated to the processing and exploitation of aerial and satellite imagery. Picterra’s team cumulates thirty years of experience in the application of AI in the processing of Earth observation imagery.

Picterra aims at democratizing the usage of such images via an interactive platform, where each user can develop and manage its own AI. Partnering human expertise and knowledge with the power of AI, bring new geo-spatial insights on our Planet as well as human activities such as monitoring infrastructures, socio-economic or environmental indicators.

**Field of Expertise**

- Earth observation satellite imagery processing (optical, SAR)
- Very high resolution aerial image processing
- Machine learning including deep learning, transfer learning, anomaly and change detection
- Cloud software engineering
- GIS expertise

**References**

Picterra has been awarded the VITUS project in the frame of the CALL4IDEAS 2017, which investigates the unmixing of Sentinel-2 imagery supported by aerial data for vine vitality mapping at high temporal resolution.

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www.picterra.ch

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | | |
| Instruments and Payloads | | ✓ | |
| Spacecraft and on-board Equipment | | ✓ | |
| Ground Segment | | | |
| Materials and Processes | | ✓ | ✓ |
| Structures | | ✓ | ✓ |
| Electronic Components | | | |
| Software | | | |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

## Precicast Additive

"Additive Manufacturing for Aerospace Solutions - Your Partner for AM Engineering Services"

**References**

- Turbo pumps for liquid space propulsion in nickel base alloy
- Structural parts in aluminum and titanium alloy

**Profile**

The deep metallurgical know-how of GF Precicast finds a new expression in GF Precicast Additive, founded in November 2016. The potential of its additive technologies, enabling design freedom, complex lattice structures, lighter parts with integrated functions directly from the 3D model, quickly and with reduced costs, add to the expertise and qualified resources of the company customize services with high value in 3D metal printing integrated with investment casting.

**Field of Expertise**

GF Precicast Additive proposes as partner for the development of innovative solutations along the entire supply chain :

- From co-design
- To direct manufacturing ot metal parts through Laser PBF and Electron Beam PBF
- From Research & Development of new materials
- To post-processing, up to quality inspections

+GF+ PRECICAST

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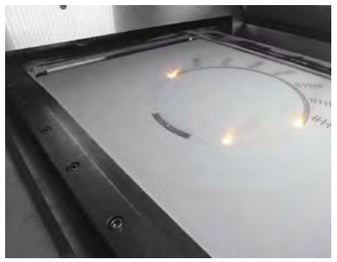


| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | ✓ | ✓ |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | ✓ | ✓ |
| Instruments and Payloads | | ✓ | ✓ |
| Spacecraft and on-board Equipment | | ✓ | ✓ |
| Ground Segment | | | |
| Materials and Processes | ✓ | ✓ | ✓ |
| Structures | ✓ | ✓ | ✓ |
| Electronic Components | ✓ | ✓ | ✓ |
| Software | | ✓ | ✓ |
| Basic Research for Space Technology | ✓ | ✓ | ✓ |
| Small Satellite Activities | ✓ | ✓ | ✓ |

## RUAG Space

"Together Ahead."

**Profile**

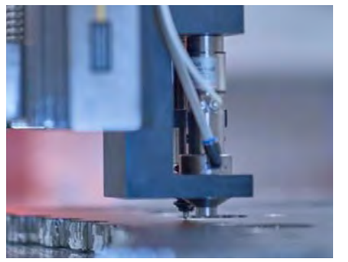
RUAG Space is the number one independent space product supplier and the leading supplier of products for the space industry in Europe, with a growing presence in the United States. Experience, outstanding reliability, customer focus and a comprehensive, clearly structured product portfolio all make RUAG Space the partner of choice for manufacturers of satellites and launchers. The skills and services RUAG offers cover all the essential aspects of space projects, ranging from mission analysis, systems engineering and project management through engineering services, assembly and integration, to support and testing at the launch site.

**Field of Expertise**

- Launcher Structures & Separation Systems
- Satellite Structures, Mechanisms & Mechanical Equipment
- Digital Electronics for Satellites and Launchers

**References**

- Development and manufacturing of payload fairings for the Ariane, Vega and Atlas programs
- Providing satellite structures and dispensers for OneWeb - aiming to secure global broadband internet service



Together ahead. RUAG

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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | ✓ | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | ✓ | ✓ | ✓ |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | | ✓ | ✓ |
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| Materials and Processes | ✓ | | |
| Structures | | | |
| Electronic Components | ✓ | ✓ | ✓ |
| Software | | ✓ | ✓ |
| Basic Research for Space Technology | ✓ | ✓ | |
| Small Satellite Activities | | | |

## Saphyrion

"Space-qualified integrated circuits and GNSS data processing instruments"

**References**

- ASICs for space-borne GNSS receivers on all recent ESA Earth Observation missions: Sentinel, Swarm, Earthcare, Metop
- Strategic partnership in European-based GNSS receiver production with: RUAG Space, Airbus Defense & Space, Thales Alenia Space
- Wide experience partnering or coordinating ESA and EU-funded projects with large enterprises, academies, research centers, SMEs, end users and integrators.

**Profile**

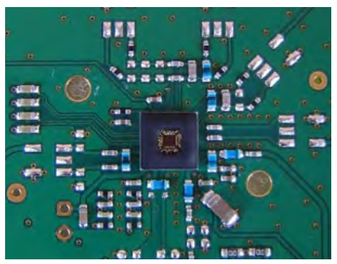
Saphyrion Sagl, located in Bioggio (Ticino), is key player in the industry domain of space-borne RF, analog and mixed mode electronics, and its enabling technology allowed the European Space Agency to pioneer compact GNSS receivers for satellite orbit control and other scientific applications.

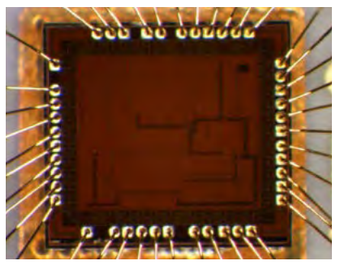
SAPHYRION developed a solid background in signal processing and systems and subsystems for ground applications, like high performance GNSS systems and laboratory instruments for GNSS data acquisition and processing.

**Field of Expertise**

Design of radiation-hardened integrated circuits (RF, analog and digital logic):

- Processing of signals in different bands (L, S, X, K)
- Electronic for RF and analog stages of space-borne telecom equipment
- Advanced instrumentation for GNSS integrity monitoring
- GNSS data processing and software defined GNSS receivers
- Data fusion (GNSS/IMU, GNSS/UWB and others) for hybridized platforms
- Consultancy in IC design and signal processing





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| | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | ✓ | ✓ |
| Life and Physical Sciences | | | |
| Satellite-based Applications | ✓ | ✓ | ✓ |
| Instruments and Payloads | | | |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | | | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | | | |
| Software | ✓ | ✓ | ✓ |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

## Sarmap

"The Earth Observation gateway"

**Profile**

sarmap's mission is to build and provide an innovative, sophisticated yet simple remote sensing software products and services, dedicated to the generation of digital information for a better management and risk assessment of Earth's natural/environmental resources.

sarmap is a Swiss company founded as spin-off of the University of Zurich. While being at the forefront of technology, it builds on traditional values such as reliability and long-term collaboration partnerships based on mutual trust and respect.

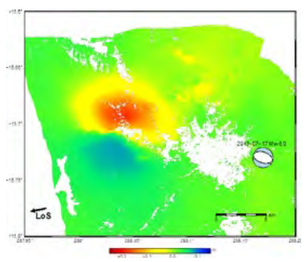
**Field of Expertise**

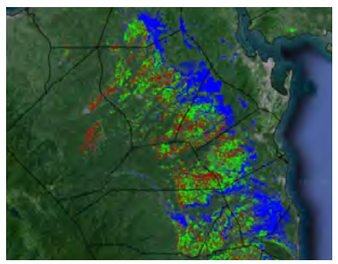
Spaceborne / Airborne monitoring solutions for:

- Topography
- Land Displacement
- Agriculture and food security
- Flooding
- Forestry and forest certification
- Change Detection

**References**

- Partner in the ESA-sponsored IAP TransparentForests project, to strengthen quality and transparency in the forest certification process.
- Partner of the SDC-sponsored Remote sensing-based Information and Insurance for Crops in Emerging economies (RIICE) project, aiming to reduce the vulnerability of rice smallholder farmers in low-income countries in Asia.
- Developing SARscape, an end-to-end state-of-the-art software processing chain for generating SAR-based products for different applications.





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# INDUSTRY

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | | |
| Instruments and Payloads | | | |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | | | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | ✓ | ✓ | ✓ |
| Software | | | |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | ✓ |

## SCHURTER

### “Safety is our Business”

**References**

SCHURTER is the sole European supplier of qualified fuses by the ESA. The cooperation has led to two products for protecting electronic modules in aerospace applications:

- MGA-S, a surface mount fuse for space application
- HCSF, a solid state, thin film, surface mount fuse for high current space application

**Profile**

SCHURTER is an internationally leading innovator and manufacturer of electric and electronic components. The company focuses on safe power supply and easy-to-use equipment. Its extensive product portfolio comprises standard solutions in the fields of circuit protection, plugs and connectors, EMV products, switches, input systems and electronic manufacturing services. SCHURTER’s global network of representative offices ensures reliable delivery and professional customer service. Where standard products are unsuitable, the company develops client-specific solutions.

**Field of Expertise**

SCHURTER is proud to meet standards such as defined in the ESA Internal Requirement Definitions or in Military Standards (e.g. MIL, NF, NNO, GAM T1) and Aviation Standards.

- We focus on the safety for power systems
- We develop customer specific fuse designs for over-current protection under extreme conditions
- We guarantee that the certification of our products, the manufacturing and the logistics are audited regularly
- We ensure a product lifetime of up to 30 years and a documented life cycle as well as lifelong information

SCHURTER
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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | ✓ | ✓ |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | ✓ | ✓ |
| Instruments and Payloads | | | |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | ✓ | ✓ | ✓ |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | | | |
| Software | ✓ | ✓ | ✓ |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

## Solenix

### “Engineering Inspiration”

**Profile**

Solenix is an international group offering high-quality software engineering services, operations and consultancy services, and software products in the space industry. We develop innovative solutions to complex problems, combining state-of-the-art technology with proven and established practices. We are well known for being a reliable, capable and flexible partner. Our customers are European space agencies and satellite operators.

Solenix was established in Switzerland in 2004 with Solenix GmbH and over the years has expanded its activities to other countries. Today, Solenix has evolved into an international group with places of business in several European countries. The group employs about 60 staff.

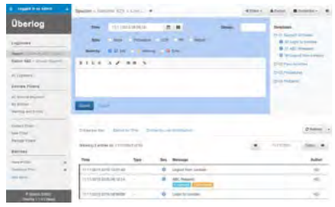
**Field of Expertise**

Development of distributed software systems with a focus on data processing and web applications:

- End-to-End System & Service Monitoring
- Electronic Event Logging, Alarming & Processing
- Artificial Intelligence and Machine Learning applied to Mission Operations
- Intelligent Planning, Scheduling and Optimisation
- Earth Observation End-to-End Processing Chains
- Mission Data Analysis & Visualisation
- Mission Monitoring & Control Systems
- Robotics & Automation Control Systems

**References**

- Überlog is an operations logbook solution for tracking events and activities, used daily by major satellite operators.
- Elveti is an easy to use, flight-proven mission control system designed to operate both single and constellations of nano & small satellites.
- Multiple contracts for ESA and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) in which we offer a broad range of services in support of ground segment development and operations, including the design and development of new systems, the evolution and maintenance of existing ones and the research and prototyping of innovative solutions.


SOLENIX

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| Segment | Research | Development | Production |
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| Earth Observation | | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | ✓ | ✓ |
| Instruments and Payloads | | ✓ | ✓ |
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| Ground Segment | | ✓ | ✓ |
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| Electronic Components | | ✓ | ✓ |
| Software | | ✓ | ✓ |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

## Spectratime

### “iPrecision Timing Solutions®”

**References**

Spectratime is the world’s larger manufacturer of Swiss-made space atomic clocks with over 100 clocks flying onboard space satellites around the earth, providing the high-precision “heart beat pulse” for the land, sea and air operations of positioning, navigation and timing applications. The company supplies atomic clocks for the following major space GNSS and other satellite communications programs:

- Beidou
- Galileo
- IRNSS
- GAIA
- GAGAN
- METOP

**Profile**

Founded in 1995 in Neuchâtel, Switzerland, Spectratime designs, manufactures and markets a full range of high-performance, low-cost crystal, rubidium and maser sources, smart integrated GPS or GNSS reference clocks, and clock testing systems. Its products are used in a wide variety of applications, including telecommunications, defense, navigation, instrument, broadcasting, and space. The company is a recognized leader in the industries it serves and distributes its products globally through Spectratime’s sales offices in Europe, Asia, and United States.

**Field of Expertise**

- High-performance crystal, rubidium & maser clocks
- Commercial & rugged military rubidium oscillator sources
- Space crystal, rubidium and maser clock sources
- GPS/GNSS synchronized crystal and rubidium clocks
- Integrated, low noise GPS/GNSS rubidium reference standards
- High-resolution ADEV clock analyzers
- Time & frequency clock experts

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www.spectratime.com



| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | | ✓ | |
| Satellite-based Applications | | | |
| Instruments and Payloads | | | |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | | | |
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| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

## SwissApollo

### “Space for Inspiration”

**Profile**

SwissApollo is a company dedicated to inspire people, by perpetuating the memory of Switzerland’s contribution to the Apollo Lunar program and keep the links and friendship with its actors.

We promote Science, Technology, Engineering and Mathematics (STEM) to the general public, especially children and students.

We support the pursuance of space initiatives, in particular through the inspiring accounts of its historical pioneers.

**Field of Expertise**

- Motivational speaker in fields of Space and Human Developments
- Organization and chairing conferences and panels discussions
- Awareness and promotion of STEM for children and students
- Appearance of key people involved in space program
- Expertise in space history, especially the Swiss implication during Apollo program
- Archive with books, newspapers and various artifacts related to Apollo.

**References**

- Several lectures for general public, children and students promoting STEM
- Several panel discussions with astronauts and scientists promoting STEM
- Official partner of the Swiss Transport Museum and Sciencecity for space exhibits
- Proofreading of the publication “Science & Fiction”, Professor Johannes Geiss, Berner Universitätsschriften
- Recommendation of the book “Innovation, the NASA way”, Rod Pyle, USA
- Television commercial starring astronaut Buzz Aldrin for Swiss Tourism

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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | ✓ | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | | |
| Instruments and Payloads | | ✓ | |
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| Ground Segment | | | ✓ |
| Materials and Processes | | | ✓ |
| Structures | | ✓ | |
| Electronic Components | | ✓ | |
| Software | | | |
| Basic Research for Space Technology | ✓ | | |
| Small Satellite Activities | ✓ | ✓ | |

## SWISSto12

### “3D printed antennas, waveguides and filters”

**References**

SWISSto12 is a highly innovative technology company, which has already successfully tested its products with key industrial customers in the satellite telecommunications industry such as:

- The European Space Agency
- Cobham antenna systems
- Thales Alenia Space
- Airbus Defense and Space

The company is currently in the process of completing the qualification of its products for aerospace and space applications in view of first flights in 2018. In parallel, its products are already commercialized for use on the ground and for scientific research applications.

**Profile**

SWISSto12 is a start-up company that spun off from the Swiss Federal Institute of Technology in Lausanne (EPFL), in 2011. The company pioneers in the field of radio frequency antenna, waveguide and filter products based on additive manufacturing. Specialized product designs are 3D printed in high-performance polymers or metals and subsequently metal plated through proprietary processes. This novel approach to manufacturing features drastic weight reductions, extended design flexibility and reduced costs. SWISSto12 products are commercialized for use both on ground and in space for satellite telecommunication applications.

**Field of Expertise**

- RF antennas, waveguides and filters
- Satellite RF payload components
- Satellite user terminal RF components
- Additive manufacturing of polymers and metals for RF applications
- Surface treatment of additive manufactured products
- RF and mechanical design and testing of RF components

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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | ✓ | ✓ | ✓ |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | ✓ | ✓ | ✓ |
| Ground Segment | ✓ | ✓ | ✓ |
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| Structures | | | |
| Electronic Components | ✓ | ✓ | ✓ |
| Software | | ✓ | ✓ |
| Basic Research for Space Technology | ✓ | | |
| Small Satellite Activities | | | |

## Synopta

### “Opto-electronic systems for space and terrestrial use”

**Profile**

Synopta GmbH was founded in Eggersriet (SG), Switzerland, in early 2004. The purpose of its business is consulting in strategic and technical areas, the representation of companies in the European market, as well as development, production, distribution of opto-electronic devices and other high-quality goods.

In addition to consulting and service activities, Synopta also develops and produces complex opto-electronic systems for space and terrestrial use, both as serial products with small or medium-sized numbers, as well as individual productions/ prototypes.

The owner of Synopta GmbH is Dr. Reinhard H. Czichy.

**Field of Expertise**

The competences of Synopta include

- Consulting in business development and strategic planning
- Public Affairs Management
- Risk and Project management
- Development skills in the fields of: Systems Engineering, Orbit analysis, Atmospheric channel modeling, Optics, Opto-Electronics, Adaptive Optics, Mechanisms, Control Electronics, Communication electronics, Software
- Beam steering and -stabilizing systems
- Optical Ground Stations
- Communication Systems
- Test systems for optical and optoelectronic devices
- Design, development and production of devices for space applications

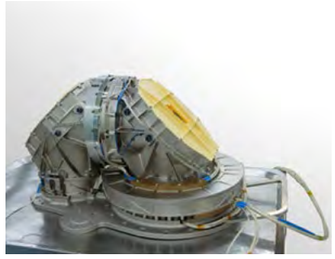
**References**

Synopta is involved in or responsible for following OGS types:

- ESA Optical Ground Station (OGS)
- Mobile Tesat OGS
- Transportable Adaptive Optical Ground Station (T-AOGS)

Synopta delivers CPA 135 for Tesat LCTs used in Copernicus/ EDRS, flying on the following missions:

- Sentinel 1A
- EDRS-A
- Sentinel 1B
- EDRS-C
- Sentinel 2B
- MAIT on-going, e.g. for Sentinel 1+2, C+D



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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | ✓ | ✓ |
| Life and Physical Sciences | | ✓ | |
| Satellite-based Applications | | | |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | ✓ | ✓ | ✓ |
| Ground Segment | | | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | | | |
| Software | | | |
| Basic Research for Space Technology | | ✓ | |
| Small Satellite Activities | | | |

## Thales Alenia Space Schweiz

"Space for Life"

**References**

- BepiColombo - Receiver Subsystem for BELA Instrument
- Sentinel-5p - Detector Module for TROPOMI Instrument
- Exomars Trace Gas Orbiter - Telescope for CaSSIS Instrument
- LISA Pathfinder - Laser Modulator, Delta-CCU Electronics and Inertial - Sensor Front End Electronics
- Alphasat, Sentinel-1/2 A/B - Telescope for Laser Communication Terminal
- SMOS - Optical Harness for MIRA

**Profile**

Thales Alenia Space in Switzerland entered the field of Optics and Electronics Systems more than 20 years ago. During this time our engineers gained substantial know-how that resulted in the design and manufacturing of sophisticated optics and electronics systems for space applications. In parallel, the needed infrastructure in the sense of clean rooms and measurement equipment was implemented to support the activities. Thales Alenia Space in Switzerland has demonstrated its high level of competence in several projects involving engineering, testing and production of optics and electronics.

**Field of Expertise**

Thales Alenia Space in Switzerland has demonstrated its high level of competence in several projects involving engineering, testing and production of optics and electronics, such as:

- Cameras for Planetary Research
- Front End Electronics for various sensors, including CCD readout
- Radiation Monitors
- Optical Terminals for broadband inter-satellite and space-to-ground communications
- Highly stable optical structures
- Optical Harnesses for satellites
- Laser Altimeters for planetary research

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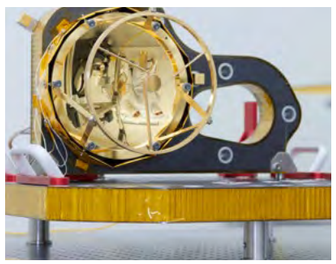
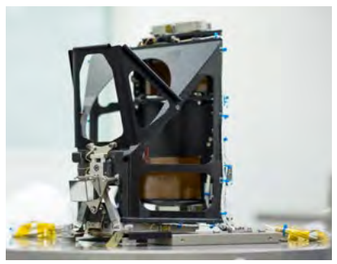






| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | | |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | | | |
| Materials and Processes | ✓ | ✓ | ✓ |
| Structures | | | |
| Electronic Components | | | |
| Software | | | |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

## TSS InnovationsProjekte

"Flexibility is our own DNA"

**Profile**

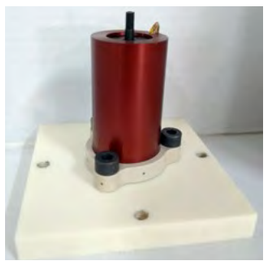
TSS InnovationsProjekte GmbH has been established in 2011 as the Swiss spin-off of one of the main italian spring manufacturer (Technosprings Italia srl, TSI), inheriting its know-how and technical expertise. This includes also a fifteen-years experience in the field of shape memory alloys. TSS designs and produces high quality metallic springs and bent components for any application, in particular aerospace, automotive, medical and watchmaking. TSS is active also in innovative research projects in the aerospace and medical fields. The company quality system is certified ISO 9001, EN 9100 and ISO 13485.

**Field of Expertise**

- Design and manufacturing of high quality springs and bent components from Ø0.06mm in any metallic material, e.g. steel, Titanium, Inconel, Nivaflex, Pt-Ir, Copper, Bronze
- Design and manufacturing of actuators and devices based on shape memory alloy
- Contract Manufacturing of high quality metal springs and shape memory components for invasive medical devices for dental and vascular applications

**References**

- ESA CONTRACT 4000123630/18/NL/PS/gp: Development and Testing of a High Temperature Shape Memory Alloys Actuator for HDRM. Status: completed
- Interreg IT-CH 2014-2020: Shape memory alloys for damping. Status: current
- Shape Memory mechanism for latch and release of satellite and aerospace modules and payload (SHREK). Status: completed. TSI in collaboration with SELEX ES, AEREA SpA, CNR-IENI.



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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | ✓ | ✓ | ✓ |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | ✓ | ✓ | ✓ |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | ✓ | ✓ | ✓ |
| Software | ✓ | ✓ | ✓ |
| Basic Research for Space Technology | ✓ | | |
| Small Satellite Activities | | | |

## ViaSat Antenna Systems

"Truly Global, Truly Broadband"

**References**

- Project AIDAN - Public Private Partnership with European Space Agency (ESA) to develop, validate and roll out a highly innovative ground segment for third generation class satellite system ViaSat-3.
- SatCare - ESA project of in-ambulance telemedicine with broadband satellite connectivity.
- ViaDrone - ESA project to fly Remotely Piloted Aircraft Systems in civilian airspace for new applications.

**Profile**

ViaSat is on a mission to connect the world. A global broadband services and technology company, ViaSat designs, integrates and delivers secure, high-performance satellite and wireless services. Its business unit in Lausanne is a centre of excellence for phased arrays and new technologies, products and applications for satellite communications. Applications for satellite communication include drone systems, connected vehicles, 3D printing and IoT. It is also a service and operations centre for Europe, developing key elements of the satellite system for ViaSat's next generation of high capacity satellites.

**Field of Expertise**

- Satcom systems for high-capacity satellites
- Design, manufacture and test antennas for mobile satellite telecommunication
- Centre of excellence for phased array
- Drones systems and applications
- Connected vehicles
- Internet of Things
- 3D Printing

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# RESEARCH

# RESEARCH

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | ✓ | ✓ | ✓ |
| Satellite-based Applications | | | |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | ✓ | | |
| Ground Segment | ✓ | | |
| Materials and Processes | ✓ | ✓ | |
| Structures | ✓ | | |
| Electronic Components | ✓ | ✓ | ✓ |
| Software | ✓ | ✓ | ✓ |
| Basic Research for Space Technology | ✓ | | |
| Small Satellite Activities | ✓ | ✓ | |

## CERN

**Space Activities**

- Support of scientific space missions, including on ISS, mainly in astroparticle physics, and in astronomy, and cosmology (e.g., Euclid, AMS). Instrument performance characterisation and calibration.
- Testing facilities: ground testing and qualification of flight equipment, mainly for irradiation (e.g., CHARM, VESPER, IRRAD), and for materials characterisation, cryogenics and magnetic testing.
- Technologies: from microelectronics to data handling, from radiation monitoring to cryogenics and from thermal management to superconducting magnets.

**Profile**

Physicists and engineers at the European Organization for Nuclear Research use the world's largest and most complex scientific instruments to study the basic constituents of matter – fundamental particles. The particles are made to collide at close to the speed of light. The process gives physicists clues about how the particles interact, and provides insights into the fundamental laws of nature.

CERN's mission is: to provide a unique range of particle accelerators that enable research at the forefront of human knowledge, to perform world-class research in fundamental physics, to unite people from all over the world, and to push the frontiers of science and technology, for the benefit of all.

**CERN at a Glance**

- World-class research in particle physics
- Expertise in the fields of accelerators, detectors, and computing
- 2560 members employed by CERN, but up to 13 000 people on site at any one time
- 22 Member States
- 2016 Budget: 1153.2 MCHF
- Currently 18 start-ups using CERN technology
- Main application fields beyond particle physics: medical technologies and aerospace applications
- CERN's dedicated Knowledge Transfer group engages with experts in science, technology and industry to create opportunities for the transfer of CERN's technology and know-how.


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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | | |
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| Software | | | |
| Basic Research for Space Technology | ✓ | | |
| Small Satellite Activities | ✓ | ✓ | |

## CSEM

**Profile**

CSEM is a private, non-profit research and technology organization and a Swiss innovation accelerator—a catalyst for the transfer of technologies and know-how from fundamental research to industry.

CSEM delivers unique advanced technologies to the industrial sector, thereby reinforcing the sector's competitive advantage. Supported by federal and cantonal authorities CSEM bridges the gap between academic findings and industrial requirements.

CSEM's research strategy is built around five strategic programmes: microsystems technology, systems engineering, ultra-low power integrated systems, surface engineering and photovoltaics and energy management.

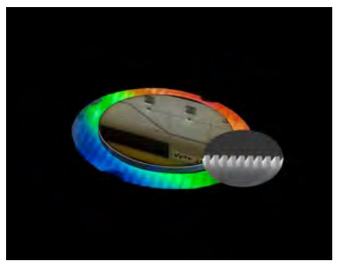
**CSEM at a Glance**

(in 2015)

- Headquartered in Neuchâtel, with 4 regional centres in Zurich, Muttenz, Alpnach, and Landquart.
- Total Income: 83 MCHF
- Income in Space: 5.4 MCHF
- 450 employees
- 47 nationalities
- Over 15 years, 42 new ventures (start-ups & spin-offs)
- 186 overall patent families

**Space Activities**

- High precision mechanisms and scientific instrumentation
- Atomic clocks
- Flash imaging LiDAR
- Robotics, control engineering, firmware
- Micro-sensors, MEMS and MOEMS (from design to small volume production and reliability)
- Biomedical engineering (integrated sensors, telemedicine)
- Life support and habitation systems at the ISS
- Telecommunication (intra-satellite wireless communication, antenna miniaturisation, etc. )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# RESEARCH

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | ✓ | |
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| Small Satellite Activities | | | |

## EAWAG

**Space Activities**

- Surface water quality remote sensing
- Optical properties of natural waters
- Remote sensing of plant-water interactions
- Urban flood monitoring
- Model assimilation of Earth observation products

**Profile**

The Swiss Federal Institute of Aquatic Science and Technology, Eawag, is one of the world's leading water research institutes. It combines natural sciences, engineering and social sciences, which enables comprehensive research of water from pristine rivers and lakes, right through to automated waste water management systems. In close collaboration with authorities and other interest groups, Eawag provides a unique research environment to investigate questions that lead to new scientific findings and to solutions for the basic challenges facing society. Spaceborne Earth observation is an essential information source for both, and fiducial reference measurements acquired at Eawag aim to further improve their use on local to global scales.

**EAWAG at a Glance**

- Operating income: 70.6 MCHF
- 500 staff members
- 9 major awards (in 2019)
- 8 spin-offs
- 90 SNF/NCCR/Innosuisse and 22 EU projects on-going


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| Segment | Research | Development | Production |
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| Earth Observation | ✓ | ✓ | |
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| Structures | | | |
| Electronic Components | | | |
| Software | ✓ | ✓ | |
| Basic Research for Space Technology | ✓ | ✓ | |
| Small Satellite Activities | | | |

## Empa

**Profile**

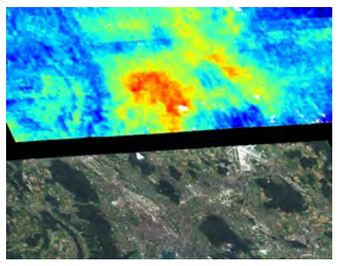
Empa, the Swiss Federal Laboratories for Materials Science and Technology, an interdisciplinary research institute of the ETH Domain, conducts cutting-edge materials and technology research. Our research and development activities focus on meeting the requirements of industry and the needs of society, and thus link applications-oriented research to the practical implementation of new ideas in the areas of nanostructured, "smart" materials and surfaces, environmental, energy and sustainable building technologies as well as bio- technology and medical technology.

**Empa at a Glance**

- Operating Income: 192.5 MCHF
- 966 staff members
- 65 prizes and awards (in 2017)
- 72 spin-offs and start-ups
- 120 SNSF, 103 CTI/Innosuisse and 69 EU currently undergoing projects

**Space Activities**

- Air pollution and climate change: remote sensing and modeling
- Energy: flexible high efficiency solar cells
- Safety: body monitoring with smart sensing textiles
- Reliability: electronic systems
- Materials and processes: additive manufacturing & X-ray analytics

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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | ✓ | ✓ |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | | |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | | | |
| Materials and Processes | ✓ | ✓ | |
| Structures | | | |
| Electronic Components | | | |
| Software | ✓ | | |
| Basic Research for Space Technology | ✓ | | |
| Small Satellite Activities | ✓ | | |

# PMOD/WRC

**Space Activities**

- Mechanical Workshop
- Electronic Workshop
- Cleanroom Iso7
- Cleanbench Iso5
- Vacuum Chamber
- Optical Laboratory

**Profile**

The Physikalisch-Meteorologisches Observatorium and World Radiation Center is a private non-commercial organization, which is a branch of the SFI foundation in Davos.

The PMOD/WRC

- Serves as an international center for the calibration of meteorological instruments measuring radiation;
- Develops radiometers and telescopes for ground-based and space-based use.
- Researches the Earth's ozone layer, climate evolution and the causes of solar activity

Measurements obtained in space and on the ground are used for research projects, which assess the relation of the solar variations to climate change and space weather.

**PMOD/WRC at a Glance**

- Annual budget: 5.8 M CHF
- 40+ staff members
- Operational service of four calibration centers for the World Meteorological Organization:
- Solar Radiometry Section (WRC-SRS)
- Infrared Radiometry (WRC-IRS)
- Atmospheric turbidity (WRC-WORCC)
- UV radiometry (WRC-WCC-UV)
- Research: Radiation metrology, Solar physics, solar influence on climate, atmosphere, and Space Weather
- Collaborations nationally with ETH Zürich, University of Bern, University of Zürich, FHNW, IRSOL

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# ACADEMIA

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | | |
| Life and Physical Sciences | ✓ | | |
| Satellite-based Applications | ✓ | ✓ | |
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| Electronic Components | ✓ | ✓ | ✓ |
| Software | ✓ | ✓ | ✓ |
| Basic Research for Space Technology | ✓ | | |
| Small Satellite Activities | ✓ | ✓ | ✓ |

# EPFL

**Profile**

The École Polytechnique Fédérale de Lausanne (EPFL) is Europe's most cosmopolitan technical university with students, professors and staff from over 110 nations.

A dynamic environment, open to Switzerland and the world, EPFL is centered on its three missions: teaching, research and technology transfer.

EPFL works together with an extensive network of partners including other universities and institutes of technology, developing and emerging countries, secondary schools and colleges, industry and economy, political circles and the general public, to bring about real impact for society.

**EPFL at a Glance**

- Created in 1968 (roots back to 1853)
- 10'124 students (BSc, MSc, PhD)
- 338 faculties
- Annual Expenses: 965 MCHF
- 210 start-ups established between 2000 and 2015
- 14th World University for Engineering and Technology (2015 THE)

EPFL

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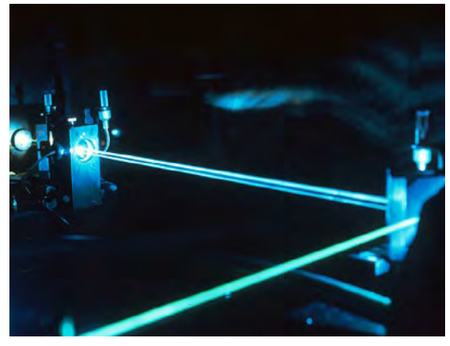
## Applied Computing and Mechanics Laboratory (IMAC)

**Profile**

The mission of IMAC is to take advantage of multi-disciplinary synergies in order to study the real behavior large civil-engineering structures. We maintain competence in structural mechanics, dynamics, measurement of full-scale structures, optics, material science and information technology.

**Space competences**

- Active and intelligent structures
- Infrastructure monitoring, diagnosis and prediction



**Contact**

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EPFL

## Biorobotics Laboratory (BIOROB)

**Profile**

The BioRob works on the computational aspects of locomotion control, sensorimotor coordination, and learning in animals and in robots. We are interested in using robots and numerical simulation to study the neural mechanisms underlying movement control and learning in animals, and in return to take inspiration from animals to design new control methods for robotics.

**Space competences**

- Self-reconfigurable modular robots
- Amphibious field robotics
- Bio-inspired control methods for articulated robots

**Contact**

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BIOROB
Laboratoire de biorobotique

# ACADEMIA

## Composite Construction Laboratory (CCLAB)

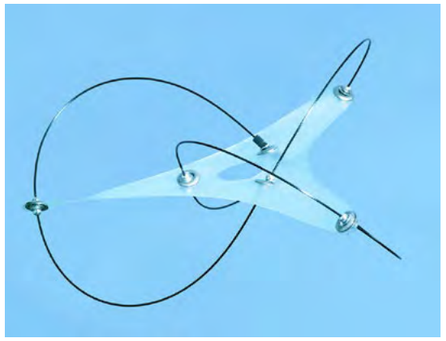
**Profile**

CCLab's research mission is to make significant contributions to the development of a new generation of sustainable high-performance infrastructure systems. Research interests focus on composite or hybrid solutions on the material, component and structural system levels with an emphasis on advanced composite materials and lightweight structures.

**Space competences**

CCLab's research can contribute to the development and design of multifunctional and deployable load-bearing structures based on lightweight advanced composite materials.

- Bending-active structures
- Tensegrity structures
- Deployable structures
- Multifunctional structures
- Fire endurance, fatigue and fracture



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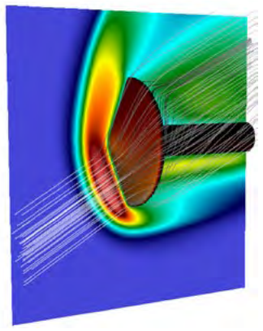
## Computational Mathematics and Simulation Science (MCSS)

**Profile**

The MCSS focuses on the development, analysis and application of high-order accurate computational methods for time-dependent partial differential equations, including research activities in reduced order methods, methods of uncertainty quantification, methods for multiscale problems in time and space, and the use of machine learning techniques in computational science and predictive simulation science.

**Space competences**

- Large scale electromagnetics and plasma physics simulations
- Uncertainty quantification for complex systems
- Reduced order models for complex multi-physics problems
- Trajectory modeling and collision avoidance under uncertainty
- Data driven decision support
- Sensor integration and optimal placement
- Digital twins of complex systems



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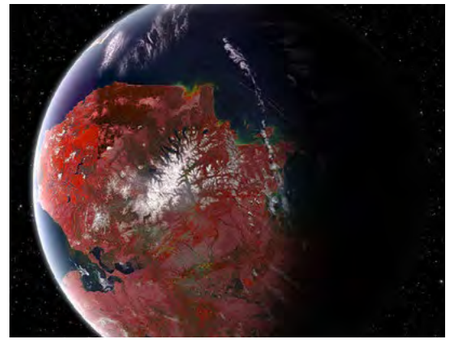
## Earth and Planetary Science Laboratory (EPSL)

**Profile**

The EPSL aims at understanding how planetary bodies formed and evolved through the study of processes happening on surfaces, in mantles and in cores. Scientists in the group use various techniques of physics and chemistry to characterize the composition and behavior of planetary materials with application to planets (the Earth, Mars), moons (the Moon, icy satellites), and smaller objects (asteroids and meteorites).

**Space competences**

- Science Lead in the phase 0 of the SOLVE mission
- Remote sensing of planetary surfaces
- Study of meteorite samples
- Earth observation from space



**Contact**

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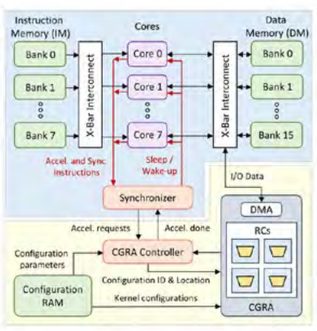
## Embedded Systems Laboratory (ESL)

**Profile**

The Embedded Systems Laboratory (ESL) focuses on the definition of system-level multi-objective design methods, optimization methodologies and tools for high-performance embedded systems and machine-learning based Multi-Processor System-on-Chip (MPSoC) architectures.

**Space competences**

- 3D Stacked Architectures with Interlayer Cooling
- Design of Artificial Intelligence (AI) coarse-grained reconfigurable array (CGRA) accelerators on reconfigurable hardware (FPGA)
- Dynamically Adaptive Power, Thermal and Reliability Aware Architectures for MPSoCs
- Smart Wearable Technologies for Continuous Human Monitoring




**Contact**

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# ACADEMIA

## EPFL Space Center

**Profile**

With the creation of the Space Engineering Center (eSpace) in 2014, EPFL positioned itself as a key player in space technology. As part of its mission, eSpace is actively training a new generation of space engineers, ready to respond to the upcoming rise in small satellite constellations. eSpace is at the forefront of spacecraft development, pushing the capabilities of small satellites beyond anything achieved until now.

**Space competences**

Earth and space observation

- Electronics
- Materials and structures
- Microtechnology and optics
- Modeling and aerothermodynamics
- Plasma and energy science
- Robotics and mechanical systems
- Software

**Contact**

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eSpace
EPFL Space
Center

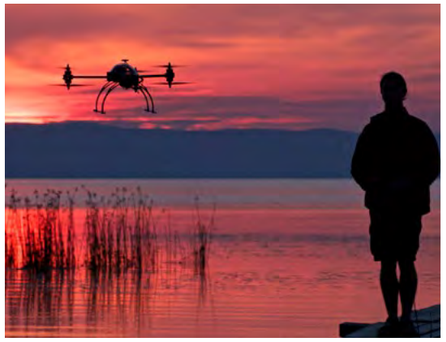
## Geodetic Engineering Laboratory (TOPO)

**Profile**

Position and attitude determination of moving platforms or subjects is the mainstream of the lab research activity. The expertise in algorithm development for real-time or post-mission positioning is applied to precise trajectory determination of land or airborne vehicles and pedestrians. TOPO makes use of satellite based (GPS, Glonass, Galileo) positioning, inertial sensors, magnetic sensors, imagery and networked based positioning.

**Space competences**

- Geodesy, surveying and cartography
- Development of algorithms in the field of geodesy
- Integration and calibration of sensors
- Development in the field of satellite positioning



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EPFL



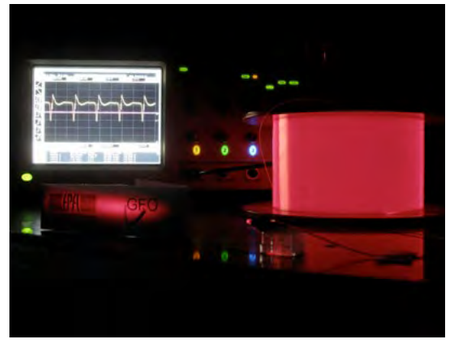
## Group for Fibre Optics (GFO)

**Profile**

The core research of the group is oriented towards advanced applications of optical fibres that range from optical signal processing to sophisticated sensing techniques. The group is also a key player in distributed fibre sensing based on optical nonlinearities. This type of sensors is foreseen to be an essential tool to secure critical installations, such as dams, tunnels and pipelines.

**Space competences**

- Optical fibres for advanced applications
- Optical signal processing
- Optical sensing
- Distributed fibre sensing
- Microwave photonics
- Several ESA funding for PhD, advanced research and industrial applications

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EPFL

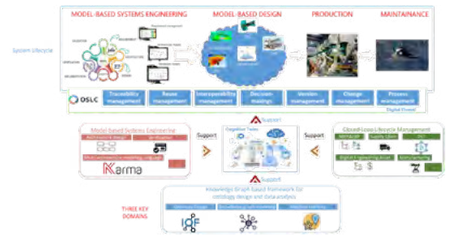
## ICT for Sustainable Manufacturing Group (ICT4SMG)

**Profile**

The ICT4SM Group studies the underlying principles and methods for designing the complex Cyber-physical systems and Internet of things (IoT) systems involving a combination of systems engineering, ontology engineering, design methodology and software engineering. Our focus is on the space and other critical systems including product development, manufacturing and large scale system of systems.

**Space competences**

- Cognitive Twins for space system development and operation.
- Systems engineering approach for architecture development and lifecycle management of space systems.
- Model-based systems engineering for space system architecture design, process management, and verification.
- A knowledge graph modeling framework (IOF) to support decision-makings and data integration of space system development.

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ICT4SM

# ACADEMIA

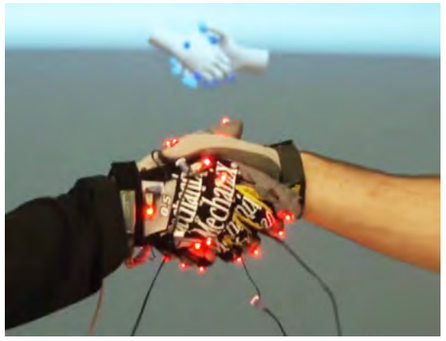
## Immersive Interaction Research Group (IIG)

**Profile**

Our researches focus on embodied interactions, i.e. involving users through full-body movements to achieve new classes of tasks or activities not feasible with traditional human-computer interfaces. It can be employed for training and rehabilitation or for the evaluation of potentially complex environments.

**Space competences**

- Experimental evaluation of human activity (presence,embodiment, motion sickness
- Real-time full-body motion capture and retargeting (including fingers)



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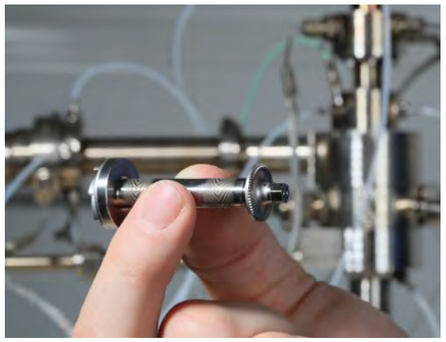
## Laboratory for Applied Mechanical Design (LAMD)

**Profile**

The LAMD focuses on (1) automated design and optimization methodologies using adaptive surrogate modeling techniques, (2) small-scale turbomachinery for small scale gas turbines, compressors for heat pump cycles and fuel cell blowers as well as for expanders for waste heat recovery and (3) gas lubricated bearings for high-speed rotors and low friction. The LAMD seeks strong ties with industry as well as with other academic institutions connecting its research with “real world” problems through collaborative projects.

**Space competences**

- Integrated design and optimization methodologies for automated design
- High-fidelity surrogate modeling techniques
- Design and selection of bearing technologies
- Scaling issues on the aerodynamic turbomachinery design
- High power density gas-bearing supported turbocompressors for high temperature lift heat pumps and fuel cell blowers
- Gas-bearing supported turboexpanders for waste heat recovery



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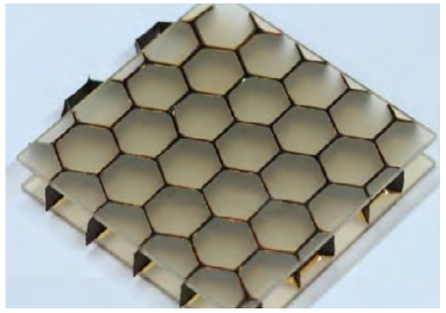
## Laboratory for Processing of Advanced Composites (LPAC)

**Profile**

LPAC aims to establish the scientific base for the next generation of materials and processes in the fast-growing fields of polymers and composites. This involves novel approaches to develop material systems and process cycles, with controlled flow, solidification kinetics and surface characteristics, process simulation and costing, and quantitative durability analysis for optimal life cycle strategies.

**Space competences**

- Advanced composite materials processing, out-of-autoclave processes
- Functional composites: self-healing, integration of sensors, actuators (SMA), tailored damping
- Bonding and adhesion
- Physical (DSC, DMA, CTE, optical microscopy..) and mechanical testing of composites, simulation of thermal/ environmental cycling
- Materials for demisability of space structures



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## Laboratory of Astrophysics (LASTRO)

**Profile**

LASTRO addresses fundamental questions regarding the dark sectors of the Universe as well as the formation and evolution of galaxies. These dark sectors include the study of dark matter and the elusive dark energy responsible for the observed accelerated expansion of the Universe.

**Space competences**

- Mapping the redshift distribution of galaxies and quasars within the last 11 billion years of the Universe
- Mapping the distribution of matter within the last 7 billions years of the Universe with imaging surveys
- Probing the first galaxies, which ended the dark ages

**Contact**

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# ACADEMIA

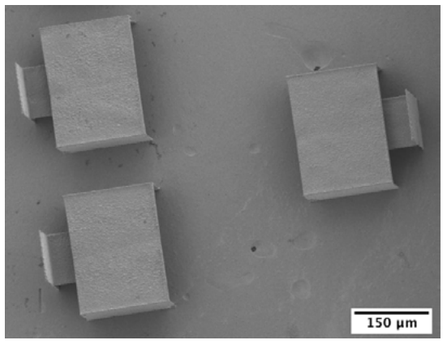
## Laboratory of Mechanical Metallurgy (LMM)

**Profile**

Research at the Laboratory for Mechanical Metallurgy adresses the science and engineering of structural metallic materials, with particular focus on advanced metallic materials. It spans the spectrum from materials processing to the exploration of links between the microstructure and the mechanical or physical properties of metallic materials, generally but not only destined for structural applications.

**Space competences**

- Infiltration processing
- Solidification processing
- Microcasting
- Metal matrix composites
- Microcellular metals
- Mechanical behaviour of metallic materials and micromechanics

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## Laboratory of Photonics and Quantum Measurements (K-LAB)

**Profile**

As a pioneer in cavity optomechanics and microresonators for frequency comb generation, Prof. Kippenberg and the LPQM have remained at the forefront of both fields. The highly sensitive quantum control of macroscopic oscillators via optomechanical coupling is of tremendous interest for displacement sensing, time keeping, or RF filtering. Simultaneously, the integrated silicon nitride photonic platform developed at EPFL enables the generation of frequency combs with a wide spectral coverage, with on-chip microresonators fabricated at the wafer scale.

**Space competences**

- Unprecedented sensitivity in displacement sensing via optomechanical coupling
- Space compatible on-chip generation of precise frequency combs.
- LIDAR
- Record Tbit/sec bandwidth in soliton frequency comb based coherent communication
- Frequency combs with >10 GHz mode spacing for spectrometer calibration in the search for exoplanets

**Contact**

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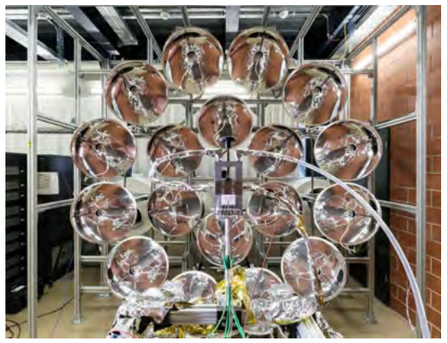
## Laboratory of Renewable Energy Science and Engineering (LRESE)

**Profile**

LRESE aims at developing efficient, economic, sustainable, and robust conversion and storage approaches of renewable energies in fuels, chemical commodities, and power. We specifically focus on the conversion of (concentrated) solar energy into fuels through high temperature solar thermochemical approaches and low temperature photoelectrochemical approaches.

**Space competences**

- Development of kinetic models for ablation materials
- Coupled experimental-numerical techniques for the morphological and transport characterization in ablation and insulation materials
- Material testing in our high-flux solar simulator



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## Physics of Aquatic Systems Laboratory (APHYS)

**Profile**

The aims of the APHYS Laboratory are to understand the physical processes in natural waters and specifically the responses and sensitivities of aquatic systems to external forcing. The main focus is on anthropogenic influences, such as nutrient and particle inputs, hydropower production, use of heat and cold from natural waters, and climate change.

**Space competences**

- Inland water remote sensing using hyperspectral imagers
- Automated sampling of in situ hyperspectral water optical properties in Lake Geneva for the validation of Sentinel 3 data from ESA
- Algorithm development addressing vertical heterogeneities in bio-optical models for NASA's PACE mission

**Contact**

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# ACADEMIA

## Reconfigurable Robotics Lab (RRL)

**Profile**

At the Reconfigurable Robotics Lab we focus on design, actuation, fabrication, and control of unique robotic systems. Our research is committed to inventing and developing interactive robots with novel fabrication techniques and integration processes that push the limits of mechatronic systems. These efforts enable us to create and study soft, reconfigurable, and interactive robots that are highly adaptable to their environment and the task at hand.

**Space competences**

- Multi-functional modular robots for astronaut assistance, maintenance and repair tasks, as well as extraterrestrial exploration
- Origami-based actuation systems and shape-changing mechatronic structures
- Compliant soft robotic technologies for human and environment interactions

**Contact**

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Reconfigurable Robotics Lab

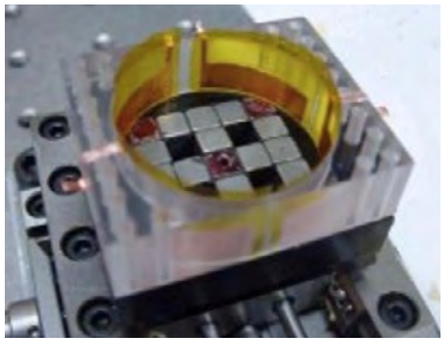
## Robotic Systems Laboratory (LSRO)

**Profile**

Robotic Systems Lab is interested in the design and realization of advanced robotics hardware, mainly in the fields of industrial, ultra-precision and medical robotics. We are specialists in ultra-precision robotics (gravity balance and light trap for Cesium atomic clock built for METAS, the Swiss Office of Standards and Metrology).

**Space competences**

- Ultra-precision devices based on flexure hinges and parallel kinematics used for telescopes (PRIMA DDL)
- Contact-free magnetic levitation, diamagnetic levitation, very fast rotors (3 mil rpm)
- Electrostatic drives



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EPFL



## Swiss Plasma Center (SPC)

**Profile**

The SPC contributes to advancing basic plasma physics of interest for fusion and for space and astrophysical plasmas, as well as for developing industrial plasma applications covering a wide range, from solar cells to packaging industry to aircraft and satellite technology.

**Space competences**

- Development and basic studies of novel concepts for helicon thrusters for space propulsion
- Experimental and simulation/ numerical studies of satellite slip-ring vacuum breakdown
- Low pressure plasma spraying for high power plasma for thermal testing, surface treatment, and fast coating of surfaces

**Contact**

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EPFL

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | | |
| Life and Physical Sciences | ✓ | ✓ | ✓ |
| Satellite-based Applications | ✓ | ✓ | |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | ✓ | | |
| Ground Segment | | | |
| Materials and Processes | ✓ | | |
| Structures | ✓ | ✓ | |
| Electronic Components | ✓ | ✓ | ✓ |
| Software | ✓ | ✓ | ✓ |
| Basic Research for Space Technology | ✓ | | |
| Small Satellite Activities | ✓ | ✓ | |

# ETH Zürich

**Profile**

Freedom and individual responsibility, entrepreneurial spirit and open-mindedness: ETH Zurich stands on a bedrock of true Swiss values. Our university for science and technology dates back to the year 1855, when the founders of modern-day Switzerland created it as a centre of innovation and knowledge. At ETH Zurich, students discover an ideal environment for independent thinking, researchers a climate which inspires top performance. Situated in the heart of Europe, yet forging connections all over the world, ETH Zurich is pioneering effective solutions to the global challenges of today and tomorrow.

**ETH Zürich at a Glance**

- Created in 1855
- 22'200 students including 4,170 doctoral students, from 126 countries
- 500 professors
- Annual revenue: 1,897 CHF million
- 438 spin-offs since 1973
- 6th International University Ranking (QS 2020)


**ETH Zürich**
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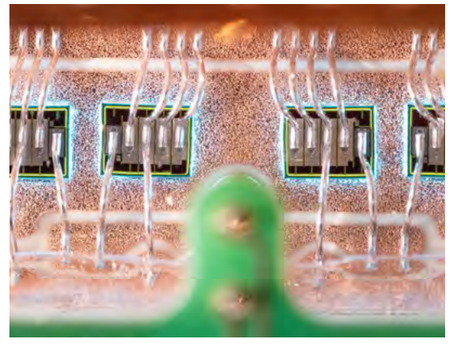
## Advanced Power Semiconductor Laboratory (APS)

**Profile**

The Advanced Power Semiconductor Laboratory (APS) is a competence center for both electrical characterization as well as for the reliability and ruggedness testing of bare and packaged power semiconductor devices. A fully equipped electrical characterization lab in a radiation-controlled zone allows for the analysis of active material (e.g. directly after radiation hardness testing).

**Space competences**

The research focus of the APLS lab lies on power semiconductor devices and their packaging. Areas of interest include device fabrication, characterization and testing as well as device modeling. Special emphasis is placed on improving current understanding of device reliability and ruggedness of modern power devices including wide-bandgap materials.



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Advanced Power Semiconductor Laboratory

## Institute of Agricultural Science (IAS)

**Profile**

The Institute of Agricultural Sciences (IAS) is the platform for research and teaching in agricultural sciences at ETH Zurich. Today and in the future agricultural research requires a multifaceted approach, integrating agricultural and natural science-based methods and concepts. Agricultural production systems are closely interrelated with other systems and are highly complex.

**Space competences**

- Agricultural Ecology
- Biocommunication and Entomology
- Crop Science
- Glassland Sciences
- Molecular Plant Breeding
- Plant Nutrition
- Sustainable Agroecosystems

**Contact**

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D USYS

# ACADEMIA

## Institute for Atmospheric and Climate Science (IAC)

**Profile**

The Institute of Atmosphere and Climate Science (IAC) focuses on atmospheric and climate processes. Research is directed at understanding how human activities alter these processes via changes in greenhouse gases, aerosols, chemical constituents, and land surfaces and how this impacts upon climate, ozone, UV radiation, pollutant exposure, ecosystems, water resources and extreme events.

**Space competences**

- Atmospheric chemistry
- Atmospheric dynamics
- Atmospheric physics
- Climate and water cycle
- Climate physics
- Land-climate dynamics

**Contact**

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D USYS

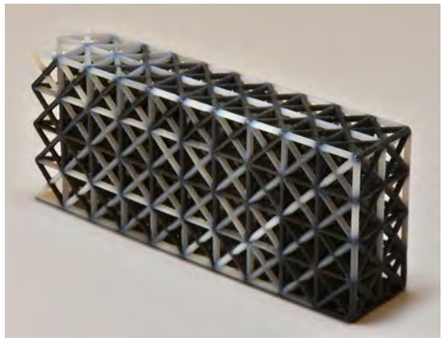
## Institute of Design, Materials and Fabrication (IDMF)

**Profile**

The Institute of Design, Material and Fabrication (IDMF) focuses on Engineering Design as a fundamental discipline within Mechanical Engineering including novel material systems, design methodology, methods and tools, development of innovative technical solutions and novel fabrication processes. IDMF will develop new synergies in research and industrial collaboration as well as in the Engineering Design education at MAVT.

**Space competences**

- Composite materials
- Adaptive, reconfigurable and active structures
- Product development
- Additive manufacturing
- Design for additive manufacture
- 4D printing
- Computational design methods including design automation, generative design, multi-disciplinary optimization, topology optimization



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D MAVT



## Institute for Dynamic System and Control (IDSC)

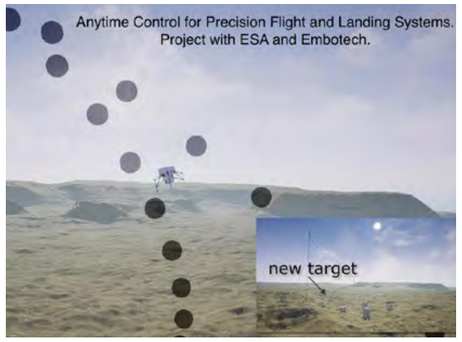
**Profile**

Research at the Institute for Dynamic Systems and Control addresses the efficient monitoring, control and design of complex systems. The considered applications cover a wide range of problems, from autonomous aerial and ground vehicles, to combustion engines and even biomedical systems.

**Space competences**

IDSC offers various competences around automatic control systems relevant for space applications, including:

- System modeling
- Optimal planning and control
- Multi-agent systems
- Learning-based control
- Efficient computation methods




**Contact**

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IDSC

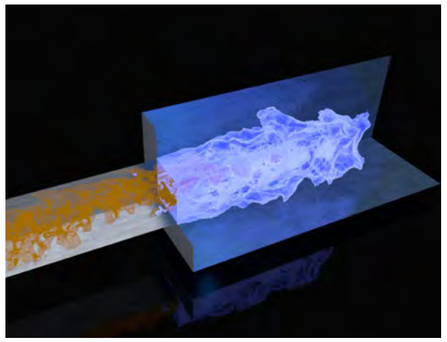
## Institute of Energy Technology (IET)

**Profile**

The Institute of Energy Technology (IET) is active in research and education in the field of energy science and engineering, aimed at the realization of sustainable energy systems that are environmentally friendly, economically viable, socially compatible, reliable and ecure.

**Space competences**

- Aerothermochemistry and Combustion Systems
- Combustion and Acoustics for Power Systems
- Reliability and Risk Engineering
- Energy Conversion



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D MAVT

# ACADEMIA

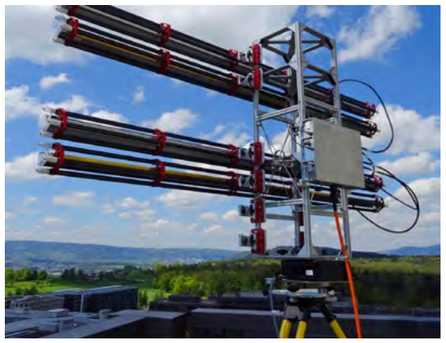
## Institute of Environmental Engineering (IfU)

**Profile**

The Earth Observation Research Group of Institute of Environmental Engineering focuses on remote sensing using innovative techniques and tools for the derivation of quantitative environmental parameters for future satellite missions such as Polarimetric Synthetic Aperture Radar (Pol-SAR), Multi-Parametric SAR Interferometry (Pol-InSAR, TomoSAR), science coordination of ongoing and future SAR missions, and coordination and execution of ground-based and airborne campaign.

**Space competences**

- Radar Remote Sensing (Synthetic Aperture Radar)
- Environmental Product Development (Hydrosphere, Geosphere, Cryosphere, Biosphere, Urban)
- Electromagnetic Modeling and Inversion
- Image Processing
- Operation of Ground Base Radars (KAPRI)



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D BAUG

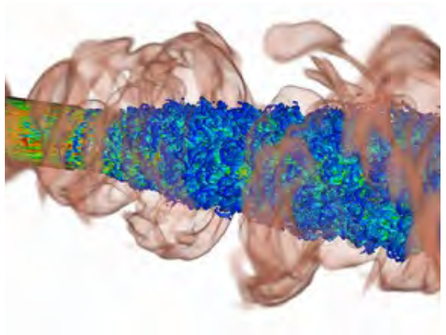
## Institute of Fluid Dynamics (IFD)

**Profile**

The IFD conducts research in the area of computational and experimental fluid mechanics. Current research includes simulation of turbulent single-phase and multi-phase flows, implementation of modern imaging techniques, simulations of turbulent and unsteady separated flows and the application of probability-densityfunction (PDF) methods to turbulent flows.

**Space competences**

- Modeling of turbulence and turbulent reactive flows
- Flow in porous Media
- Rarefied gas kinetics
- Flow imaging techniques



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D MAVT



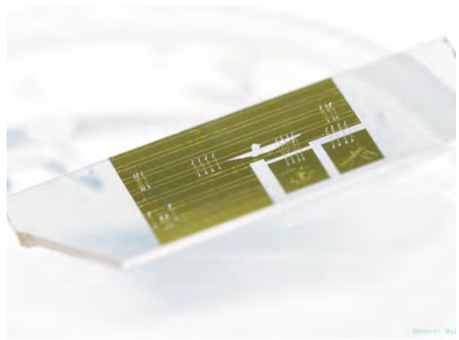
## Institute for Quantum Electronics (IQE)

**Profile**

The Institute for Quantum Electronics (IQE) was founded in 1988 on the initiative of Prof. Hans Melchior and Prof. Fritz Kneubühl and has since then been situated on the ETH Hönggerberg campus. Currently, the institute consists of seven research groups, working on quantum optics, quantum optoelectronics, trapped-ion quantum information, ultrafast dynamics, quantum photonics, ultrafast-laser physics, and optical nanomaterials.

**Space competences**

The Institute for Quantum Electronics (IQE) cover a broad range of topics, including quantum optics, quantum-structure engineering, laser physics, ultrafast phenomena and high-field physics. We provide teaching of the physics curriculum for ETH students at all levels, including specialized lectures in quantum optics and quantum electronics. Another strength is the connection between fundamental science and technological applications. A number of successful companies have spun-off from IQE.



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D PHYS

## Institute of Geochemisty and Petrology (GeoPetro)

**Profile**

Research at the Institute of Geochemistry and Petrology combines theoretical, experimental and analytical work on many sample types. Its goal is to better understand the fundamental principles behind the origin of the solar system and the Earth, the formation of continents, mountains and oceans as well as the occurrence of volcanism and ore deposits. Space competence is particularly central in the Planetary Geochemistry group. Its research focuses on processes, which occurred before, during and after the formation of the planets including the Earth.

**Space competences**

- Analyses of extraterrestrial samples returned by space missions or found on Earth (meteorites, interplanetary dust, lunar or asteroidal materials, solar wind)
- Cosmochemistry: Detection of elements and their isotopes at high-precision
- Mass spectrometry
- Planetary volcanology
- Planetary differentiation and core formation

**Contact**

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D ERDW EARTH SCIENCES

# ACADEMIA

## Institute of Geodesy and Photogrammetry (IGP)

**Profile**

The Institute of Geodesy and Photogrammetry core competences are the science of geomatics, especially Geodetic Metrology and Engineering Geodesy, Satellite Geodesy Physical Geodesy and Geodynamics, Photogrammetry, Image Analysis and Remote Sensing.

**Space competences**

- Geodetic metrology
- Satellite geodesy
- Physical geodesy
- Geodynamics
- Photogrammetry
- Image analysis
- Earth observation and remote sensing
- Development of cubesat (CubETH)

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Tel:+41 (0) 44 633 30 55 • sek@geod.baug.ethz.ch • www.igp.ethz.ch

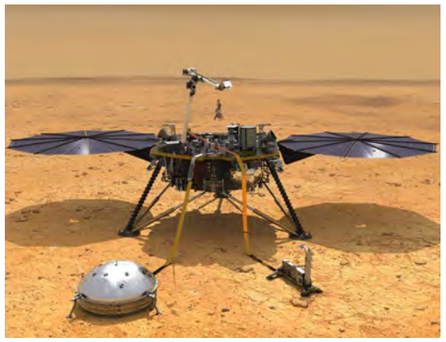
## Institute of Geophysics

**Profile**

The Institute of Geophysics performs leading research and teaching activities over a wide range of geophysical disciplines. Activities range from theoretical modelling towards experimental and observational geophysics, from studying small-scale processes in the shallow subsurface towards large-scale processes forming the Earth and other planets.

**Space competences**

- nvolved in the Mars mission “Insight” in the area of seismology and characterization of the shallow Martian subsurface, and the instrument’s electronics (http://www.insight.ethz.ch).
- Responsible for the sensing and control electronics of the gravitational reference sensor for the Laser Interferometer Space Antenna “LISA” mission.
- Developing methodologies for highly cost-effective acquisition of geophysical data during space missions



**Contact**

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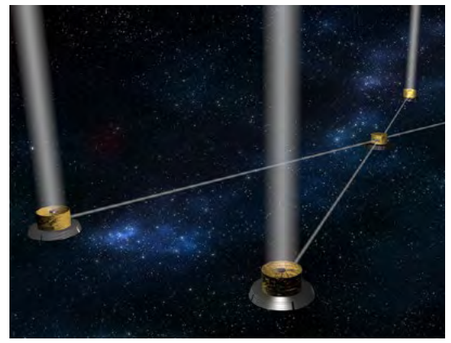
## Institute for Particle Physics and Astrophysics (IPA)

**Profile**

The Institute for Particle Physics and Astrophysics has around 200 staff and students and is organized into 11 research groups. Our work ranges from high-energy interactions between fundamental particles, neutrino physics, astroparticle physics, precision particle physics experiments at low energies, ion beam physics, cosmology and structure formation, galaxy and black hole astrophysics and star and planet formation. We are also developing instruments and components for space experiments utilizing our laboratory facilities.

**Space competences**

- Infrared Instrumentation for James Webb Space Telescope, Very Large Telescope and Extremely Large Telescope
- Cryogenic Space Engineering
- Space Instrumentation for solar physics (e.g. Solar Orbiter, Proba-3, etc.)
- Observational Astrophysics and Cosmology



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Tel:+41 (0) 44 633 27 70 • milena.ramirez@phys.ethz.ch • www.ipa.phys.ethz.ch

## Institute of Robotics and Intelligent Systems (IRIS)

**Profile**

The Institute of Robotics and Intelligent Systems (IRIS) of ETH Zurich, is doing cutting edge robotics research in a large diversity of fields. It currently consists of eight laboratories that conduct research in areas ranging from nano-robots for biomedicine, to systems for rehabilitation and autonomous aerial vehicles and legged robots.

**Space competences**

IRIS offers a large variety in robotics competences of interest for space applications including:

- Solar Airplanes for multi-day operations
- Visual Navigation Systems
- Health monitoring and training
- Compliant Robot Arms
- Walking and wheeled robots for space applications


**Contact**

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# ACADEMIA

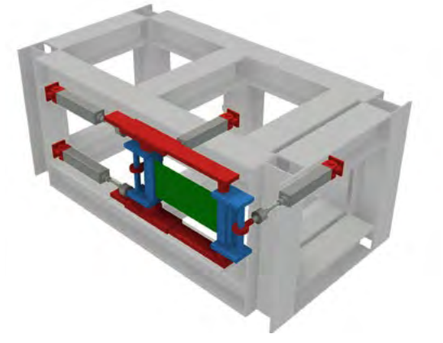
## Institute of Structural Engineering (IBK)

**Profile**

Institute of Structural Engineering (IBK) competences span from classical fields of structural engineering, including design of concrete, steel, timber, masonry and composite structures, structural mechanics, analysis and modeling, and seismic and fire risk assessment and uncertainty quantification. IBK also addresses challenges in monitoring, upkeep, resilience and renewal of urban infrastructures, sustainable design in changing environment, and work to incorporate digitalization and artificial intelligence into structural design processes.

**Space competences**

- Coupled thermal and mechanical structural testing of spacecraft components
- Coupled thermal and mechanical structural modeling and response analysis of spacecraft systems and components
- Hybrid physical-numerical simulation of coupled multi-physics response of spacecraft systems
- Response uncertainty quantification and stochastic hybrid simulation



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ibk
Institut für Baustatik und Konstruktion, ETH Zürich

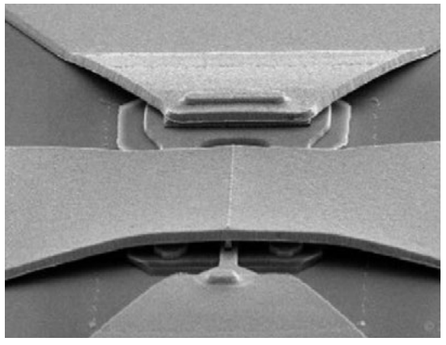
## Millimeter-Wave Electronics Laboratory (MWE)

**Profile**

The Millimeter-Wave Electronics group members focus on III-V compound semiconductor devices and processes from modern sub-terahertz applications to all-electronic terahertz sources.

**Space competences**

- High Electron Mobility Transistors
- Heterojunction Bipolar Transistors



**Contact**

ETH Zurich D-ITET • MWE - Millimeter-Wave Electronics Group • Gloriastrasse 35 • ETH/ETZ K 82 • CH - 8092 Zürich • Tel:+41 (0) 44 632 28 10 • bettina.gronau@mwe.ee.ethz.ch

D ITET



| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | ✓ | |
| Life and Physical Sciences | | ✓ | |
| Satellite-based Applications | ✓ | ✓ | |
| Instruments and Payloads | ✓ | ✓ | ✓ |
| Spacecraft and on-board Equipment | | ✓ | |
| Ground Segment | ✓ | ✓ | |
| Materials and Processes | ✓ | ✓ | |
| Structures | ✓ | ✓ | ✓ |
| Electronic Components | ✓ | ✓ | |
| Software | ✓ | ✓ | |
| Basic Research for Space Technology | ✓ | ✓ | |
| Small Satellite Activities | ✓ | ✓ | |

# FHNW

**Profile**

The FHNW University of Applied Sciences and Arts Northwestern Switzerland dedicates a fair amount of resources to space projects. Representing the cantons of Aargau, Basel, Basel-Landschaft, and Solothurn, near the borders of Germany and France, and midway between the cities of Basel and Zurich, it exploits its strategic position for the success of its endeavors in this domain. Its research program involves national and international partners from industry and academy, therefore creating a link between these two poles. In particular, the School of Engineering leads several national and international initiatives that include hardware construction, software development, and project management.

**FHNW at a Glance**

- 9 schools
- More than 11'000 students
- 29 bachelor and 18 master programmes
- 58 institutes

n|w University of Applied Sciences and Arts Northwestern Switzerland

**FHNW**

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www.fhnw.ch/technik

# ACADEMIA

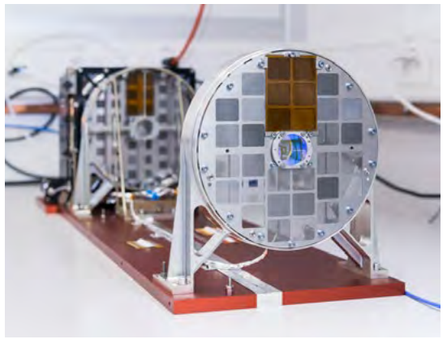
## Institute of of Data Science (I4DS)

**Profile**

The Institute of Data Science consists of a team of about 60 specialists, including computer scientists, physicists, mathematicians, designers, and communicators. It addresses challenges in a wide variety of projects, exploiting possible synergies across application fields. Space is one of its most prominent domain of activity, for which it develops software as well as hardware for scientific instruments

**Space competences**

- STIX: X-ray telescope on Solar Orbiter
- X-ray detectors and Grids
- Instrument design
- Testing and calibration
- Ground software
- Date analysis software
- Data mining and analytics
- Project Management



**Contact**

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University of Applied Sciences and Arts Northwestern Switzerland

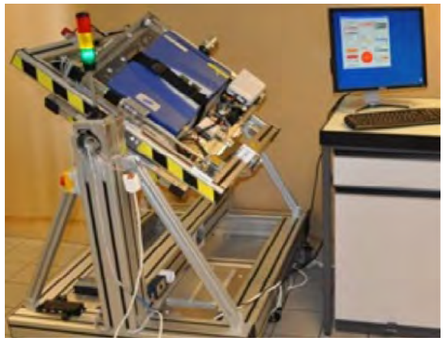
## Institute of Automation Engineering (IA)

**Profile**

The IA focuses its application-oriented research and development in the promising systems engineering domain, ranging from the development of smart systems to the integration of sensors and actors to improve functionalities of automated devices & processes. Our main competences include the advancement of automated handling systems, systems analysis & modelling, advanced control systems & signal processing methods, measurement & diagnostic devices, microsystems technology.

**Space competences**

- Systems integration of measurement & control devices (e.g. with smart sensors & actors)
- Mechatronics test equipment (e.g. for microgravity simulation on earth)
- Miniaturization of high-rel instruments & sensors (e.g. for cometary ultralow pressure measurement, for outgassing detection on spacecraft and satellite test facilities)
- Ultrafast FPGA algorithms (e.g. for FFT & filter bank algorithms for radio astronomy, atmosphere physics, general purpose spectral analysis)



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University of Applied Sciences and Arts Northwestern Switzerland



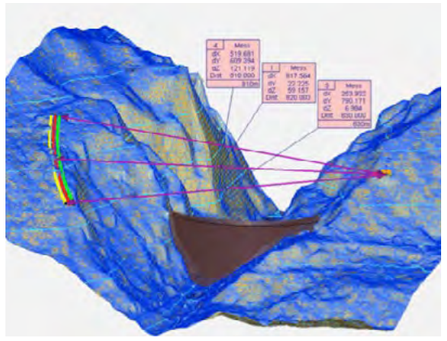
## Institute of Geomatics (IGEO)

**Profile**

Key topics of application-oriented research and development at IGEO are methods and technologies for earth observation, monitoring and satellite-based navigation and measuring, for example using GNSS (Global Navigation Satellite System). Our competences range from the integration of sensors, the development of software and implementation of applications to name but a few.

**Space competences**

- Semi-automatic photogrammetric and spectral processing of multispectral satellite imagery for various applications (e.g. agriculture, archaeology, 3D-modelling)
- Object-based image analysis and change detection by combining spectral and geometric features extracted from satellite imagery
- Development of methods based on GNSS- and IMU-techniques for navigation of unmanned vehicle systems



**Contact**

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University of Applied Sciences and Arts Northwestern Switzerland

## Institute of Polymer Engineering (IKT)

**Profile**

The IKT is working in the field of polymer science, development of fibre reinforced materials, design of fibre reinforced structures and related manufacturing methods. The institute covers competences all along the value chain for composite materials starting from material development, material characterization, structural design, manufacturing engineering and prototype manufacturing and testing on lab scale.

**Space competences**

- Systems based on polymers
- Composite structures
- Joining technology for composites
- Landing technologies
- Manufacturing processes

**Contact**

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University of Applied Sciences and Arts Northwestern Switzerland

# ACADEMIA

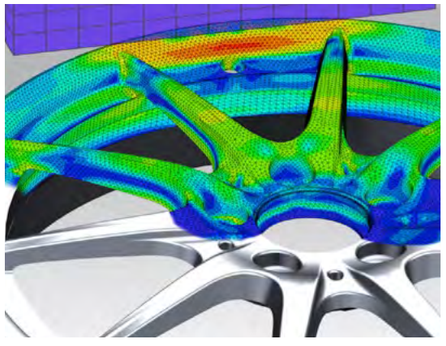
## Institute of Product and Production Engineering (IPPE)

**Profile**

The IPPE is focussed on application-oriented research and development of products and production processes involving cutting-edge technology. The competences include simulation and testing of mechanical systems, additive manufacturing and 3D laser micro-machining. Latest CAE/ CAM systems and modern laboratory infrastructure enable the experimental and numerical expertise required to support our industrial partners.

**Space competences**

- Lightweight structure design and development
- Material and process development for automation
- Additive manufacturing
- Mechanical testing (static, sine and random vibration, shock, fatigue)



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n|w University of Applied Sciences and Arts Northwestern Switzerland

## Institute for Sensors and Electronic (ISE)

**Profile**

The ISE is the competence center for sensors with special focus on aerosol technology as well as for microelectronics, signal processing and communication. We support our partners with the execution of research, development and consulting including serial production according to industrial standards. Our interdisciplinary team consists of approximately 35 specialists in electrical engineering and physics, often with extensive industrial experience.

**Space competences**

- Space Competences
- Classical and Quantum Cryptography
- Ground Segment for Nanosatellites
- Communication Technologies
- High Altitude Balloons
- Microelectronics for Functionally Safe Communication
- Aerosols Technology and Sensors

**Contact**

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n|w University of Applied Sciences and Arts Northwestern Switzerland



| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | ✓ | |
| Instruments and Payloads | ✓ | ✓ | |
| Spacecraft and on-board Equipment | ✓ | ✓ | |
| Ground Segment | | | |
| Materials and Processes | ✓ | ✓ | ✓ |
| Structures | ✓ | ✓ | |
| Electronic Components | ✓ | ✓ | |
| Software | ✓ | ✓ | |
| Basic Research for Space Technology | ✓ | ✓ | |
| Small Satellite Activities | ✓ | ✓ | |

# HES-SO

**Profile**

The HES-SO Engineering and Architecture Faculty has three missions: to provide practical training at university level, to foster applied research and to deliver technical services to private sector partners. The Faculty offers interdisciplinary competences within its 6 schools (over 5,000 students). Its activities are devoted to the realisation of high quality and reliable products and anchored into the regional industrial systems. The HES-SO schools collaborate closely with SMEs, industries and research institutes.

**HES-SO at a Glance**

- 21'000 students
- 28 schools of higher education across Western Switzerland
- 46 Bachelors and 26 Masters

The HES-SO Engineering and Architecture Faculty includes :

- 4'656 students
- Schools of higher education amongst which Haute Ecole Arc Ingénierie, School of Engineering and Architecture Fribourg (HEIA-FR), Geneva School of Engineering, Architecture and Landscape - HEPIA, School of Engineering – HES-SO Valais-Wallis – HEI and School of Engineering and Management - HEIG-VD, CHANGINS – School of Viticulture and Enology
- 22 Bachelors and 6 Masters



Hes·so
Haute Ecole Spécialisée de Suisse occidentale
Fachhochschule Westschweiz
University of Applied Sciences and Arts Western Switzerland

**HES-SO**

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www.hes-so.ch

# ACADEMIA

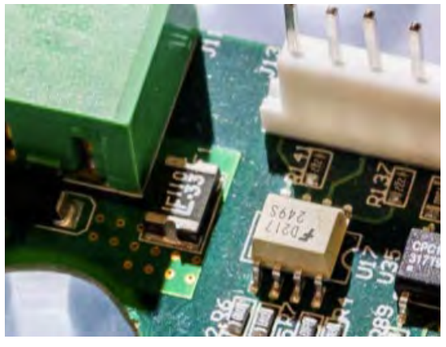
## Embedded-Computing Systems, HE-Arc, Neuchâtel

**Profile**

Defined as an autonomous system, often in real time, specialising in a specific task and with limited resources, an embedded IT system is built on three main pillars: Hardware, Software and programming, Signal processing and communication. We employ our expertise to optimise the efficiency of industrial processes, develop smart medical systems and address various challenges facing society, such as global water management.

**Space competences**

- Hardware development
- Embedded Software
- Low Power Embedded Systems
- Communication Systems
- Signal Processing



**Contact**

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## Inst. des Sciences et Technologies Industrielles (inSTI) - HEPIA, Geneva

**Profile**

inSTI is the research Institute of the Industrial Technology Department of the HES-SO / Geneva. Aiming at being a partner of choice in research and development for the local and regional industrial fabric, inSTI develops its R&D activities through technology transfers toward the economy (Innosuisse projects, EU projects, mandates...) on one hand, and through scientific publications and conferences on the other hand.

**Space competences**

- REXUS rocket based microgravity experiment
- Bioengineering
- Eco-Engineering
- Fluid mechanics applied to the fields of energy and microgravity
- Materials, nanotechnology and micro technology designs
- Tribology
- Robotics

**Contact**

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## Institute of Systems Engineering, HEI, Sion

**Profile**

The focus of the institute is to specify the mechanical dimensions of the building blocks and their connections for CubeSats with their limits in space and power supply. These systems comprise the mechanical housing of the satellite, an On-Board Computer (OBC), the Attitude and Orbital Control System (AOCS), the communication system to the ground and the instruments dedicated to the satellite's mission.

**Space competences**

- Development of electronic (digital or analog) and mechanic devices used in spacecrafts
- Fulfilment of the requirements in relation
- to flight electronics: quality, reliability, high performance, good integration, energy efficiency
- Acquisition and processing of low intensity analogical signals•Integration of processors and complex digital functions (IP core)
- Design of actuators using shape-memory alloys

**Contact**

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www.hevs.ch • Prof. E. Carreño-Morelli • Powder Technology & Advanced Materials •
Tel:+41 (0) 27 606 88 37 • efrain.cmorelli@hevs.ch • www.hevs.ch

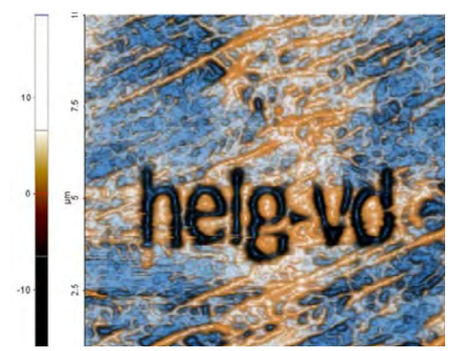
## Laboratory of Applied NanoSciences (COMATEC-LANS)

**Profile**

The Laboratory of Applied NanoSciences is specialized in advanced materials engineering and surface micro- and submicrostructure characterization. Its interdisciplinary team of engineers and scientist develops and designs advanced materials and processes for coating, printing, and surface treatment for decorative and functional applications.

**Space competences**

- Advanced atomic force microscopy, optical profilometry: nano- & microstructure analysis of metals, oxides and polymer surfaces or thin films
- Atmospheric pressure plasma surface treatment
- Pilot tests & feasibility studies for industrial surface treatment, processing, coating, and inkjet printing
- Polymer nanocomposites, nano- and microfiber membranes and filters
- Electrical, optical and wetting properties of materials and surfaces




**Contact**

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# ACADEMIA

## Reconfigurable & Embedded Digital Systems (REDS), HEIG-VD, Yverdon-les-Bains

**Profile**

The Reconfigurable and Embedded Digital Systems institute (REDS) is a team of passionate researchers composed of eight professors and twenty engineers, very active in the design of embedded systems, from the idea to the prototype, from the PCB design to the software application through FPGA and firmware. We are capable of crafting an entire system from hardware to software for low-consumption and high-performance applications, with the aim of reducing their energy footprint, whether for IoT or data analysis.

**Space competences**

- FPGA accelerator design and integration
- Failsafe software development (bootloader and application)
- Heterogeneous device support (GPU, FPGA, CPU)
- Design of embedded systems
- Software defined radio (SDR)
- Formal verification hardware and software
- Antenna custom design
- Video and image signal processing

**Contact**

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heig-vd
HAUTE ÉCOLE D'INGÉNIERIE ET DE GESTION DU CANTON DE VAUD
www.heig-vd.ch

## ROSAS Center, HEIA-FR, Fribourg

**Profile**

The Robust and Safe Systems Fribourg (ROSAS) Association, established in June 2015 as a non-profit organization, has the objective to operate the "ROSAS Center Fribourg", a unique in its kind Competence Center for robust, safe, reliable and secure systems. ROSAS is an industry-driven association with members.

**Space competences**

- Definition of high-level reliability and safety requirements for a future Space Traffic Management System (STM) including space debris, space weather, clean space, hazard and risk assessment and mitigation measures
- Development of a Space Navigation Service Provider (SNSP) Certification Process based on ANSP regulations including the suitability of ground / aircraft CNS equipment for suborbital spaceflights


**Contact**

Haute Ecole d'ingénierie et d'Architecture Fribourg • ROSAS Center Fribourg • Passage du Cardinal 13B • CH - 1700 Fribourg • Tel:+41 (0) 26 429 67 90 • info@rosas.center • www.rosas.center

ROSAS
Center Fribourg



## Surface Engineering, HE-Arc, Neuchâtel

**Profile**

Our surface engineering expertise enables us to develop custom solutions and applications. Reflecting the expectations and needs of industrial players, we use our skills to improve and optimise surfaces by working on their design, the choice of materials and their properties.

**Space competences**

- Surface characterization services
- Surface treatment for decorative and functional purposes

**Contact**

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haute école
neuchâtel berne jura
arc

## Swiss Welding Institute (SWI)

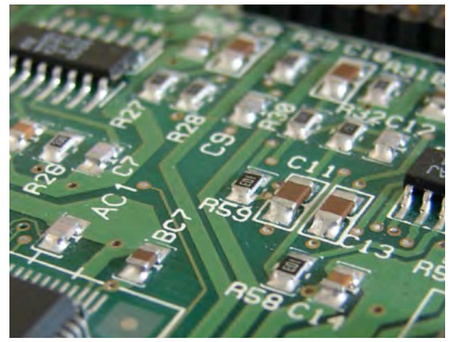
**Profile**

The center of Sainte-Croix specializes in electronic soldering. Its team will assist you for your certifications, for your trainings in high-reliability or industrial electronic soldering, for the choice of soldering parameters, of soldering process and the implementation of validation tests.

**Space competences**

Spatial certifications:

- Operator ECSS-Q-ST-70-08 Cat. 3 (Hand soldering THT)
- Operator/Inspector ECSS-Q-ST-70-26 Cat. 2/3 (Crimping)
- Operator ECSS-Q-ST-70-28 Cat. 3 (Repair and modification)
- Operator/Inspector ECSS-Q-ST-70-30 Cat. 2/3 (Wrapping)
- Operator ECSS-Q-ST-70-38 Cat. 3 (Hand soldering SMT)
- Inspector ECSS-Q-ST-70-08/38 Cat. 2



**Contact**

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swi
SWISS WELDING INSTITUTE

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | ✓ | |
| Life and Physical Sciences | ✓ | ✓ | |
| Satellite-based Applications | | ✓ | |
| Instruments and Payloads | ✓ | ✓ | |
| Spacecraft and on-board Equipment | ✓ | ✓ | |
| Ground Segment | ✓ | ✓ | |
| Materials and Processes | ✓ | ✓ | ✓ |
| Structures | ✓ | ✓ | |
| Electronic Components | ✓ | | |
| Software | ✓ | ✓ | |
| Basic Research for Space Technology | ✓ | ✓ | |
| Small Satellite Activities | ✓ | ✓ | |

# HSLU

**Profile**

Since 1958, the Lucerne School of Engineering and Architecture has contributed and strengthened Switzerland as a business location by providing bachelor's and master's degree programs, continuing education programs and applied research. With around 2,000 students pursuing bachelor's and master's degrees and almost 1,000 attending continuing education programs, the School is one of the most in-demand institutions in Switzerland. The some 400 researchers organised in 12 competence centers carry out interdisciplinary research on two focal points: "Building as a System" and "Energy for the Future".

**HSLU at a Glance**

- Bachelor's degree programs in Architecture, Interior Architecture, Civil Engineering, Building Technology, Electrical Engineering, Mechanical Engineering, Business Engineering Innovation, Medical Engineering and Energy Systems Engineering.
- The Center of Continuing Education offers practical and interdisciplinary education and training, from seminars and certificate courses to continuing education programs.

Lucerne University of
Applied Sciences and Arts
HOCHSCHULE
LUZERN
Engineering and Architecture
FH Zentralschweiz

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## Biotechnology Space Support Center (BIOTESC)

**Profile**

BIOTESC is the Swiss User Support Center of the European Space Agency ESA. It supports scientists in conducting biological, educational and technology experiments in microgravity conditions of the International Space Station (ISS). Before flight, all experiments are tested for their scientific and their operational compatibility. BIOTESC plans and executes these tests in the laboratory of the Space Biology Group. During the space mission, BIOTESC assists the crew conducting the experiment from the control room in Hergiswil.

**Space competences**

- Life science experiments
  - Molecular Muscle
  - Biorock
  - Rotifer B
- Technology demonstrations and applications
  - CIMON
  - AstroPi
  - MARCONISSTA
- Educational Payloads
- Management of Biological laboratory in Baikonur Cosmodrome

**Contact**

BIOTESC Biotechnology Space Support Center • Lucerne University of Applied Sciences and Arts •
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Biotesc
Biotechnology Space Support Center

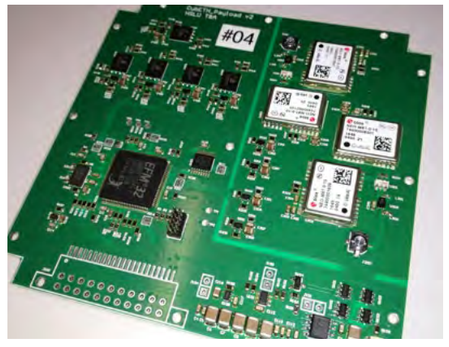
## CC Electronics

**Profile**

The Competence Center Electronics (CCE) team has demonstrated core competences in key technology areas such as communication system design, digital and embedded system design, multiphysics simulation and analog electronic circuit design. CCE supports university level space activities as well as space companies mainly in the field of communication systems and ground segment infrastructure for precursor missions.

**Space competences**

- Design and development of rf/microwave communication modules
- Design and development of payload electronics (hardware and firmware)
- Design and development of ground segment infrastructure
- Modeling/analysis of multiphysics systems (acoustics, mechanics, em-waves (rf, optics) and ac/dc thermo-electric systems)

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Lucerne University of
Applied Sciences and Arts
HOCHSCHULE
LUZERN
Engineering and Architecture
FH Zentralschweiz

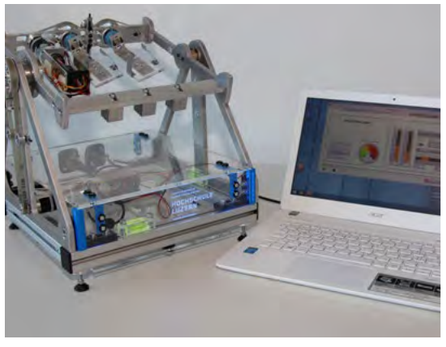
## CC Mechanical Systems

**Profile**

The Competence Center (CCMS) provides all competences for a holistic and effcient design of mechanical systems, including their design and development up to their manufacturing, assembly and testing. It is specialized on applied research and sophisticated engineering services, including the fields of design, simulation, material and functional testing and prototype generation. The CCMS supports university level space activities and space segment companies.

**Space competences**

- Design and structural/thermal analysis
- Multi-body analysis
- Materials mechanical testing
- Micro-mechanical testing
- Space mechanisms systems
- Systems engineering
- Zero-g experiment
- Random Positioning Machine
- Mechanism and scientific instruments



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Lucerne University of Applied Sciences and Arts
HOCHSCHULE LUZERN
Engineering and Architecture
FH Zentralschweiz

## Institute of Medical Engineering, Space Biology Group

**Profile**

The group is conducting biomedical and biotechnological research in the context of space medicine, answering the fundamental question how physical forces, such as gravity, are translated into biological responses. The related experiments are carried out often on microgravity research platforms like airplanes performing parabolic fights, sounding rockets or the Space Station. The group maintains in addition a National Center for Biomedical Research in Space in collaboration with the University of Zurich.

**Space competences**

- Construction of microgravity simulators
- Construction of space-proven bioreactors
- Construction of space-proven electro-physiological instruments
- Enabling real-time microscopy under simulated and real microgravity
- Facilitating alternative microgravity research platforms

**Contact**

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| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | ✓ | | |
| Satellite-based Applications | | | |
| Instruments and Payloads | | | |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | | | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | | | |
| Software | | | |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

# UNIL

**Profile**

The University of Lausanne (UNIL) is a higher teaching and research institution composed of seven faculties. Its research activities focus on three main themes: human and social sciences, life sciences and medicine, and environmental sciences. UNIL lays great store by the quality and innovation of its research and teaching. UNIL also promotes a highly interdisciplinary approach.

**UNIL at a Glance**

- 15'600 Students
- 3'900 Research, teaching and technical staff
- 175 Research units
- Annual Budget: 630MCHF


UNIL | Université de Lausanne

**University of Lausanne (UNIL)**

Vice Rector for Research and Innovation
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# ACADEMIA

## Industrial Ecology Group

**Profile**

For the last 200 years, the process of industrialization has brought unprecedented benefits to humankind, but has also generated serious environmental concerns. The field of industrial ecology constitutes an attempt to address these challenges by exploring the analogy between natural ecosystems and industrial systems at various scales (households, companies, complete value chains, countries). Industrial ecology translates into various operational strategies, like industrial symbioses, eco-industrial parks, circular economy, etc.

**Space competences**

- Terrestrial and space research synergies on artificial closed ecosystems
- Environmental topics (e.g. micropollutants in confined spaces)
- Life support systems

**Contact**

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UNIL | Université de Lausanne



| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | ✓ | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | ✓ | ✓ | |
| Instruments and Payloads | ✓ | ✓ | |
| Spacecraft and on-board Equipment | ✓ | | |
| Ground Segment | ✓ | ✓ | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | ✓ | ✓ | |
| Software | | | |
| Basic Research for Space Technology | ✓ | | |
| Small Satellite Activities | | | |

# UniNE

**Profile**

The University of Neuchatel (UniNE) is an internationally recognized institution, known for its reasonable size and favorable student-teacher ratio. With more than 4000 students from Switzerland and beyond (22% international students), it provides high quality teaching and support and is ranked among the 20 best small universities worldwide. Bachelor and Master's degrees are compatible with most other European universities and are in line with society's expectations in a variety of innovative and cutting-edge fields. Situated halfway between Geneva and Zurich, UniNE is a perfect place for those who wish to study or to undertake high-level research in a magnificent environment, near lake and mountains.

**UniNE at a Glance**

- 4 faculties: humanities, science, law, economics and business
- > 4'000 students
- 600 doctoral candidates
- 750 staff members (FTE equivalent)
- > 1'000 degrees (awarded in 2019)
- > 600 research projects

UNIVERSITÉ DE NEUCHÂTEL

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# ACADEMIA

## The Time and Frequency Laboratory (LTF)

**Profile**

The mission of LTF is to explore and push the frontiers in time and frequency research, optical metrology, and ultrafast science and technology. In collaboration with METAS, LTF developed the Swiss primary atomic fountain clock FOCS-2. LTF closely collaborates with local and national space actors like EPFL, CSEM, atomic clocks industry, and others.

**Space competences**

- Time & Frequency metrology
- Ultrafast lasers
- Optical frequency references for atomic clocks and space applications
- High-performance and miniaturized vapour-cell atomic clocks
- Various frequency combs systems
- Stabilization of microwave and optical oscillators
- State-of-the-art ion beam sputtering (IBS) machine for custom optics
- Cold atoms

**Contact**

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UNIVERSITÉ DE NEUCHÂTEL



| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | | | |
| Satellite-based Applications | | | |
| Instruments and Payloads | | ✓ | |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | | | |
| Materials and Processes | | | |
| Structures | | | |
| Electronic Components | ✓ | ✓ | |
| Software | ✓ | ✓ | |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

# USI

**Profile**

Università della Svizzera italiana (USI) is a young and lively university, a hub of opportunity open to the world where students are offered a quality interdisciplinary education in which they can be fully engaged and take centre stage, and where our researchers can count on having the space to freely pursue their initiative. Students, professors and researchers, hailing from over 100 countries, convene on the three campuses in Lugano, Mendrisio and Bellinzona. Since 1996, USI is in constant evolution, always taking on new challenges while remaining true to its guiding principles: quality, openness and responsibility. USI is organised in five faculties and is active is several research and study areas, among which: architecture, communication sciences, computational science, data science, economics, health studies, humanities, informatics, law, medicine and biomedicine.

**USI at a Glance**

- 5 faculties
- 2'971 students
- 9'276 graduates
- 869 academic staff
- 23 Institutes
- 50 Bachelor's, Master's, PhD's and Advanced studies programmes
- 110 research partner universities and institutes
- 84 Start-ups supported
- Budget: 95 MCHF

Università della Svizzera italiana

**USI - Università della Svizzera italiana**

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www.usi.ch

# ACADEMIA

## Advanced Learning and Research Institute (ALaRI)

**Profile**

The Advanced Learning and Research Institute (ALaRI) is part of the Faculty of Informatics of USI. Since 1999, it has been active in research and education in cyber-physical and embedded systems. The Institute is an active participant in a number of Swiss and international research endeavors. Research effort is focused on computational intelligence, including algorithm development as well as design and implementation of intelligent systems.

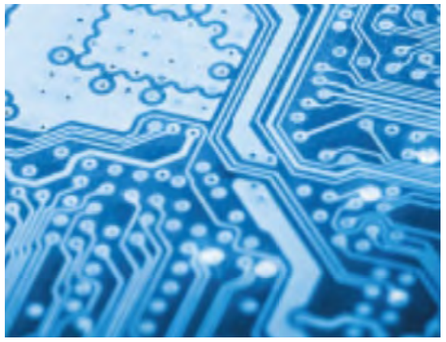
**Space competences**

ALaRI is active in the following fields:

- computational intelligence for embedded systems
- machine learning
- security for embedded systems
- design and development of embedded systems

Specifically to space applications, ALaRI activities are related to:

- GNSS signal processing
- hardware and software for GNSS instruments
- GNSS interference detection



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Università della Svizzera italiana

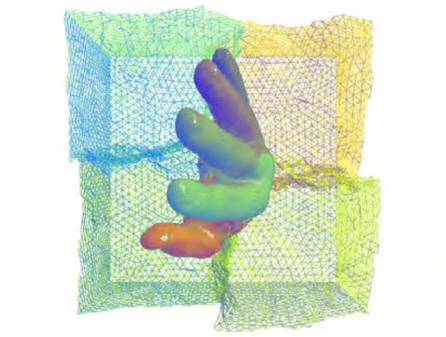
## Institute of Computational Science (ICS)

**Profile**

ICS is a major node in Switzerland for research and education in computational and data science. Imbedded into a dense network of national and international cooperation partners, ICS carries out high-level research with a general focus on computational methods for life sciences, social sciences, natural and environmental sciences, economy, and engineering.

**Space competences**

- Computational Shape Analysis
- Computational Time Series Analysis
- High Performance Methods for Numerical Simulation in Science, Medicine and Engineering
- Medicinal Chemistry & Drug Design
- Advanced Computing Laboratory



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Università della Svizzera italiana



| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | ✓ | ✓ | ✓ |
| Life and Physical Sciences | ✓ | ✓ | ✓ |
| Satellite-based Applications | ✓ | ✓ | ✓ |
| Instruments and Payloads | ✓ | ✓ | |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | ✓ | ✓ | |
| Materials and Processes | | ✓ | |
| Structures | | | |
| Electronic Components | ✓ | ✓ | |
| Software | ✓ | ✓ | ✓ |
| Basic Research for Space Technology | ✓ | ✓ | |
| Small Satellite Activities | | | |

# UZH

**Profile**

With its 26'000 enrolled students, the University of Zurich (UZH) is Switzerland's largest university. Founded in 1833, UZH was Europe's first university to be established by a democratic political system. Today, UZH is one of the foremost universities in the German-speaking world. Made up of seven faculties covering more than 100 different subject areas, the University offers a wide variety of Bachelor's, Master's and PhD programs. In addition, UZH's continuing education programs offer excellent learning opportunities.

**UZH at a Glance**

- Founded in 1833
- Largest, most diverse university in Switzerland
- Seven faculties and over 150 institutes
- Four University hospitals
- 26'000 students
- 5'000 researchers including > 650 professors
- A new patent every two weeks
- A new spin-off every two months
- Two research agreements with industry per day

University of Zurich[UZH]

**UZH**

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# ACADEMIA

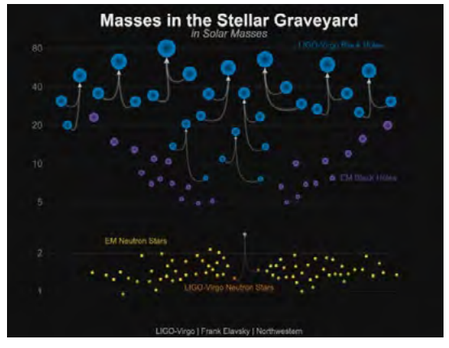
## Black Holes and Gravitational Wave Detection

**Profile**

The groups of Prof. P. Jetzer and Prof. L. Mayer work on gravitational wave experiments, especially on ESA's future Laser Interferometer Space Antenna (LISA). Their research focuses on theoretical and computational modeling of gravitational wave sources and their resulting wave-forms. They are both members of the LISA Consortium. Prof. Jetzer is also member of the LISA Consortium Board and of the LISA Science Study Team, and coordinator of the ESA Topical Team on ACES and general relativity.

**Space competences**

- Theoretical and observational astrophysics
- Astrophysical supercomputing simulations
- Gravitational wave research (LISA/LISA Pathfinder/LIGO)
- Tests of general relativity using the Atomic Clock Ensemble in Space (ACES)

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University of Zurich[UZH]

## Cell Biology - Gravitational Biology and Biomechanics

**Profile**

Using parabolic flights, suborbital rocket and International Space Station (ISS) experiments, the group of Prof. O. Ullrich investigates the role of gravity in cellular signal transduction, cell dynamics and gene expression regulation in order to understand how gravitational forces contribute to cellular homeostasis and how cells adapt to an altered gravity environment.

**Space competences**

- Gravitational Biology
- Space Life Sciences
- Manned Spaceflight
- Hardware design and development
- Parabolic Flights (incl. Swiss Parabolic Flight program)
- Suborbital ballistic rockets
- International Space Station (ISS)


**Contact**

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University of Zurich[UZH]



## Glaciology and Geomorphodynamics Group (3G)

**Profile**

Research of the Glaciology and Geomorphodynamics Group (3G) at the Dept-of Geography has a focus on the cryosphere and high-mountain regions in the context of climate change. The group applies modeling, Earth observation data and digital elevation models (DEMs) from a variety of sources for the analysis of related processes, impacts and risks.

**Space competences**

- Optical remote sensing of glaciers and change assessment
- DEM extraction from stereo images

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University of Zurich[UZH]

## Integrative Spinal Research (ISR) Group

**Profile**

Using parabolic flights, the International Space Station (ISS), and ground reference studies, the Integrative Spinal Research Group investigates the effects of micro- and hypergravity on the human spine with the aim of improving spinal health.

**Space competences**

- Parabolic Flights
- International Space Station (ISS)
- Ground Reference Studies
- Clinical Trials
- Back pain


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University of Zurich[UZH]

# ACADEMIA

## Origin and Evolution of Exoplanets and Solar System

**Profile**

The Origin and Evolution of Exoplanets and Solar System research group is divided into two entities. The other one is led by Prof. L. Mayer and focuses on astrophysics and planetary science, developing theoretical models for planet formation and evolution, planetary interiors, and the characterisation of exoplanets. Prof. L. Mayer's entity focuses on the origin and evolution of protoplanetary disks and on the early stage of planet formation.

**Space competences**

- Theoretical astrophysics and Planetary Science
- Astrophysical supercomputing simulations
- Exoplanet Detection and Characterisation (PLATO)
- Solar System Exploration (Juno, JUICE)
- Exoplanetary Atmospheres (ARIEL)


**Contact**

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Prof. L. Mayer • lmayer@physik.uzh.ch • www.ctac.uzh.ch/en/Research/research-groups/Lucio-Mayer.html

University of Zurich[UZH]

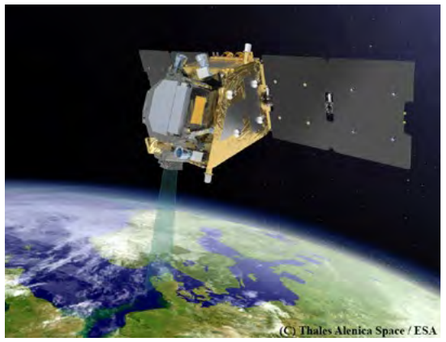
## Remote Sensing of Water Systems (RSWS)

**Profile**

The Remote Sensing of Water Systems (RSWS) group is embedded in both, the Dept. of Geography at the University of Zurich and the Swiss Federal Institute of Aquatic Science and Technology, Eawag. RSWS's central goal is to advance water systems research using novel Earth observation technology (i.e. ESA's future FLEX satellite mission) and process models. Our fundamental research activities are centered around the measurement of water dynamics in the Earth system.

**Space competences**

- Fluorescence spectroscopy (FLEX mission)
- Method development and processing infrastructure (FluoSpecchio)
- Remote sensing of terrestrial and aquatic photosynthesis
- Remote sensing for water and carbon cycle research
- Stakeholder solutions

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University of Zurich[UZH]



## Robotics and Perception Group

**Profile**

The University of Zurich's Robotics and Perception Group, led by Prof. D. Scaramuzza, specializes in developing autonomous drones that navigate using only onboard cameras, without GPS. Their research activities are supported by funding from ERC, SNSF, NCCR Robotics, and several academic-industrial collaborations, such as SONY, HUAWEI, INTEL, HILTI.

**Space competences**

- Computer vision
- Sensor fusion
- Autonomous navigation and exploration
- Localization and mapping
- Motion planning and control
- Machine learning & Deep Neural Networks

**Contact**

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University of Zurich[UZH]

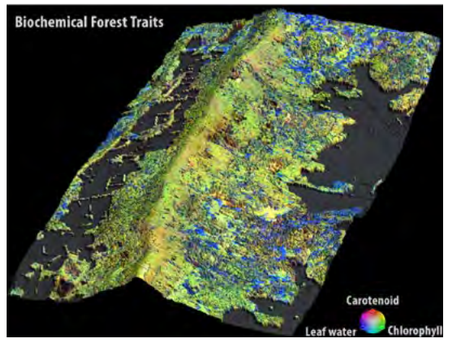
## Remote Sensing Laboratories

**Profile**

The Remote Sensing Laboratories (RSL) are embedded in the Dept. of Geography. RSL's central research goal is to advance understanding of the Earth system sciences using Earth observation methods. Combining fundamental and applied research allows the group to assess the impact of the human dimension on regional, national and global change.

**Space competences**

- Imaging spectroscopy, SAR & LiDAR research
- Methods, models, and software development
- Measurement and processing infrastructure
- National and international cooperation
- Policy and stakeholder advice

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University of Zurich[UZH]

# ACADEMIA

## Science Lab UZH

**Profile**

The Science Lab UZH provides a modern and future oriented impression of natural sciences and promotes interdisciplinary skills for school pupils, students, teachers and the general public through interactive and cross-disciplinary workshops. The aims with the courses offered, inter alia, in the fields of Earth observation, robotics, data sciences, applied mathematics, physics/astrophysics or biology, is to foster the interest in natural sciences and to help young people understand the effects of human behavior on nature and on the environment.

**Space competences**

- Science communication and cross-curricular education formats
- Applied Earth observation and remote sensing
- Software development and programming
- Augmented and virtual reality
- Digital skills and digital transformation
- National and international cooperation

**Contact**

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University of Zurich[UZH]

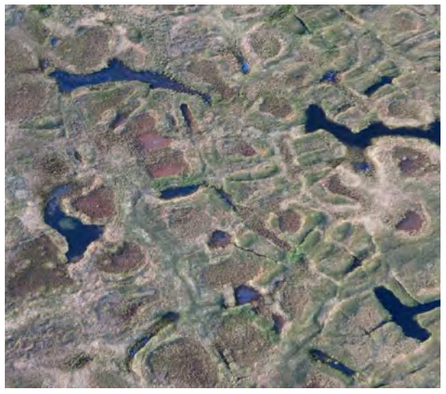
## Spatial Ecology and Remote Sensing

**Profile**

Our research group focuses on the interaction of ecosystems with global change drivers, in an Earth System Science context. We combine ecological experimental approaches, field measurements, air- and spaceborne radiation measurements, and radiative transfer modelling, to connect processes from the leaf, to the plant and landscape scale, from the soil through the vegetation canopy up to the atmosphere.

**Space competences**

- Remote sensing data analysis for ecological applications
- Radiative transfer modelling in vegetation canopies
- Energy fluxes
- Ecosystem monitoring using drones
- Remote sensing of arctic terrestrial ecosystems
- Validation of satellite-derived land surface products
- BRDF and albedo



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University of Zurich[UZH]



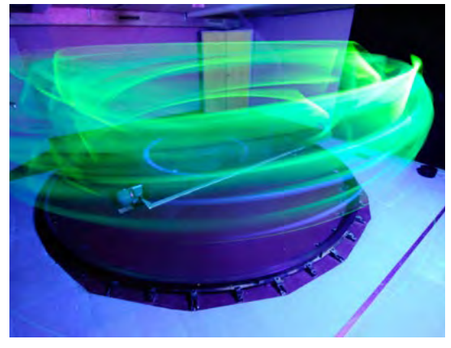
## Swiss Space Travel & AiR Sickness (SSTARS)

**Profile**

We investigate habituation of self-motion perception in novel motion environments. This includes adaptation to artificial gravity and g-transitions and other Earth-based applications ranging from preventing motion sickness in aviation to rehabilitation in neurological patients. The group is within the Vestibulo-oculomotor Lab (Neurology/Ophthalmology/Otolaryngology departments, University Hospital Zurich) and has access to motion simulators, a human centrifuge, virtual reality setups, eye tracking systems and clinical test devices.

**Space competences**

- Space motion sickness and its cognitive and autonomic correlates
- Motion sickness and disorientation
- Artificial gravity
- Motion simulators, perceptual motion illusions, virtual reality
- Motor responses (Eye movements, postural balance)
- Perceptual responses for orientation and self-motion perception



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University of Zurich[UZH]

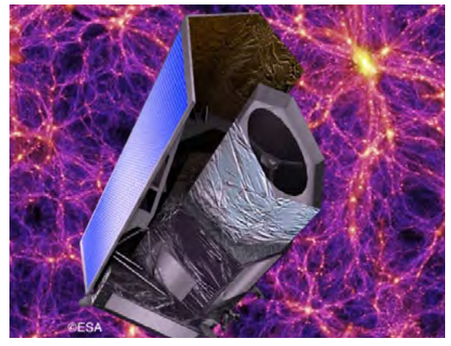
## The Dark Universe

**Profile**

The astrophysics group is part of ESA's Euclid mission, whose goal is to map our entire observable Universe and get new insights on the nature of dark matter and dark energy. The astroparticle physics group focuses on the direct detection of particle dark matter with dual-phase (liquid and gas) xenon time projection chambers.

**Space competences**

- Large scale simulations & analyses
- Liquid xenon detectors
- Low-noise and low-background electronics
- Radio-isotope detection with ultra-low background HPGe diodes
- Single-photon detection

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University of Zurich[UZH]

# ACADEMIA

## UZH Space Hub

**Profile**

The UZH Space Hub is an innovation cluster of the University of Zurich with the focus on space and aviation activities. Together with academic and industry partners the aim is also to strengthen innovative space and aviation activities at the Switzerland Innovation Park Zurich (IPZ) in Dübendorf by pooling experiences, expertise, networks and infrastructure. Thanks to the Swiss Air Force, UZH has also been allowed to use the neighboring military airfield Dübendorf for research flights.

**Space competences**

- Astrophysics
- Earth Observation
- Space Life Sciences
- Infrastructure, e.g. aircraft
- Airborne and spaceborne R&D
- Link academia – industry
- Swiss Parabolic Flights (ZERO-G)
- Access to International Space Station ISS


**Contact**

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University of Zurich[UZH] UZH Space Hub

| Segment | Research | Development | Production |
|---|---|---|---|
| Earth Observation | | | |
| Life and Physical Sciences | ✓ | ✓ | |
| Satellite-based Applications | | | |
| Instruments and Payloads | ✓ | ✓ | |
| Spacecraft and on-board Equipment | | | |
| Ground Segment | ✓ | ✓ | |
| Materials and Processes | ✓ | ✓ | |
| Structures | ✓ | ✓ | |
| Electronic Components | ✓ | ✓ | |
| Software | ✓ | ✓ | |
| Basic Research for Space Technology | | | |
| Small Satellite Activities | | | |

# ZHAW

**Profile**

The ZHAW is one of the leading universities of applied sciences in Switzerland. The School of Engineering and the School of Life Sciences and Facility Management are directly involved in space-related activities.

The School of Engineering focuses on topics which will continue to be relevant in future. Our 13 institutes and centres guarantee superior-quality education, continuing professional training, and research and development with an emphasis on the areas of energy, mobility, information and health.

The expertise of the School of Life Sciences and Facility Management in the areas of the environment, food and health enables us to make a vital contribution ot solving social challenges and improving quality of life.

**ZHAW at a Glance**

- In its work in research & development, the ZHAW concentrates on important societal challenges, with a particular focus on energy and societal integration.
- With locations in Winterthur, Zurich and Wädenswil, the ZHAW is firmly integrated in the local region whilst also cooperating with inter-national partners.
- There are eight Schools in the University: Applied Linguistics, Applied Psychology, Architecture, Design and Civil Engineering, Engineering, Health Professions, Life Sciences and Facility Management, Management and Law, and Social Work
- In 2018 ZHAW had over 12'000 students, 1'080 research associates, 855 lecturers and 262 professors


Zurich University of Applied Sciences

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# ACADEMIA

## Centre of Aviation (ZAV)

**Profile**

The Centre for Aviation has strong focus on Aircraft Technologies and Aviation Operations. We are very interdisciplinary with competences from aerodynamics, flight mechanics, system engineering up to human factors and communication. Safety and system reliability are very important but also understanding of space weather is one of our activities.

**Space competences**

- System Safety, Failure and Hazard Analysis
- Metal Fatigue Investigation for Space Structures or Equipment
- Human Machine Interaction Systems for Control Stations
- Human Factors in Control Room or Space Vehicles

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## Institute of Materials and Process Engineering (IMPE)

**Profile**

The Institute of Materials and Process Engineering (IMPE) combines competences in materials science and process engineering to develop innovative materials, coatings, processes and equipment. We are a multidisciplinary research center with the goal to bring together basic and applied research in a collaborative environment sharing both their expertise and the most advanced research facilities.

**Space competences**

Materials and Process Engineering for:

- Metals
- Composites
- Surfaces
- Coatings
- Ceramics
- Adhesives
- Polymers

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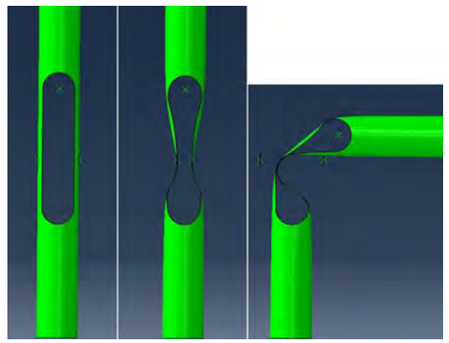
## Institute of Mechanical Systems (IMES)

**Profile**

The core competencies of the Institute of Mechanical Systems lie in the area of mechanical structures under heavy mechanical loading. The focus is on the three application areas of biomechanical engineering, lightweight construction engineering and applied mechanics. Components are developed, tested and simulated analytically, numerically and experimentally.

**Space competences**

- Development of lightweight structural components and high-precision mechanisms out of steel, light metal alloys and composites, load path optimization in conjunction with design for additive manufacturing
- Numerical and experimental characterization of steady and unsteady inertial, aerodynamic, elastic loads
- Numerical and experimental modal analysis, measurement of vibratory level



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## Institute of Mechatronic Systems

**Profile**

The Institute of Mechatronic Systems @ ZHAW is active in teaching, advanced vocational training and R&D. The team is made of up to 54 qualified, industry-proven and multidisciplinary professors, experienced engineers, and researchers that carry out applied research and development on a national and international level.

**Space competences**

- High-precision mechatronic systems
- Electro-optical data transmission
- Advanced control
- Robotics and automation
- Vision and navigation
- System technology

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## Institute of Natural Resource Sciences

**Profile**

The Institute of Natural Resource Sciences (IUNR) is involved in education, research and development at the intersection between ecological science and engineering. Research and educational activities are destined towards the efficient and sustainable use of natural resources and the conservation of landscapes as natural habitats. We are a team of multidisciplinary researchers in the three thematic fields of a) ecological engineering, b) ecosystems and biodiversity, and c) environmental and agrofood systems.

**Space competences**

- Closed-Loop-Life-support-systems
- Hydroponic- and aquaponic systems
- Microalgae cultivation & microbiology
- Human and organic waste treatment and -recycling
- Close-range ecological monitoring
- Spatio-temporal analysis and modelling
- UAV-based measurement infrastructure

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