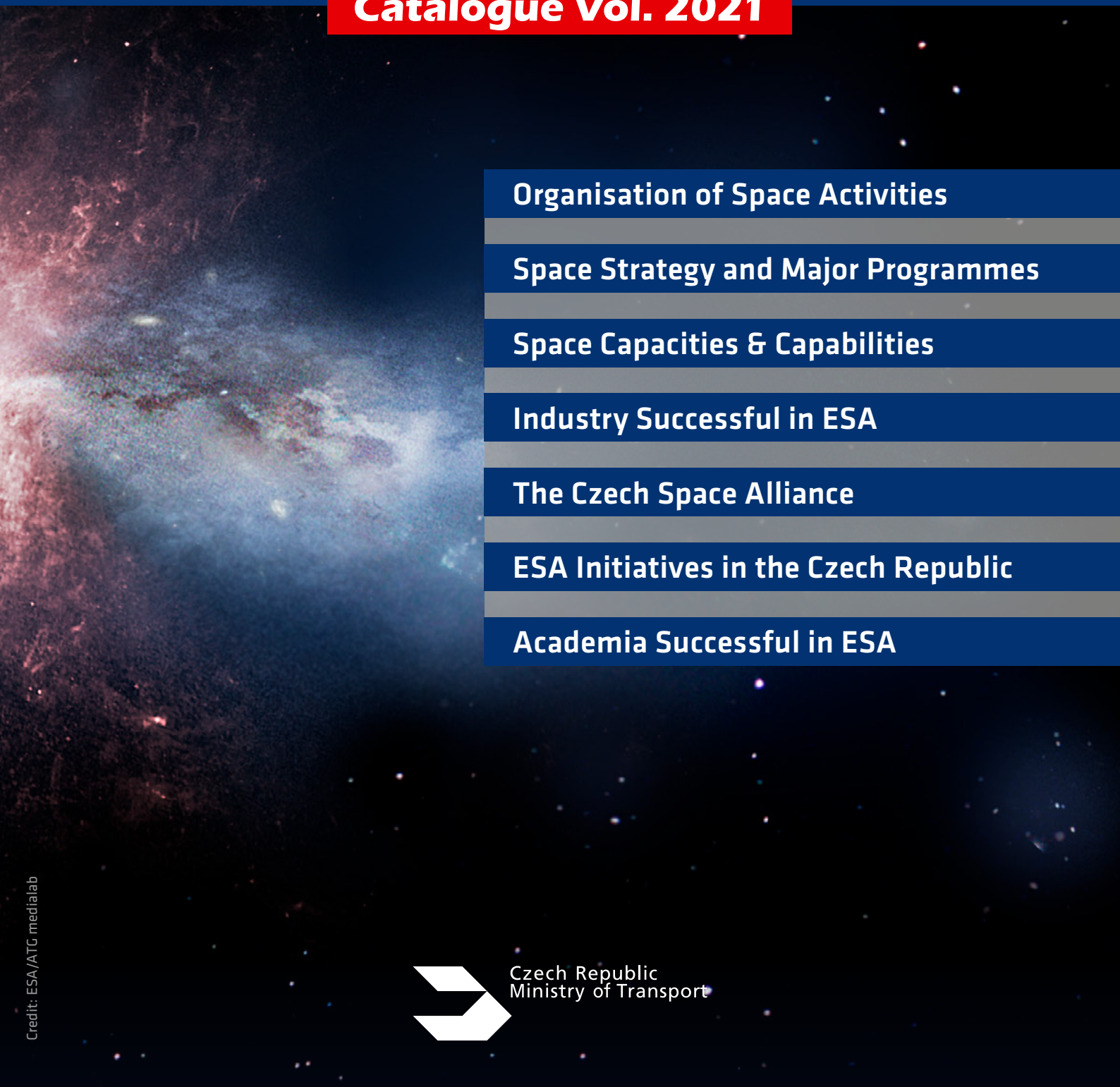
Czech Republic Successful in ESA

Catalogue Vol. 2021



- Organisation of Space Activities
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Credit: ESA/ATG medialab

Czech Republic
Ministry of Transport

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For more information about space activities in the Czech Republic, visit the Czech Space Portal!

CZECH SPACE PORTAL

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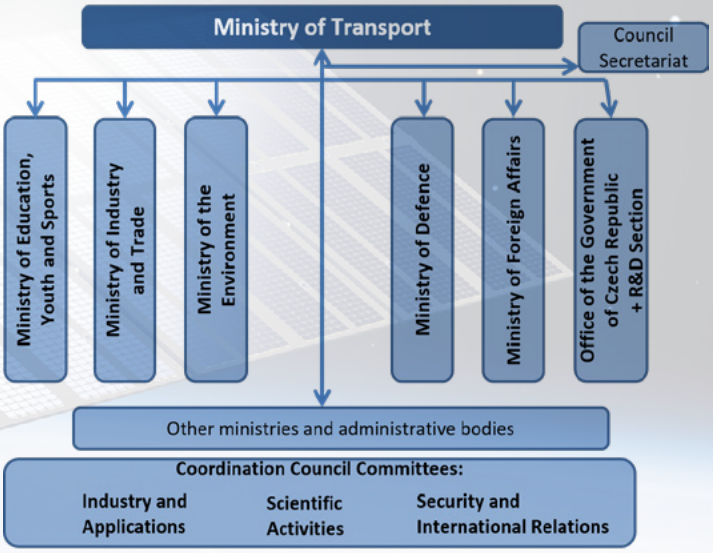
Organisation of Space Activities

Since 2011 the Ministry of Transport of the Czech Republic is the coordinator of all space activities in the Czech Republic. For effective and transparent coordination, the Minister of Transport established a Coordination Council as his permanent advisory and initiatory body. The Coordination Council consists of high level representatives of the Ministry of Transport, the Ministry of Industry and Trade, the Ministry of Education, Youth and Sport, the Ministry of the Environment, the Ministry of Foreign Affairs, the Ministry of Defence and the Office of the Government of the Czech Republic. The Coordination Council has established cross-sectional committees as an interface with industry and academia - "Industry and Applications" and "Science Activities". The "Security and International Relations" Committee deals with security and international aspects of space activities. The Ministry of Transport has been responsible for elaborating and delivering the National Space Plan to the Government of the Czech Republic. The document has been updated in cooperation with other relevant Czech ministries and bodies and the new plan was approved by the Government in October 2019. The National Space Plan 2020 – 2025 represents a basis for decision-making of further Czech involvement in space, support of industry and academia, and participation in European and international projects and programmes. The Czech Republic acceded to the European Space Agency (ESA) in November 2008 and the Ministry of Transport provides the only formal interface to the European Space Agency in the Czech Republic. The Ministry of Transport is also responsible for all space issues in the European Union, in particular the European space policy and the administration related to Galileo and EGNOS programmes. Concerning Copernicus Programme, it shares its responsibility with the Ministry of Environment. The successful bid for the European GNSS Agency (GSA) seat in Prague has also been coordinated by the Ministry of Transport team. The GSA is set to transform into the Agency for the EU Space Program (EUSPA) in 2021.



COORDINATION COUNCIL FOR SPACE ACTIVITIES

Space Strategy and major Activities

The new National Space Plan 2020 – 2025, which was approved by the government in October 2019, defines the long-term vision for the Czech Republic, which builds upon the two previous National Space Plans (from 2010 and 2014), i.e.:

- To have an international image of industrial and scientific excellence;
- To be a high value-added economy;
- To be competitive and innovative;
- To be capable of absorbing and retaining the intellectual capital it creates;
- To be an example of an excellent complementarity and cooperation between its industrial and academic tissues;
- To be an expert user of space resources and infrastructure in operational products and services (EO, navigation, etc.).

The main objectives entailed in this vision are:

- Czech Space Capacity and Capability Building to Increase Excellence and Competitiveness
- Active Position in International Relations to Increase Visibility of the Czech Republic

The plan also sets out specific goals, in particular to:

- maximise return-on-investment,
- be compliant with market trends and needs,
- create, protect and exploit IPR,
- be innovative and disruptive,
- foster excellence,
- create synergies between SMEs and large industries,
- increase the ratio of private investments,
- stimulate and accelerate technology and knowledge transfer.

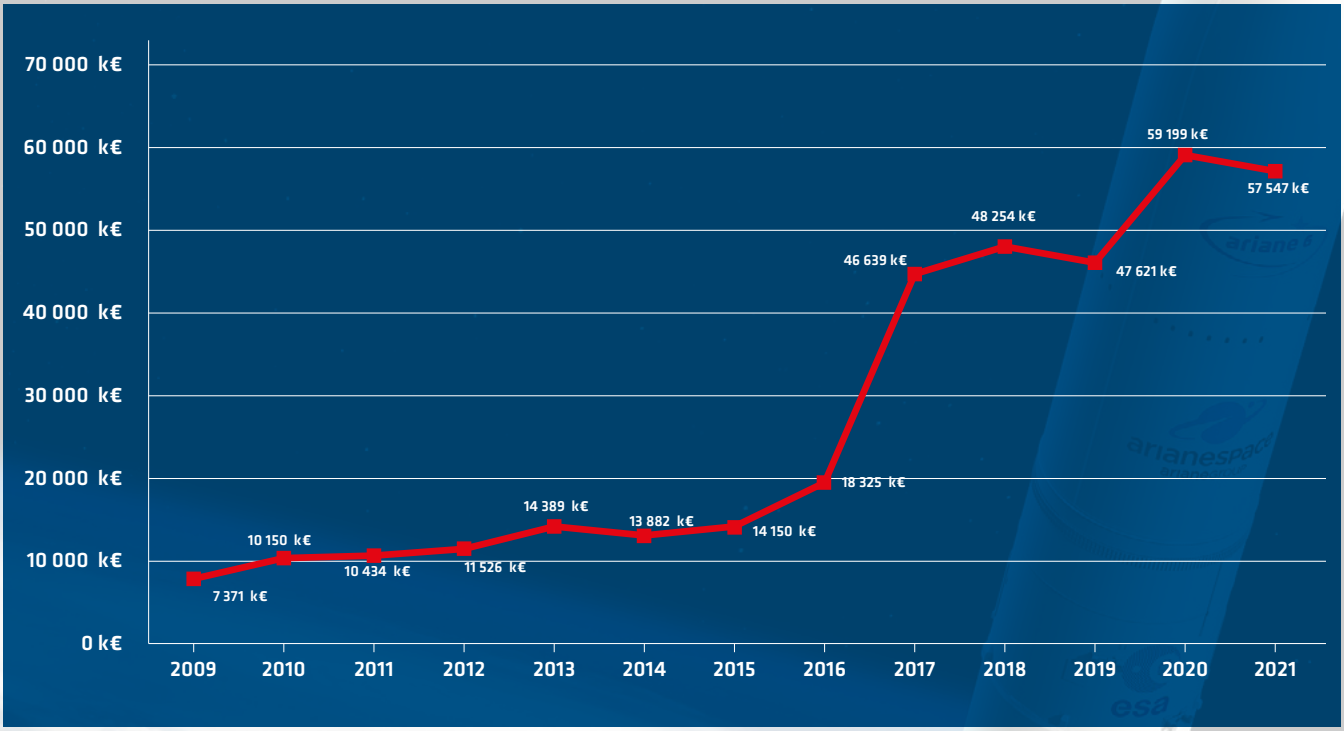
Space activities of the Czech Republic include especially:

- Participation in ESA mandatory activities and especially in ESA optional programmes, which are the main tool for the development of Czech space activities.
- National Space Programme implemented via Framework Project Implementing ESA's Support of Space-related Activities in the Czech Republic.
- Participation in EU space programmes and in the EUMETSAT programmes.
- Securing ESA's support of space-related activities in the Czech Republic through a dedicated framework project.
- Development of space technologies, design, analysis and testing.
- Space applications development activities in several sectors, e.g. transport, industry, environment and resource management.
- Space-related scientific research at universities and institutes of the Academy of Sciences of the Czech Republic.

National Space Plan 2020 – 2025

Credit: ESA - P. Carril

Contributions to ESA



ESA Optional Programmes

The Czech Republic currently participates in the following ESA optional programmes:

Earth Observation
- EOEP (Earth Observation Envelope Programme)
- FutureEO (Future Earth Observation Programme)
- EarthWatch – InCubed
- EarthWatch – InCubed+
- EarthWatch – GDA (Global Development Assistance)
- EarthWatch – TRUTHS
- CSC (Copernicus Space Component)
- GSC (GMES Space Component)
- MTG (Meteosat Third Generation) Development
- METOP Second Generation

Satellite Navigation
- NAVISP (Navigation Innovation and Support Programme)

Launchers
- Ariane 6 Development
- Vega C Development
- Vega E Development
- FLPP (Future Launchers Preparatory Programme)
- LEAP (Launcher Exploitation Accompaniment Programme)
- Programme for Competitiveness Improvements: Ariane6/Vega C
- Space Rider
- Ariane 6 and P120C Transition Programme

Satellite Communication (ARTES Elements)
- Future Preparation
- Core Competitiveness
- BASS (Business Applications Space Solutions)
- 4S (Secure Satcom for Safety and Security)
- ScyLight
- HydRON (High Throughput Optical Network)
- SAGA (Secure And cryptoGrAphic Project)
- Neosat
- Novacom II
- Triton-X
- QKD Sat
- Iris

Human Spaceflight, Microgravity and Exploration
- E3P (European Exploration Envelope Programme)

General Support Technology Programme
- Element 1 “Develop”
- Element 2 “Make”
- Element 3 “Fly”
- Precise Formation Flying Component

Space Situational Awareness / Space Safety Programme (S2P)

PRODEX (Scientific Experiment Development Programme)

Czech Republic also implements through ESA a Framework project implementing ESA’s support of space-related activities in the Czech Republic with a yearly budget of about 14,5 M€ (depending on current CZK exchange rate).

Space Capacities & Capabilities

Multi-Discipline Technologies

- **Design, Simulation and Testing of Mechanical Systems for Space Applications:** Stress, thermal and fluid dynamic calculations; Fatigue life and fracture mechanics evaluation; Design of highly loaded components and their optimization; Numerical computation involving complex physical effects; Climatic, mechanical and life-time testing of components, parts and materials; Additive manufacturing; Composite production and bonded sandwich structures, epoxy adhesives for extra high strength bonds; Production and delivery of qualified mechanical parts, assembled modules and subsystems.
- **Flight Hardware Design and Production:** Development of digital circuits and single-chip microcontrollers; In-flight use of wireless sensors; System health monitoring (SHM); Space hi-rel electronics cleanroom manufacturing activities; Products for crystal chemistry, growth of crystals for technical applications, optics including x-ray, acousto-optics, electro-optics etc.; Equipment for material sciences and technology in space; Development and manufacturing of apparatuses and devices according to specific requirements, including use of COTS components suitable for space environment.
- **Inertial Sensors for Space Application**
- Electric Power and Controls for Space Applications: Power management, including conversion and distribution; Electric actuation; Energy storage systems (including energy accumulation and generation); Thermal management;
- **Software:** On-board software (Flight Software for various missions; Complete software packages; StartUp SW, Mission critical SW & Application SW); Ground segment software (Satellite Control Systems, Mission Control System and EGSE; robotization of antennas and telescopes, control systems development, tracking software); Software development for the Earth Observation and Navigation Services Infrastructure.
- **On-board Systems:** avionics incl. hardware, software, network interfaces / data buses, modules to provide integrity of on-board data systems, integrated test-beds, AOCS.
- **Laser Technologies:** various laser instruments, laser communication, laser tracking of space debris (photon detectors), space resources prospecting and analysis.
- **Development of High Altitude Platforms/Pseudosatellites (HAPs)**
- **Midstream Segment:** Building of whole mission operation centres, uplink and downlink communication antennas and related infrastructure; Building and operation of data centres and archives, computational and dissemination platforms for EO or any other kind of space data; Big data computing, cloud computing.

Earth Observation (EO)

- EO data processing – multispectral, hyperspectral and SAR data. Development of new EO data based products (incl. integrated applications) based on EO data, e.g. SAR ground motion and infrastructure monitoring, SAR, multispectral and hyperspectral data for environment applications, agriculture, land use, land cover, monitoring or natural disasters, monitoring and modelling of atmosphere etc., development of new processing algorithms;
- Laser scanning data use / products development;
- Integration of EO data based information into GIS and customers systems, services for both midstream and end-users;
- Scientific EO data processing, e.g. GOCE, SMOS, SWARM and others;
- Machine learning and Artificial Intelligence for EO data processing; blockchain based services / technologies for EO;
- Spectroscopy, spectrometry, SAR interferometry, gravimetry;
- Calibration / Validation, development of Internet of Things (IoT) networks, which could serve for calibration and validation of EO data;
- Cryogenic and coolers for cooling of the payload on EO satellites;

Satellite Navigation

- Precise time and clocks (on-board management of atomic clocks or for precise time distribution through optical satellite networks); GNSS science (atmospheric effects on propagation of electromagnetic waves); space geodesy; precise orbit determination of satellites;
- Building and operation of GNSS permanent reference station networks (excl. manufacturing of the GNSS receivers / antennas); Developing software suites for real time monitoring performance of GNSS, across all international constellations and over extended periods, showing relative trends among different constellation developments;
- GNSS enabled applications in many domains (transportation and logistics, fleet management, intelligent transport systems, e-Call, drones, environmental protection, civil engineering, precise agriculture and forestry, personal tracking and health monitoring, location based services, sports, geo-marketing, media and entertainment etc.); autonomous mobility (automated and connected cars, precision agriculture by automated tractors and harvesting vehicles); crew management of police and rescue forces in crisis and emergencies.

Satellite Communication

- SatCom airborne terminals development for both civil and military aviation including unmanned aerial vehicles (UAVs), associated products like high power amplifiers, data links and security gateways (focus on safety critical air-ground data and voice communication for air traffic management);
- Secured quantum optical communication (unbreakable quantum encryption techniques, laser photon emitters and receivers and sensor heads);
- modelling of electromagnetic field propagation through the atmosphere;
- space and ground hardware development (super-capacitors, solar panels deployment mechanisms, antenna pointing mechanisms, propellant tanks and other components);
- Satellite TV, integrated applications.

Launchers and Propulsion Systems

- Mechanisms and composite and metallic structures; Low shock Hold Down Release Actuators;
- Monomers and polymeric materials (coatings, adhesives, casting resins); Synthesis and tailored surface modifications of nanoparticles; Nanocomposites and hybrid composites; Thermo-insulation materials; Multifunctional anticorrosive coatings;
- Embedded microcontrollers; In-flight use of wireless sensors; Structural health monitoring systems;
- Pyrotechnical systems; Separation systems for small satellites;
- Computational mechanics; System level design Launcher aerodynamics, aerothermodynamics, launch acoustics;
- Payload Fairing technologies; Isolation systems and payload comfort damping;
- High-performance Valves and control electronics;
- Inertial sensors for inertial navigation, on-board computer navigation and control systems Thrust Vector Control (TVC) technology based on electromechanical actuators;
- Electrically driven pumps for rocket propellants; High-performance valves for cryogenic rocket engines and their control electronics.

Space Situational Awareness (SSA)

- **Space Weather (SWE):** Provision of SWE services (Solar activity forecasts, Real-time Ionospheric monitoring, Daily geomagnetic forecasts, Radiation dosimetry); SWE sensors exploitation (Solar white light and H-alpha imaging, Solar radio observation, Ionospheric measurement, Geomagnetic observations); SWE Application development (Ionospheric disturbance detection and monitoring, Magnetospheric research, geomagnetic disturbance forecasts, Dosimetry applications for crewed space missions); SWE sensors development (various fields); SWE studies and modelling; SWE data processing;
- **Space Surveillance and Tracking (SST):** SST monitoring and cataloguing; SST data processing and Software applications development; SST Assets networking technologies; SST sensors development and qualification (optical and laser technologies); telescope control and processing software;
- **Near Earth Objects (NEO):** NEO observations & information provision; NEO mitigation support (incl. fireball monitoring); Advanced NEO spectroscopy technologies; Research and development in the field of special optics, optoelectronics systems and optical measurement methods, robotisation and remote control of telescopes; NEO Software development (tasking and scheduling of telescopes, long-term archiving and analysation of NEO data).

Space Science and Exploration

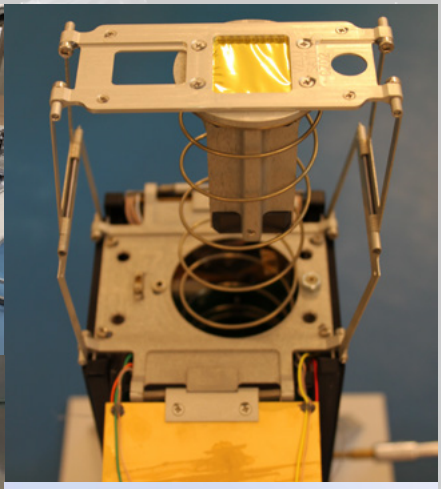
- Various scientific instruments, including e. g.: Langmuir probes, thermal plasma measurement units; Low frequency wave receivers; Wave analysers; Space radiation detectors; Micro-accelerometers; Single photon laser detectors; X-ray scintillation; Power supply and distribution units; Optical assemblies; Plasma wave instrument units for Solar Orbiter mission; Scientific data simulations; High-power lasers; High-resolution mass spectrometry etc.

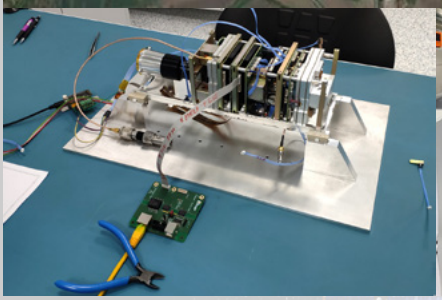
The main Czech goals in academia in the field of space R&D area include:

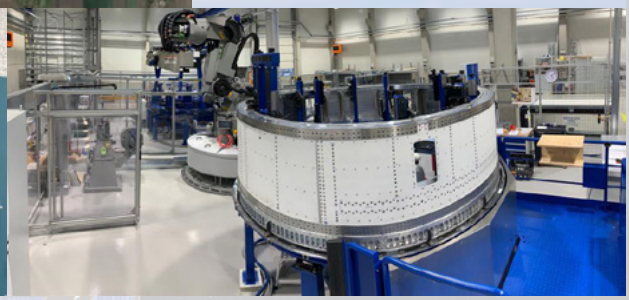
- **For space physics:** plasma and radiation environment near Earth and in solar system, solar research, meteorite research, objects in solar system, stellar research;
- **For Earth sciences and EO data applications:** gravitational research, space geodesy, magnetospheric and ionospheric research, planetary atmospheric spectroscopy and analytical chemistry, atmospheric and hydrological research, mineralogical and carbon cycle studies, land cover and urban development, disasters management;
- **For life sciences:** biological research (algae grow) and radiation biological modelling, psychological aspects (stress) of spaceflight;
- **For telecommunication research and application:** atmospheric radio propagation, generic satellite navigation signal receiver development, indoor signal modelling, microwave onboard transmitters;
- **For propulsion systems research:** system analysis, innovative thermal protection, structural and thermal modelling, pyrotechnic devices;
- **For space platform systems:** small satellites systems, electronic and electromechanical systems, robotic systems, composite advanced materials, optical and polarization filters;
- **For ground segments:** satellite data processing architecture and method development, spacecraft ground control and testing procedures.

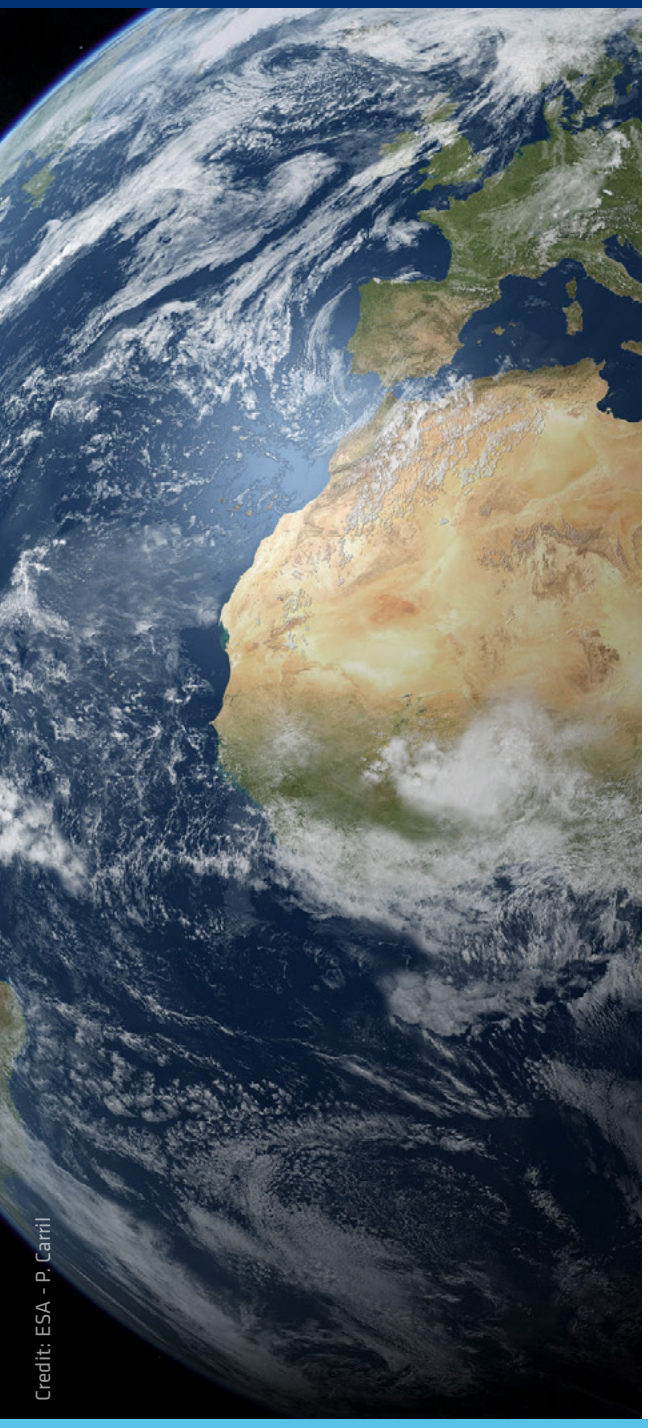
Industry of the Czech Republic

Successful in ESA









Credit: ESA - P. Carril

Industry

Manufacturing

R & D

Testing

5M s.r.o.

Member of the
Czech Space Alliance

5M s.r.o.
Na Záhonech 1177,
Kunovice 68604
Czech Republic
http://www.5M.eu

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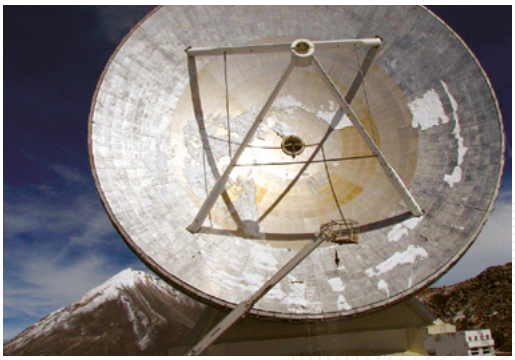


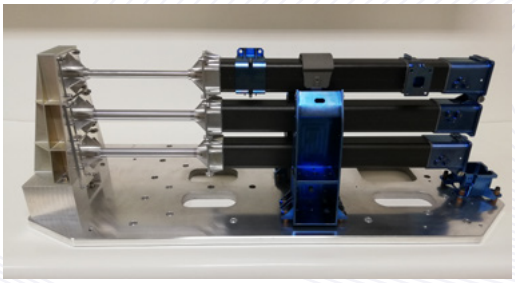
Radio telescope mirror made by 5M precise sandwich panels

General Description

5M s.r.o. is a medium-sized company operating in the area of the development and manufacturing of composite and sandwich materials and related subsystems. 5M has a wide range of customers in space applications and aircraft manufacturer as well as railway transportation and electric industry. Investments to R&D are roughly 8% of the annual turnover. 5M was awarded as the Company of the Year of 2010 in the Czech Republic.

Competences & Capabilities

Development and manufacturing of structural composite parts such as sandwiches and sturts. Development mechanical subsystem for solar array, manufacturing of small size solar arrays. Design and manufacturing of radiation shielding. Development and supply of structural epoxy foli and paste adhesives, epoxy resins, pre-impregnated fabrics (prepregs, semipregs). Development and manufacturing of composite and sandwich structures for optics.



CFRP tubes for demonstrator of MagBoom for JUICE made in cooperation with Frentech Aerospace, LK Engineering and VZLU

Major Space Projects & References

- Programme: TRP
  Name: PCDU Radiation Shielding of the JUICE SSTS
  Prime contractor: Airbus Defence and Space, Spain
  Duration: 2017-2019
- Programme: TRP
  Name: Critical Review and Assessment on CFRP and Polymeric Material Usage for Crew Compartments and Manned Transport Systems
  Prime contractor: Thales Alenia Space, Italy
  Duration: 2017-2019
- Programme: Third Party Project
  Name: Flexible Solar Array Mechanical Subsystem
  Prime contractor: 5M s.r.o.
  Subcontractors: Thales Alenia Space France, Frentech Aerospace, LK Engineering, BD Sensors and VZLU
  Duration: 2019-2021

Space Related Equipment, Labs & Certificates

- AS/EN 9100:2009
- EN ISO 9001:2009
- POA PAR 21.G EASA 748/2012
- DIN 6701 A1
- IATF 16949

CFRP sandwich panel for magnetic divertor for Athena made in cooperation with Frentech Aerospace, LK Engineering and VZLU

Facility

- 10.000 m² area total including
  - 5.000 m² of working area totally
  - 3.000 m² of warehouses
  - 1000 m² of offices
  - 300 m² of area with controlled temperature and air filtration
  - 100 m² clean room ISO 8
  - 300 m² of labs with controlled climate
- 245 employees

5M production facility

Equipment

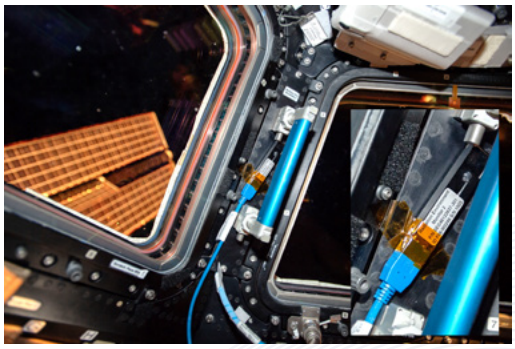
- Autoclave up to 250°C, diameter 2000 mm, length 4000 mm
- Automated cutting of prepreg
- Laser positioning system for prepreg lay-up
- Several CNC machines up to part dimensions 7500 x 1400 mm
- Kuka robotic arm
- Ovens up to 250°C, dimensions of 6000 x 3000 x 2200 mm
- Presses up to 180°C, max. dimensions 3000 x 1700 mm
- Pullpress up to 180°C for various diameters
- 9 pultrusion lines

Labs

- Universal testing machines, load cells up to 100 kN equipped with Environmental Chamber for temperature range from -60°C to +250°C
- Thermal cycling
- Outgassing Measurement Device
- CNC atmospheric plasma treatment 600 x 850 mm
- CTE measurement with DIL 822 (Dilatometer)
- DMA (Dynamic Mechanical Analyser)
- TGA 2 (Thermogravimetric Analyser)
- Rheometer Discovery HR1
- DSC 1 (Differential Scanning Calorimeter)

Quality Control

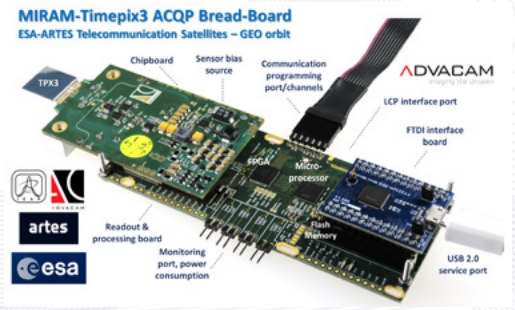
- CMM (Wenzel, max. part dimensions 3000 x 1500 x 1200 mm)
- Optical Microscopy and Defectoscopy
- Ultrasonic non-destructive testing



General Description

ADVACAM produces advanced radiation imaging detectors and novel particle tracking cameras based on state-of-the-art Timepix and Timepix3 ASIC chip CERN technology. Highly integrated instrumentation (see photo) and customized solutions (see photo) are developed for a wide range of applications including space where low-power light-mass payloads are most valuable for high-resolution wide-range detection and monitoring of space radiation on board satellites for ESA (compact payloads for spacecraft) and on the ISS/NASA (miniaturized online radiation dosimeters for spacecrew). The innovative devices together with advanced methodology and precision data processing enable to characterize mixed radiation fields in wide range of particle fluxes, energy (stopping power) and direction (full sky field-of-view) – see figure.

ADVACAM is a spin-off SME of the IEAP CTU Prague and the Medipix Collaboration based in CERN founded in 2013. R&D, applications and projects are carried out in close cooperation with the IEAP CTU Prague and CERN as well as with Czech space entities CSRC/BD Sensors, SERENUM, VZLU and Rigaku.



Competences & Capabilities

Design, development and manufacture of advanced radiation detection instrumentation based on hybrid semiconductor pixel detector technology Timepix by the Medipix-CERN collaboration.

R&D in radiation imaging, spectrometry, dosimetry and particle tracking. Directional detection of energetic charged particles in wide field-of-view. High-resolution wide dynamic range characterization of mixed radiation fields.

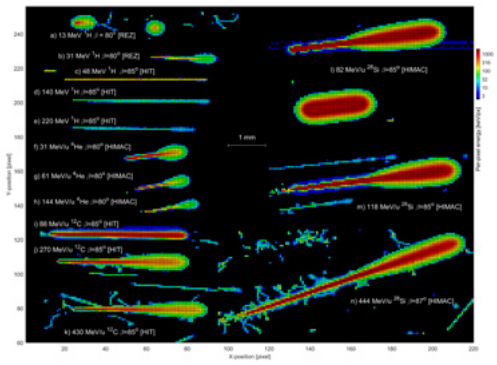
Testing, characterization and calibration of radiation detectors including in-house radiation lab sources. Know-how of radiation testing and calibration at particle beam/accelerator sources.

Applications and development of novel techniques of high-resolution radiation detectors and miniaturized low-power radiation cameras. Space radiation research for space weather and radiation effects studies.

The staff of nearly 30 consists of skilled technicians and experienced engineers in micro-electronics, HW/SW, data processing together with specialized scientists in radiation dosimetry and nuclear physics.

Major Space Projects & References

- "Miniaturized Radiation Monitor for GEO-orbit telecommunication satellites", see photo, contract MIRAM for ESA, together with the IEAP CTU Prague.
- Pixel Detector Data Processing Engine", contract DPE for ESA, prime contractor Advacam.
- "Space Radiation Capabilities, Technologies and Payloads", contract SR-CTP for ESA, together with SERENUM, CSRC/BD Sensors, VZLU and Rigaku.
- Online miniaturized radiation dosimeters MiniPix-TPX for space crew onboard the ISS and NASA ORION missions, see photo, direct NASA-JSC and ADVACAM activity.
- "MIRAM payload demonstrator onboard GOMX-5 Cubesat in LEO orbit", ESA mission LEO orbit, led by IEAP CTU Prague.



Space Related Equipment, Labs & Certificates

- Manufacture, testing, production overall ISO 9001
- Manufacturing and production area 250 m^2 (microelectronics lab and assembly premises 100 m^2)
- Clean room space 15m^2, packaging of semiconductor pixel detectors, wire-bonding, wafer and assembly testing and high-precision assembling and machining of components.
- X-ray lab 50m^2, X-ray prober stations, wire-bonding system, microscope soldering equipment, thermalized chamber, regulated cooling units, vacuum chamber, X-ray imaging and micro-CT systems, automatized robotic scanner

ADVACAM

Industry
Manufacturing
Software
Services
R & D
Testing

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ALEEGO

IN THE AIR WE GO

Industry

R & D

Services

Software

ALEEGO s.r.o.

General Description

Founded in 2016, ALEEGO is a drone (UAV) services company. Their technologies focus on commercial applications, photogrammetry and thermography where the benefits of using drones and piloted aircraft are valuable commodities for enterprises.

ALEEGO cooperates with customers from the industrial sector such as Energy, Construction, Renewables, Real Estate, and from Agriculture in the areas of infrastructure inspection, asset monitoring, aerial mapping, topography survey, 3D modeling, stockpile volumetric measurement and consulting.

Using their online platform to connect UAV customers with qualified UAV pilots, they have +50 pilots onboarded across Europe. The UAV pilots registered on ALEEGO platform are professionals qualified by ALEEGO Pilot Supervisor. ALEEGO holds all needed flight permits, insurance policies and training allowing it to perform any possible mission.

Competences & Capabilities

Agriculture and forestry:

- Identify weather or wildlife damages
- Plan irrigation to use less water and chemicals
- Increase productivity by using multispectral vision
- Treatment with aerial non-chemical solutions (trichogramma)

Real Estate:

- 3D scan for BIM application
- Creating virtual show / virtual 3D visit for real estate companies
- Insurance survey

Agriculture and forestry:

- Identify weather or wildlife damages
- Plan irrigation to use less water and chemicals
- Increase productivity by using multispectral vision
- Treatment with aerial non-chemical solutions (trichogramma)

Civil Work:

- Quarries stock survey
- Project progress indicator by using automated survey
- Inspection of regulatory measures to ensure infrastructure safety.

Energy:

- Quickly locate area of improvement
- Increase safety of employees and assets
- Locate point of failure using thermal analysis
- Plan maintenance process

Industrial inspection:

- Create 3D models
- Increase safety of assets
- Locate point of failure using thermal analysis
- Plan maintenance process

Renewables:

- Inspection of wind farms and solar farms using thermal analysis
- Detect defective photovoltaic cells and wind turbines

Operations:

- Plan flight path
- Request flight authorization to Civil Aviation Authorities (CAA)
- Ensure secured flight operation by setting flight procedures
- Securing data on cloud storage using blockchain

Major Space Projects & References

ESA kick-start activity – blockchain was implemented onto Aleego platform to secure confidential data from our customers and to ensure the ability to submit indisputable original mission documentation in case of an incident.

Space Related Equipment, Labs & Certificates

- GPS tracking device ideal for tracking of assets/ vehicles: GSM connectivity, A-GPS sensor
- RTK ground station to improve GPS accuracy

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asphericon

Industry

Manufacturing

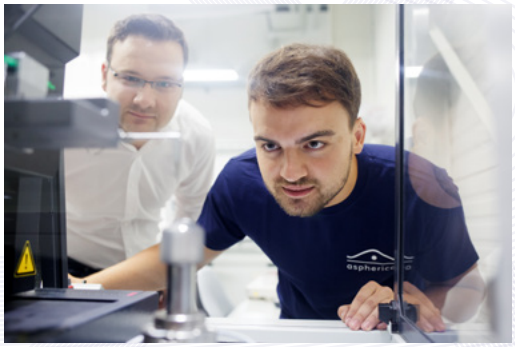
Services

R & D

Testing

General Description

As an independent and recognized specialist, asphericon is the technology leader in the field of aspheric components and optical systems. Latest manufacturing technologies, continually evolving proprietary control software, world class measurement equipment and highly qualified employees ensure that asphericon can provide more than 600 customers worldwide with innovative optical solutions.



Competences & Capabilities

asphericon is the pioneer for the first completely digitized production process in photonics. Based on a worldwide unique, self-developed and patented control software for CNC manufacturing, asphericon combines all manufacturing parameters in a central database system. The result is an optimized and flexible manufacturing process for prototypes, single pieces and large series. asphericon accompanies its customers from optical design, production and coating, full-surface interferometric measurement and documentation up to the assembly of optical components as well as their optical characterization.

Major Space Projects & References

Project: Sentinel 4 / Copernicus programme (ESA/EU)

Description: High-resolution spectrometer

Realisation: Aspheres, spheres with high-end surface form tolerances and surface roughness (≤ 0,5 nm), manufactured from demanding materials (CaF2, LAK9, SF6, SiO2)

Project: Sentinel 5 / Copernicus programme (ESA/EU)

Description: High-resolution spectrometer system (UV – SWIR)

Realisation: Ultra-precise optical components (spheres, cylinder) with irregularities ≤ 1fr

Project: Star Tracker

Description: Autonomous attitude determination

Realisation: Aspheric and spherical components with high-end surface form tolerances (≤ 0,5 fr) and surface roughness (≤ 0,002 µm)

Project: IRPOL

Description: Infra-red lens polishing for high performance applications

Realisation: Polishing of precise aspheric components for infra-red applications with high-end surface form tolerances (≤ 0,5 fr) and surface roughness (≤ 0,5 nm)

Further references on request.

Space Related Equipment, Labs & Certificates

Facility

10.000 m² total area

Clean room classes ISO 5 and 7

High-precision labs with controlled climate

Equipment

Optical Coatings (190nm-5100nm)

Multi-wavelength interferometry

Full surface tactile measurement

Non-contact centre thickness measurement

2D/3D measurement

Confocal 3D defect characterization

Roughness measurement

Wavefront measurement

Measurement of MTF, PSF, Strehl ratio

LID-/CRD measurement

Certificates

DIN ISO 9001:2015

RoHS & REACH compliant production

asphericon s.r.o.

asphericon s.r.o.
Milířská 449
463 12 Jeřmanice
Czech Republic
www.asphericon.com

Responsible for space and ESA projects:

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E-mail: v.penickova@asphericon.com

Industry

Manufacturing

R & D

Testing

ATC Space s.r.o.

General Description

ATC Space is 100% of the German company Aerotech Peissenberg (ATP), a well-known manufacturer of aircraft engines and gas turbines parts. The main customers are well known OEM's of aircraft engines and turbine like Rolls Royce, Safran, Pratt Wittney, GE, MTU, etc. and finally implemented on AIRBUS, Boeing and other aircrafts. ATC Space is active in the space business with vision to become centre of competence for milling and assembly operation structures and components for space applications. The ARIANE 5 workshare covers the exclusive segment complex assembly of two lightweight components, namely the aerodynamic cover PAR2 and the thermal protection System FAIRING2. According the launch rate up to seven shipsets per year, ATC Space fulfils its obligations in delivery always in quality and on time. Furthermore, with the effective subscription of the Czech Government for ARIANE 6 program in 2016, ATC Space was contractually awarded for the development and manufacturing of the lateral booster structures, the so called ESR Forward and ESR Rear Skirt. The overall ATC Space company vision is to (re-)establish the centre of mechanical engineering in the area of Klatovy. ATC Space has "passion for unique structures".

ATC Space operates as a reliable partner in the area of special assembly and riveting for primary structures in the scope of ARIANE 5. In the ARIANE 6 Program ATC is responsible for the development and final industrialisation and cooperates as reliable partner for the high precision milling of stiffening elements with special galvanic surface treatment and also the final assembly and delivery for final integration. The ARIANE 6 scope of work is performed in new facility, that is optimized according the requirements for a nominal production rate of 32 skirts per year. The new facility was finalized in 2018. Always in the view of a high-tech and state of the art production - sustainable for the next 30 years, we set up a dedicated milling centre with one of the most modern machinery and special assembly area with robotics. All of the produced parts and components are tested and inspected in house by special means before they are released for delivery to the customer.

In 2019 ATC Space had 30 employees and we are continuously recruiting with a targeted manpower that is 55-60 employees. Company turnover in full operational capability is planned 12 mil EUR per year in serial production.

Competences & Capabilities

The main competences of ATC Space is turning and milling of extremely heat resistant titanium- and nickel-based alloys and aluminium alloys, fulfilling required precision in the maximum tolerance of 0,01 millimetres. The components and parts produced in Klatovy are mainly of highest critical level.

Major Space Projects & References

- Ariane 5 - cover PAR2 and the thermal protection System FAIRING2
- Ariane 6 - ESR Forward and ESR Rear Skirt

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Email: info@atc-space.cz

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General Description

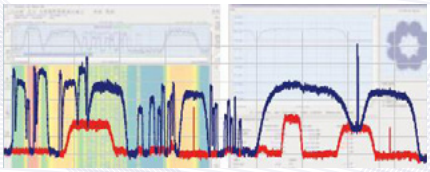
Atos is a leader in digital services with pro forma annual revenue of circa €12 billion and about 100,000 employees in 73 countries. Serving a global client base across Manufacturing, Retail & Transportation; Space, Public Sector & Health; Financial Services; Telco, Media & Utilities business sectors.

Atos IT Solutions and Services, s.r.o. head office is in Prague, with branch offices in Brno, Ostrava, and in Vysoke Myto. The company currently employs about 300 people; the majority are highly qualified analysts and software and hardware engineers with university degrees.

Competences & Capabilities

The Space department in the Czech Republic was established in 1998. Since its inception the Czech Space department group has cooperated on the development of various software and hardware solutions for ESA, German National Space Agency (DLR), and leading satellite Integrators.

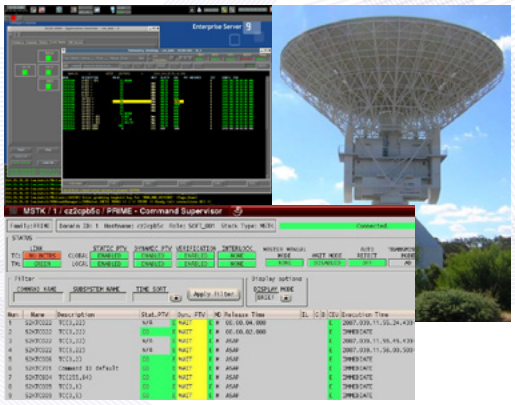
- Our main expertise is in the fields of:
- Satellite Monitoring & Geolocation Systems
- Mission Control System & Ground Station Software
- Electrical Ground Support Equipment
- Products for EGSE / SCOE



SkyMon: Satelite Monitoring & Geolocation System

SkyMon is the sattelite carrier monitoring and interference localisation system - proven, reliable and highly scalable. SkyMon is deployed at more than 10 sites arround the world, managing 57 anntena front ends in total.

Mission Control Systems



& Ground Station Software

- Proba-3 Combined EGSE & MCS system
- European Ground System Common Core (EGS-CC) Phase C/D Components development and Technologies Proof of Concept
- Parallel computing for fast Telemetry processing during short passes
- Operational Data Off-line Analysis Correlation and Reporting System (ARES)
- Ground Station Automation and Off-line Operations
- Transient Objects for M&C in GSSC/GMM
- Study of SCOS-2000 deployment over WAN
- Advanced Monitoring for a Modern Generic MCS
- Monitoring & Control Module for ESTRACK Ground Stations

Electrical Ground Support Equipment & Special CheckOut Equipment

- Biomass Instrument RF SCOE
- Sentinel-6 RF Suitcase
- Space Bus NEO SAS, UMB, AOCS SCOEs
- Metop SG S-Band RF SCOE
- Metop SG Scatterometer SCOE
- Proba-3 RF SCOE
- Euclid Power SCOE
- Euclid PLM EGSE and CDMU SCOE
- Euclid TT&C SCOE
- Euclid Power Control & Distribution Unit SCOE
- Sentinel-4 UVN Platform Interface Simulator Assembly
- Sentinel-4 UVN Data Evaluation EGSE
- MTG Data Handling SCOE
- MTG Payload Data Distribution SCOE
- Solar Orbitter Power SCOE
- Galileo Payload Test System
- Galileo FOC and IOV TT&C SCOEs

Resistive Sensors Simulator

ResSim is an instrument simulating resistive thermometers or other resistive components or sensors used in industry and aerospace.

- Modular Device in 1U 19“ case with User Interface
- Contains up to 10 simulation cards (Pt1000, Pt100)
- Up to 48 channels in 1U form with channels isolated from each other and from the instrument
- Simulation of failure states (sensor short, disconnected)
- Operates in two modes: resistance simulation or temperature simulation
- Can be controlled remotely over Ethernet

Secondary Power Proection Device

ProTec is a DIN rail device performing real time secondary OVP & OVC protection for Li-Ion battery, Battery Simulators, and similar devices.

- Separated power and control blocks
- Two independend channels
- Nonvolatile treshold storage
- Self-test signal injection feature
- ETHERNET - TCP/IP remote control (SCPI)
- Puls control,
- Interlock

Industry

Manufacturing

R & D

Services

Testing

Software

Atos IT Solutions and Services, s.r.o.

Member of the Czech Space Alliance

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Industry

Manufacturing

R & D

Services

Testing

AVX Czech Republic s.r.o

Member of the Czech Space Alliance

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General description

AVX is a leading international manufacturer and supplier of advanced electronic components, interconnect, sensing, control, and antenna solutions with 29 manufacturing facilities in 16 countries around the world. AVX offers a broad range of devices including capacitors, resistors, filters, couplers, sensors, controls, circuit protection devices, connectors, and antennas.

The company has over 30 years experience in producing industry-leading, high-reliability passive components, offering an expanding range of products for defense, aerospace, space, and other high reliability industries. AVX currently has 11 factories in Europe and USA qualified to AS 9100, IECQ-CECC, IATF 16949:2016 and ISO 14001:2015 standards. The company also has a number of products qualified to COTS+, ESCC, SRC, MIL and DSCC drawings, as well as optional custom screening and test service capabilities.

AVX Czech Republic

AVX Czech Republic s.r.o. is a subsidiary of AVX Corporation, which is headquartered in Fountain Inn, South Carolina, USA, and made up of three divisions, which include:

- Tantalum Division in Lanškroun, which manufactures solid and Wet tantalum electrolytic capacitors;
- Ceramic Division in Uherské Hradiště, which manufacturers ceramic capacitors and other passive components; and
- Interconnect Solutions Division in Bzenec

Globally, AVX Tantalum Division has the industry leading position in high-reliability tantalum capacitors, and is the largest supplier of high-reliability solid and Wet tantalum capacitors for medical and military/aerospace applications with the industry's widest range of medical, COTS-Plus, MIL specifications, and space level products. The division is a global leader in MnO2 solid electrolytic technologies, which include the smallest case size MnO2, the highest temperature up to 230°C, and the lowest DCL product offering.

The AVX Tantalum Division in Lanškroun develops and produces capacitors with a major share worldwide. For more than 10 years, the Lanškroun plant has produced ESCC qualified SMD tantalum capacitors. AVX's other Tantalum Division plants are strategically located in El Salvador, Japan, and the USA. Their capabilities include: solid and wet tantalum, conductive polymer, and niobium oxide technologies for consumer, wearable, telecommunications, automotive, high reliability, medical, and special aerospace applications.

The AVX Ceramic Division in Uherské Hradiště produces a wide range of passive component products, including multilayer ceramic capacitors, film capacitors, termistors, varistors, and power capacitors, and serves key customers from the computer, automotive, telecommunications, and as well as for industrial, military and space.

The AVX Interconnect Solutions Division in Bzenec focuses on interconnect solutions, which primarily consists of automotive, telecom, and memory connectors.

AVX Lanškroun

The history of AVX Lanškroun originated in 1991 when the former TESLA Lanškroun began subcontracting for AVX. Two years later, AVX Czech Republic s.r.o. was established in 1993. Today, the Lanškroun plant is a major employer in the Pardubice region and maintains about 900 working places. The Lanškroun plant is comprised of a team of experienced professionals that provides high-level technical, customer, and logistic support daily and contribute significantly to AVX's strong competitive position as a global leader in electronic components along with the advanced R&D team.

Since 1998, there have been many technological upgrades and innovations introduced by the R&D team, beginning with the high-temperature tantalum capacitors (up to 150°C) for automotive applications. Today's product ranges offer an extension of the

capacitors to 200°C in the surface mount style or 230°C as the hermetically sealed or Wet radial style option.

Another major achievement of AVX Lanškroun was the introduction of extremely stable performance capacitors based on niobium oxide (NbO) anode material instead of traditional tantalum. In 2004, the plant's capabilities were further extended to include conductive polymer technology. AVX is the first company to market several new polymer technologies, such as the highest voltage in the industry, over 100Vr (Elektra award 2010), the smallest case size 0603, the highest reliability polymer in hermetically sealed package for extended lifetimes (Elektra award 2015); and the highest energy density. AVX's product portfolio also expands on new ESA space qualification for low ESR polymer TCS series.

AVX is acting worldwide in various space programs, however on EU we have established supplier position for the European Space Agency (ESCC Generic Specification No. 3012), and offers surface mount tantalum capacitors, TAJ ESCC released 1993, TES ESCC released 2013 and polymer capacitors TCS ESCC, released in 2020.

During 2010 through 2013, hermetic packaging of conductive polymer capacitors from the TCH series was developed in cooperation with the European Space Agency (ESA) for space-level applications as a part of the Czech Incentive Program, and the ESCC specification is currently underway.

In cooperation with ESA, AVX offering new TAC microchip product range enabling to downsize tantalum capacitor case down to 0603. The space-oriented developments also provide design engineers with options to downsize, enabling significant reductions in both payload and physical space, which are extremely beneficial in aerospace applications.

SMD tantalum, niobium and conductive polymer capacitors, WET tantalum and special tantalum capacitors, ceramic capacitors, EMI filters

- **Space:** ESCC3012/001, ESCC3012/004, ESCC3012/006, T-level, SRC/SRW9000
- **Defense:** DSCC/DLA, COTS-Plus

Space Related Equipment, Labs & Certificates

- ESA qualified Lanškroun plant
- **Certificates:** IECQ-CECC, IATF 16949:2016, ISO 14001:2015, Sony Green Partner Award, ESCC 3012/001, ESCC3012/004, ESCC3012/006
- MIL-PRF-790

General description

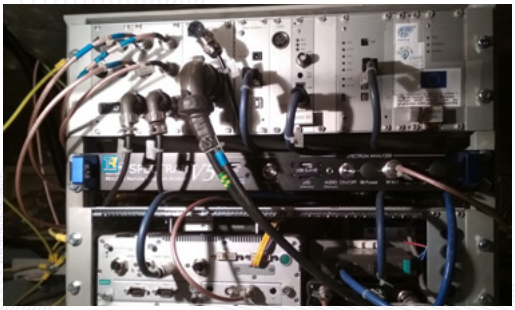
AŽD Praha, as a leading supplier of signalling systems and solutions to railway undertakings and railway infrastructure owners and managers, is highly motivated to provide its customers the most advanced systems and technologies, all developed and produced in its labs and factories. Besides the railway market, AŽD Praha serves also to road telematics, traffic control, property and personal security users and operators and, last but not least, manufactures and supplies also telecoms devices and systems. To achieve this goal, a vast range of research and development facilities are allocated in a number of AŽD Praha divisions and subsidiaries in the Czech Republic, Slovakia, Poland, Serbia and Bulgaria. These resources and staff are backed by a number of scientists in cooperating research institutes and universities in these countries. Expert knowledge of our staff is not limited just to signalling, control and telecommunications, but it spans a number of scientific disciplines from theory of safety codes, information and software theories used in safety critical systems, further to reliability theory, radio modulation theory, radio signal propagation and coverage analysis, EGNSS safety and dependability analyses, not to mention all. In addition to the hundreds of privately funded research and innovation projects completed in the course of our evolution to the leading railway signalling company, our R&D divisions have participated in many national and international research projects, mostly funded by national or European bodies, like the European Space Agency, European Commission, Czech Ministry of Transport, Technology Agency of the Czech Republic or Czech Ministry of Industry and Trade. Thanks to our knowledge base, R&I capabilities and reputation AŽD Praha became an Associated member of the Shift2Rail JU in 2015, even being a member of its Governing Board. Besides that, AŽD Praha experts are regular and active contributors to the research and standardization activities in several international institutions, associations and consortiums – UNIFE/UNISIG, CENELEC, ACRI, CAT, etc.

Competences & Capabilities

The majority of projects are focused to the complete applied research, innovation and development, validation and assessment of products which are then introduced into a production cycle. The state-of-the-art sample and serial production infrastructure allows us to manufacture prototypes ready to be tested and validated in our own company labs as well as in accredited labs anywhere in the world. Also projects with an innovation potential, not ready for market uptake, get interest and room in the company R&D labs or polygons, even at our own 2 rail test tracks in northern and eastern Bohemia.

Major Space Projects & References

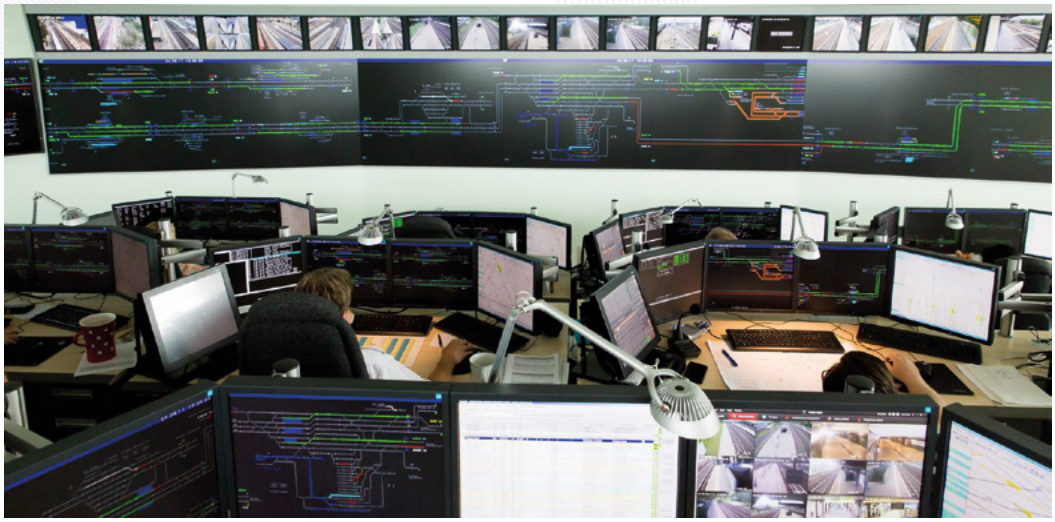
- „Train Integrated Safety Satellite System (3InSat) Demonstration Project", funded by ESA in the course of the IAP Programme (project Nr. 4000105788/12NL/ NR), 2012-2015
- „NGTC - Next Generation Train Control", funded by EC in the course of FP7 (project Nr. 605402), 2013- 2016,
- „RegioSAT – Enhancing railway safety on regional lines using satellite systems", funded by the Technology Agency of the Czech Republic (project Nr.TA01030124), 2014-2016
- „STARS - Satellite Technology for Advanced Railway Signalling" funded by EC in the H2020-Galileo-2015-1 call (project Nr. 687414), 2016-2018



- „X2Rail-2 - Enhancing railway signalling systems based on train satellite positioning, on-board safe train integrity, ..." a Shift2Rail member's project funded by EC in the H2020-S2RJU-2017 call (project Nr. 777465), 2017-2020
- "CArrier Phase RESiliencE (CAPRESE) – "Techniques Supporting Resilience for High-Integrity Train Control Applications", funded by ESA in the course of the NAVISP Programme (project Nr. NAVISP-EL1-017), 2018-2020
- "TrainLOC – Conditions for deploying train locators based on GNSS systems on the railway network", funded by the Technology Agency of the Czech Republic (project Nr. TIRSMD707), 2019-2022.
- „X2Rail-5 - Start-up activities for Advanced Signalling and Automation Systems" a Shift2Rail member's project funded by EC in the H2020-S2RJU-2020 call (project Nr. 101014520), 2020-2023

Space Related Equipment, Labs & Certificates

- GNSS SIS stationary and mobile test sets
- GNSS RF signal analyzers and recorders
- Measurement and test rail vehicle and train set
- Regional rail test tracks > 50 km
- Inertial systems test bed
- Odometry systems test bed
- Climatic and EMC test chamber



Industry
Manufacturing
Software
Services
R & D
Testing

AŽD Praha s.r.o.

AŽD Praha s.r.o.
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BBT – MATERIALS PROCESSING

Industry

Manufacturing

R & D

Testing

BBT-Materials Processing, s.r.o.

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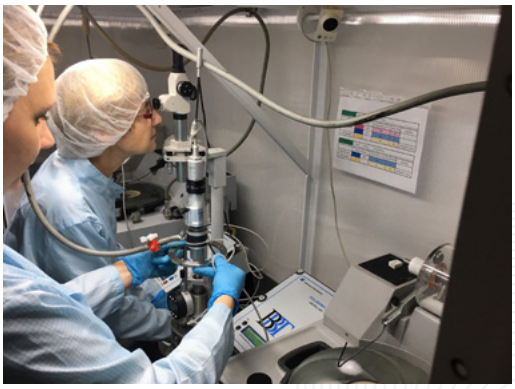


Processing laboratory

General Description

BBT-Materials Processing Ltd. is a private SME technological company dedicated to development and production of high-performance mid-IR polarization optics, phase delay components and acousto-optical substrates for a wide range of scientific and industrial applications.

The company is a worldwide leader in crystal growth and processing of high purity Calomel (mercurous chloride) crystals applied in mid-IR and thermal IR optics (laser polarization, beam attenuation, scientific systems, astronomy, etc.). The unique properties of this optical material make it a great candidate for manufacturing of different types of components such as polarizers, depolarizers, savart plates, beamsplitters, AO cells, birefringent components for interferometry and FTIR spectroscopy, custom substrates, and other optics applied from VIS to mid/TIR-IR spectral region.

Major Space Projects & References

- INTERKOSMOS – **MORAVA I**, **II** and **III** (1976-97) on board Salyut 6-Sojuz and MIR – material science.
- Space furnaces **CSK** and **TITUS** for MIR and FOTON.
- **TITUS MPP** Multi-Purpose Platform for ISS (International Space Station)
- **RIM-MIR**, **TES** and **TEST-TES**: A recalescence of Ag-Ge alloys on MIR using the CSK-1 furnace.
- **MIR'92** (1992-3), **EuroMIR'94** (1994-5), **EuroMIR'95** (1995-6), **GermanMIR 97** (1997), **MIR 99 – PERSEUS** (1999) - material experiments on MIR using the CSK-1 and TITUS.
- **DEMON** (2011-2014) Development of Quality Evaluation Methods for Calomel Optical Elements
- **NAOMI** (2010-12): New acousto-optic device based on calomel for hyperspectral imaging in space applications.
- **IAPETHOS** (2014-16): Infrared advanced polarizer for Space applications.
- **THETIS** (2016-17): TIR Hyperspectral Imager based on the Calomel AOTF (Acousto-Optical Tuneable Filter).
- **CALIOPE** (2018-2020) Calomel-based TIR optical AOTF breadboarding.
- **ECLIPSE** (2018-2020) Development and production of Calomel IR polarizer and testing in relevant environment.
- **IAPETHOS2** (2018-2021) Infrared Advanced Polarizers for Space and other Applications 2.
- Other projects within **KONTAKT**, **PRODEX**, **FP7**, **EUROSTARS** etc.
- **TWINS** (under preparation): Birefringent Fourier transform spectrometer for space applications

Calomel Glan Foucalt MIR polarizer.

Calomel Wollaston MIR polarizer.

Competences & Capabilities

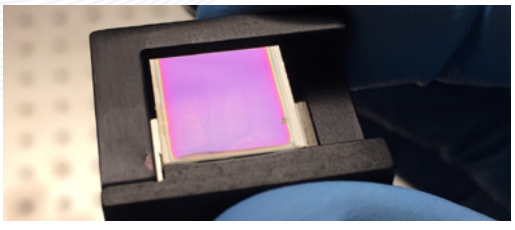
- Manufacturing of precision IR polarization optics
- Research and Development in optics
- Lapping and polishing services
- Quality assessment of optical products
- Optical inspection of the infrared components

BBT -Materials Processing Ltd. has a long-term experience in R&D activities in Crystal growth, Optics, Acousto-Optics, and relevant areas. The scientific team of BBT – Materials Processing, Ltd. participated as a prime- or subcontractor in series of technological contracts focused on the development of new optical and acousto-optical components for terrestrial and space use. These projects, usually in cooperation with international participants, have been supported by various national or non-government institutions and supporting programs incl. ESA, H2020, EUREKA, FP7 program and others.

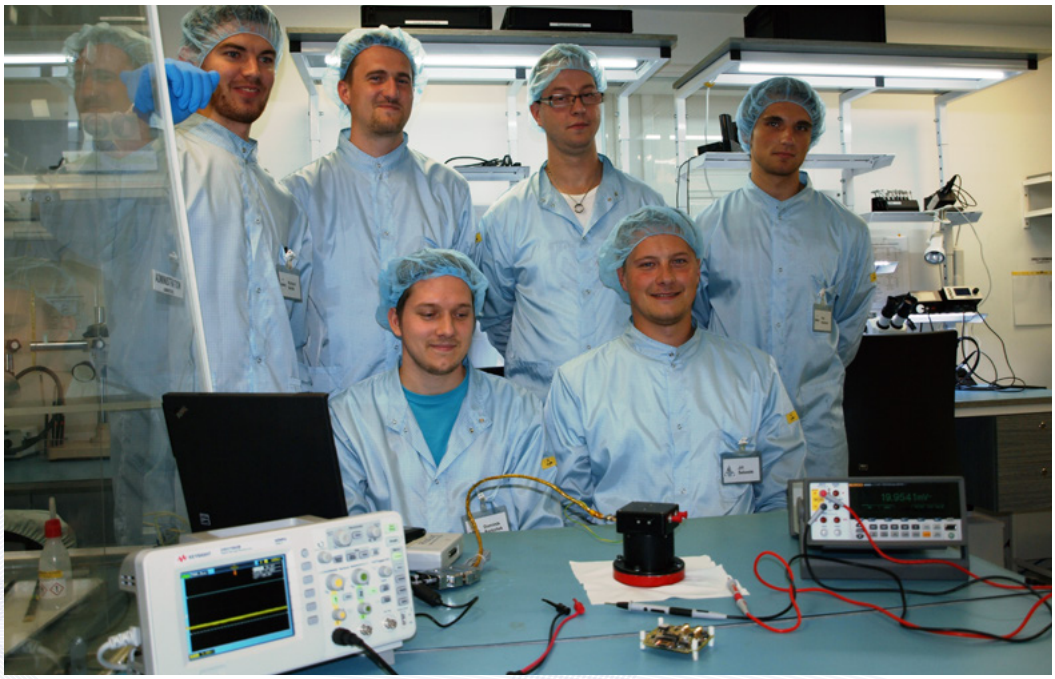
Space Related Equipment, Labs & Certificates

Crystal growth units (VPT method).
Crystal optics manufacturing.
HW for testing and quality evaluation of optical and acousto-optical components:

- conoscope
- Interferometer
- IR Spectrometer
- 2D HP imaging filter
- HP integral measurement
- Integral extinction ratio (VIS, IR)
- COHERENT 9,3μm CO_2 laser system (17W)
- Optical microscope
- Tyndall scattering
- 2D optical Fourier transform
- 2D depolarization imaging
- MTF/PSF



AR coated prisms



Industry

Manufacturing

Services

R & D

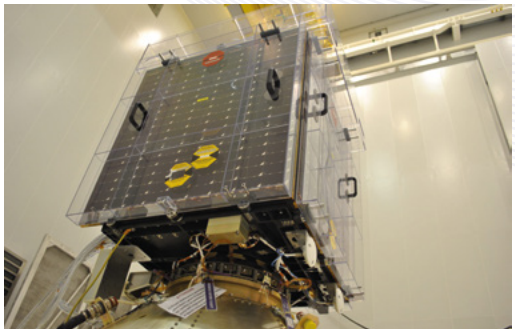
Testing

General Description

BD Sensors (BDS) is a privately owned company founded in 1993 to develop and produce pressure measurement instruments. Its sister companies are located in CZ, DE, RUS and China having around 300 employees world-wide. In 2013 BDS started an ESA project for space sensor to be applied in rocket engines. Merge of BDS and CSRC (Czech Space Research Center) realized in Nov 2017 resulted in BDS empowered with the "CSRC Space Division" having more then 20 years of "Space Heritage" in the field of complex realization of space electronics projects based on electronics & mechanics design, EGSE, embedded software and cleanroom manufacturing. CSRC main power consists in the long-lasting practice proven by a series of successfully operating instruments in various ESA satellites. Having implemented the ESA ECSS standards related to the electronics design and cleanroom manufacturing activities including regular ESA industrial audits makes BDS and attractive business partner for the whole space and aerospace industry.

Major Space Projects & References

- Satellite INTEGRAL, PSAC Project (launched)
- Satellite SMART-1, EPDP Project (launched)
- Satellite DEMETER, I/V Converter Project (launched)
- Satellite PROBA 2, DSLP&TPMU Project (launched)
- Satellites SWARM/TEASER, MAC (launched)
- Satellites PROBA V, SATRAM (launched)
- ISS / ACES - European Laser Timing Instrument (ELT)
- Solar Orbiter – PWR for the RPW & STIX Instruments
- SABIP - Space Based ADS-B Payload Development
- SUPCAPS - Banks of Supercapacitors for Space
- ELISA - Laser Head, PWR and Modulator Driver
- EUCLID - SVM Electrical Simulator and EGSE
- METOP SG - 3MI, Filter Wheel Controller
- NEOSAT - Thermal Test Benches, Thermal-vacuum
- JUICE - APME Manufacturing and Testing



Competences & Capabilities

- Space Electronics Design and Manufacturing
- EGSE Design and Manufacturing
- Space Mechanics Design and Manufacturing
- Titanium SAPT for Space, Pressure Sensors
- Harness & Cabling Manufacturing and Testing

Digital & analog circuits, microcontrollers, signal processors, FPGA, VHDL, simulations and analysis, PCB layout, functional tests, power supply, data processing units, controllers.

The MAIT activities include ESA qualified PCB hand-soldering assembly, unit integration and functional testing. The application areas include space, military and industrial electronics. The model philosophy covers BB, E(Q)M, PFM, FM. The assembly & inspection activities performed by the ECSS qualified staff in the 100.000 class cleanroom, ESA approved SMT Verification Programme according to ECSS-Q-ST-70-038.

Space Related Equipment, Labs & Certificates

- Validated Cleanroom (cl.100 and 100 000), 170m^2 + 40m^2
- Industry electronics assembly & integration premises
- Certified Cleanroom Staff according to:
  - ✔ ECSS-Q-ST-70-08
  - ✔ ECSS-Q-ST-70-38
  - ✔ ECSS-Q-ST-70-26
  - ✔ ECSS-Q-ST-70-28
- ESA SMT Verification Programme ECSS-Q-ST-70-038
- Space electronics manufacturing processes
- ESA Industrial Rates Audits
- Certificate ISO9001:2008

BD SENSORS s.r.o.,

CSRC Space Division

Member of the Czech Space Alliance

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BizGarden

Industry

R & D

Services

Software

BizGarden s.r.o.

General Description

BizGarden s.r.o. is a private non-profit research organisation. Since its foundation in 2010, the company is focused especially on mobile services, utilisation of space technologies and signals in downstream applications and support of space downstream community.

Our main focus is on business model generation and market research, internationalisation and networking.

BizGarden is supporting young entrepreneurs and startups and is running a small co-working space (www.koplac.cz) which is used as a lab for new innovations and a place where ambitious young people from all over the world meet and work on their projects and new ideas.

We are members of StartupWeekends organizers community. The SWB#4 in 2019 was part of Czech Space Week and was focused on Space enabled or focused startups. Two startups initiated during this event are actually in operation (https://farmtospace.com and https://gardenauts.cz)

We also have a broad knowledge on H2020 and ESA project and business development, document and project preparation and administration.

Competences & Capabilities

BizGarden is specialised in non-technical research and innovation focused on market potential, business model generation and opportunities assessment for space technologies and services, design, development and market roll out of business models. We perform this research on international, national, regional and corporate levels.

Major Space Projects & References

- European Satellite Navigation Competition, Czech Award. (reference: Ministry of Transport CZ, Anwendungszentrum GmbH, Oberpfaffenhofen - Germany) - 2011-2014.
- EMMIA (reference: DG Enterprise and Industry, bavAIRia e.V. - Germany) 2011-2014
- Safety and Information Services for Ski Resorts in Emerging Markets - prime contractor on Feasibility Study within ESA ARTES 20 programme Integrated Applications Promotion. 2013-2015 https://artes-apps.esa.int/projects/sis-srem-fs

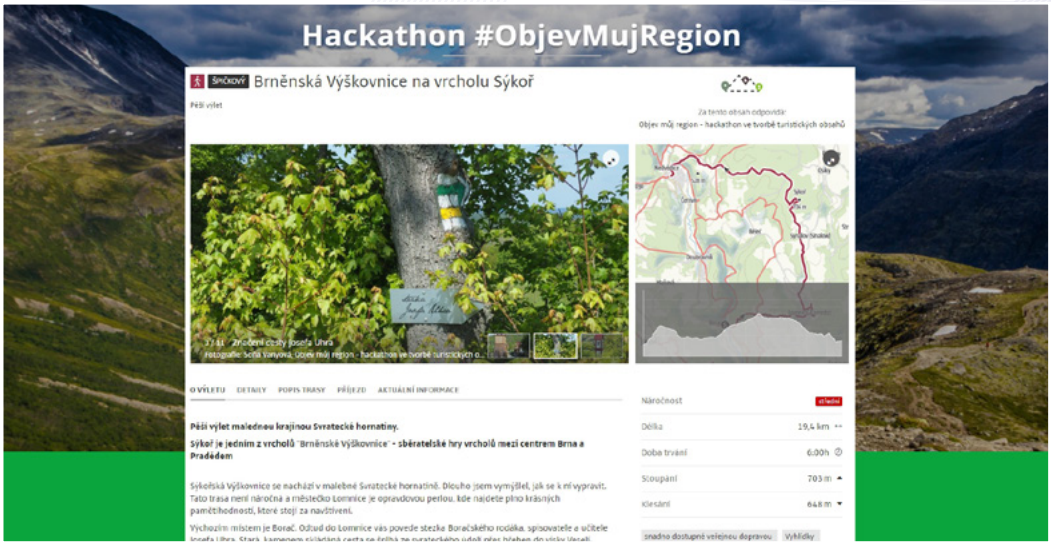
- SIS-SREM – Demonstration project within ESA ARTES 20 programme, Integrated Applications Promotion. 2015-2016 https://artes-apps.esa.int/projects/sis-srem
- Spin-off of SIS-SREM project Alpdest CEE, s.r.o. (founded 2015)
- AUDROS - Autonomous drone services in the CBRNE operations with ESA ARTES AIP programme, Feasibility Study 2018 - 2019, https://business.esa.int/projects/audros
- Spin-off of AUDROS project DRONHUB INNOVATIONS Sp. z o. o., https://dronhub.eu (Founded 2019)
- EDA Published information about the AUDROS project (http://www.eda.europa.eu/info-hub/press-centre/latest-news/2020/08/07/joint-eda-esa-audros-project-edges-closer-to-demonstration)

The year 2020 was specific and as many companies, our activities have been influenced by the global SARS-CoV-2 (Covid) pandemy. BizGarden did not stop its activities during this year. We did work on the preparation of the AUDROS Demonstration project and were able to negotiate and sign the contract before the end ot the year 2020.

AUDROS
AUTONOMOUS DRONE SYSTEMS

Spin-off company Dronhub Innovations Sp. z o.o. received the first private equity investment after several months of negotiations with two private investors.

BizGarden also initiated the setup of Digital Innovation Hub Tourism 4.0 (https://www.t40.cz) which aim is to support digital transfromation in the travel industry in central Europe. Space technologies and space signals play a significant role in digital transfromation of the industry which is the most affected industry by the global SARS-CoV-2 (Covid) pandemy.



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CGI

Industry

R & D

Services

Testing

Software

CGI IT Czech Republic s.r.o.

General description

Founded in 1976, CGI is among the largest IT and business consulting services firms in the world. Operating in hundreds of locations across the globe, CGI delivers end-to-end capabilities, from strategic IT and business consulting to systems integration, managed IT and business process services and intellectual property solutions, helping clients achieve their goals, including becoming customer-centric digital enterprises. CGI works with clients around the world through a unique client proximity and best-fit global delivery model to accelerate their digital transformation, ensure on-time, within budget delivery, and drive competitive advantage in today's increasingly digital world. CGI Czech Republic has more than 800 specialists in Prague, Brno, Pilsen, and Ostrava.

Competences & Capabilities

We are a long-term supplier of the various parts of the Galileo system provided at European level. With the European Space Agency (ESA) or the European GNSS Agency (GSA), CGI cooperates on major projects. In the Galileo program, CGI participated as the main contractor of the ground segment design, participated in the development of the control system of the orbiting satellites deployment and continued on other sub-projects. Notably, CGI is the largest independent supplier of security systems for Europe's Galileo satellite navigation program and European leader in military satellite communications.

CGI IT Czech Republic s.r.o. (CGI CZ) has been active in GNSS systems since 2009 and already has significant contracts in its project portfolio with regard to Galileo Public Regulated Service and other GNSS systems. The company is also active in the Earth Observation and is working on an on-going development of an Earth Observation Monitoring platform for monitoring of vast areas with a focus on infrastructure operators. Through these long-standing client relationships and our dedicated practice of space and satellite experts, we have earned a reputation for solving technically difficult software challenges with secure solutions, delivered on time and proven to work every time.

Major Space Projects & References

- Galileo Public Regulated Service (PRS) Pilot project in the Czech Republic
- Galileo PRS CPA Feasibility Analysis for Slovakian Ministry of Transport
- „Le Cross", improving safety at rail level crossings by using GNSS Technologies (together with CGI UK, CGI FI and Finnish research institute VTT)
- Participation on various projects for GSA (cooperation with CGI UK)
- Participation on a project related to Copernicus (cooperation with CGI UK)
- The Categorization of Threats to the Galileo Open Service and Measures to Mitigate them for the Ministry of the Interior
- Galileo PRS Information Distribution System for the National Security Authority
- Project EDRS Globe – European Data Relay System (cooperation with CGI NL)
- Security Support Contract for the GSA
- ESA InCubed: EO AUTOMOP (CGI SatSight): Earth Observation Monitoring Platform
- ESA Earth Observation Video Exploitation Platform (cooperation with CGI IT)

Space Related Equipment, Labs & Certificates

- Certificates:
  - ISO 9001:2015 & TickIT
  - ISO 14001:2015
  - ISO 20000- 1:2011
  - ISO/IEC 27001:2013
- GSA Security Accreditation Board – PRS Support
- NSA "Secret" and "Confidential" Clearance including certified IS

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Industry

R & D

Services

Software

CleverFarm, a.s. (Member of the CleverMaps family)

General Description

CleverFarm addresses the challenge of helping to feed fast growing global population while the amount of available land for farming is reducing.

In order to achieve materiel savings and yield increase, CleverFarm utilize in its unique way satellite data by long term historical analysis and continuous remote field scouting bolstered with IoT sensors and engaging analytics using artificial intelligence.

Competences & Capabilities

In the domain of satellite data processing, we have created the crop model allowing us determine the real biophysical conditions of the plants anywhere on the earth and further expand the services in precise crop nutrition, yield estimation and early warnings of crop damages caused by human and natural conditions.

In other words, we show them what is happening on their fields, before it become physically visible.

Most of the competitors use the basic vegetation indexes which are limited in the quality of the information provided, we combines in situ observation with mobile laboratory analysis and using machine learning allowing us to determine real plant conditions such as biomass volume, chlorophyll and water content.

Another service of using satellite data is providing farmers analysis of 20 years satellite data history to identify what crops they should grow to achieve the highest possible yields.

And we do this while lowering their original resources.

CleverFarm bolsters this historic data with IoT sensors - providing realtime information about the humidity, temperature, soil moisture and other critical information to improve crop yields.

Farmers are able to use this data to predict pests and diseases in crops prior to an outbreak - allowing for them to apply pesticides only when needed.

Major Space Projects & References

- 350 paying customers(agriculture subjects) in the application
- Having 9 partners around the world to expand our products
- Cooperation with one of the leader in agriculture Syngenta
- Scalability in different segments like city greens and golf courses

CleverFarm - data-based farm management. #Foodsafety

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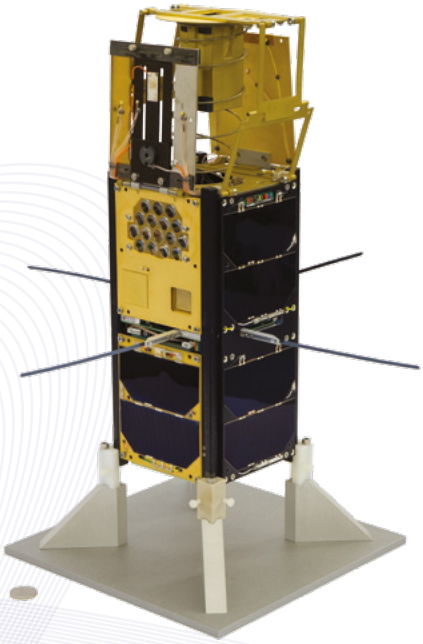
General Description

Czech Aerospace Research Centre (VZLU) (established 1922) is a national center for research, development and testing in aeronautics and space. Its mission is to provide scientific support and create innovative solutions that can be applied in industry.

We are strong at: satellite equipment, aerodynamics, structure strength and durability, material and corrosion engineering, composite materials and technologies.



Industry

R & D

Design

Testing

Competences & Capabilities

- Design and manufacturing of composite structures for aerospace
- Engineering work:
  - ✔ FEM analyses and calculations
  - ✔ Aeroelasticity, modal analyses, flutter analyses including wind tunnel experiments
  - ✔ CFD and FEM coupling, special CFD codes development
  - ✔ Analysis of flight characteristics of suborbital space vehicle incl. descent flight
- Design and integration of nanosatellites (Cubesats) – validation of new technologies in space (IOD)
- Structural testing - from material tests, coupons up to full scale structural tests (static/fatigue)
- Mechanical testing - vibration, centrifugal tests (max. 50kg, up to 25g), shock (10000 gSRS)
- Environmental testing - Thermo-vacuum chamber (1m^3, -80°C - +150 °C, 10-4 Pa)
- Consulting services in quality assurance and implementation of ESA standards
- Development and production of scientific instruments and electronic devices for space application (provided by Serenum company – a subsidiary of VZLU)

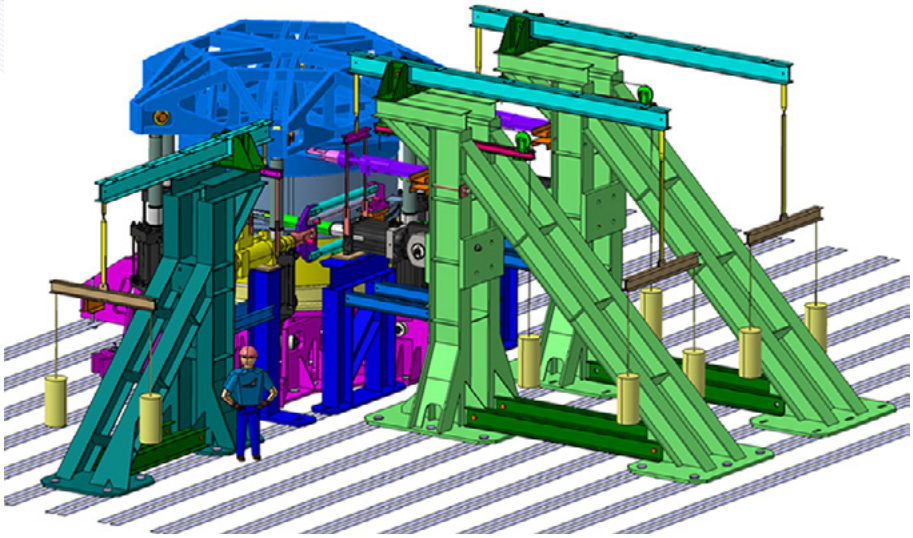
Major Space Projects & References

- **ARIANE 6** - Strength analyses and testing of booster structural parts, cooperation with MT Aerospace. (2018-2020)
- **VZLUSAT1** mission - Experimental verification of space products and technologies on nanosatellite, project is linked to European QB50 project - network of 50 CubeSats for multi-point, in-situ measurements in the lower thermosphere and the re-entry research.
- **SWARM** - Project supported by ESA with EADS Astrium (now Aribus Defence and Space) as prime contractor. Within the project one engineering model and three flight units of capacitive microacelerometer including ground segment equipment have been delivered for three satellites of the SWARM mission (2005 -2011).
- **PROBA-3** - ESA technology project. Front door assembly design, project management and PA of Optical Objective Assembly for ASPIICS coronagraph (2011 - 2013)
- **VTI-FLUTTER** - TAS-I (2011-2013) - local aeroelasticity research of a launcher, contract within ESA CUST1.2 FLPP program. Design, CFD and flutter calculations and wind tunnel experiments.
- **EUCLID** - Design, Manufacturing and Qualification of mechanical elements for EUCLID (ITT/AO/1-7628) (2014-2016): Panel design, development and qualification tests
- **X-Ray** - Wide System for X-ray imaging detector Timepix

Space Related Equipment, Labs & Certificates

- Clean room ISO 8 (100 000)
- Clean room ISO 6 (1000)
- Thermo-vacuum chamber (1m^3, -80°C - +150 °C, 10-4 Pa)
- Shock Table (10000 gSRS)
- Shaker (max. weight of the specimen under test 350 kg, usable frequency range 1 – 3000 Hz, peak sine force 22,2 kN, max. RMS random force 22,2 kN, peak shock force 66,7 kN, max. velocity 2 m.s^{-1}, max. acceleration 600 m.s^{-2})

Czech Aerospace Research Centre – VZLU a.s.



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daiteq

Industry

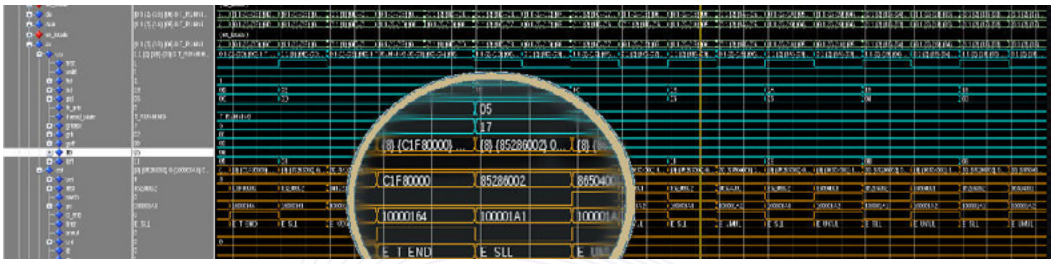
R & D

Services

Testing

Software

daiteq s.r.o.



General description

daiteq provides arithmetic extensions for optimal computation of software-defined radio algorithms and image processing algorithms in LEON processors. Our developments cover floating-point as well as fixed-point arithmetic.

For floating-point processing in LEON processors we provide a highly configurable floating-point unit that supports all common floating-point precisions as defined in the latest IEEE 754 (2019) standard, and in addition packed floating-point formats. If needed, the FPU can be configured to an arbitrary precision before synthesis.

For fixed-point processing in LEON processors we provide custom integer ALU that supports SIMD-within-a-register operations, denoted as SWAR, that are beneficial for GNSS processing as well as audio/video processing, such as vector correlation, demodulation, addition, subtraction and multiplication for vectors of data stored in a single integer register.

Application programs can make use of our extensions through new data types that can be defined in C programs, and compiled with a LLVM compiler with daiteq extensions.

Technology demos are available for the Xilinx, Microchip and NanoXplore FPGAs.

Competences & Capabilities

SWAR extensions for LEON2-FT
The SIMD-within-a-register (SWAR) arithmetic extensions are targeted towards fixed-point applications that work with sub-word precision, e.g. 3 bits (in LEON2 1 word consists of 32 bits), such as satellite navigation applications or data encryption; the performance of the processor can be increased through an implementation of SIMD-like operations on variables that are stored alongside in one 32-bit word, thus sharing the data-path circuitry for two or more operations executed in one clock cycle.

At present six SWAR modules are available for LEON2-FT. Three application-specific modules are meant to accelerate GNSS processing, namely correlation and demodulation of GNSS signals and sine/cosine lookup. Three more generic modules accelerate applications that work with up to 16-bit numbers and use mostly addition, subtraction and multiplication, such as audio or video processing.

daiFPU
The daiteq FPU (daiFPU) is an IEEE Std. 754 (2019) compliant floating-point unit, designed primarily for LEON processors as a replacement of the former Meiko FPU. The daiFPU supports binary64, binary32, binary16 formats and their combinations, including full hardware support for subnormal numbers.

The daiFPU is targeted to providing flexibility for the FPGA and ASIC technology used in satellite navigation and image processing applications. The key advantage is the ability to increase the actual functional density of the silicon used on board of satellites in the context of the actual on-board computations. This is done through allowing the user to parameterize the FPU at the synthesis time in a way to ensure the correct function of the application while not using more resources than necessary. Classical FPUs used for example with the LEON processors are based on fixed data bus widths of 32 or 64 bits, often in situations where a reduced precision would be sufficient (e.g. 16 bits), also with operations that may not be used in their application. With the daiFPU the user can select seven major configurations at the synthesis time that support individual floating-point formats, their combinations, or packed floating-point formats. For each major configuration the user can specify whether floating-point division and square root should be supported.

Packed operations are supported in some daiFPU configurations. They are defined for pairs of floating-point values stored in a single register (for two half-precision values stored in one single-precision floating-point register), or in a register pair of two consecutive registers (for two single-precision values stored in a pair of even-odd single-precision registers). Besides common SIMD processing on pairs of values new floating-point instructions have been implemented that support implementation of complex floating arithmetic for the packed formats.

Software toolchain
The LEON2 extensions provided by daiteq are complemented by a software toolchain based on extended binutils and llvm. The extended binutils introduce new assembler instructions and machine operation codes for half precision floating- point operations, packed floating-point operations and SWAR operations. The modified llvm compiler introduces a new half-precision (binary16) floating point type, and allows users to define half- or single-precision (binary32) data types that form two-element vectors, targeting the packed-format daiFPU configurations. For the SWAR types the llvm compiler allows users to define new sub-32 bit integer types that can form arrays; these arrays

are automatically partitioned and mapped to individual SWAR operations that work with 32-bit SWAR values.

LEON in NanoXplore FPGAs
daiteq has developed a new technology mapping library for LEON processors that provides adaptation to the NanoXplore NG-Medium FPGAs. The new library has been validated through a number of LEON2-FT designs executed in the NanoXplore DK625 Version 2 development kit.

Design services
Design and implementation of LEON-based systems in FPGAs, targeting Xilinx, MicroSemi, NanoXplore. Floating-point computations. Support for GNSS processing in LEON2-FT. Hardware accelerators for image processing applications and other data-parallel applications. Design of FPGA-based controllers. Independent benchmarking of performance of embedded processors and systems.

Major Space Projects & References

TRP/ITI: Multi-threaded processor for space applications. The project resulted in two major achievements: 1. Implementation of a multi-threaded single-core prototype LEON2-MT processor in the FPGA technology, and its evaluation in terms of computing throughput and resource requirements compared to LEON2-FT. 2. Extended evaluation of the micro-threaded programming model. Parts of a representative payload application were implemented in a C language extended with new thread management language constructs similar to CUDA and profiled in hardware.

GSTP: ESA IP core extensions. Two extensions for the LEON2-FT processor – a configurable floating-point unit, and configurable instruction set extensions – focus on increasing the applicability of LEON2 to areas that are sensitive to power consumption as well as manufacturing cost of the device; these are namely space-related and consumer applications. Through an explicit support of flexibility in the manufactured device it is possible to further increase the efficiency of the user computation, visible through increased computation throughput, decreased power consumption and increased reuse value of designs. The activity has delivered custom-designed hardware extensions for LEON2-FT as well as software extensions for the LLVM compiler. The extensions have been validated through execution and profiling of core parts of a GNSS positioning algorithm. In the next phase the extensions will be ported to the NOEL-V (RISC-V) processor from Cobham Gaisler.

METOP SG: Design review of the 3MI Filter Wheel Controller Design.

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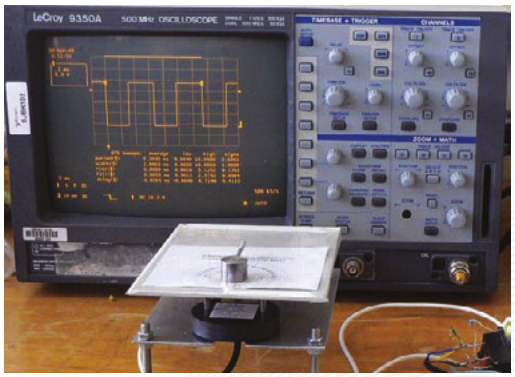


General description

EGGO Space offers a wide range of services and expertise including testing of EEE components, Industrial Screen-printing&Recycling of contaminated substances.

EGGO Test House benefits from a vast experience in testing electrical mechanical and life properties of electronic components as well as hzbrid integrated circuits and their applications.

The main range of Test Laboratorys activities consists of climatic, mechanical and Life time testing of components, parts and materials as well as interpretation and processing of results and defect analyses for electrical engineering and related industries. These tests serve customers from various industries including electrical, automotive and aerospace.

The organization and Test Laboratory procedures comply with the provisions of the European Standard ČSN EN ISO/IEC 17 025. The Test Laboratory was awarded the statute of a certified subcontractor for Electrotechnical Testing Institute, Prague.

One of the main activities of EGGO Test House is to provide support services in development or qualification for space devices or components as defined in fields of activity of the Czech National Space Plan, chapter 5.5- Devices and Components and Flight Hardware.

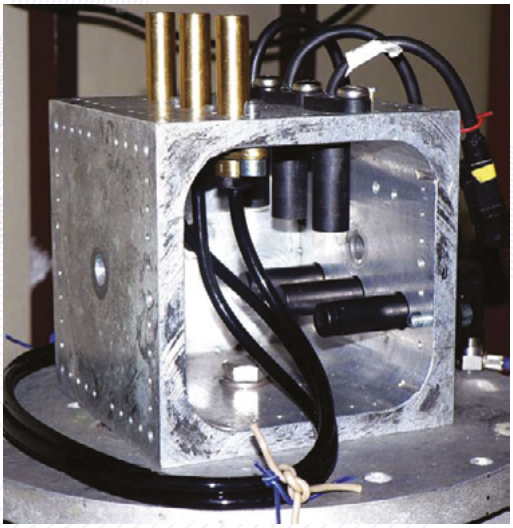
EGGO became a member of the Czech Space Alliance at the start of 2011.

Competences & Capabilities

- Reliability testing
- Failure analysis
- Temperature/ humidity stress
- Mechanical stress, solderability
- Non-linearity measurements
- Corrosion test
- Evaluation testing of passive components (Supercapacitors, Tantalum capacitors, Resistors, Relays) as per ESCC standards (ESCC 2263000)
- Designing and manufacturing of electronic devices for special purpose machinery&test measuring equipment.

Major Space Projects & References

- Reliability Testing of AVX low ESR Tantalum capacitors types TPS and TPM for AVX/CNES project
- Contract no: 400010504/10/NL/PA- Low ESR Tantalum Capacitor Evaluation and Qualification . Contractor: AVX Corporation- Tantalum division, Subcontractor: EGGO Space s.r.o- responsible for the Evaluation of Tantalum Capacitors phase
- Contract no: 4000103977/11/NL/Cbi- Development of Test Facility Dedicated to Passives Components (The project was selected under the CZ industry incentive scheme by ESA&CZ government). Contractor: EGGO Space s.r.o
- Contract No. 4000105661/12/NL/NR ARTES 5.1 Evaluation of Supercapacitors and Impacts at system level. Contractor: EGGO Space s.r.o
- Contract No. 4000111435/14/NL/WE High Density Connector Suitability for Space Application ARTES 5.1. Contractor: EGGO Space s.r.o

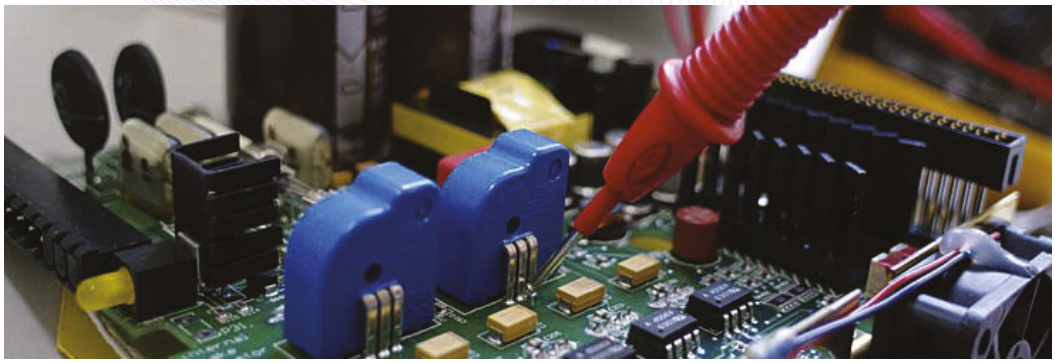


Further projects:

- Measure maximum rating of components (physical limit)
- Identify limit of current technology and evaluate new technology for high vibration and shock
- Determine derating of components

Space Related Equipment, Labs & Certificates

- Testhouse with large portfolio of the Test equipment including: Thermal chambers, Vibration apparatus, mechanical shock apparatus. etc
- ISO 9001:2009
- ISO 14001:2005



Industry

Testing

EGGO SPACE s.r.o.

Member of the Czech Space Alliance

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Industry

R & D

Services

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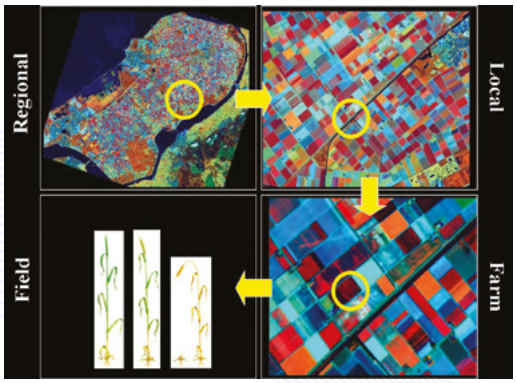
General description

The company EKOTOXA s.r.o. is an expertise, research and consultancy centre providing services for rural development, water management, agriculture, forestry, environment, regional development and spatial planning. Most of company'sactivities are carried out on the interface of the mentioned areas. The company was founded 1990 and at present its staff consists of about 45 employees and several external co-operators. The company operates within the Czech Republic as well as in several foreign countries. Between most signicant Czech clients belong besides Ministry of Agriculture, Ministry of Environment, regional authorities, municipalities and research institutions. Key international clients are European GNSS Supervisory Authority (GSA), Ministries of Agriculture and Paying Agencies of several EU member and candidate countries (Slovakia,Hungary, Romania, Turkey, Croatia, and Macedonia). EKOTOXA has participated in several international projects of the EU programmes (INTERREG IIIB, PHARE, MEDA, IPA, 6th and 7th FP).

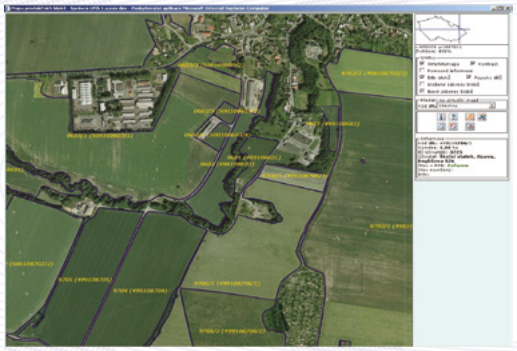
Competences & Capabilities

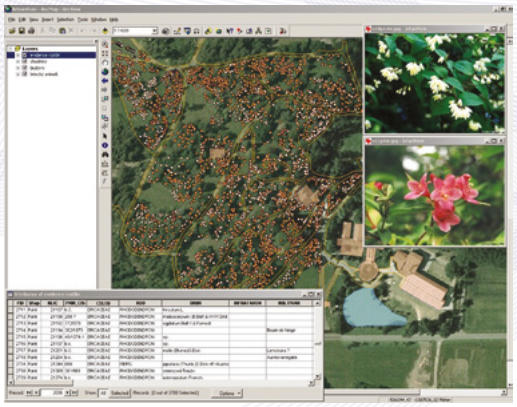
- Complex land consolidations
- Proposals of flood prevention measures in landscape
- Landscape assessment with emphasis on agriculture, land use and water management
- Conceptual documents in the sphere of rural development and nature conservation
- Environmental studies and monitoring
- Research project
- Statistical and map analysis defined by the demand of regional policy
- Analysis and studies on agriculture and agri-environmental measures
- GIS and IT solutions
- Elaboration of applications for subsidies from operational programmes on behalf of municipalities and LAGs
- Participation on the evaluation of programme document (HRDP) for MoA CR
- Promotion of regional sights by smart guide
- Co-ordination of integrated projects
- Seminars and consultations



Major Space Projects & References

FieldFact (GJU 06/2412/CTR/FieldFact): "Introduction and Promotion of GNSS in the agricultural sector", 2006 – 2008. Project partners: ALTERRA (NL), JRC (EU), VEXCEL (NL), UWM (PL), PPO (NL). Mission of the project was to investigate the potential and application of the Galileo for agriculture and agricultural user community using critical analysis of GNSS use in agriculture, demonstration actions showing new opportunities with Galileo and promotion GNNS and Galileo (GNSS-2) activities on agricultural fairs and field events.

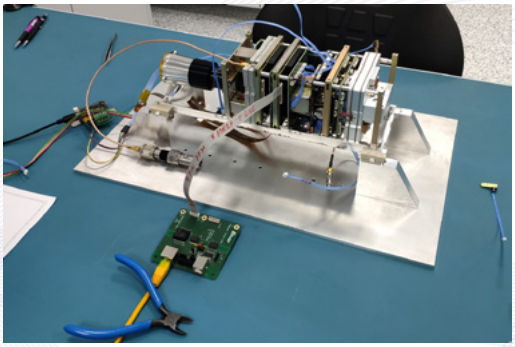




UNIFARM (Nr. 287206): "GNSS User forum on Navigation based Innovation for Farmers", 2012 - 2014. Project coordinates a user forum of GNSS technology agricultural users to express and defend the needs in the development of GNSS applications and services. It also serves as a new dissemination channel to increase awareness.

General description

Eltvor Instruments, s.r.o. (Eltvor) is a startup company founded by three HW&SW design engineers who worked together on number of time&frequency R&D projects in the past. The Eltvor company was started with the mission to continue with the time&frequency products development, especially for industrial customers. Besides government and scientific users, Eltvor long-term strategy is to provide time-as-a-service for critical infrastructure, independent of GNSS. Eltvor also offers custom instrument development in electronics&photonics with cutting-edge performance for both terrestrial and space segments.



An upload of flight software to the satellite (August 2020) with Eltvor EGSE.

Competences & Capabilities

The time&frequency products are based on the system block IPs (Intellectual Property) such as offset phase/frequency generation, micro-stepping and measurement. Eltvor ongoing development is targeting a laser Doppler instrument intended for industrial metrology and a simple multichannel time event meter mainly for quantum optics applications.

Another Eltvor IP, namely compact camera HW&SW, proved handy in the course of VZLU's VZLUSAT2 CubeSat development: it was donated by Eltvor to form this satellite's main payload, replacing less suitable and less mature solution. The Eltvor team re-designed, manufactured and programmed a dual camera and tailored it for the VZLUSAT2 in a 4 months time span, awaiting launch of the satellite at the time of writing.

The core strength of Eltvor team is in signal processing design and FPGA as well as CPU implementation, time&frequency measurement, RF system design and generic embedded computing centered mostly around C, Linux, FPGAs (namely Zynq and Microchip/Actel), and numerical prototyping and batch processing in Julia.

Eltvor members originated in the past decade a unique design of ground-station satellite time-transfer modem deployed in several pieces to support accurate time dissemination in frame of operational satellite navigation system. Eltvor builds on this experience in the modem project mentioned below, but also in the internal R&D preparing future spaceborne RF systems. Current Eltvor's portfolio of proven technology contains a microwave transparent (bent-pipe) transponder, as well as DVB-S2 transmitter.

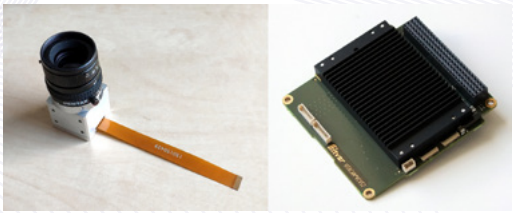
Major Space Projects & References

Eltvor has designed and programmed the main payload of VZLUSAT2 satellite: two cameras (HW&SW) for Earth observation. The control computer board made by Eltvor for the cameras was re-used once more on board of the same satellite to serve in another payload: the X-ray imaging detector.

Currently, Eltvor is working on Digital Modem for Two-Way Satellite Time Transfer in the frame of ESA NAVISP program. The goal of the proposed project is to develop a modem for Two-Way Satellite Time and Frequency Transfer (TWSTFT), based on a fully digital implementation, challenging the current state-of-art performance, and finished to allow small series industrial production and operation requirements.

The Eltvor core team worked in the leading engineering roles on several ESA projects in the past. The R&D projects covered comparison of optical time-transfer links for GNSS (link model, demonstrator and measurement campaign), optimal clock ensembling algorithms (based on Kalman filter with robust C language implementation), and manufacturing of a portable timing device.

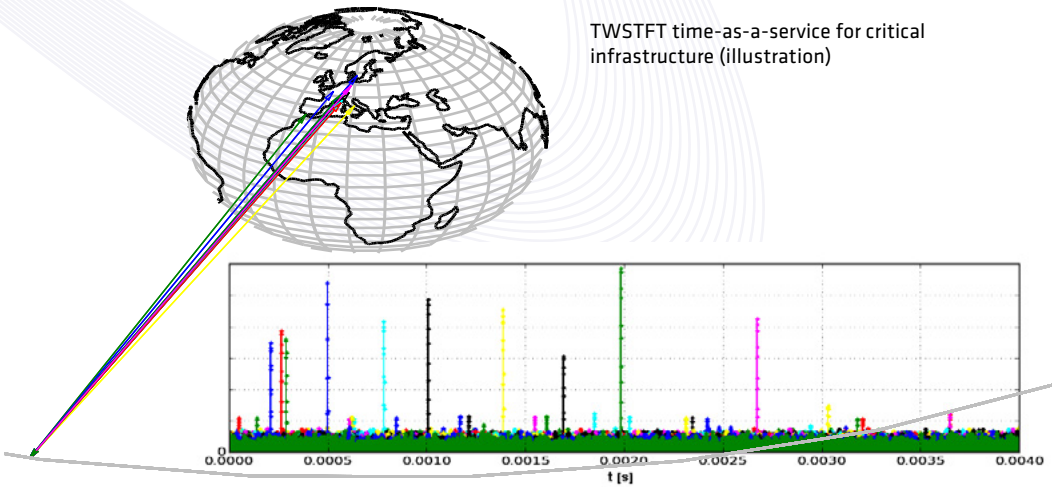
Space Related Equipment,



Eltvor's CubeSat Earth observation camera module Vitacam/vcam1m3

Labs & Certificates

Eltvor uses open-source flow for software (C, Linux kernel, u-boot and Julia) and hardware (KiCad for PCB design) development. For FPGA development, Eltvor uses both Xilinx proprietary (Vivado) as well as open-source (GHDL) tools and IP blocks. These tools were approved during development of CubeSat FM space equipment currently being prepared for a launch. Eltvor also possesses standard equipment for electronics instrument prototyping, small series production and characterization such as spectrum analyser, high-speed oscilloscopes, power supplies, soldering stations, etc.



TWSTFT time-as-a-service for critical infrastructure (illustration)

Industry

Manufacturing

R & D

Services

Software

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Industry

Manufacturing

R & D

Testing

Software

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Czech Space Alliance

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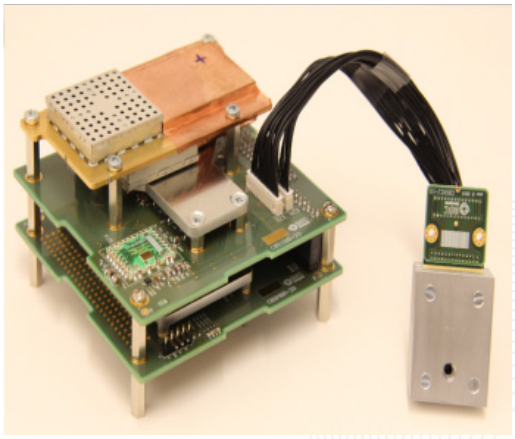


General description

esc Aerospace is an agile product neutral systems integrator with the depth of experience. The size, low overhead, extensive solutions partnerships and global reach enable to meet the highest complexity technological challenges and meet our clients´ needs with best value solutions.

esc Aerospace is as a software & hardware producer, also active in a field of innovative R&D aerospace projects with focus on space qualified on-board control systems, RPAS/UAV, Navigation etc

Competences & Capabilities

esc Aerospace´s main areas of activities include Space Systems & Applications, Cyber Security & Systems, Full Service UAS Integration.

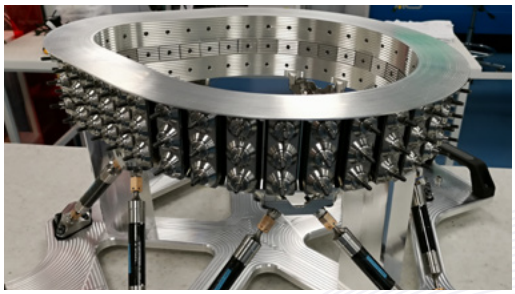
- On-board systems: Qualified flight software, Avionics & On-board Computer (OBC), Radiation monitor & sensor systems (Ionizing radiation hardened detector payloads)
- Applications: Secure & resilient communications leveraging SATCOM, Data analysis
- Test systems (EGSE/SCOE)
- Technologies (Concept, PoC & impl.): Network (Firewall, IDS, IPS...), Endpoint (VM, AV, exploit prevention), Information Security (DPL, Data Privacy)
- Counter UAS, Multi Service Aerial Platform, Mission Mgt. System, UAS Traffic Mgt. Integration.

Major Space Projects & References

- Spacepix – radiation monitor & revolutionary ASIC designed for wide range of space radiation measurements
- 5 generations of RPAS/UAS avionics – VTOL, microUAS, LMAMS
- Solar Orbiter – STIX Instrument On-board Software: Solar Orbiter Mission STIX instrument – space qualified flight software (PRODEX)
- Meteosat Third Generation (MTG) – payload modeling for DCS & GEOSAR
- SWARM – Microaccelerometer instrument: space qualified flight software, Criticality level "Mission critical", EGSE software
- R&D projects
  - OSRAp: On-board software reference architecture for payloads (GSTP)
  - OBCP-BB: Space qualified flight software. Requirements and I/F definition for future OBCP Building Block. Future modular reusable/reference on-board SW architecture, the on-board control procedures engine (GSTP)
  - OBSW-RAC: Space qualified flight software: On-board software reference architecture consolidation. On-board software reuse in a systematic manner, following activities CorDeT and Domeng (GSTP)
- SENTINEL-4 Performance Assessment Tool for the S4/UVN Instrument (EOEP)
- Demise Observation Capsule Flight SW, EGSE HW & SW (FLPP3 – Future Launchers Preparatory Programme)
- CORONAS-Photon Solar Mission Soft X-ray Instrument for SphinX project
- ANTARES IRIS: Baseline Satellite Payload Emulator. Analysing requirements and defining high-level System Options of new Air-Ground communication system for ATM (ARTES10)
- ARCA – S&A Collision Avoidance System ARCA – UAVs

Space Related Equipment, Labs & Certificates

- esc Aerospace applies ECSS standards:
- ECSS-E-ST-40C Space Engineering – Software
- ECSS-E-ST-70C Ground systems and operations
- ECSS-E-70-41A Ground systems and operations - TM/TC packet utilization
- ECSS-M-ST-40C Rev. 1 Space Engineering – Configuration management
- ECSS-M-ST-80C Risk management
- ECSS-Q-ST-20C Quality Assurance
- ECSS-Q-ST-80C SW Product Assurance
- laboratory and manufacturing assembly room / factory 4.0., IoT., equipped with oscilloscopes, DAQ stations, spectral and data analysers, signal generators and soldering stations.



Magnetic Diverter (ATHENA) cooperation Frentech Aerospace, L.K. Engineering & BUT Brno

General description

Frentech Aerospace s.r.o. is a state-of the-art company, very well equipped with modern and productive CNC machines, quality assembly premises with clean room facility and air-conditioned inspection room with four CMMs. Frentech Aerospace presents itself as a sophisticated company with installed system for real time production control CPC (by Mazak). In scope of this system is actively used software for Planning, Tool Management System and Machine Monitoring System. The company is focused on production and delivery of parts and assembled modules mostly for aircraft and space mechanisms for space industry. Beside this line of business also delivers products for demanding fields such as instrument technology, microelectronics, nanotechnology, radar technique, production of special machines, medicine and vacuum technique. For programming there are four installations of Solid Works and Solid Cam (CAD/CAM). Frentech Aerospace is a member of the Czech Space Alliance and Czech Industry Association.

Competences & Capabilities

Production and delivery of parts and modules for aircraft and space industry (80% of turnover), production of precision mechanics for other lines of business (20% of turnover). Focus on space activities (50% of turnover -2018): Engineering and production of mechanism for spacecraft (Solar Array Deployment Mechanisms, Cryostat Structure, Booms, HDRM, Actuators and others), participation in ESA (European Space Agency) and ESO (European Organization for Astronomical Research in the Southern Hemisphere) projects. Another significant activity is testing, mainly geometrical, thermal and thermal vacuum testing, bake-out with TQCM monitoring, monitoring of particulate and molecular contamination and leak-proof testing.

Major Space Projects & References

The main ESA projects:

- ESA tender AO6647 (NEW GENERATION MULTIMEDIA ANTENNA DEPLOYMENT AND POITING MECHANISM - FRA)
- ESA tender AO10164 (Cryostat Structure for Meteosat Third Generation),
- ESA tender AO7397 (THE DEVELOPMENT OF A NEW GENERATION HINGE FOR FOR LARGE APPENDICES),
- ATHENA (development, production and testing of Magnetic diverter)

Cooperation within the ESA projects:

- EUCLID (ADS), JUICE – RIME ANTENNA (SpaceTech), Mag Boom (SENER), JASON CS _ Solar Array (SpaceTech), Dispenser for VEGA Launchers
- ESA Projects for FLEX, PLATO, parts for Turbo pumps for VEGA, Valves for VEGA
- HEPA Filters for ExoMars 2016 and ExoMars 2020
- Canister and Lid Release Mechanism for ExoMars2020 Production of special mirrors assembly for ESO (project ALMA in Chile), parts for Extreme Large Telescope (EELT) in Chile.

Commercial projects:

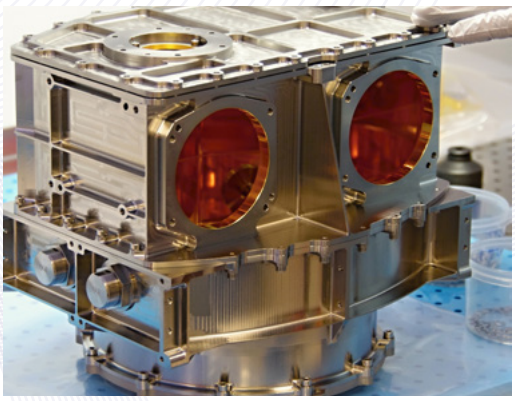
- Precision parts for telecommunication satellites,
- Delivery of 500 pcs. deployment mechanisms for project IRIDIUM NEXT,
- Delivery of parts for Turbo pumps – engines for ARIANE 5 (AVIO)
- Delivery parts for project ONE WEB – for Reaction wheels and Star tracker

Czech development projects:

- Actuator simulator (2 different models) – cooperation with L.K. Engineering s.r.o. (CZ)
- Electro pumps for space engines – design and development Sobriety s.r.o. (CZ)
- Elecro controled valvs for VEGA – design and development Sobriety s.r.o. (CZ)
- New Precision Actuator for Space application with using material AlBeMet – cooperation with Honeywell (CZ)
- Deployment system with usning SMA material – cooperation with L.K. Engineering s.r.o. (CZ)
- J-Boom with SMA motorisation – developt with L.K. Engineering s.r.o. (CZ), VZLU (CZ) and 5M s.r.o. (CZ)

Business Cooperation with Airbus Defence and Space, Premium Aerotec, Thales Alenia Space, EATON Germany, MTAerospace, EMERSON, Nord Micro, Colins, Thales Alenia Space, SAFRAN, MBDA, BOSCH, Flextronics, SpaceTech, RUAG, Honeywell, AVIO and more....

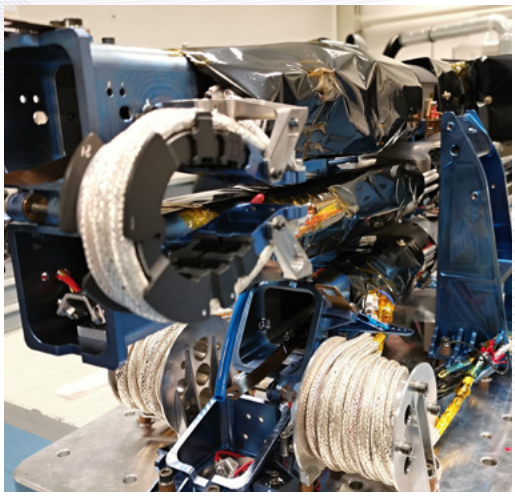
Frentech Aerospace s.r.o. cooperates with Czech companies within several projects. For information about the partnership can be found on the http://bstg.space/



MTG Cryostat

Space Related Equipment, Labs & Certificates

- Production area 2400 m^2
- Assembly premises 400 m^2
- Clean room (ISO7 class 10 000 and ISO5 class 100) In Clean room (ISO7 class 10 000) is placed a test thermal chamber (approx. 1 m^3) for temperature range from -180°C to +200°C including possibility of test performed in vacuum. There is also device for leak testing and CMM machine. In the clean room is installed equipment for Particulate and Molecular contamination control. For Bake-out control is TQCM equipment used.
- Certificates: ISO9001, AS9100 rev. D, ISO14001 and Airbus certification.
- Frentech Aerospace is qualified for Thales Alenia Space for special processes (CQT448).



MAG Boom – Cooperation Frentech Aerospace, L.K.Engineering, 5M & VZLU

Frentech Aerospace
member of Czech Aerospace Systems

Industry
Manufacturing
R & D
Testing

Frentech Aerospace s.r.o.

CZECH SPACE ALLIANCE

Member of the Czech Space Alliance

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GINA
SAVE LIVES THROUGH TECHNOLOGY

Industry
R & D
Services
Testing
Software

GINA Software s.r.o.

General description

GINA Software s. r. o. is a technology company that develops and delivers the first response digital platform GINA to mission critical organisations worldwide. In the field of situation mapping, we are in the top five most recognized European companies and GINA has been awarded as one of the top European space-related technologies in 2012 (Galileo Masters competition). Gina is developing mobile technologies for sharing of accurate real-time situation via an interactive map. It introduces new communication channel for exchange of geo-located data combined with localization, mapping and task management features. This way it makes decision making faster and more accurate.

Gina is a combination of tactical mapping software and mobile hardware designed for emergency tasks, security services or staff management. It was designed for usage in the most challenging conditions in the world. Thus, prevents misunderstandings, speeds up communication and protects staff.

Competences & Capabilities

TACTICAL COORDINATION: Integration of staff and assets with dynamic map by GPS location tracking (variety of hardware: GSM, satellite, radio)

DYNAMIC MAPPING: Mapping of terrain and situation as simple as drawing on a paper map (on mobile handhelds, tablets and PCs)

DATA EXCHANGE: Reliable offline access to information from various sources from anywhere (map portfolio, data layers, teammates locations, files, data from sensors) COMMUNICATION: Accurate communication of information which words nor pictures can express (drag & drop navigation, task management, events scripting)

Major Space Projects & References

- European Satellite Navigation Competition: using systems of Galileo and EGNOS. Regional winner (2012)
- ACRIMAS: pilot and first ECML workshop on Mobile Interoperability for International Field Deployment (2012)
- Public safety agencies (Czech Republic – national emergency system; Slovakia, Germany, Switzerland – fire fighters)
- Search and Rescue Operations (Haiti, Japan, Lebanon, Czech Republic)
- Monitoring of Cholera Epidemics, Political and Crime Situation (Haiti)
- Deployment for Security Organizations, Members of ASIS International
- Deployment for European Commission
- Personal and Assets Protection (Qatar)
- First Rapid Emergency System Against Pandemic (FIRTS RESPonse), project to help citizens and health professionals in Italy to deal with the challenges of the coronavirus outbreak.

Space Related Equipment, Labs & Certificates

- Assets & Vehicle Tracking devices: Rugged GPS tracking device ideal for tracking of assets/vehicles: GSM connectivity, A-GPS sensor, Programmable buttons, Magnetic cradle, Tracking frequency 5s
- Mobile Terminals: Robust device with ergonomic design for whole day usage, enabling easy battery swapping and extension by accessories: Smartphone features, GPS location sharing
- Iridium Satellite Terminal: Unique solution for intelligent tracking over satellite and mobile networks: Iridium / GSM / 3G network connectivity, Price equivalent to personal satellite trackers, Predictive location sending, Interactive map, Lower running costs by tents of percent

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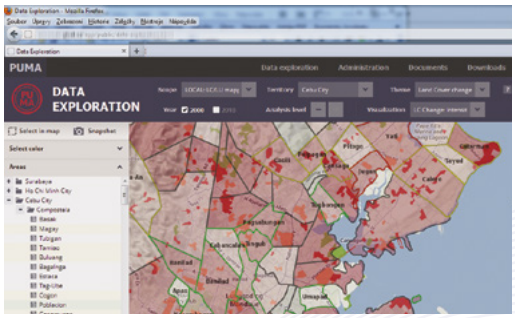


General description

Gisat was established in 1990 as the first remote sensing and geoinformation service company in the Czech Republic. The mission of the company is to provide its clients with wide range of value added, complete, high quality and 'state-of-the-art' geoinformation services based on the Earth Observation technology. Thanks to the long-term presence on the European geospatial market and extensive experience from the past projects Gisat has established sustainable and reliable partnerships with its domestic and international clients and partners. The service portfolio extends from satellite data and geomatics software distribution, through specialized image & GIS data processing and analysis, up to advanced geoinformation products and services.

Competences & Capabilities

Main areas of activity include aiborne and satellite data processing and analysis, GIS development and modeling, geo-information assessment, geoportal development and applications, satellite data mapping and monitoring, design and development of web based analytical platforms for spatial data exploration. Earth Observation data based mapping and monitoring services represent the key activities of the company. Gisat possesses operational production lines for generation of standard mapping products, yet flexible for service contents modification and user or regional customization. Gisat's activities cover an impressive range of thematic areas. Environmental, agricultural and urban monitoring & mapping and support to emergency & development projects around the world belong to main application areas.

Major Space Projects & References

References

Copernicus

Copernicus (formerly GMES) is the European Programme for the establishment of a European capacity for Earth Observation. It is the principal European initiative to boost up European EO related business answering growing demand for various geo-spatial data and services from European and regional users. Gisat is ranked among the main European service providers in Land Monitoring, Emergency Management and Security thematic domains.

European Space Agency

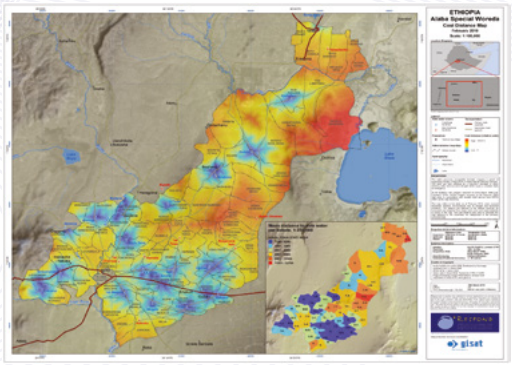
In last 5 years Gisat has successfully concluded tens of ESA projects in various programs, such us EOEP, GSTP, TRP or ARTES IAP. The company focuses on development of practical applications using satellite imagery, development of dedicated web based platforms for geoinformation analysis and assessment and development of novel methods and technologies for EO data exploitations.

European Environmental Agency

Gisat's experts have been involved for more than a decade in European land cover mapping. Since 2001 Gisat is a member of the international consortia assisting the EEA in its attempts to achieve sustainable development and to improve our environment. This team includes a valuable expertise in Europe to analyse the environmental data with regards to developments in society and the economy and with regards to various environmental and sectoral policies.

Recent projects

- Earth Observation for Sustainable Development to support Internatinal Financing Institutions (Urban domain), 2016 - 2020, ESA
- Thematic Exploitation Platform for Urban, 2015 - 2022, ESA
- Urban land recycling information services for sustainable cities, 2013 – 2016, EC FP7
- Developing an analytical platform for European Territorial Monitoring System, 2013 – 2014, EC ESPON
- European Topic Centre on Urban, land and soil systems, 2015 – 2018, EEA
- Copernicus Emergency Management Service Risk and Recovery Mapping, 2015 – 2018, DG JRC
- Developing the Platform for Urban Management and Analysis for World Bank, 2012 – 2016, WorldBank
- Earth observation services for European Investment Bank, 2012, ESA
- Earth observation services for WorldBank, 2011 – 2015, ESA
- Earth observation support for Asian Development Bank Activities, 2014 - 2015, ESA
- Social Media and Mobile Applications Development for EO Ground Segment and Mission Operations, 2015 – 2017, ESA



Space Related Equipment, Labs & Certificates

Gisat's products and services rely on the use of state-of-the-art information technology. All methods applied are updated and improved according to the most recent developments in the EO domain worldwide and are verified with the cooperation of both domestic and foreign research institutions.

Satellite data mapping represents the key service of the company. Thus the operational processing chains for the main application areas are internally set-up and further developed.

The company is ISO 9001 & ISO 14001 certified to guarantee the quality of provided services and to reflect the responsibility in environmental impacts of its activities.

Industry
R & D
Services
Testing
Software

GISAT s.r.o.

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Industry

Manufacturing

Services

Testing

R & D

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http://www.glelectronic.cz

Manufacturing workplace
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General description

G.L. Electronic is an independent Czech company that has been offering a complete implementation of Hi-Rel electronic devices and wiring harnesses in the aerospace industry for over 12 years. The production and integration of individual devices take place within the ESA standards and ECSS standards in certified cleanroom ISO 8. We provide technical and consulting support in the field of design, production, testing and integration of flight devices.

Competences & Capabilities

G.L. Electronic is specialized in two segments: Aerospace and Ground & EGSE.

Aerospace segment - production of Hi-Rel electronics for aerospace devices and instruments. The main activities: ESA qualified assembly, repair and modification of PCBs (level EM, EQM, FM), complete implementation of bonding, conformal coating, quality control according to ECSS specifications, functional tests of HW and SW on PCBs according to customer's requirements (including final unit tests) and design. We provide harness manufacturing, functional tests and final harness integration on the Mock Up for STM, EQM and FM models.

Ground segment & EGSE - complete electrical assembly, mechanical integration and testing of rack boxes for harnesses TVAC with testing instruments.

Services: testing in the climate and vacuum chamber, electrical testing of cable harnesses (continuity test, insulation test and double-wire measuring for 258 points), wire tension test, microsection of crimped joints, endoscopic visual inspection. We provide full technical support and complete reporting according to the aerospace standard for individual measurements by these devices.

Major Space Projects & References

- Complete manufacturing realization for electronic instruments, particularly in the field of space technologies.
- Manufacturing EGSE-assembly of electronic boxes
- Assembly of harnesses
- QA and PA for projects
- Bonding and conformal coating
- Final routing and installation of harnesses
- Functional test of the boards & final units projects

Manufacturing - PCB hand soldering assembly

- SOLAR ORBITER-RPW/TDS & SWA/PAS-CEM units EM/EQM/FM, in cooperation with Academy of Sciences (UFA) and Charles University
- EXOMARS: Electromagnetic Wave Analyzer (WAM), in cooperation with Academy of Sciences (UFA)
- EXOMARS: EQM/FM, in cooperation with Leonardo
- CDAM: EQM, in cooperation with OHB-I
- EUCLID: EM/EQM/FM, in cooperation with OHB-I
- METOP SG MWI: EQM/FM, in cooperation with OHB-I
- JUICE-LRF: BB/EM/F, in cooperation with UFA
- ARGOS 4: CPU-NGA for Steeel Electronique
- PROBA-3: devices for SERENUM (VZLU)

Harness manufacturing, testing and integration

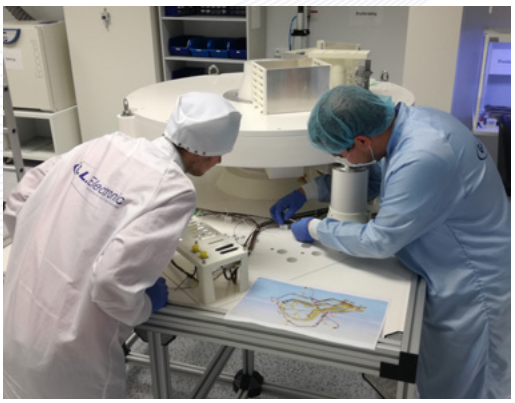
- VEGA-VV18 SSMS: FM, in cooperation with SAB Aerospace
- NAOS: EGSE, in cooperation with OHB-I
- CIMR - Copernicus: FM, in cooperation with Thales Alenia Space
- AHA for ROSE-L: FM, in cooperation with Airbus
- JUICE MGAMA: EQM/FM, in cooperation with Sener
- VEGA SSMS POC Dispenser: FM, in cooperation with SAB Aerospace/AVIO/ESA
- METOP SG MWI: EM/FM, in cooperation with OHB-I/ Space Engineering
- S-GEO-(EGSE): FM, in cooperation with CGS-OHB
- SSIS - VERTA/VESPA: space vehicle separation systemfor satellites Proba V, final integration French Guyana, launched 4/2013, in cooperation with SAB Aerospace/ASI/ESA
- EDRS-C: FM, in cooperation with CGS OHB
- LARES: harness for instrument and CUBESAT, launched 2/2012 in French Guyana, in cooperation with CGS/ASI/ESA
- ESAIL: EGSE/FM, in cooperation with Luxspace OHB

Activities done in Kourou, French Guyana, 2008-2020

- Mangousta: electrical installation of security camera system with IR sensors and integration of A/V systems
- Vega & Soyuz launching pads: technical support to CGS/ Telematic Solution, electrical installation of phone, audio and video signalling, safety (gas leak), partial integration of rack boxes, installation of optical cables
- Vega SSMS POC Dispenser: final integration of cablesto the dispenser on the top of the VEGA rocket

Space Related Equipment, Labs & Certificates

- Cleanroom: ISO 8, class 100 000
- Cleanroom production and storage area: 210 m²
- Continuous temperature and humidity measurement: 22°C ± 3°C / 55% ± 15%
- Portable 3-channel laser meter of dust particles. Measurement range: 0.3µm, 0.5µm, 5.0µm. Kanomax 3887
- Integration hall with a 2000 kg crane for flight HW: 150m², ISO 8 (in cooperation with SAB Aerospace)
- Facilities for avionics, laboratory for microsection
- Certificates: ISO 9001:2015
- ESA trained and certified technicians: CAT2 & CAT3
- ECSS-Q-ST-70-08, ECSS-Q-ST-70-38,
- ECSS-Q-ST-70-28, ECSS-Q-ST-70-26
- CNES verification process of SMD for hand soldering of Solar Orbiter of flight level PCBs (TDS and SWA-PAS instruments), valid from 7/2015
- ESA verification process of SMD hand soldering of flight level PCBs: ESA-TECMSP-LE 007989



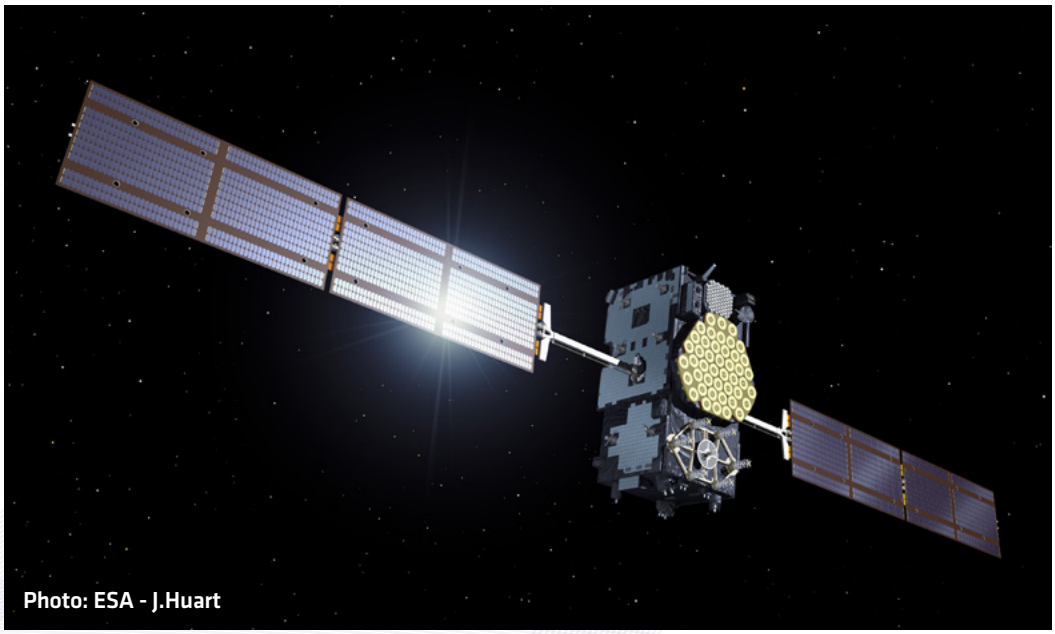


Photo: ESA - J.Huart

GNSS Centre of Excellence

Industry

R & D

Services

GNSS Centre of Excellence z.s.p.o.

General description

GNSS Centre of Excellence (GCE) is a non-profit association, officially founded in November 2012. The founding members are Czech Railway, Air Navigation Service Provider, Road and Motorway Directorate, and Czech Railway Infrastructure Administration. Among its members of the professional association belong Universities, Research Institutes and companies incl. SMEs.

The objective and purpose of the GCE is to strengthen activities of the Czech Republic in the field of development, testing and deployment of GNSS applications and to provide a base/background for cooperation among the major spheres of transportation (air, rail, road) and industry; to provide ideas of new GNSS systems to industrial partners, centralized ongoing fragmented activities, initiate new activities and to provide expert background and consultancy.

GCE's mission is also to accelerate the development and deployment of applications using EGNOS as well as Galileo in the CEE region (Central and Eastern Europe). GCE provides its members with expertise on GNSS technology, project management of R&D projects, background research, monitoring of trends and opportunities in GNSS.

Competences & Capabilities

GNSS and aviation:

- RNP Approaches & PinS publication and implementation

GNSS and RFI:

- RFI detection & mitigation
- Critical infrastructure protection

GNSS and rail:

- Utilisation GNSS in rail signalling systems
- Competencies in ERTMS/ETCS

Project Management competencies:

- Management of large & complex projects under different granting schemes
- Competencies in HORIZON2020 granting process
- Procurement process of the ESA and GSA
- National granting schemes & procurement processes
- PM competences and consultation

GCE is not only an association or a consultation company but has technically experienced personnel working on R&D projects. GCE with its broad network of stakeholders cooperates with public authorities, research institutions and businesses on technical and R&D activities focusing on implementation of GNSS-based technologies in transportation.

GCE is a member of EGITF (EU GNSS Interference Task Force), RAiSG (RNAV Approach implementation Support Group) and GNSS RAW Measurements Task Force

Major Space Projects & References

Project: GNSS vulnerability & mitigation in Czech Republic (ESA NAVISP element 3) – Main objective is to support Czech Republic's activities related to the GNSS/PNT vulnerability. A set of analysis and reports are prepared for GNSS/PNT stakeholders (including tailor-made outcomes) as well as for government entities to better understand GNSS/PNT vulnerability and for better deployment of mitigation activities on company, institutional and governmental level. Real-time on-field testing campaigns of GNSS RFI are being done for different stakeholders in order to test impact of the GNSS RFI on their systems.

Project: GiDeLOC – Czech detector of GNSS RFI events (National research security program administrated by the Ministry of Interior of the Czech Republic) – Main objective is to develop unique monitoring system capable of detecting jamming and spoofing types of interferences. System is capable of locating the place of RFI sources through AoA, TDOA and triangulation algorithms.

Photo: ©GSA

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Honeywell

Industry

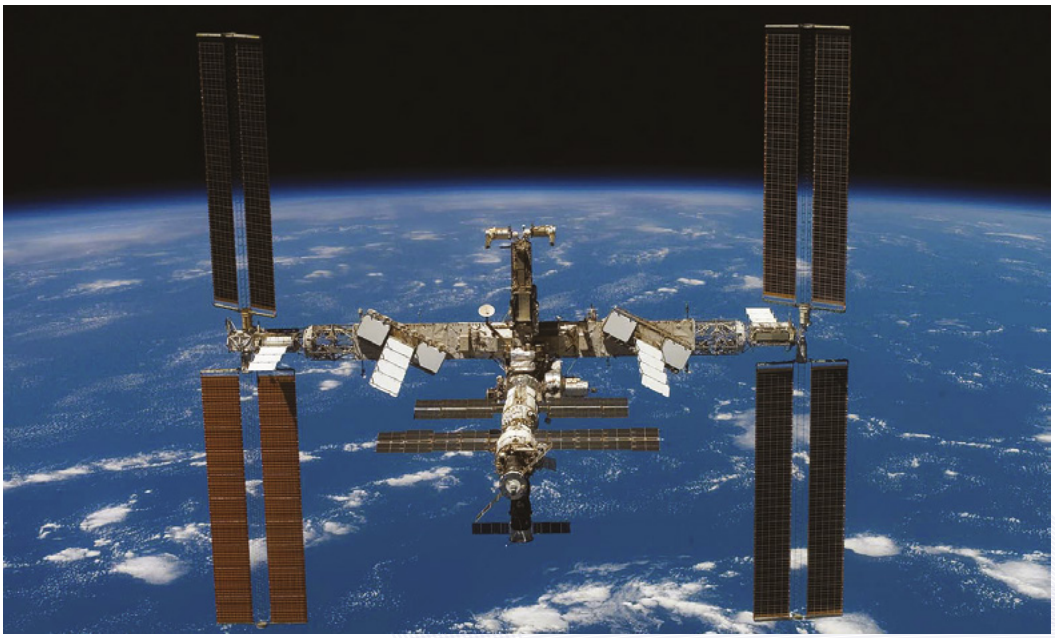
Manufacturing

R & D

Testing

Software

Honeywell International s.r.o.



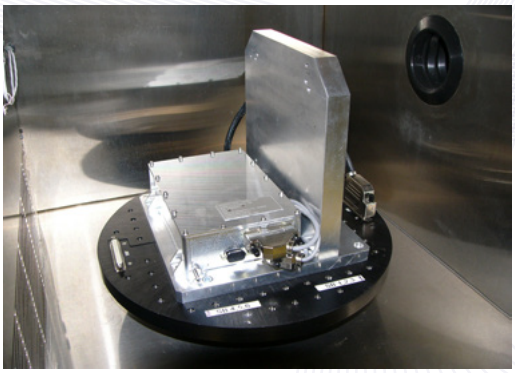
General Description

Honeywell has a long and proud heritage in the Czech Republic. Since opening its first office in 1962, Honeywell has expanded to operate from three locations in the Czech Republic: Prague, Olomouc and Brno. Each of these sites offers a range of skills, capabilities and technologies. In the space sector, Honeywell provides innovative products that have contributed to the mission success of many different and varied space platforms. Honeywell has provided thousands of systems required for accurate momentum control, pointing, vibration isolation, guidance and navigation, semi-conductors, data control and other satellite, launch vehicle, missile and interceptor products.

Major Space Projects & References

Process Controllers: Honeywell provides a variety of process controllers for varied space applications.

Satellite Guidance & Attitude Control: Honeywell has more than 40 years' experience producing first rate guidance, navigation and control products for various space platforms. Products include: ✔ Miniature Inertial Measurement Unit (MIMU) ✔ High Performance Fiber Optic GyroBased Inertial Reference System ✔ Micro Electro-Mechanical Systems (MEMS).



Integrated Space Vehicle Health Management: Honeywell's cutting-edge Integrated Vehicle Health Management (IVHM) system captures and integrates comprehensive database, it also function as a "brain" that can analyze total-vehicle data, diagnose problems, recommend corrective actions, and verify return-to-health data.

Multi-constellation Global Navigation Satellite Systems (GNSS) Honeywell is running multiple research projects in multi-constellation global navigation satellite system (GNSS) receivers. Our products include EGI (Embedded GPS/INS), SIGI (Space Integrated GPS/INS), EGPWS (Enhanced Ground Proximity Warning System), etc. Research labs in the Czech Republic have currently expertise in all aspects of GNSS technology including ultra-tight coupling of GPS and INS and high integrity INS/ GPS algorithms for precision approach and autonomous landing. This is complemented with expertise in designing and testing of Inertial measurement sensors and units for various space applications.

Competences & Capabilities

Honeywell's footprint in the Czech Republic builds upon a history of excellence in serving the European space industry and our customers also include worldwide space agencies, prime contractors and commercial suppliers. Leveraging our industrial and research capability across the Czech Republic, Honeywell serves space users with state of the art research and technology capability in number of areas: • Process Controllers • Satellite Guidance & Attitude Control • Integrated Space Vehicle Health Management • Control Moment Gyros • Reaction and Momentum Wheels • Momentum Control Systems • Antenna pointing mechanisms • Satellite Communication • Actuation and Vibration Control Systems • Microelectronics • Design and Manufacturing of Mechanical Components • Pointing Mechanisms for Optical Communication.

Close cooperation with ESA have created new successful projects in **Satellite Communication:** ✔ ATN/OSI and security gateway development for Inmarsat User Terminal (Iris-Precursor) enabling SatCom to complement VHF datalink as enabler for near and mid-term safety critical ATM applications ✔ Design and development of User Terminal of new satellite communication system for safety critical air/ground data and voice communication Honeywell has extensive experience in Vibration Isolation Isolating of complete satellites from launch vibration, and in reducing on-orbit disturbances. Utilizing this experience and a dedicated development laboratory, Honeywell has the expertise leading to a high probability of mission success, regardless of the spacecraft challenge presented.

Space Related Equipment, Labs & Certificates

A new Line-of-Sight test bed is enabling Honeywell to support its customers in risk-reduction testing of new dynamic and structural control systems for new satellite programs. With the Advanced Momentum Control Array System (AMCAS) Honeywell offers: • Upfront modeling and simulations • Validation of modular and scalable designs • Experimentation with various attitude, momentum and vibration control scenarios and interactions • Verification of new control schemes and code • Testing of hardware and software in an open or closed looped test environment • Refine control laws.

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Industry

Manufacturing

R & D

Services

Software

General description

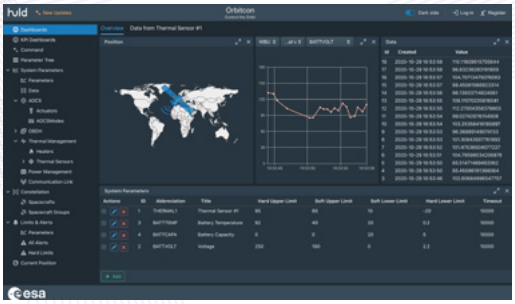
Huld is a European technology design house with over 400 employees and 13 offices in Finland and the Czech Republic. With us, you build intelligent solutions that last for tomorrow – and beyond. Huld offers an internationally unique combination of software and product development expertise. We bring more intelligence to our customers' business – and to the entire world. We always work for a more intelligent future, and care about the world around us.

Competences & Capabilities

Huld has attracted the best experts experienced with providing high-reliability software solutions for many of Europe's most ambitious space missions and customers like Airbus D&S or OHB. Our purpose is to provide technological design expertise to our customers on their journey beyond tomorrow, safely & securely. By combining design thinking, agile methodologies, and technological insights we help our clients to reach the next level of their product development. We digitalise industries and business operations and support our clients in their next generation product development by designing and developing usable, sustainable, and intelligent equipment, all this by ensuring their compliance to the strictest safety requirements.

Major Space Projects & References

- **Sentinel-4 UVN** – The Sentinel-4 mission is a part of the COPERNICUS programme, whose overall objective is to support Europe's goals regarding sustainable development and the global governance of the environment. We participated in the implementation of a validation test for MIL-STD-1553B data bus (Milbus), the main bus for command and control of instrumentation and platform units.
- **BepiColombo ISVV** - BepiColombo is Europe's first mission to Mercury. Our engineers participated in ISVV of three of those components - central software, failure control electronics and solid-state mass memory.
- **Sentinel-4 L1bPP** - The S4 UVN L1b Prototype Processor (L1bPP) project aims to develop an L1b prototype data processing software (a data processor). Huld engineers participated in the core development team.
- **SCA** - The MetOp-SG Scatterometer is intended as a follow-up to the MetOp ASCAT and a wind mode of the Active Microwave Instrument (AMI) on the ESA Earth Remote Sensing satellites ERS-1 and ERS- 2. Huld developed the DCU ASW together with the Prime (Airbus DS). Implementation, including Detail Design, Coding and extended Unit testing, was done at Huld premises.
- **BIOMASS Support CSW** - Biomass was selected as the 7th Earth Explorer mission to reduce uncertainty in the worldwide spatial distribution and dynamics of forest Biomass to improve current assessment and future projection of the global carbon cycle. Huld was involved in the development of Payload management within CSW and responsible for the development of software components and software support.
- **HERA Phase B1** - HERA is a planetary defence demonstration mission to a binary asteroid scheduled for launch in 2023. Huld is subcontracted for Application Software (ASW) and Inter Satellite Link (ISL) related design.
- **HERA CubeSat Phase A** - The objective of this project is to perform a phase A study of a 6U CubeSat payload for the HERA mission to define mission architecture and system design concept, and the necessary system specifications up to the PDR level. As a member of a broader consortium, Huld provides complete software design needed for the mission: from the OBSW architecture definition, failure recovery, mapping the asteroids for autonomous navigation, to the Mission Control concept.
- **Orbitcon** is a project currently under-development, intending to create a full-fledged mission control system (MCS) customized for SmallSats. It offers standard interfaces and easy mission instantiation. The service will be hosted in a cloud environment, accessible globally, with all tools needed to cover a whole lifecycle of a mission. To enable quick expansion of the service, we will encourage the connection of existing Ground Stations (GS) via predefined interfaces, i.e. Space Link Extension (SLE). In parallel, we develop a modular reference design that can be used for a nascent Ground Stations (GS). The design covers VHF, UHF, and S-BANDs and will be available as an open architecture too. The reference GS design guarantees seamless integration with our MCS.



- **The Tiira project** addresses the first step towards the standalone GNSS/Galileo receiver with open source solution and will result in a Minimum Viable Product and a commercially viable solution for cooperative navigation targeted to premium mass market.

Huld s.r.o.

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IDEA-ENVI
Integrated development of applications

Industry

Services

Software

General Description

IDEA-ENVI s.r.o. .(Ltd.) is a Czech company founded in December 1994.

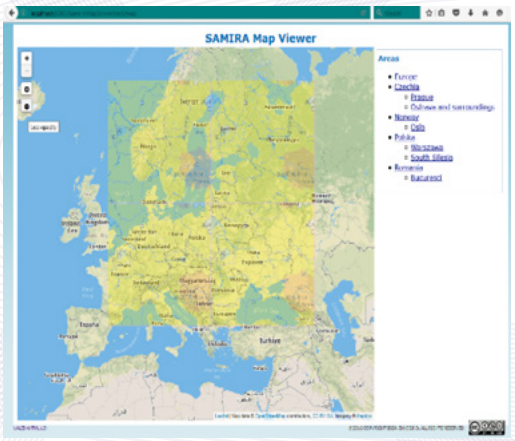
From the beginning of its establishment, the company orientated itself towards software development for the Czech Hydrometeorological Institute. Company philosophy continued to focus on developing software and creating useful applications for companies and government establishment. It focused on the principles of open systems, on the development of applications using advanced software engineering design methods, and on powerful database environment. The company operates in cooperation with a number of the world's leading IT suppliers which facilitates a broad variety of solutions and an optimal approach to customer needs.

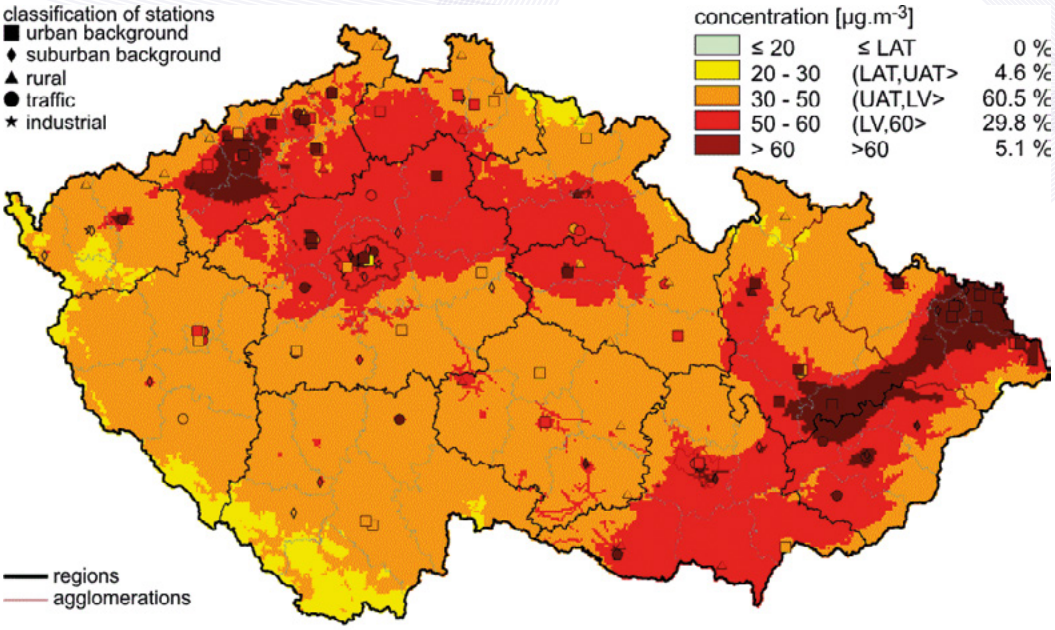
The programme application and building-ups are designed on the basis of particular costumer's conditions and needs. Connection and integration of a system GIS and a relating database enables improvement of presentation and simulation of all sorts of situations which describes data model on a geographical background.

IDEA-ENVI s.r.o.

Competences & Capabilities

The main company activities are building the informational environmental systems. The company builds systems based on customer/server architecture in UNIX background and operating systems (mainly WINDOWS), communication and a webpage data presentation. We use our comprehensive knowledge and long-time professional experience with high relational databases (INGRES, ORACLE).





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Valašské Meziříčí
http://www.idea-envi.cz

Responsible for space and ESA projects:

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Ariane 6 ©ESA-David Ducros

General description

Iguassu Software Systems (ISS) providing software solutions to ESA, Eumetsat and other international customers since 1994. Hence it is no surprise that ISS was the first Czech company

- to work on ESA and Eumetsat projects (since 1994)
- to successfully deliver a fixed price project to Eumetsat (1998, through SciSys contract)
- to succeed in Galileo tender (2005, with INDRA)
- to win the first Czech contract through an ESA international tender (2007 with ACS)
- to start developing software for Ariane 6 (2017)
- to sell GNSS software to Japan and Africa (2017)

Competences & Capabilities

Between 1994 and 2004, ISS developed its space experience in Meteosat TP MCC CF, sat. control system SCOS, ground segment systems and user support (ESOC), Envisat payload processing (ESRIN), IRIDIUM terminal test software (UK), MSG, MCF (UK, Eumetsat, Prague), MSG PGS etc.

Since 2005 (start of ESA PECS), ISS has been developing space software solutions for

- GNSS, mainly SBAS performance tools. Our software runs in the TAS-F EGNOS simulator, CNES, ESA, Africa, ESSP, Romania, and even in the Japanese government institute ENRI
- EO performance & infrastructure technologies (e.g. open source largely scaleable catalogue for ESRIN)
- SSA – robotic telescop test bed, optical sensors qualification, telescope data processing chain
- Sat-com (Antares with TAS-I & Indra), IRIS (INMARSAT)
- launchers, telemetry processing software for Ariane 6 and for its ground segment

Major Space Projects & References

Current projects:

- **Ariane 6** - ground segment development for CNES, prime Telespazio
- **Ariane 6** - telemetry processing for Ariane Group, prime Critical Software
- **SSA** - P3-SST-XXII: Polish SST small telescope assessment and prototyped operations, prime Sybilla Technologies
- **SSA** - P3-NEO-XII: Telescope data processing chain, ISS prime, 3 subcontractors
- **SSA** - P3-SST-III - Robotic Telescopes Demonstration, ISS prime, 3 subcontractors
- **GNSS** - Galileo High-Accuracy User Terminal HMI, prime Spaceopal
- **GNSS** - NAVISP-EL1-035- Machine-Learning to model GNSS systems, prime Integricom
- **GNSS** – 5 year commercial project to support and upgrade our product EVORA

Successfully concluded since ESA membership:

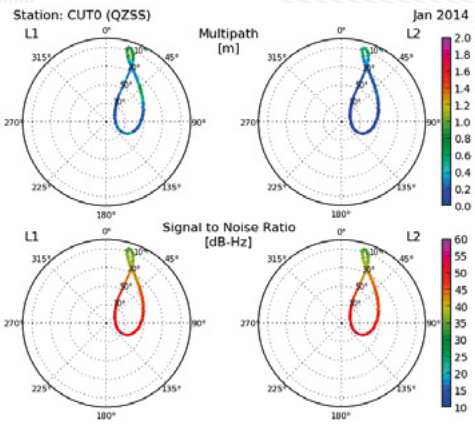
- 2018 **SSA** P2-SST-X: Support observations and sensor qualification, for ESA ESOC, prime e-GEOS
- 2017 **SatCom** Iris Service Evolution Study, System Test Approach, for ESA ESTEC, prime Inmarsat
- 2017 **SSA** Test-Bed for the Automated Follow-Up Telescope Remote Control, GSTP, prime ISDEFE Spain
- 2017 **GNSS** – SENDAI, long term GNSS performance evaluation tool, Dual Frequency Multi-constellation
- 2017 **SatCom** FP7 participation in the extensive aerospace consortium ASHLEY
- 2016 **GNSS** SBAS Simulator with DFMC capabilities (DN)
- 2016 **Operations** - CCSDS Mission Operations Specification Graphical Editor, AO7634 +CCN, for ESOC
- 2016 **GNSS** Real-time SBAS performance monitoring tool, AO7397 (ISS prime, TAS-F subcontractor)
- 2015 **SatCom** ANTARES satcom for civilian air-traffic, AO6050, subcontracts to TAS-I and Indra
- 2014 **GNSS** Multi-Constellation Long-Term GNSS Assessment (SENDAI), AO6647 (ISS prime)
- 2014 **EGSE** Euclid SVM Electrical Simulator software design, AO7613 (CSRC prime for h/w)
- 2012 **GNSS** Interference Monitor System for GNSS Reference Stations, AO6149 (Airbus Gmbh prime)
- 2011 **EO** Parallel Data Mining Components, AO6052 (ISS prime)

First Galileo projects, before GSA in Prague (2005-2008)

- **2008 - Galileo** - ALGINT co-development for SciSys
- **2005 - GJU** – SAR ground segment development for MEOLUT in the Indra GISAR consortium

Commercial products

- **EVORA** – real-time GNSS performance monitoring, multi-constellation, dual frequency (MCDF)
- **SBAS Simulator II** – volume simulator, MCDF
- **SENDAI** – long term GNSS performance monitoring statistics and data mining too, MCDF



Clients, partners. references

- ESA (ESOC, ESRIN, ESTEC, EGNOS Project Office), Eumetsat, GJU/Indra, ACS, CAM GmbH, Iridium sub., SciSys, Indra, Integral-F, TriPolus-UK, Airbus Space and Defence D/F, TAS-F, TAS-I, GMV, Integricom, Vega-D, GNSS technologies (our distributor in Japan), Quasar, Clemessy, Critical Software, Telespazio, Ariane Group, ESSP
- We sold our commercial GNSS products to ESSP (EGNOS operator), TAS-F, West African ANS, Romanian Space Institute, Japanese government institute (for QZSS SBAS), Telespazio and CNES

We can also work in Spanish, German and Portuguese, with basic French, and Japanese.

Non-revenue earning space activities

- leading and promoting the industry association Czech Space Alliance (www.czechspace.eu) since 2006
- negotiated bi-lateral co-operation agreement with the Brazilian Space Agency AEB (signed by the Minister of Transport, Nov. 2011), prepared bi-lateral cooperation agreement with JAXA and the Japanese Cabinet Space Office, negotiation with the Mexican Space Agency, GISTDA, UAE Space Agency...
- chairing the Industry and Applications Committee under the Space Coordination Council of the Minister of Transport (SCCMT) and participating in the SCCMT (effectively the Czech national space agency) itself
- company MD is a member of the Czech branch of COSPAR (Committee on Space Research)

IGUASSU SOFTWARE SYSTEMS

Industry

R & D

Software

Iguassu Software Systems, a.s.

CZECH SPACE ALLIANCE

Member of the Czech Space Alliance

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Jiri Doubek,
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E-mail: mailus@iguassu.eu

KBmicro
Space Systems and Advanced Electronics Development

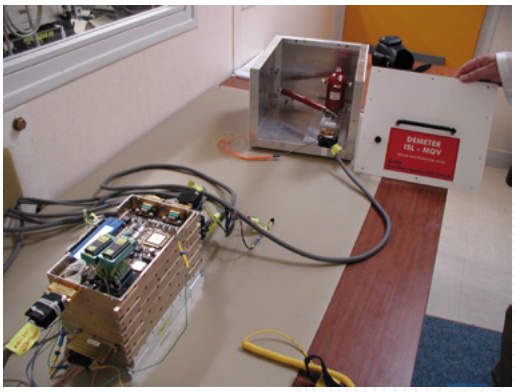
Industry

Manufacturing

R & D

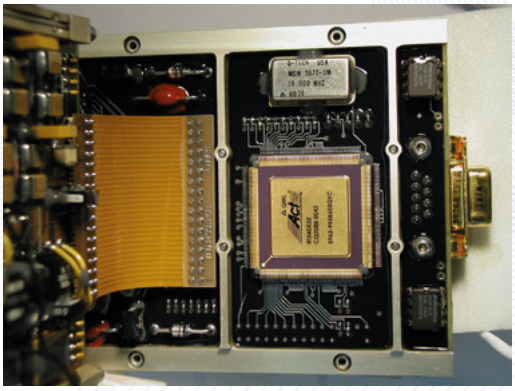
Testing

KB micro s.r.o.



General description

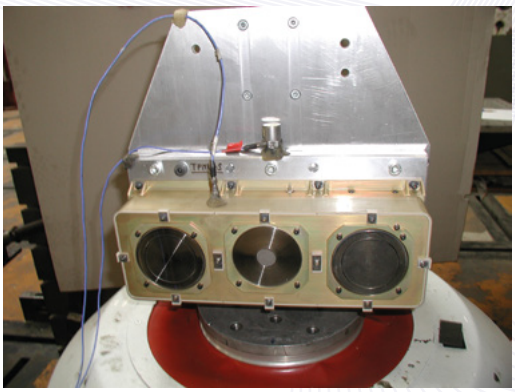
KB micro is privately owned Ltd. company, located in Brno, Czech Republic, and founded in 1991. It is specializing in the development of high reliability electronics hardware and software, mainly for space related projects.



Competences & Capabilities

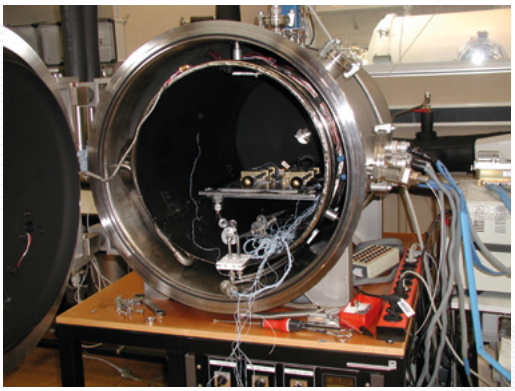
KB micro's domain of activity is the complex realization of small autonomous electronic units for space projects based on electronics design, embedded software design and mechanical design with outsourced manufacturing by established partners.

Main areas of activity include Hardware Design, Software Development, Design Verification, Project Management and Mechanical Design and Manufacturing.



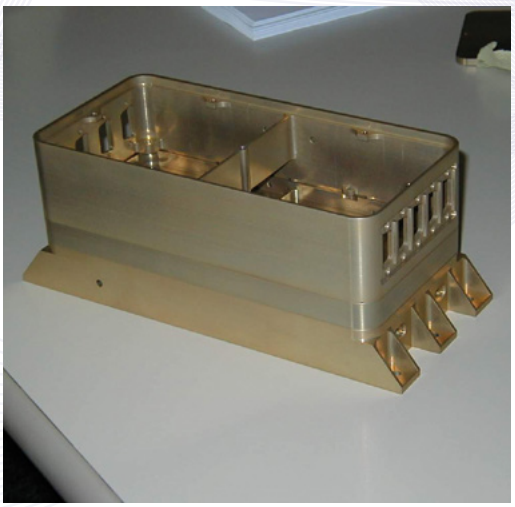
Major Space Projects & References

- Satellite INTEGRAL: PSAC Unit - design of DPU, HV PSU & HV Dividers, PCB Layout, FPGA design, Mechanical design and data preparation for testing and analysis
- Satellite SMART1: EPDP Unit - design of DPU, Analog Board, HV converter, PCB Layout, Mechanical design and data preparation for testing and analysis
- Satellite DEMETER: I/V Converter - design of I/V Converter, PCB Layout, Design Testing and Attendance to qualification process
- Satellite PROBA2: DSLP Unit - design of DPU, PCB Layout, FPGA design, Mechanical design and data preparation for testing and analysis



Space Related Equipment, Labs & Certificates

- Cleanroom (Class 100 000)



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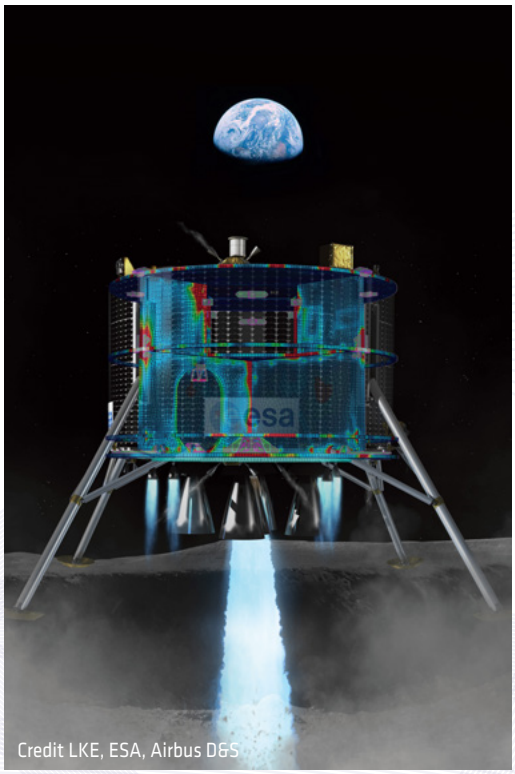


Credit LKE, ESA, Airbus D&S

General description

L.K. Engineering (LKE) provides engineering services for space applications. The core activities are focused on analysis-based design using advanced engineering computations. LKE can offer a solution to companies in each part of the product development cycle such as innovative design proposal, conceptual trade-off studies, optimized detailed design, manufacturing documentation, and preparation and evaluation of verification activities. We use the most advanced computational and design techniques, technologies and knowledge available to satisfy challenging requirements of today's space products. These practices and our experience help to reduce the cost and time during the development period and contribute to product competitiveness.

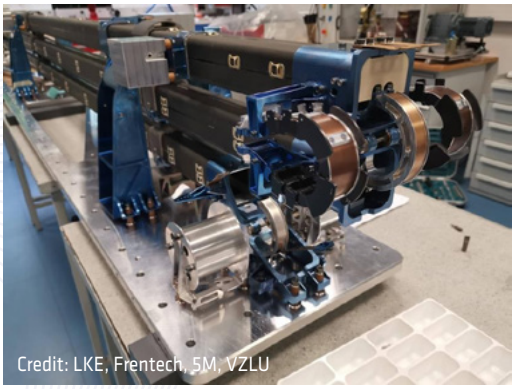
Skilled team of engineers has brought their experties into the design of spaceflight hardware, R&D projects or the design of Ground Support Equipment.

Beside the space domain, LKE provides services to a diverse group of clients and the team of LKE experts has successfully accomplished projects for various areas of industry such as power generation, transportation or architecture.


Credit: LKE, ESA, RUAG

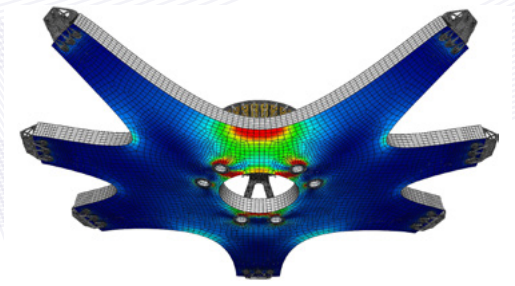
Competences & Capabilities

- Analysis-based design of spacecraft subsystems
- Comprehensive structural and thermal evaluation of spacecraft
- Complete manufacturing documentation
- Generation of test specification, test planning and test evaluation
- Launcher aerodynamics, aeroelasticity, acoustics
- Additive Layer Manufacturing of metals


Credit: LKE, Frentech, 5M, VZLU

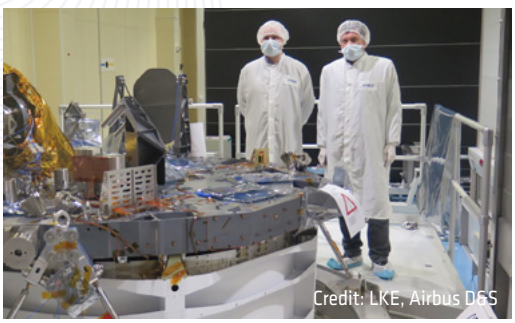
Major Space Projects & References

- Thermal and thermo-elastic analysis of microaccelerometer unit for SWARM (CSRC)
- Thermal analysis of European Extremely Large Telescope enclosure (ESO)
- Temporal Extrapolation Methods in Thermal Testing (Airbus D&S)
- Thermal and structural analysis of ACES/ELT unit (CSRC)
- Simulation of flutter response on launcher VTI panel (TAS)
- Structural optimization and thermo-elastic analysis of LUNAR LANDER spacecraft structure (Airbus D&S)
- Design of Spacecraft Components for Additive Manufacturing (ESA)
- Thermal control of EUCLID payload module (Airbus D&S)
- Numerical simulation of Acoustic, Thermal and Shock loads on the VEGA payload fairing and future designs (RUAG Space)
- Detailed design of release mechanism for radar antenna of JUICE spacecraft (STI)
- Development of innovative Shape Memory Alloy motorization of magnetometer boom and solar arrays (ESA)
- Mechanical design of Charged Particle Diverter demonstrator for ATHENA spacecraft (ESA)


Credit: LKE, Frentech, BUT

Space Related Equipment, Labs & Certificates

- ISO 9001, 14001


Credit: LKE, Airbus D&S

Industry

R & D

Services

Testing

L.K. Engineering s.r.o.

CZECH SPACE ALLIANCE

Member of the Czech Space Alliance

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Industry

Manufacturing

R & D

Services

Testing

MCE Slaný s.r.o

General Description

Founded in 1991, MCE Slaný s.r.o. is the largest steel structure construction company in the Czech Republic. Specializing in bridges, heavy steel construction, and large-scale weldments, MCE Slaný is a subsidiary of the Austrian HABAU GROUP. MCE is dedicated to meeting our customer requirements in steel structure construction with customized, individual solutions.

MCE Slaný is an expert, all-in-one general contractor whose Hi-Tech projects include deliveries of Airbus assembly and handling products, supply of aerodynamic and aero-acoustic tunnels for Mercedes-Benz and BMW, and delivering on demanding, non-traditional projects for both assembly and production.

Competences & Capabilities

We manufacture reliable and high-quality steel structures and our proven best-practices, advanced production technologies, and highly-qualified professional workforce ensure compliance and satisfaction from start to finish.

We specialize in medium and heavy steel construction with materials up to 690 MPa, including special steels such as HARDOX. We deliver comprehensive project security from technical support and equipment development to all stages of construction, including oversized transport, assembly, and installation. Our customers, Airbus, ABB, and Siemens are world leaders in innovation and technology.

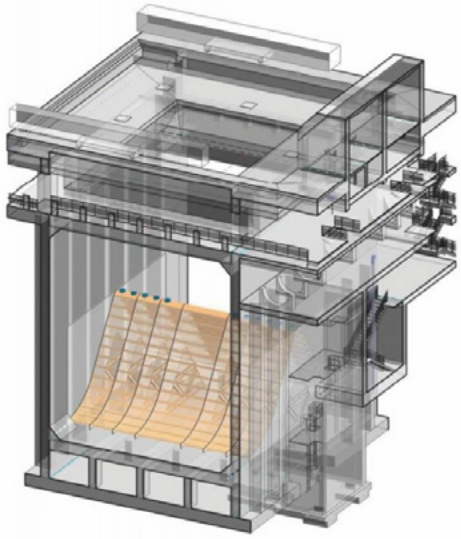
Major Space Projects & References

All-inclusive production of the deflector shield for the ELA 4 Launch Ramp of the Ariane 6. Weighing ca. 650 tons, plus ca. 120 tons in parts, MCE Slaný developed or assisted in every stage of the project including but not limited to:

- Device development (and calculations)
- 3D model production
- Production
- Deflector shield assembly and water-cooling system performance
- Metallizing all components via hot-dip galvanizing
- Finish coat
- Overseas packaging
- Transport
- Final assembly (Kourou, French Guiana)
- Manufacture and supply of Toolox spare parts

Space Related Equipment, Labs & Certificates

- 10,000 tonnes of steel structures per year
- 440,000 hours of production capacity per year
- 35,600 m^2 of production area
- 3 paint shops
- Maximum parts manufactured dimensions (100 tons, 30 x 7 x 4.5m)
- Staff and devices for NDT testing UT, MT, PT, all level 2
- ISO 9001
- ISO 14001
- BS OHSAS 18001
- EN ISO 3842-2, EN 1090-1, -2 EXC -4
- EN 15085 CL -1



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Industry

Manufacturing

R & D

Services

Testing

Software

Meopta - optika s.r.o.

General description

- Global manufacturer of precision optics.
- Specializied in the design, engineering and assembly of complex optical, opto-mechanical and photo-electronic systems.
- Innovative, total solutions for the consumer, industrial and military markets.

Major Space Projects & References

The main ESA projects:

- TESLA OH-OB (Prism&band filters design, development, production, coating, and qualification).
- Flex (Mirror&coating design, development, production, and qualification).
- OHB - SHS project (Optical and mechanical design, development, production, and qualification).

Competences & Capabilities

- Long tradition of producing high quality precision optics and mechanics for components, subsystems and full turn/key systems.
- Development process from the development of an initial prototype through the serial production of a final product.
- Team of outstanding designers and engineers.
- Guarantee of the highest level of quality and performance in manufacturing.

Space Related Equipment, Labs & Certificates

- Manufacturing area of 58.000m^2.
- Clean rooms with class up to 10 (equivalent ISO 4) + AMC control.
- In house testing equipment (excluding thermal vacuum and radiation).
- More information about our lab possibilities: www.testinglab.meopta.com
- Certificates: ISO9001, ISO14001, AQAP2110

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Based in the Czech Republic

Meopta - optika, s.r.o.
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misterine

Industry

R & D

Services

Testing

Software

Misterine s.r.o

General Description

Misterine s.r.o. is a Czech startup company founded in 2016, focusing on industrial use of augmented reality (AR). Our mission is to significantly reduce people's workload by pioneering real-time augmentation of industrial processes with visual information.

We have employees and clients from all over the world – namely Europe, the US and Japan.

Competences & Capabilities

Our primary competence is industrial application of AR (augmented reality), VR (virtual reality) and computer vision. We especially focus on aviation and space industries, providing innovative solutions for assembly, maintenance, training, customer service, sales and marketing. Our solution is particularly beneficial in situations where people struggle with complicated processes that are difficult to memorize or that are unique for each product. We offer:

- Data analytical tools that can automate the creation of 3D AR presentation and related authoring processes.
- AR training manual for engine assembly.
- Visual presentation on multiple platforms including iOS, Android, MS Windows, MS HoloLens and custom-built systems such as a combination of a data projector and a camera.
- Consultations for AR usage and implementation into existing setups in aviation industry.

Major Space Projects & References

VIPER – Visualization of Industry Processes in Enhanced Reality. In collaboration with GE Aviation Czech s.r.o. and under the supervision of ESA ESTEC, Misterine developed an innovative authoring tool for creating and editing service manuals for augmented reality (i.e. AR manual). This authoring tool has functions to import process definitions in formats like S1000D and to automatically create a foundation of AR manuals. Animation can be created from 3D data of the product. With this authoring tool, any aerospace company can create their own AR manuals in an easy, secure and efficient manner without external developers or services. The VIPER project has been successfully completed in November 2020. The combined authoring and AR visualization tool is currently available on the market.

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martin.klima@misterine.com

General Description

NG Aviation SE is Czech company focusing on bringing new state-of- the-art solutions into the field of digitization of aeronautical data for airports, air navigation providers, airlines and other aviation stakeholders. The portfolio of NG Aviation SE provides solutions in managing and sharing aeronautical data throughout all aviation stakeholders.

Our global project called NG-AIME (New Generation - Aeronautical Information Management Environment) is unique platform for digitization of aeronautical data, which allows users to manage safety critical data and optimize processes at the airport. NG-AIME enables to connect geographical information with quantitative aeronautical information and develops AIXM 5.1 format which is recommended from International Civil Aviation Organization (ICAO), European Organization for the Safety of Air Navigation (Eurocontrol) and Federal Aviation Administration (FAA). Digital information with time and geographical representation bring actual situation to the systems, e.g. closed runways and taxiways, work in progress areas, temporary routes, etc....

NG Aviation is cooperating also with the European Space Agency. NG Aviation successfully won the project from European Space Agency called SPACE-BASED SERVICES FOR SMART AIRPORTS with the topic: Implementation of digital navigational database of aerodrome data. Aerodrome data is in AIXM 5.1 format for the provision of the Digital NOTAM messages.

Additionally, NG Aviation was granted the contract with Eurocontrol for Digital Airport Guidance for implementation of AIXM 5.1 for airport usage. Aerodrome Mapping database as a part of the digital data sets defined by ICAO Annex 15 plays indispensable role in digitization of aeronautical data which is a part of airport management.

It is noteworthy to mention that NG Aviation participated as a speaker on The Global Investment in Aviation Summit - The General Civil Aviation Authority in Dubai (GIAS) and will participate as a speaker on 'The Global Airport Leaders Forum 2019, hosted by The Airport Show 2019

Major Space Projects & References

ESA

NG Aviation is part of the European Space Agency from 2016. NG Aviation received contract with ESA for the Smart airports project for 4 European airports, with the focus on analysis and implementation of digitalization of aeronautical data, clarification of aviation industry expectations and preparation of detailed user requirements on the level necessary for defining service and requirements for SW development.

Airport aeronautical information management system includes the production and maintenance of Airport Mapping Data in accordance with Eurcoae ED-99B/ RTCA DO-272B standards and Obstacle management in accordance with Eurcoae ED-98C/RTCA DO-276C digital delivery via AIXM 5.1. This highly accurate data can be consumed for numerous operational purposes such as Airport Ground Operations, Airside operation, Digital NOTAMs and digital PIB.

Eurocontrol – Digital Airport

Initial SWIM" family of projects, which includes under "5.3.1 Implement Aeronautical Information Exchange system/service" a task to develop an Airport Digital Data

Airport Digital Data aims to develop guidance material, data management and procedures describing a common body of knowledge for the provision of digital aeronautical data covering terrain, obstacle and aerodrome mapping related data aspects in the context of SWIM and in support of related ATM digitization efforts. The deliverable of this task consists of updating of the EUROCONTROL related materials according to the AIME system solution.

AirNAV Indonesia

NG Aviation delivered strategic AIM training for the practical implementation of digitization of aeronautical data and consultation for setup of digital environment. NG Aviation created and implemented digital aeronautical data in AIXM 5.1 for Denpasar International Airport (Bali). The service included creation of georeferenced data and their connection with aeronautical information published in states Aeronautical Information Publication.

NG Aviation delivered Aerodrome Mapping Database which is collection of airport features in AIXM 5.1 format. NG Aviation is provided service of creation of this kind of data and also automated software verification and validation of aerodrome mapping data in ICAO recommended format AIXM 5.1.

Czech Airforce

NG Aviation delivered consultancy, training and implantation for the digital aeronautical environment based on the new ICAO Annex 15 version 16 valid from November 2018. NG Aviation defined technical specification and procedures for the digital environment according to the ICAO and NATO STANAG standards.

NG Aviation processed verification and validation of the AIXM 5.1 data and delivered digital analyses for the data correction.

NG Aviation set up environment for the AIM and designed procedures for the exchanging data between aviation stakeholders. The part of the delivery was also Quality Management system set up based on ISO 9001 follow ICAO guidelines for data creation.

GCAA

NG Aviation delivered NG AIME system for the initial implementation. NG Aviation created Aerodrome mapping database for UAE airports: Dubai International Airport, Abu Dhabi international airport, Sharjah, Al Ain, Ras Al Khaimah airport.

ICAO electronic Terrain and Obstacle data workshop

NG Aviation instructors received certificates for electronic terrain and obstacle data. The session was focused on digitization of aeronautical data and data collection according to the data quality requirements.

ICAO MID workshop

NG Aviation had workshop AIM GROUP on Middle East for digital data sets. The sesion was focused on setting up strategic plan for the implementation digital products and procedures for digital environment.

NG AVIATION

Industry

Manufacturing

R & D

Services

Testing

Software

NG Aviation SE

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Industry

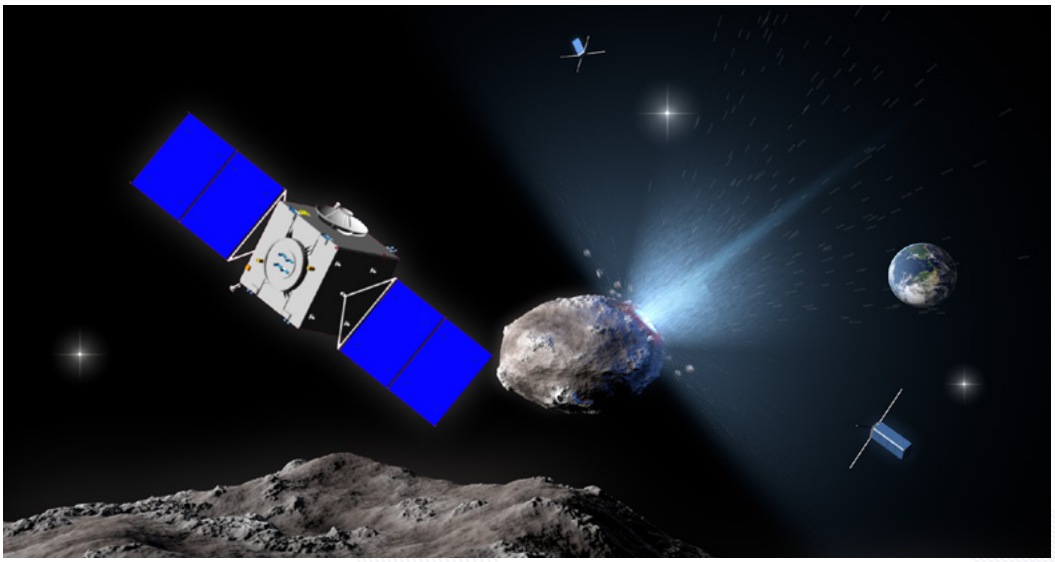
Manufacturing

R & D

Services

Testing

OHB Czechspace s.r.o.



General Description

OHB Czechspace s.r.o. is a new member of the OHB SE Group and started its operational business in 2018. At its engineering offices located in Brno, OHB Czechspace provides services as a prime contractor and sub-contractor in the field of development and systems engineering for space applications.

In its first years the company will predominantly provide services in the field of mechanical engineering, including design and analytical verification, procurement of related structural hardware, integration and mechanical testing. OHB Czechspace also provides all related project management, product assurance and systems engineering services including the interface management to any other subsystem (e.g. harness, thermal). In the near future OHB Czechspace aims to be responsible for the development and supply of large structural subsystems (e.g. complete satellite structures) and intends to increase the scope of provided services for space applications.

OHB Czechspace is in preparation to become ISO 9001 certified in 2020

Competences & Capabilities

- Design of structural items and systems from the conceptual phase to detailed design according to the Customer's requirements and standards:
- Generation of 2D and 3D models
- Evaluation of relevant concept trade-offs
- Detailed design & design optimization
- Generation of engineering drawings

Analysis and verification of space products according to ECSS Standards (if required), such as structural items, sub-assemblies, satellite systems, electronic equipment:

- Generation of FE models from 2D and 3D CAD models
- Static analysis (linear and non-linear)
- Dynamic analysis, such as modal analysis and vibration analysis (incl. random and acoustic analysis)
- Stress verification
- Thermo-elastic analysis
- Deformation analysis & stability analysis
- Design optimization
- Joint verification (e.g. bolts and inserts)
- Fatigue analysis & fracture mechanics analysis
- Generation of condensed models (e.g. Craig Bampton Model)
- Model correlation with test data

Procurement and integration of structural items:

- Procurement of all metallic and composite structural items, such as bracketry, sandwich panels, adapters, tubes, and rods
- System activities related to procurement (e.g. specification writing)
- Supervision of manufacturing activities and related product assurance
- Specification and supervision of needed development, qualification and acceptance testing activities (e.g. development specimen test campaign for derivation of mechanical properties)
- Coordination of the integration facility
- Integration

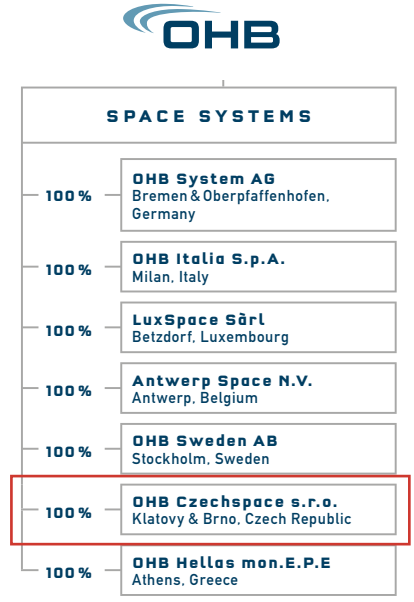
The services provided by OHB Czechspace related to mechanical testing of every assembly such as satellite systems or electronic equipment:

- Coordination of the test facility
- Preparation of the test procedure and definition of the sensor
- Design of test adapters and supporting structures
- Lead of the test activities
- Evaluation of the test data
- Reporting of the test results

Major Space Projects & References

OHB Czechspace is supporting various ESA studies and satellite projects of institutional and private customers in the domain structural analysis and design. A few examples of work packages are listed hereunder:

HERA Phase B1 and B2 (ESA's asteroid deflection and planetary defence mission)
H2SAT (satellite for telecommunication)
ELECTRA (satellite for telecommunication)
MOON TRANSFER STAGE (ESA study)



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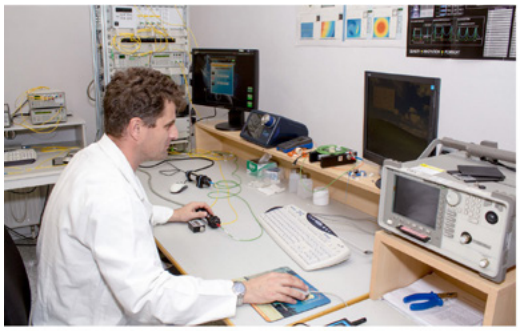

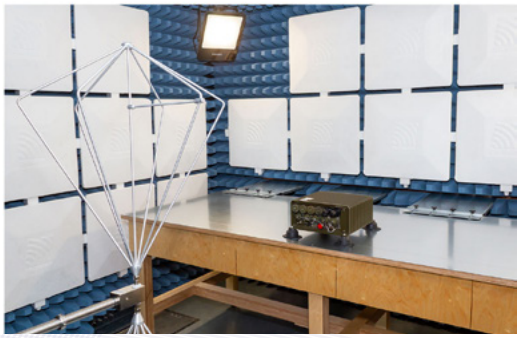

OPTOKON

FIBER OPTIC TECHNOLOGY
CALIBRATION LABORATORY

Industry

Manufacturing

R & D

Services

Testing

Software

OPTOKON, a.s.

General description

OPTOKON, a.s. is a 100% Czech owned joint- stock company with over 30 years of experience in the information and communications technology market. OPTOKON develops and manufactures connectivity solutions for high-quality communication networks. The company significantly contributes to operational reliability and safety in global voice, data and video transmission through its fiber optic systems. The high product quality and forward-looking system designs means that OPTOKON ensures that networks are fit for the future and that investments remain sound in the long term. OPTOKON connectivity solutions are used in offices, data centers, by network operators, in homes, in industry and the military, where OPTOKON NATO approved solutions dominate the global market. The OPTOKON Czech and Malaysian calibration laboratories offer accredited calibration services.

Our Testing Division carries out mechanical, thermal and EMC tests according to standard EN ISO / IEC 17025.

Competences & Capabilities

Main areas of activity include:

- Connectors, Cable Assemblies
- Cable Management Systems
- Splitters, WDM, CWDM & DWDM
- Data Network Equipment
- PON Solution
- Fiber Optic Test Equipment with Bluetooth wireless and USB control
- OPTOKON Ruggedized Harsh Environment Optical Network Products
- Optical, hybrid and special cables for mobile and tactical use
- Service and Calibration Center

OPTOKON specializes in the production of military tactical components for use in harsh environmental conditions, aerospace and broadcasting and currently supplies the military forces of more than 20 countries with high quality military tactical components using unique Expanded Beam technology.

Major Space Projects & References

- Astronomical Institute ASCR- Telescop interconnection, fiber optic infrastructure

Space Related Equipment, Labs & Certificates

- OPTOKON Research & Development Innovation Department
- Testing climatic chamber for individual test methods, according to the standard ČSN EN ISO/IEC 17025
- Accredited Calibration Laboratory No. 2315
- EN ISO 9001:2015 Certified Quality system
- EN ISO 14001:2015 EMS system in all processes
- AQAP certified

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ProjectSoft®

Industry

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Services

Software

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General description

ProjectSoft was founded in 1990 in Hradec Králové as an automation and engineering company. Dynamic growth enabled the extention of provided services by additional fields – machinery-technologies and information technologies. The company also started its own electronics production. In 1998 ProjectSoft became a join stock company and since 2003 it has had a concern structure. In 2012 the company with its 68 employees celebrated its 22 years' jubilee. We belong among the top suppliers of automatic technology processes, information and robotic systems. Our customers are industrial enterprises and scientific institutes. The essential part of our activities is implemented in the food industry. We own and create our knowhow for the robotization and control of astronomical devices. We have developer and have been improving our own system for the visualization of technological processes. We supply entirely new technologies and also provide reconstructions and refurbishments of existing technologies or their parts. We provide a wide range of services – from machinery equipment design and supply, energy distribution systems, through automation parts up to information systems. Yet our work doesn't end with project's delivery. The very first implemented projects was the robotization of a miniature observatory of an amateur astronomer, Mr. Zdeněk Bardon (currently the director of ProjectSoft HK), followed by the implementation of control of a 0,5m telescope. These first "astronomical swallows" have gradually brought ProjectSoft to winning the competition and successful delivery of a 2m telescopes control for four observatories, 1m telescope of ESA´s Optical Ground Station on Tenerife Island, 1,5m Danish telescope La Silla.

Competences & Capabilities

Thanks to our 20 years experience in the industrial automation we could use without any fear the same control system which was delivered by ProjectSoft for the control of production in one of the most famous Czech breweries, Budweiser České Budějovice (and not only there) also for the demanding control of astronomical telescopes. This solution brings many benefits:

- long lifetime of all components
- wide range of extensible cards: inputs, outputs, counters, etc.
- service and spare parts are problem-free and easily available worldwide

In spite of higher computing power and flexibility of personal computers. the use of a standard programmable controller is more suitable because:

- complete control program is executed directly in the controller. All computations are executed in one processor, eliminating the need for complex network communication. This ensures top reliability of the control
- programmable controller is considerably more reliable than classical computer
- programmable controller runs full RealTime operating system

Personal computers are used only for visualization and the remote control. The telescope also can be controlled without PC though standard TCP/IP protocol. Placing the critical parts of the control in the programmable controller and the auxiliary parts in the personal computer creates new conception model of the robotized telescope.

Major Space Projects & References

Four of five telescopes, which were made by Carl Zeiss Jena, were robotized by our company.

Robotization of 1,54m Danish telescope

The company provides renovation of existing astronomical telescopes, domes, spectrographs and other astronomical instruments, requiring computer control, robotic and automatic operations. We are able to guarantee quick implementation and turn-key deliveries. To significantly increase the lifetime of our installations, we build them from commercial off-the-shelf solutions and components. That also helps to mitigate one of the most critical problems – availability of spare parts, as these are available worldwide from various suppliers. Thanks to this approach, we are currently working on full reconstruction and remote control of the Danish 1.5m telescope at ESO's La Silla observatory in Chile. The telescope will be remotely controlled from Europe, without any on-site presence of the staff. This work is expected to be finished in May 2012.

Robotization of OGS 1m telescope

The main objective of the project was to extend and improve the precision of tracking of objects moving in the vicinity of the Earth. That includes not only active artificial satellites, but also satellite debris and small solar system bodies. The project results can be used for related purposes – for example in ground stations for Meteosat of the 3rd generation, GMES satellites or optical ground stations.

The original OGS control system was prone to many problems, resulting in low accuracy, unreliable operation and obsoleteness. Design specifications called for a new control system, which would deliver higher accuracy and slewing speeds, reliability, security, easy serviceability, and which would add the possibilities of expanding its functions and openness for third party systems.

The resulted industrial control system was installed on European Space Agency (ESA)'s Optical Ground Station (OGS) which specializes in laser satellite communication.

ProjectSoft´s fully robotized observatory BluEye 600

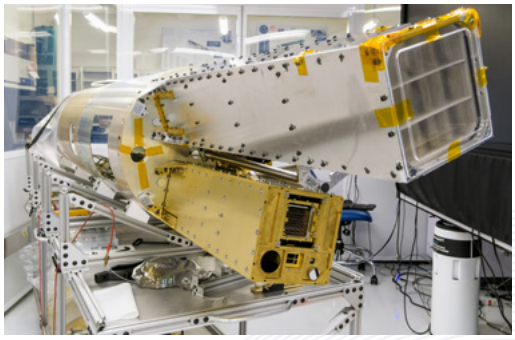
On ultraspeed Alt/Az installation (speed of moving is up to 90°/sec) a RC optical system telescope with diameter of the mirror of 0.6m is installed. The installation which is exclusively based on industrial components including PLC Beckhoff is equipped with most modern direct-drive control. A special dome is designed so that it enables fast opening and doesn't prevent the telescope from fast moving. All modern industrial electronics is installed in a special container and a number of meteorological sensors independently care about ultimate safety of the whole observatory.

The complete equipment can serve not only for astronomy but also for example for watching gamma flashes, for laser terminals or telemeters, for searching cosmic dust/satellites and so on.

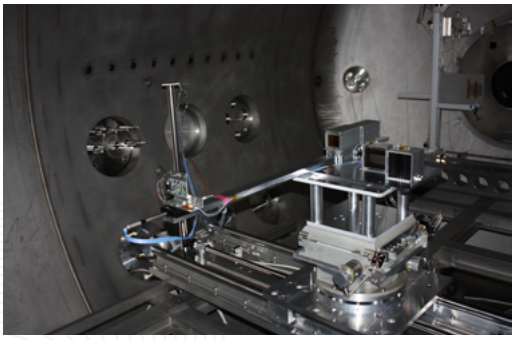
We expect more other ways of usage by future customers. A turnkey delivery of the observatory includes complete installation.

Space Related Equipment, Labs & Certificates

- Certificates: ISO9001



Rocket experiment - Wide X-ray System for X-ray imaging with detector Timepix (launch 2018, assembled at The Pennsylvania State University, USA).



Test at vacuum chamber
(Panter test facilities, Germany).

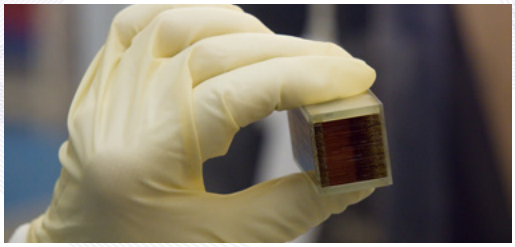
General description

Rigaku Innovative Technologies Europe s.r.o. (RITE) belongs to the Rigaku Corporation group (Tokyo, Japan). RITE was established in 2008 as European center of excellence for the design, development and manufacturing of X-ray optics, X-ray detectors and X-ray sources, as well as other related scientific products for industry and research. RITE completes a triad of Rigaku X-ray equipment research and development (R&D) laboratories, now spanning the globe, with facilities in Japan, the United States and Europe.

Competences & Capabilities

RITE expertise and experience focuses on various optical technologies (especially replicated and Multi-Foil X-ray Optics), X-ray imaging and X-ray sources. The test facilities and measurement devices include optical and X-ray imaging and image analyses (including X-ray enclosure), scanning electron microscope (SEM), atomic force microscope (AFM), contact profilometer (Taylor - Hobson). RITE and its specialists can, due their long experience, offer consultations and expertise in these fields. Half of the employees hold Ph.D.'s in physics and all have backgrounds in either physics or chemistry.

XSight Micron high resolution X-ray camera.



1D X-ray optics for VZLUSAT-1, on orbit since June 2017.

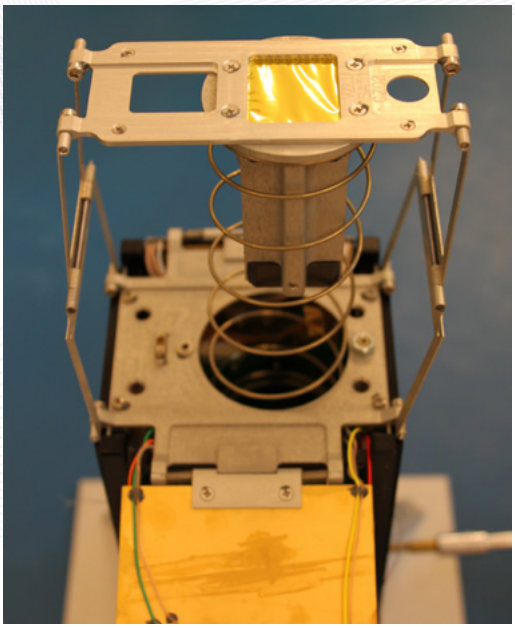
Major Space Projects & References

- VZLUSAT2 mission - X-ray optical payload equipped with Rigaku X-ray Optics and miniaturized TimePix detector with CdTe sensor, the task of this payload is to observe the Sun, capture flashes of supernovae in hard X-rays and serve as a directional screen. Energy range from 5 keV to 500keV (see www.vzlusat2.cz), expected launch in December 2020.
- VZLUSAT1 mission - Experimental verification of space products and technologies on nanosatellite, project is linked to European QB50 project - Wide-angle X-ray imaging system with Timepix detector (see www.vzlusat1.cz), on orbit since June 2017.

- Wide X-ray System for X-ray imaging with detector Timepix – rocket experiments (launch spring 2018, assembled at The Pennsylvania State University – Department of astronomy and astrophysics, USA).
- Space radiation capabilities, technologies and platforms for small spacecraft and CubeSats (SR-CTP) - the second generation Czech CubeSat will be built at the QEM level which includes radiation composite shielding, X-ray optics telescope coupled to a pixel detector Timepix as X-ray focal plane detector, and outgassing sensors (2018 - 2020).
- International projects
- Novel X-ray Optics Technologies for ESA X-ray Astrophysics Missions – ESA PECS project (end 06/2011).
- Applications of Kirkpatrick Baez Imaging Systems in Space – co-operation with Colorado and Iowa University - Ministry of Education, Youth and Sports (2008- 2012).

Space Related Equipment, Labs & Certificates

- AFM microscope
- SEM microscope
- Taylor-Hobson contact profilometer
- software for design and ray-tracing of X-ray optics for space and laboratory applications (Lobster Eye, Kirkpatrick-Baez system, ellipsoidal and parabolic optics)
- X-ray optical test bench
- X-ray optical vacuum test bench
- Microfocus X-ray sources
- Metrology X-ray matrix detectors
- Laboratory equipment for X-ray detectors and X-ray optics characterization



1D X-ray telescope for VZLUSAT-1, on orbit since June 2017.

Industry

Manufacturing

R & D

Testing

Rigaku Innovative Technologies Europe, s.r.o.

CZECH SPACE ALLIANCE

Member of the Czech Space Alliance

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252 41 Dolní Břežany
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Industry

R & D

Services

Testing

S.A.B. Aerospace s.r.o.

General description

S.A.B. Aerospace s.r.o. is a Czech private SME with the head quarter located in Brno operating in the Space Business since 2014.

The company's core business is focusing on the development of Mechanical Sub System for Launcher, Satellites and Payloads (Earth Observation and Microgravity). SAB has consolidated its primary role in the VEGA program, with system responsibility for the development of the VEGA SSMS Dispenser (Small Spacecraft Mission Service).

Assembly and integration activities are performed in the new ISO 8 Integration Facility created by SAB in the Brno Technology Park.

Competences & Capabilities

PROJECT OFFICE

- Project Management
- System Engineering
- Product Assurance

ENGINEERING

- Mechanical Design (3D CAD Modeling)
- Structural Analysis
- Thermal Analysis
- Multibody Dynamics Analysis (e.g. Mechanism Engineering)

SERVICES

- MANUFACTURING
  - Machined Parts (outsourced)
  - Composite Parts (outsourced)
- ASSEMBLY/INTEGRATION AND QUALIFICATION activities performed by certified operators:
  - Internally in clean room 100000 Class (e.g. Assembly Integration of Flight HW internally developed)
  - By the customer (e.g. EDRS-C panel integration and alignment at OHB System premises)
  - Vibration and Shock Testing (using external facility)
  - TVAC Testing (using an external facility)

Major Space Projects & References

VEGA SSMS Dispenser:

SSMS is an ESA project which aims to:

- define and develop for the Vega Launch System a dedicated and comprehensive launch preparation process and related hardware, to enable the launch of multiple SmallSat missions,
- guarantee timely and affordable access to space to SmallSat from European and International Organizations and Institutions,
- offer SmallSat Customers a competitive Launch Service Agreement tailored to meet launch needs of SmallSat.

In the frame of the SSMS project SAB is in charge of the development of the Dispenser system to carry and deliver to orbit a selected number of SmallSat.

To cover as much market needs as possible (e.g.: Ride share and piggy back missions), the current dispenser conceptual design foresees four modular elements combined together according to mission needs.

PLATO: SAB is responsible for overall development, manufacturing and testing of PLATO SVM.

PLATO (PLAnetary Transits and Oscillations of stars) is the European Space Agency (ESA) M3 (medium-class) astronomical science mission for the search of exo-planets. This is performed by detecting and characterizing transit signature of exo-planets in front of the parent star, as well as measuring seismic oscillations of central stars of exo-planetary systems and other selected stars."

EXOBIOLOGY Facility:

The EXOBIOLOGY Facility is developed by ESA for supporting exobiology experiments on the ISS. SAB, as subcontractor of Kayser Italia, is responsible for the mechanical Sub-system design.

UV-VIS Spectrometer:

SAB is involved in the development and manufacturing of the spectromodule to serve the experiments EXOCube, OREOCube, ICECube on the Exobiology Facility.

SAB, as subcontractor of OHB System AG, is responsible for:

- Cells Handling System and Ground Model Platform Design and MAIT
- Conceptual Design for the Accommodation in the new Exobiology Facility

MetOp-SG MICRO WAVE IMAGER (MWI):

SAB is responsible for the delivery to OHB-I of the Baseplate and Thermal Skirt subsystem.

Space Related Equipment, Labs & Certificates

The new facility created by SAB in Brno includes one production area for electronics, one clean storage and one Integration Hall for mechanical systems AIT.

Facility characteristics:

- Clean Room ISO 8
- Usable surface 600 sqm
- Usable height 6 m
- Equipped with 2 ton Lifting crane

SAB Aerospace s.r.o. is certified ISO 9001:2009

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Responsible for space and ESA projects:

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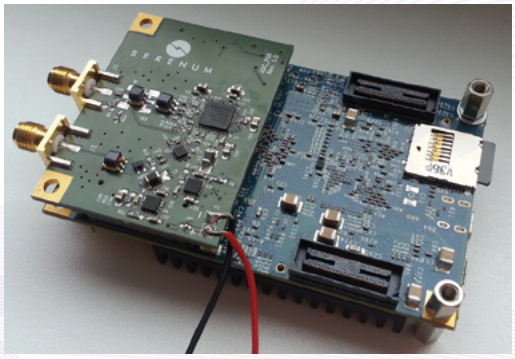
General Description

Company provides mechanical design of instrument parts or subsystems (housing, cases, mechanisms, locking devices, fixtures) including modelling and numerical analyses.

In electronics we develop and manufacture inertial and measurement systems and time and frequency control equipment. Design and development of custom systems.



Major Space Projects & References

MAG BOOM for JUICE (2015-2017): HDRM & EGSE & Engineering for JUICE Magnetometer Experiment boom.

EGEP ID89 (2014-now): Comparison of optical time-transfer links for GNSS: link model, demonstrator and measurement campaign.

HPTFL (2014-now): High performance time and frequency microwave link for ESA. Development of digital electronics based on anti-fuse FPGAs.

PROBA3 (2012-now): Front door assembly design for ASPIICS coronagraph.

JUICE (ITT/AO/1-7809) (2014-2016): Qualification of shielding applied to structural panel. Vibration and thermal analyses, vibration tests support.

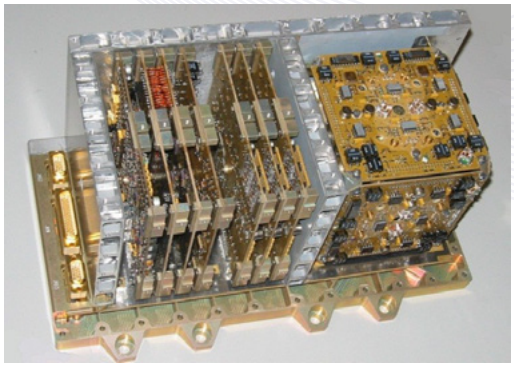
EUCLID (ITT/AO/1- 7628) (2014-2016): Vibration analyses and tests supply.

OCEARI (2014-2015): Development of optimal clock ensembling algorithms for ESA.

ELT2 (2014-2015): ACES ELT Ground Station Calibration. Manufacturing of portable timing device including control of ELT detector module intended for use in SLR stations calibration missions.

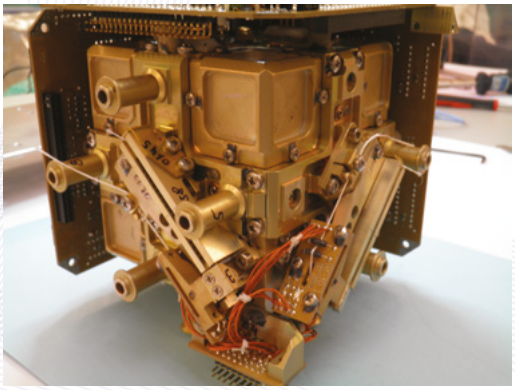
TT III-TX (2014-2015): Digital version, both transmit and receive, of TimeTech's modem for ranging and time transfer.

SWARM (2005 -2011): Three flight units of capacitive microaccelerometer were developed and delivered for three satellites of SWARM mission.



Competences & Capabilities

Locking devices and housing design for space application (HDRM, pin-pullers, Cases), MGSE and EGSE development (FEA, Thermal), Measurement and control design (Localization systems; analysis and implementation of controllers and estimators; digital signal processing), Time and Clock Management (Precision time metrology, custom built equipment, measurement, generation and distribution of precise time), Custom design and development of electronics (Digital signal processing, data acquisition systems, FPGA design, IP core development), Custom design and development of mechanical parts (fixtures, material selection, stiffness assessment, strength, modal, thermal and durability characteristics, Supporting static, dynamic, fatigue, thermal calculations etc.). Space HW design verification and testing.

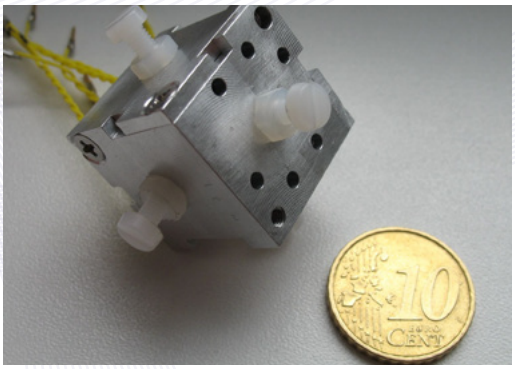


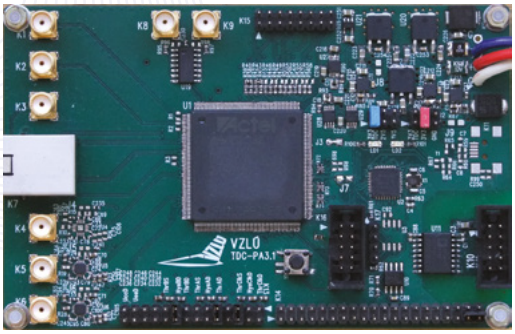
Space Related Equipment, Labs & Certificates

Thermovacuum chamber in clean room class 100 000, (1m^3, vacuum better than 10^4 Pa, variable temperature from –60 to +120 °C,)

Vibration testing (53 kN, 35 kN, 22 kN)

Centrifuge (max 25g, max 100 kg)





SERENUM

Industry

R & D

Services

Testing

Software

SERENUM, a.s.

SERENUM, a.s.
Beranových 130
http://serenum.cz

Responsible for space and ESA projects:

Mgr. Radek Peřestý
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Phone: (+420) 225 115 115

Industry

Manufacturing

R & D

Services

Testing

Software

Sobriety s.r.o.

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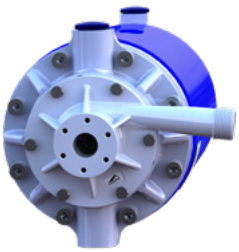
E-Pump



Oxidizer Inlet Throttling Valve

Turbopump Bypass Regulation Valve

General Description

Sobriety s.r.o. is a research and development company specialising in product design and comprehensive computer simulation engineering services. Sobriety s.r.o. started in 2002 as an exclusive supplier of CFD services for ŠKODA AUTO a.s. Complementary to these activities, now Sobriety s.r.o. develops regulating and chamber valves for the new LOX/Methane expander cycle rocket engine M10, part of the upper stage of the Vega-E launcher. Sobriety also develops another rocket engine element, which is an electrically driven propellant pump and this development is performed within ESA projects in cooperation with European rocket engine manufacturers. Equipped with innovative high-speed synchronous motors, fluid dynamic bearings and seals, these e-pumps allow for significant simplification of liquid-propellant rocket engine architecture.

Competences & Capabilities

- **Design** projects comprise space, aerospace, automotive and machine design applications (concept design and studies, prototyping, systems engineering, test bench design, mechanical design, product assurance, thermal vacuum testing, design and production documentation)
- **IT** projects involve validation by analysing real-world measurements, design of experiments, experimental data processing and more. Since 2009 the company focuses on algorithms used in engineering processes, real-time object tracking, real-time optical measurements and image processing.
- **Numerical analyses** engineers accomplish projects covering space and automotive applications, machine design (valve aerodynamic characteristics, pump performance analysis, bearing cooling and local boiling, 1D/3D rotor dynamics, model verification, FEM thermal and structural analyses, test prediction and correlation, pump performance analysis).
- **Electronics** engineers are administering dedicated product development. Such as Limit - ACPD/DCPD measurement device, AC/DC converters, motor inverters, special measurement devices, PMSM design, industrial buses.

Major Space Projects & References

- VEGA-E M10 ENGINE VALVES PACKAGE: prime contractor and design authority on electrically actuated regulating valves and pneumatic chamber valve for expander cycle rocket engine
- E-PUMP: electrically driven pump for 6kN class liquid-propellant rocket engine
- SOLAR PANEL HINGE: design of test bench, instrumentation and tooling
- PHOBOS PHOOTPRINT: soil simulator study, design of Zero-G test platform
- ACES ELT (European Laser Timing): structural and fracture analysis of the SPAD laser head housing
- EXOMARS: design for LID and IR interface
- MTG CRYOSTAT: structure for IRS and FCI instruments
- OMICRON SPACE HABITAT: concept of orbital habitat
- S.H.E.E. (Self-deployable Habitat for Extreme Environments)

Space Related Equipment, Labs & Certificates

The company is a member of the Czech Space Alliance.

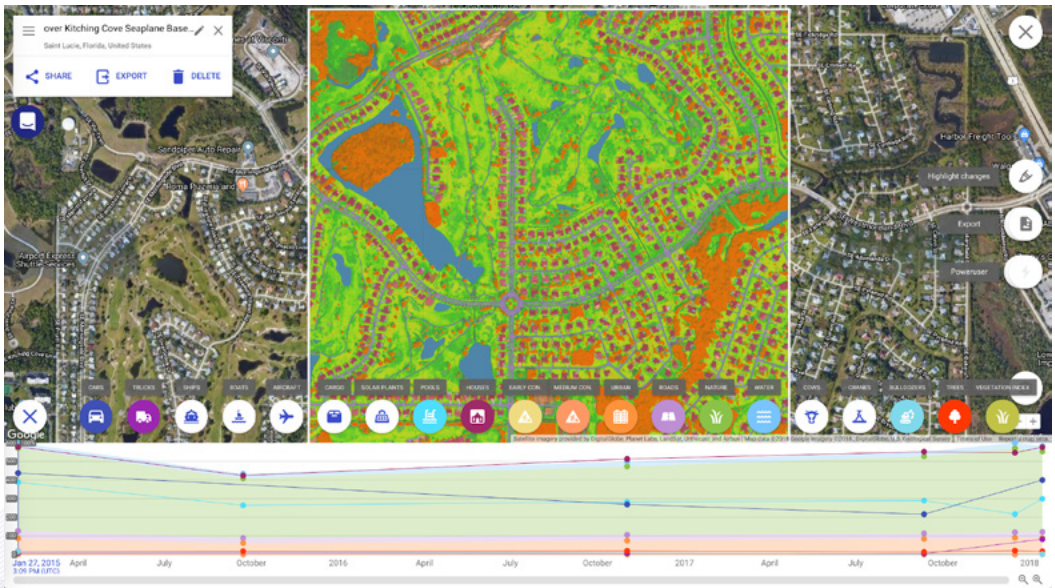
The company is certified according to ISO 9001:2015 (Quality), ISO 14001:2015 (Environmental) and ISO/IEC 27001:20013 (Information security).

Company's main products are:

- Special high-speed rotary machines
- Valves for rocket engines
- Optical measuring system MERCURY RT®
- Special aerodynamic bearing and sealing up to 500,000 RPM
- Bearing and rotor dynamics design software DynRot BR
- Potential drop technique material measuring system LIMIT using ACPD and corrected DCPD measurement
- Aerodynamics SW development tools AeroFLOW®

Fuel Main Valve

SPACEKNOW



Industry

R & D

Services

Testing

Software

General Description

SpaceKnow empowers decision-makers with ultra-large-scale planetary analysis. Our secret? A proprietary, AI-powered analytics engine, combined with the world's most comprehensive collection of earth observation imagery.

Our mission is to train machines to analyze satellite images to generate insights and to provide actionable intelligence.

Our AI-driven platform unlocks the power and potential of geospatial analysis. SpaceKnow is pioneering the use of space-based data that nowcasts the trends of the global economy and business activity and provides insights to financial markets, businesses, defense, government, and not-for-profits.

We apply image processing, computer vision techniques, machine learning, and deep neural networks to provide:

- Generalized change detection using both optical and SAR data
- Online object detection and count estimations
- Scene semantic segmentation into regions of interest
- Estimation of economic trends and design of econometric indexes
- Alerting & monitoring capability of any area of interest using near-real-time access to the world's most comprehensive collection of earth observation imagery

Competences & Capabilities

We offer analytics as a service: a fully automated and scalable cloud solution of any Area of Interest for a variety of objectives:

- Economic indexes (production monitoring)
- National security and safety
- Construction site oversee
- Military operations (uncommon target detection)
- Industrial facility analysis
- Disaster site damage assessment
- Environmental changes
- Agricultural production
- Natural resources (e.g. coal storage, oil, water)

Major Space Projects & References

Top leading financial, industrial and defense players are among our key customers worldwide.

Space Related Equipment, Labs & Certificates

SpaceKnow utilizes cutting edge technology both in software and hardware domain and highly skilled researchers and data scientists in order to deliver our customers with actionable intelligence. Our software solutions reflect the latest and most efficient trends within the Machine Learning & Artificial Intelligence fields, while our cooperation with leading providers of satellite data ensure up-to-date and high-quality imagery.

SPACEKNOW

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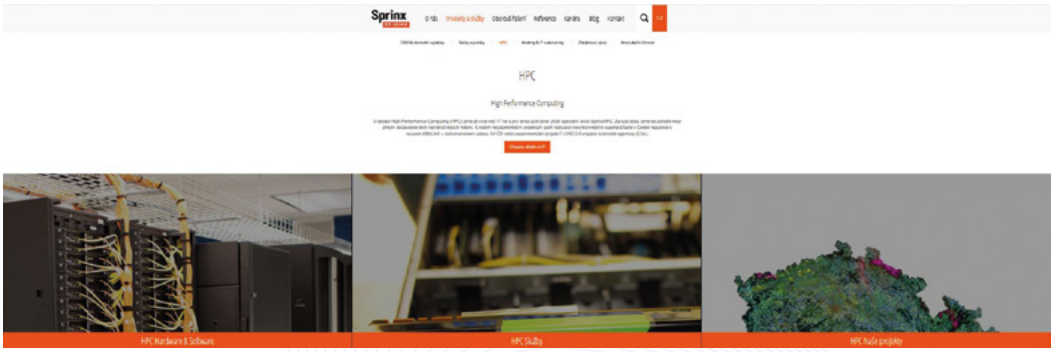
Sprinx
THE DOERS



Industry

Software

R & D

Testing

Sprinx Systems, a.s.

General Description

Sprinx Systems is one of the leading Czech technology companies - established in 1996. Our divisions focus on the development, distribution and implementation business systems and portals completely based on modern internet/intranet technologies, security and infrastructure consulting and building special high performance computers. Our products and solutions are used on a daily basis by a large number of customers in the Czech Republic and Slovakia.

Space Related Equipment, Labs & Certificates

- Strategy of own software development and computer science services
- Development and support of #2 internet portal in Czech Republic (until 1999)
- Company Certification (Microsoft Gold Partner, Symantec Enterprise Security Partner, Intel Integration Partner, NVIDIA Tesla Preferred Provider, Checkpoint Security Partner, National Security Office)
- Registered ESA software supplier with regularly trained staff in ESA standards and techniques with experience from several ESA PECS funded projects
- Leader of ESA project FLOREO (Flood Risk Earth Observation monitoring), deployed via ESA Earth Observation SSE (Services Support Environment) portal and dedicated national portal
- Close cooperation with Czech universities and Czech Space Office
- Quality management system implemented (ISO 9001:2000 certified since 2005, EFQM certification Pending)

Competences & Capabilities

Sprinx Systems has become a leading Supplier of demanding solutions for academic and commercial entities. Sprinx Systems implements projects with an emphasis on project planning from submitters. The projects mainly produce designs and optimizations of software and hardware for the infrastructure of various applications. Applications for the operation of demanding web solutions (virtual labs, portals) and solutions for high performance computing (GPU workstation, SMP systems, computing clusters).

Additionally, the task is to provide technical "know-how". This allows Sprinx Systems to deliver specialized high-performance hardware tailored to the customer or branch-oriented software. Sprinx Systems also offers a wide range of services which include: prophylactic maintenance of HPC solutions, parallel programming, as well as; consulting services, training, operations, and project management. HPC department naturally has its own development department which implements awarded research projects in order to provide maximum quality of background for their implementation in practice.

Major Space Projects & References

- Project SHOCK
- Project SAFETREE
- Project FLOREO
- Segment Langmuir Probe
- Realization of "Amálka" supercomputer
- Realization of „Nemo" supercomputer
- Realization of „Hubert" supercomputer
- Delivery of software compilers for many projects

Sprinx HPC

Sprinx Systems, a.s.
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Responsible for space and ESA projects:

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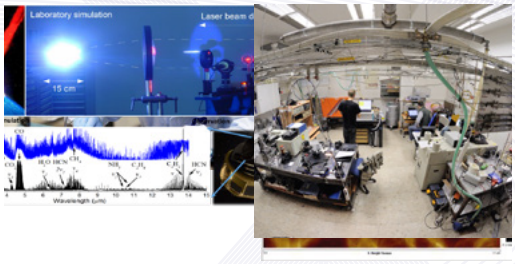
Phone: +420 251 014 211

General description

SYNPO is a research and manufacturing company with more than 70 years tradition in R&D of polymeric materials. Several research teams are working on synthesis of epoxies, polyesters, polyurethanes, and polyacrylates and on formulation of paints, composites and adhesives. One of our major research areas is development of nanostructured and hybrid polymers and polymers based on recyclable and renewable raw materials. Analysis, evaluation and testing are carried out in accredited laboratories. SYNPO has extensive experience in technology transfer; from laboratory through pilot plant to a full commercial scale manufacturing. SYNPO closely collaborates with Czech industry and companies in the European Union, USA, and Japan. **Synpo complies with ISO 9001:2015.**



Competences & Capabilities

R&D areas

- Synthesis of epoxy, alkyds, polyesters and polyurethanes resins
- Preparation of nanostructured polymers
- Synthesis of emulsion and solution polymers and acrylic dispersions
- Polymers based on renewable raw materials
- Targeted modification of nanoparticles
- Dispersion of nanoparticles in various binder, masterbatch preparation

Applications

- Composites (construction, electronic, automotive, aviation and space)
- Paints and coatings
- Laminating resins
- Casting and sealing compounds
- Adhesives, sealants and putties
- Foams (construction, electronic, automotive, aviation and space industry)

Recent projects for customers

- Cryogenic thermal insulation foams (fuel tanks of space vehicles)
- Antiradar coatings
- High temperature resistance coatings (over 300 °C)
- High refractive index polymeric systems
- Coatings with high abrasion resistance and resistance against aggressive liquids
- Rubbers with low gas/liquids permeability (military applications)

Technology areas of SYNPO, of interest to the aerospace industry

- Composite materials
- Thermal protection systems
- Materials for cryogenic applications
- Paints & coatings
- Joining (adhesives) of parts/structures made of different materials

Major Space Projects & References

Projects supported by ESA

- iners material study
- Epoxy Core Development
- Tailor Designed Carbon Nanotubes for Superior Composites

Space Related Equipment, Labs & Certificates

- Certificate of quality management ISO 9001:2015
- Testing Laboratory of Analytical and Physical Chemistry, Testing Laboratory of Evaluation and Testing, Calibration Laboratory of Viscometry are accredited by the Czech Accreditation Institute, according to ČSN EN ISO / IEC 17025.

Analytical equipment for complex analysis of polymeric materials

- LC, LC-MS, GPC, GPC-MALS, GC, GC-MS, Pyrolysis GC
- FTIR, UV, FTIR microscopy
- AFM
- Particle size distribution
- Titration and weighing methods, classical analyses...

Evaluation and testing

- DSC, MDSC
- TMA, DMA
- Universal testing machines
- Climatic chambers
- Equipment for accelerated weathering and corrosion tests of paints
- Salt spray chamber and chamber for the evaluation of the resistance in the sulphur oxide atmosphere
- Corrosion tests (NSS, AASS, SO2)

Pilot plant production

- Polymerization reactors
- Pearl Mills
- Dissolver
- Apparatuses for color matching
- Spraying techniques
- Cooling belt (Sandvik)
- Kneading equipment with discharge using discharge worm or discharge equipment (Morton, Werner & Pfleiderer)
- Calenders, presses

Industry

Manufacturing

R & D

Testing

SYNPO, akciová společnost

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Industry

Manufacturing

R & D

Testing

TOSEDA s.r.o.

Member of the
Czech Space Alliance

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Responsible for space and ESA projects

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Mobile: +420 721 967 071

Ing. Jiří Zelenka, CSc.
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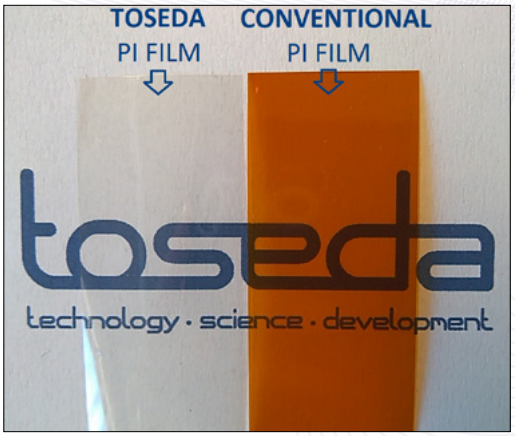
General Description

TOSEDA s.r.o. is an SME providing contract research and development, small scale production, and consultation services in the field of polymer chemistry and nanotechnologies. TOSEDA closely collaborates with the major EU space industry partners and European Space Agency (ESA). Since 2013 a member of the Czech Space Alliance. The main mission of TOSEDA is to fill the gap on the market with specialties that are usually commercially unavailable or produced out of the EU region.

Major Space Projects & References

ESA projects

- Development of epoxy based syntactic foam encapsulant (2013-2016)
- Resin development for cryogenic application (2014-2015)
- Design of inner wetted thermal system for LH2 metallic tank (2014-2016)
- Carbon nanotube technology and engineering for various space applications (NATAP) (2016-2018)
- Thermal joint development for NEOSAT - Phase C (2017-2021)
- Extended pot life resins for out of autoclave processing for large and complex part (2017-2021)
- Electrically conductive "black" primer - CCN1: Extension for optical applications (2017-2022)
- Development of "green" polyurethane materials for use in spacecraft and launcher applications - CCN1: Extension towards applications as conformal coatings and potting material (2017-2022)
- Transparent polyimide films for thermo-optical applications (2020-2021)
- Feasibility study for development of a new generation conformal coating for space applications (2020-2021)



Outputs/prototypes

- Nanohybrid transparent polyimide foils for thermo-optical applications (long time stability at +350 °C and withstanding temperature +500 °C)
- Thermal interface materials (TIM) pads and pastes with extremely high thermal conductivity (electrically conductive and non-conductive versions)
- Multifunctional „black" primer for thermo-optical applications
- One component epoxy adhesive (storable at RT for several years, curable at +120 °C)
- Expandable adhesive curable at low temperature (+80 °C)
- Barrier coatings and composites with improved resistance against liquid gasses (LH2...)
- Resins with extended pot life for out-of-autoclave manufacturing large and complex CFRP parts
- "Green" conformal coatings and potting materials for electronics
- Cryogenic insulation (foams, aerogels)

Analytical and testing services

- Outgassing, AFM, SEM, optical microscopy, DMA, DSC, TGA, rheology, thermal and thermo-mechanical properties, FTIR, NMR, ATOX, UV irradiation

Competences & Capabilities

Main activities

- Custom design, development and commercialization of novel polymeric and nanocomposite materials for hi-tech applications targeted especially for space industry

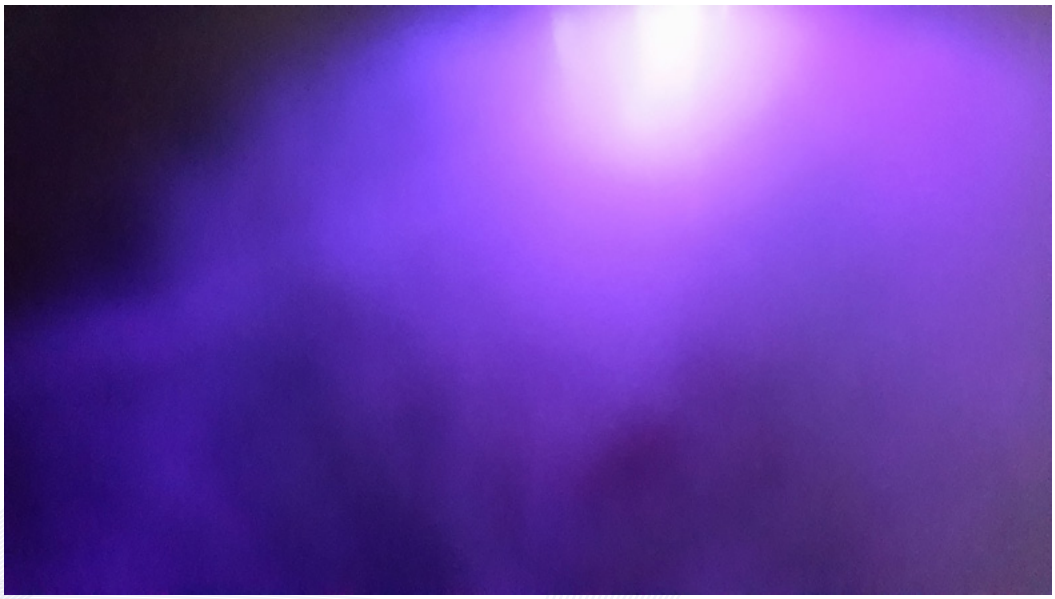
R&D

Nanotechnologies

- Synthesis, tailored surface modification and dispersion of various nanostructures in selected environment

Polymeric systems

- Synthesis of special monomers and polymers
- Design and formulation of polymeric and nanocomposite systems
- Composites, adhesives, elastomers, coatings, foams, aerogels, sensors etc.



Thin Film Technological Service

Industry

Manufacturing

R & D

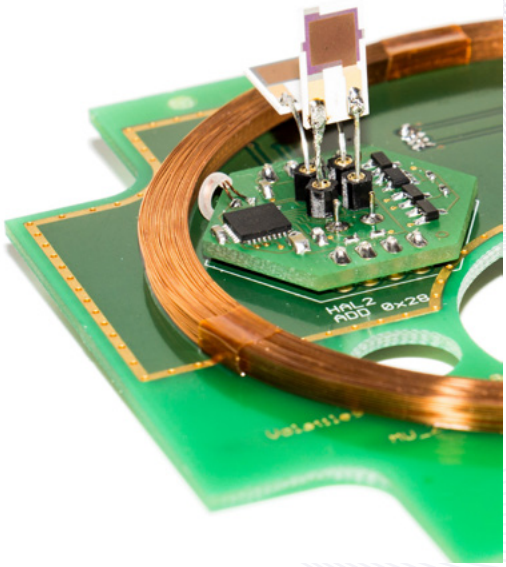
Services

General description

TTS (Thin Film Technological Service) is a small privatelly owned Czech company established in 1992 to provide comprehensive service in the field of thin film deposition by PVD technologies. It specialize in custom-made thin films for electronic and optical applications, thin film metallization and production of thin film moisture sensors.

TTS originated in the research and development community and has more than 50 years of experience in design, development and production of thin films. Its founders have participated in several space projects starting with the participation in the Interkosmos program.

In recent years its space related activities have focused on the development of coatings for the enhancement of properties of composite materials and on the use of trace moisture sensors in space. Some of its products (HAL2 moisture sensors and coatings) have recently been experimentally verified on board of VZLUSAT-1 nanosatellite.



Competences & Capabilities

Thin film technologies: Deposition of wide range of metallic and non-metallic thin films. Photolithographic patterning of thin films. Ion beam surface treatment.

Moisture sensors: Comprehensive solutions for trace moisture detection using TTS HAL sensors for both space and ground applications.

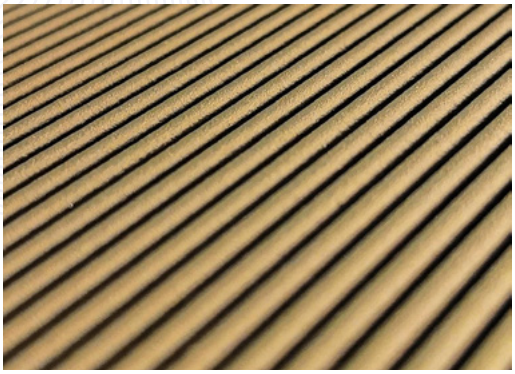
Radiation analysis: Computer simulations of transport of particles through matter with the focus on space radiation environment and its effects on spacecraft (primarily used for the design of coatings enhancing radiation properties)

Major Space Projects & References

- Qualification of Shielding Applied to Structural Panel for JUICE (2014 – 2016); Prime contractor: 5M s.r.o.; funded by ESA
- Experimental verification of space products and technologies on nanosatellite VZLUSAT-1; Principal Investigator: Czech Aerospace Research Centre, a.s.; Funded by Technology Agency of the Czech Republic
- Composites with modified surface optical properties for space applications – OPTIKOM (2017-2020); Principal investigator: 5M, s.r.o.; funded by Czech Ministry of Industry and Trade
- Composite Materials with Low Volatile Content and Radiation Resistance for Astrophysics and Space Applications (2011 – 2014); Principal investigator: 5M, s.r.o.; funded by Czech Ministry of Industry and Trade
- Space radiation capabilities, technologies and platforms for small spacecraft and CubeSats (2018 - 2020); Prime contractor Rigaku Innovative Technologies Europe s.r.o.; funded by ESA
- Design and Testing of Far and Medium Ultraviolet Coatings (2020 - 2022); Prime contractor: TTS, s.r.o.; funded by ESA

Space Related Equipment, Labs & Certificates

- PVD – 4 sputtering and ion beam devices
- Photolithography and wet processes
- Metrology – characterisation of thin films and calibration of moisture sensors
- Electronics laboratory
- Workplace of computer simulations for radiation analysis
- ISO 9001:2015 certificate



TTS, s.r.o.

CZECH SPACE ALLIANCE

Member of the Czech Space Alliance

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Responsible for space and ESA projects:

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Email: mikulickova@tts-co.eu

UNEX®

Industry

Manufacturing

Services

Testing

UNEX a.s.

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Responsible for space and ESA projects

Michal Kemler
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General description

Metallurgical and engineering group UNEX is a world-known manufacturer of bucket wheel excavators, an experienced supplier of heavy engineering components and a long-term partner of numerous multinational industrial corporations.

UNEX has already been helping for 70 years to create a tradition of Czechoslovak heavy engineering. The experience and expertise of the people; together with modern technologies, robotised and automated workplaces, a number of heavy machine tools and extensive production facilities enable to efficiently produce high quality products for various industries according to drawings and requirements of the most demanding customers.

Thanks to its own engineering shops, paint shops, foundries and forging shop, UNEX is able to deliver a wide range of heavy steel structures, including assembly, final machined castings and forgings. More than 2 thousand experts work in three plants in Uničov, Olomouc and Slovak Snina. UNEX exports most of its production all over the world.

Competences & Capabilities

Products:

- Bucket wheel excavators and mining equipment
- Welded steel parts and structures up to 120 t in weight and 40 m in length
- Castings from 50 g up to 20 t
- Die forgings from 2 kg to 25 kg
- Cut parts from standard and special materials

Technical and production capabilities:

- Design and development work, Castings production, Die forgings, Cutting and forming of materials, Welding, Machining, Heat treatment, Surface treatment and painting, Quality control, Servicing, completion and assembly

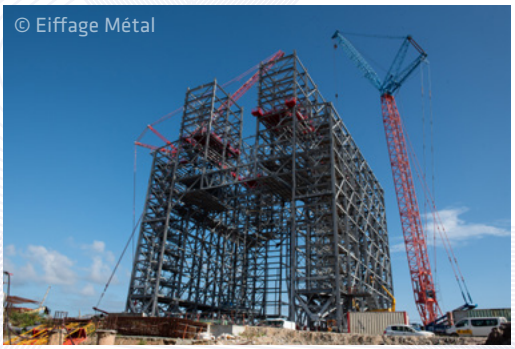
Major Space Projects & References

- manufacture of 16 sets of undercarriages and coupling components which will form part of the mobile building of a new Ariane 6 rocket launch platform at the Guiana Space Centre

Space Related Equipment, Labs & Certificates

More than 40 Czech and international certificates and permits demonstrates the quality of our company and products e.g. ISO 9001:2015, ISO 14001:2015, OHSAS 18001:2007, ISO 50001:2011, ... In the welding industry, we are certified according to the ČSN, EN and DIN standards, but we also have experience with welding according to the ASME IX, AWS D 1.1 and NORSOK M101.

The UNEX test laboratory has received a certificate of qualification for accredited testing in accordance with the standard ČSN EN ISO/IEC 17025:2005.



UNITES

Designed to test

Industry

Manufacturing

R & D

Services

Testing

Software

UNITES Systems a.s.

General description

UNITES Systems a.s. is a private company located in the Czech Republic with more than 28 years of experience in development and production of dedicated test and measurement systems – ATE solutions for semiconductor devices and FCT/ICT platform for assembled PCB testing (PCBA).

We are manufacturer and developer of very succesful mixed-signal tester – UNIMET 3000 which is widely used in Space sector for component qualification and characterization. Among our customers are companies like Airbus, ESA, Boeing, General Dynamics, ISRO, UTC, Siemens, Bosch, Dassault, Diehl, Thales and many more.

With functional testing, we already delivered over 150 projects since 2012 mostly in Automotive and Consumer sector. Among our customers are Siemens, Honeywell, Brose, SIIX, IMI, Apag, etc.

Currently (August 2019), we have 53 employees. 25 people work in R&D, 10 people work in Administration, Sales and Management and 18 in production.

Our main expertise is in hardware electronic development, control software and testing and measurement.

Notable development projects

In 2007 UNITES Systems a.s. developed high-speed test platform, a new product UNISPOT S40/S80 (now called Effitest e50) dedicated for semiconductor testing. We were partners together with Japanese company UENO SEIKI (handling equipment) and we were very succesful in Asian markets – Indonesia, China, Malaysia.

In 2012 UNITES Systems a.s. developed benchtop platform for functional and in-circuit testing of assembled PCBs called DMT (Desktop Modular Tester). DMT is a cost effective solution for functional testing mostly in Automotive sector. Till 2018 we have delivered over 130 projects (HW solution, SW application, Mechanical design) based on this platform.

In 2018 UNITES Systems a.s. developed advanced platform for functional and in-circuit testing of assembled PCBs called CMT (Cabinet Modular Tester). First customer was Siemens with test application for electromobility sector.

Notable development concepts

UNITES Systems a.s. in beginning of 2019 made proof-of-concept for Hardware In-The-Loop (HIL) universal tester of Electronic Control Unit made by company UNIS a.s. (designer of ECU, located in Brno, Czech Republic) for Aircraft engines. End users were targeted as Ivchenko-progress (Ukraine) and General Electric (GE-H85, Czech Republic).

Testing capabilites

Since UNITES Systems a.s. is a manufacturer of testing equipment, it has also quite a lot of means for test & measurement applications. Test applications and set ups are created by our team of skilled application engineers.

CZECH SPACE ALLIANCE

Member of the Czech Space Alliance

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757 01

Responsible for space and ESA projects:

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Sales Director
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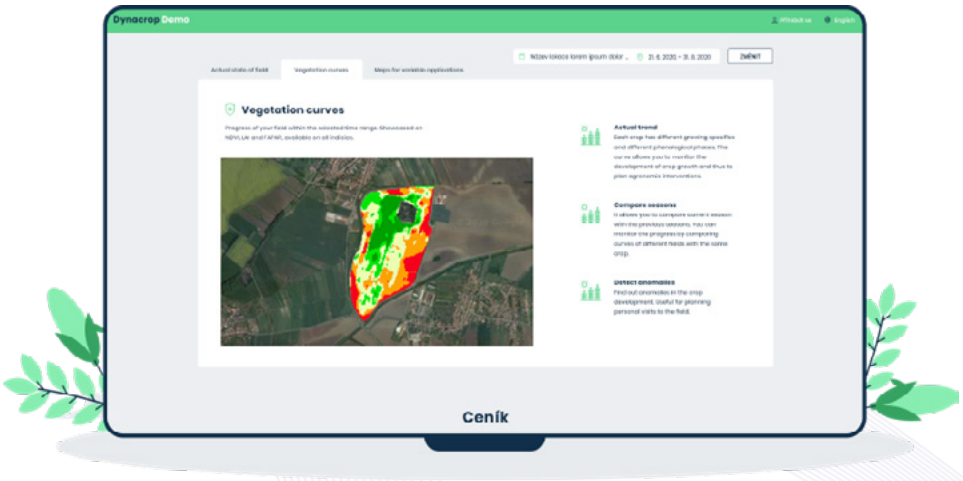
WORLD FROM SPACE



Industry

R & D

Services

Testing

Software

World from Space s.r.o.

General description

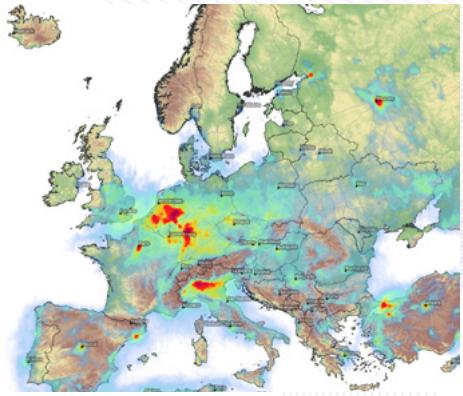
World from Space is a company focusing on the creation of downstream applications based on Earth Observation (EO) and other data, especially from the Copernicus programme. WFS has experience with EO data processing (multispectral, SAR), spatial and temporal data analysis, visualizations, machine learning and integrations into software platforms or GIS.

WFS performs analysis in the areas of agriculture, cities, air quality and the environment. The main product - DynaCrop API provides powerful crop monitoring for agricultural software platforms anywhere in the world.

In the urban domain, WFS focuses on measuring specific key performance indicators (KPIs) for climate change adaptation, drought and vegetation monitoring. It provides urban adaptation consulting, including initial analysis, action plans and monitoring results.

WFS participates on ESA contracts, H2020 research projects and consultations on the use of Copernicus data and services.

World from Space is incubated in ESA BIC Brno and is the winner of the Copernicus Masters 2018 competition. We will be happy to discuss possible cooperation on commercial contracts, research projects and non-profit activities.



Competences & Capabilities

- Automated cloud-based EO data analysis (AWS, SentinelHub, CreoDIAS, etc.)
- Global field-level crop monitoring based on Sentinel 1 and Sentinel 2 fusion
- Machine learning with EO data (eo-learn, pytorch, etc.)
- Soil moisture and drought assessment based on Sentinel 1, Sentinel 2 and SMOS
- Copernicus data analysis and consulting (CDS, ADS, EFFIS, GDO, CLMS, CEMS etc.)
- Urban EO monitoring - vegetation, temperature, air quality, sustainability indicators
- Interactive web-based map applications, dashboards and stories
- Python, JS, QGIS, SNAP,

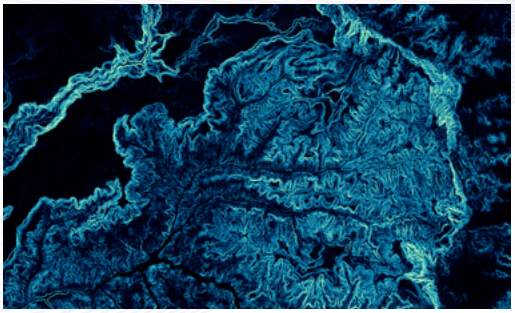
Major Space Projects & References

- DynaCrop (ESA BIC, 2019-2021) - global satellite crop monitoring for agriculture apps (dynacrop.space)
- Effective mapping of soil conditions and soil moisture to stabilize yields (TAČR, 2021-2024)
- COVID-19 Impact on Air Quality in Ukraine and the Republic of Moldova (UNDP, ESA, 2020)
- Natural Wealth and Sovereign Risk (World Bank, ESA, 2020)
- Strengthening Drought Resilience in Arid and Semi-Arid Lands in Ethiopia (GIZ, ESA, 2020)
- Urban heat wave vulnerability mapping methodology (ASITIS, Prague, 2020)
- Air quality in Ukraine and Belarus from space (Arnika, 2020)
- EO Clinic - a rapid-response use of EO in support of International Development (ESA, 2019-2021)
- Expert assistance for the Copernicus Land monitoring services and the Copernicus in situ data (EEA, 2020-2022)
- Technical support for the Copernicus Support Office and technical articles for Copernicus Observe (2019-2021)
- EO DynaCrop - drought and vegetation dynamics monitoring for farm management software (H2020, SME Instrument p1, national funding, 2019)
- Copernicus Masters - Drought Measure (Winner Government Challenge, 2018)

Space Related Equipment, Labs & Certificates

World from Space uses standard software infrastructure optimized for cloud computing. Most of the processes are based on the Amazon Web Services. WFS uses its own GitHub repository. The company implements solutions based on SentinelHub, QGIS, SNAP, GRASS GIS, GDAL, Leaflet, Carto.js, Plot.ly, d3.js, Mapbox, Maptiler and others.

The company uses shared services and spaces of Technest, South-Moravian Innovation Center (JIC) and ESA BIC Brno.



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worldfrom.space

Responsible for space and ESA projects

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ESA Subcontractor

maxmechanik
Swiss precision

Industry

Manufacturing

R & D

Testing

maxmechanik s.r.o.

maxmechanik
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http://www.maxmechanik.eu

General description

maxmechanik is a dynamic integral supplier whose core competencies are high-precision, complex machining parts and Mechanical Ground Support Equipment (MGSE). We design and produce for space, air defence and aviation sector. Certifications: ISO 9001, ISO 14001, OHSAS 18001. AS9100 certification is under process. maxmechanik has state of the art production machines and measurement technology. Our mission is «Swiss precision».

Competences & Capabilities

maxmechanik delivers over 90% of production to DACH-countries (Germany, Switzerland and Austria). Engineering, production and delivery of parts and MGSE for space and defence industry makes over 50% of turnover. 3D-printing (SLM technology) we offer with Swiss University ZHAW. ERP Enterprise Resource Planning integrated. maxmechanik participated in ESA projects as Solar Orbiter and EUCLID.

Entity Code: 1000014088

ESA Subcontractor

RayService

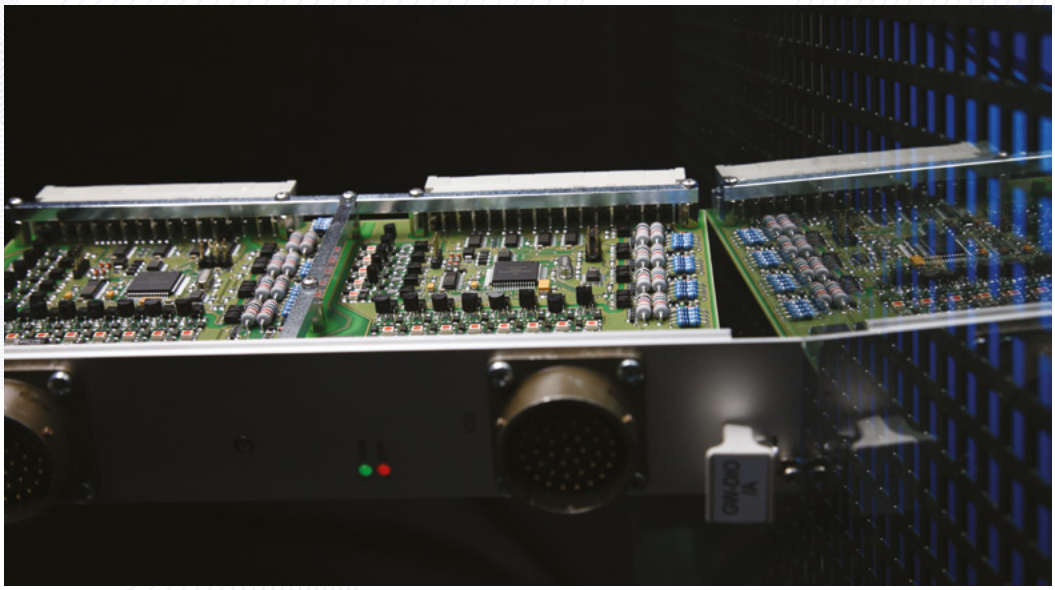
Industry

Manufacturing

R & D

Testing

Ray Service, a.s.



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E-mail: info@rayservice.com
http://www.rayservice.com

General description

ENGINEERING AND PRODUCTION OF **CABLE HARNESSES AND ELECTROMECHANICAL ASSEMBLIES**

Ray Service, a.s. is a Czech innovative manufacturing and trading company providing outstanding solutions in cable harnesses, electromechanical assemblies, electronic equipment and cable components for a wide range of space, aviation and defence customers. More than twenty years of experience and intensive development have resulted in a strong, modern enterprise, a reliable and sought-after partner on an international level.

Competences & Capabilities

Production and deliveries of cables, wiring harnesses systems, connectors, mechanical parts and modules space and aircraft industry, clean room assembly of electromechanical units, testing.

Entity Code: 1000017741

The Czech Space Alliance (CSA)

CSA is an SME association of 16 companies, established in 2006. The members are vying for space business, especially through ESA. Whilst it is an SME association, larger companies can join as associate members - sharing all the benefits and duties except for voting rights.

CSA members are winning the great majority of ESA's industrial contracts in the Czech Republic, and of the Czech budget in ESA. They are also winning international commercial contracts in Europe, Asia and the United States.

CSA founders' space experience goes back to the early 1990's
The founding members, namely BBT, CSRC (now part of BD Sensors), and Science Systems (now Iguassu Software Systems) participated in ESA and other space projects since the 1990's. When ESA carried out the 1st survey of the Czech industrial capabilities in 2002, it was surprised to find companies which had successfully implemented important international space projects, such as space qualified electronics for the Demetrius project or the MSG CF checkout software for Eumetsat.

Programme for European Cooperating States, PECS, 2005-2008
CSA members won 9 out of 12 industrial contracts
Notwithstanding the unfavourable internal space governance circumstances, the good results of the determined industry convinced ESA to shorten the initially envisaged minimum 5 year PECS period to less than 4 years.

ESA - Czech Industry Incentive Scheme system for New Member States (2008-2014)
Unlike in PECS, where projects were awarded in a hazy process by the space governance entity of the time, the full membership brought the enforcement of clear ESA rules and procedures. Therefore, the challenge of the stricter bidding process was in fact an advantage – transparency and easing of former barriers. Whereas the 4 PECS years attracted 1 or 2 new companies, the first 4 years of ESA membership attracted twelve! The limiting factor became the budget rather than industry's access to the bid submission process.

Further easing was the "ESA - Czech Industry Incentive Scheme", which allocated 45% of the mandatory contributions to the Task Force, to develop the competitiveness of Czech Industry.

This scheme proved to be an excellent boost to the newcomers to the space scene. The open tenders of the Czech Industry Incentive Scheme demonstrated steady increase of the proportion of successful projects going to industry – thus approaching the goal of the same industry/institutions balance of participation as in more established ESA states.

Since the Industry Incentive Scheme ended in 2014, we are in the same competitive environment as other established ESA members and the industry is demonstrating its ability to compete on its own, or with established partners, and to develop excellent niche competences and references.

The good industrial progress, as well as the psychologically highly important win in the protracted EU negotiations to place the GSA HQ in Prague, meant that the political decision makers took greater interest in space technologies, in the opportunities they bring to the economy, and in the way they advance the prestige of the country. Not least in that the ESA successes very aptly supported the key governmental strategy, namely to demonstrate that the Czech Republic is a technologically highly advanced country. What better way to prove it, than by giving industry the opportunity to shine in the field of space technologies. This realisation was underlined in the strong ESA budget growth from 7M € in 2009 to 48M € in 2019. The government also approved additional budget for a national space program, administered jointly with ESA, inspired by the Luxembourg Third Party Programme.

The European GNSS Agency HQ was awarded to Prague in December 2010
The preparation of the first National Space Plan 2010-2016 was a breakthrough on several fronts. Hitherto competing parties sat down and agreed a common plan and responsibilities according to relevant competences. The result was the creation of the Space Activities Coordination Council of the Minister of Transport, with Ministries of Education Youth and Sports, Industry and Trade, and Foreign Affairs taking the lead of the coordination subgroups for scientific, industrial, and international affairs respectively.

The National Space Plan 2010-2016 set out goals for 2016, taking into account the ambitions and expectations of the Czech space industry, as represented in the editorial team by the Czech Space Alliance. Most of these goals were achieved already in 2013!

In the National Space Plan 2014-2019 Czech Space Alliance was responsible for drafting the sections relevant to the industry. More ambitious goals were set out for this period together with the proposal to continue the hitherto good budget growth in the coming period, in order to allow the industry to make the most of the previous investment and of the notable growth of its experience and competitiveness.

The third issue of the National Space Plan 2020-2025 was adopted by the government in November 2019.

N.B. Please note that the "**Space Activities Coordination Council of the Minister of Transport**" is the only official entity representing the Czech Republic in space matters, including international relations such as with ESA and EU, and the one and only entity responsible for the Czech space governance.

The international promotion activities of the Czech Space Alliance

The alliance is very active in communicating to foreign partners the know-how and growing space experience of its members, be at international conferences, ESA and GSA industry days or in bi-lateral meetings with companies and space agencies or associations. In Prague, we normally organise events with the Ministry of Transport. Examples of such events are CSA presentations to the Japanese associations JASPA, SJAC and SPAC - 2011 Feb., B2B with Airbus Defence and Space UK at the Ministry of Transport, Prague - 2010 Nov., Czech-Brazilian Space Technology Days supported by Czechinvest in 2010, Czech-Japan Space Seminar with the JAXA president and the chairman of Japanese government Space Activities Commission, Prague in 2010, Czech-Dutch Bilateral Space Industry Roundtable with the Netherland Embassy and the Ministry of Transport, Prague etc. etc. Another example is the Czechinvest Space Technology Mission to Brazil in 2013, where we met top leaders of the Brazilian Space Agency and INPE, and ran an industry seminar attended by 50 Brazilian space companies. In 2016 and 2018 we presented Czech space technologies at the Czech Embassy in Japan, attended by major companies like NEC Space, the government Space Cabinet Office directors, professors, the astronaut Koichi Wakata, or a member of the Japanese parliament. Another international initiative was to discuss possible co-operation with the president of the Mexican space agency and his key staff, and participation at all Japan Aerospace exhibitions and conferences since 2006 (incl. the last one 2018), mostly instigated and co-organised by CSA. CSA secured a large slot to present Czech industry and space policy in SJAC (Society of Japanese Aerospace Companies) seminar. The Czech national stand is being kindly co-financed by the Ministry of Foreign Affairs, Czechinvest and the Ministry of Defence. Our alliance missions also went to UK, Spain, Italy, Japan, Brazil and most recently to Germany and Luxembourg. A return Luxembourg mission took place in October 2019. In the meantime, an MOU was signed with Luxembourg on cooperation in space resources exploration and utilization. The latest addition to international partners was Thailand. 25 person Thai delegation led by GISTDA toured the Czech centres of space and innovation for a week in May 2019. Subsequently we were invited to participate in the Thai Space Week and Multi GNSS Asia conference in Bangkok, where we spoke in a high-level panel, together with the representatives of Korean and Chinese space agencies.

We also give presentations in aspiring or new member states to share our experience of the transition from former communist country and its exclusively academically and politically motivated space programs. to commercially conceived, sustainable industrial development. These included Slovakia, Hungary and Lithuania. Recent invitation to a panel and to an advisory board came from Croatia, through A3 – the Adriatic Aerospace Association

We have worked on projects with companies in Germany, Italy, Spain, Austria, UK, France, Italy, Belgium, Finland, Poland, Switzerland... and we are one of the founding members of the pan-European association Space4SME. We negotiated the cooperation LOI with the Brazilian Space Agency AEB, signed by the Czech Minister of Transport and the President of AEB. MOU with the Japanese aerospace SME association JASPA was signed by our alliance. Our negotiations with JAXA over the last years led to a series of-high level ministerial meetings in Japan and Prague between the Japanese National Space Policy Secretariat (formerly the Cabinet Office for Space Policy) and the Czech Ministry of Transport. The last one was in 2018 during the ISEF-2 in Tokyo. We are also looking at synergies with the UAE Space Agency, the Thai GISTDA and others. 2020 was limiting on international activities but despite of that we participated in the Global Space Conference in Singapore, mission to the Turkish space agency and the Senate Mission to Taiwan, where we met the National Space Organisation and the space association. The latter mission will be followed in January 2021 by industry webinar, coordinated with the Taipei Economic and Cultural Office in Prague.

And your next step?

Please do not hesitate to contact us to see what we can contribute to your space activities. We can look for synergies, arrange in Prague either individual meetings, or larger events for a group of companies or an industry association. Alternatively, we can agree on a group mission to your country.

This is an opportunity for you to take advantage of the enthusiastic, technically very capable and innovative Czech companies and, last but not least, improve the geographical distribution of your ESA bids. Our cooperation or joint bids usually result in long-term partnership, which we now maintain with the principle space primes and many smaller companies. Our members have up to 25 years' experience in ESA and can boast a range of excellent references in various niche technologies.

Do Czech us out!

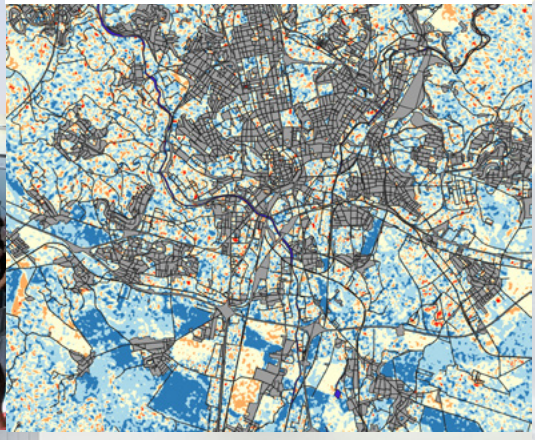
Petr Bares,
President of the Czech Space Alliance
December 2020

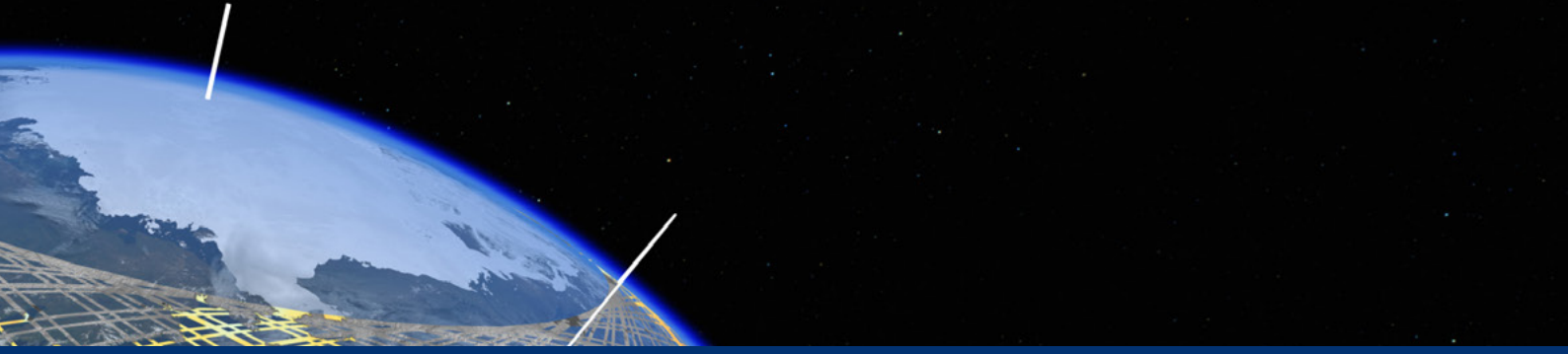
Contact:
Petr Bares
Czech Space Alliance
petr@czechspace.eu
www.czechspace.eu

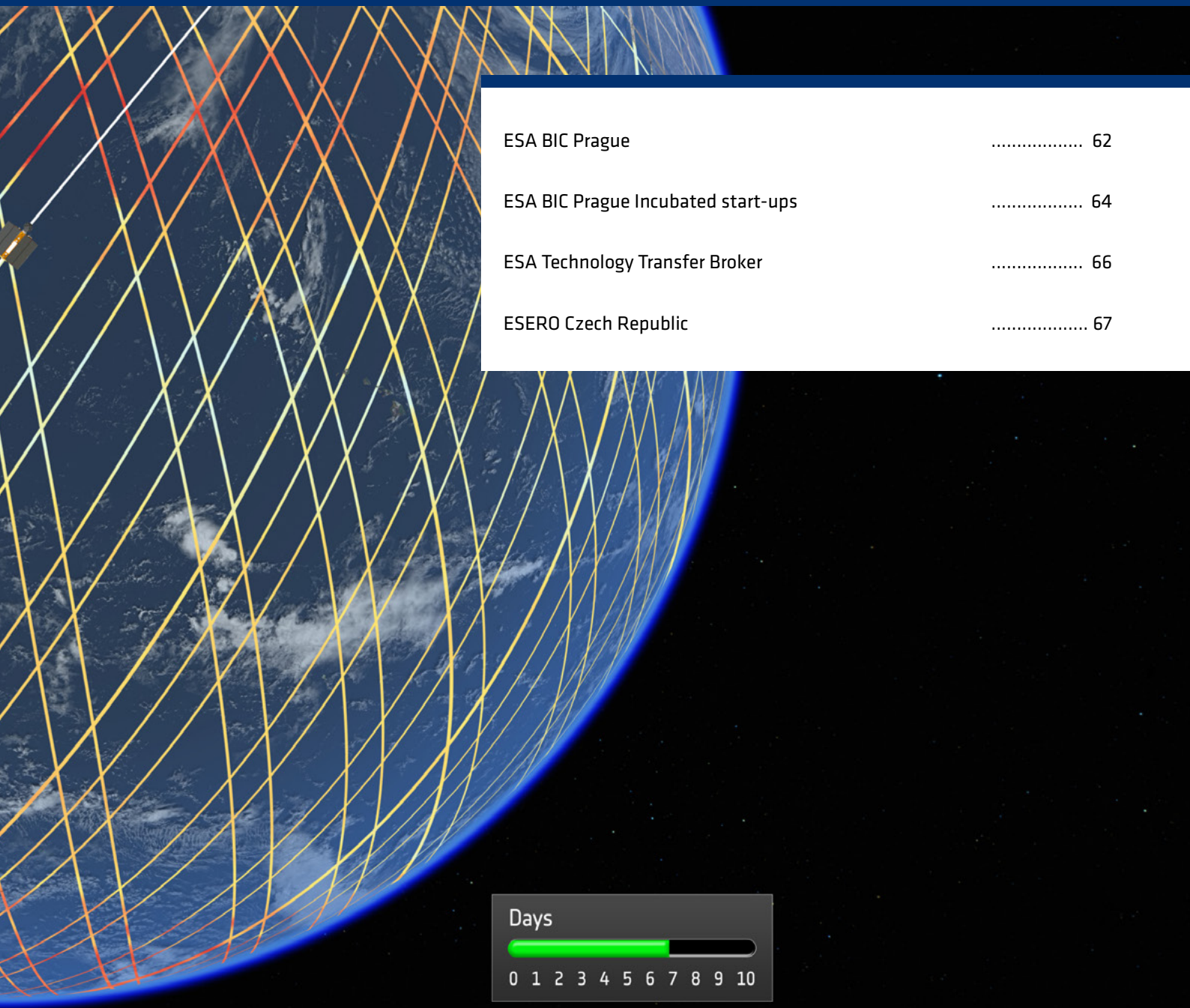
Credit: ESA / NASA

ESA Initiatives

In the Czech Republic







Credit: ESA/ATG medialab

business incubation centre
Prague

ESA BIC Prague

General description

The Czech Republic is the brain & heart of the European space industry and satellite applications. European Space Agency Business Incubation Centre (ESA BIC) Prague creates opportunities for space-related projects and re-purposing space technology. ESA BIC Prague was founded in 2016, and two years later, it was joined by ESA BIC Brno. Both incubators provide the incubation program for up to 2 years. The program includes financial support (50 000 EUR) and professional business and technical guidance. Soon, ESA BIC Prague will also introduce a new program that provides up to 200 000 EUR for highly innovative projects.

The ESA BIC incubator is a practical demonstration of the importance of investing in the space industry and scientific research. Hence discovering new cosmic horizons also expands our possibilities here on Earth.

ESA BIC Prague is part of ESA Space solutions network with 21 business incubation centres. They all work regionally to inspire entrepreneurs to turn space-connected business ideas into commercial companies. 890 startups have been supported by the network to this day.

CzechInvest operates the programme with support from the City of Prague, South Moravian Innovation Centre, Ministry of Industry and Trade, Ministry of Transport, South Moravian Innovation Centre and European Space Agency. The incubation package contains consultancy services in technology and business areas, as well as marketing support and assistance with finding suitable partners and potential investors.

Competences & Capabilities

- Incubation programme and financial support
- Technology seminars and competitions
- Space community network and mentors
- Scouting of new technologies and startups
- Business development

Major Space Projects & References

- Data Analytics Platform for Climate Resilience: international project focused on promoting use of EO data to enhance climate resilience (funded by ESA)
- Astropreneurs: acceleration programme to support startups by mentoring them on business and technical needs and helping them to access funding opportunities (funded by Horizon 2020 programme)
- Copernicus Incubation Programme: incubation programme to support startups working with Earth observation data (funded by Horizon 2020 programme)
- Copernicus User Uptake: project with the aim to spread awareness and motivate organisations to use data and services provided by Copernicus (funded by Horizon 2020 programme)
- Technical competitions and hackathons: Galileo Masters, Copernicus Hackathon, ActInSpace hackathon and others

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http://www.esa-bic.cz
https://spacesolutions.esa.int/

Responsible person:
Michal Kunes
E-mail: michal.kunes@czechinvest.org

→ ESA BIC PRAGUE | BRNO

→ We started

PRAGUE
22 start-ups

BRNO
9 start-ups

18 Incubatees
currently incubated start-ups

13 Alumni
start-ups that have completed incubation

20 Czech firms

11 Foreign firms with operations in the Czech Republic
Slovakia, Switzerland, France, United States, Egypt

→ The start-ups at ESA BIC Prague and Brno are focused on

Earth observation	Satellite navigation	Space tech	Ground segment	Drones	Advanced materials and technologies	Simulation software
8	7	4	3	3	2	4

24 Downstream
space technologies used on Earth

4 Upstream
use of technologies in space

11 Hardware

20 Software

→ Overview of investments

11 start-ups have received investments
(5x BA, 3x VC, 2x BA+VC, 1x Seed investment)

Value of investments: more than **8.75 EUR**

esa business incubation centre Prague

ESA BIC Prague Incubated start-ups

Dronetag
Developing an IoT device that can identify drones in real time and extend their functionality and the use.

Entrant
Developing a unique mathematical method, which can measure stress in real time and without sampling.

GroundCom
Bringing a complex supplementary connection for space missions by developing a net of ground stations and additional software, which will provide communication to mission operators.

Hydronaut
An underwater research laboratory and training station. The facility enables a three-member crew long-term stay under the water surface for the simulation of space missions.

Intellmaps
Introducing a digitalized system for vast hospital complexes, where they can help with logistics and management of processes, such as blood transfer.

Let's Earth
Analytical tool "MeteoInsight" providing analysis of suitable renewable resources for developers based on satellite data and data from meteorological stations.

MobisOne
Development of a multi-purpose UAV, an efficient VTOL drone, which is an autonomous vehicle with long flight capacity in accordance with EU flight regulations.

Neuron Soundware
Using audio recordings and artificial intelligence to detect unusual and possible failure behaviour of machines.

Numer8
Focusing on working with EO data. The O'fish application is created to regulate fishing and support smaller fishermen.

SkyMaps
Using data from Copernicus satellites and drones with special sensors and cameras in order to measure the quality of soil and crops.

Spacemanic
Offering innovative solutions for cubesats and developing, manufacturing and testing their components. Their first cubesat skCUBE was launched in 2017.

Stratosyst
Developing High Altitude Pseudo Satellite (HAPS) that can offer many applications from the stratosphere, f.e. Earth observation, telecommunication, infrared astronomy.

Suborbitality
Developing suborbital rocket that will provide services primarily to the entities that want to test their products or conduct experiments in the real space conditions.

Uneeqly
Developing a unique and united digital ID, which would enable simple registration to loyalty programmes in combination with intelligent data mining and customer targeting.

Varistar
Offering a comprehensive service to agriculturists. They can prepare application schemes for individual hunt based on a computer system, which assess client's needs.

VRgineers
Developing a virtual reality technology, a professional headset and virtual environment including haptic interaction.

World from Space
Monitoring of the condition of vegetation, temperature and ground moisture for the cities, regions and farmers .

Zaitra
Developing the STROM application, a forest intelligence and smart vegetation management, with which they aim to create sustainable forests for the next generations and reduce the current costs of forest managers and owners.

ZetJet Technologies
New generation of electrical turbines for High Altitude Pseudo Satellites.

Alumni

Aleego
Analytical and business platform for the management of industrial UAVs using satellite navigation and Earth observation.

Big Terra
Combining data from satellites, weather stations and numerical weather models to provide African farmers with data supporting their farm management decisions.

Festka
port bikes with frames based on the most advanced technology of carbon composite used in the space industry.

Foxworks Aerospace
Developing a space simulator intended to be used for reacting motion and behaviour of space vehicles. Visualisation engine is based on licensed NASA software.

InsightArt
Cutting-edge spectral X-ray imaging for the art inspection and authentication, this technology has been developed for space radiation research.

NaviRider
Navigation and safety application for motorbike riders using satellite navigation.

NG Aviation
Airport infrastructure management system and digitalization of aeronautical data using satellite navigation.

Octogeo, Maptiler
An alternative to Google Maps, world maps called MapTiler and pre-processed EO data in a form which allows direct application in end user products.

Strafos
Reservation and management of private flights using the Iridium NEXT satellite constellation.

Triphood
Interactive mobile application with trips for tourists based on satellite navigation.

TuddyTuddy
Entertainment mobile application for tourists using satellite navigation.

UptimAI
Probability software for simulating engineering processes, the software was developed to model hypersonic flows of space objects.

TECHNOLOGY CENTRE CAS

ESA Initiatives

ESA Technology Transfer Broker

ESA Innovation Partner

Technology Centre of the CAS

Technology Centre of the CAS
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160 00 Prague 6
Czech Republic

Responsible for space and ESA projects:

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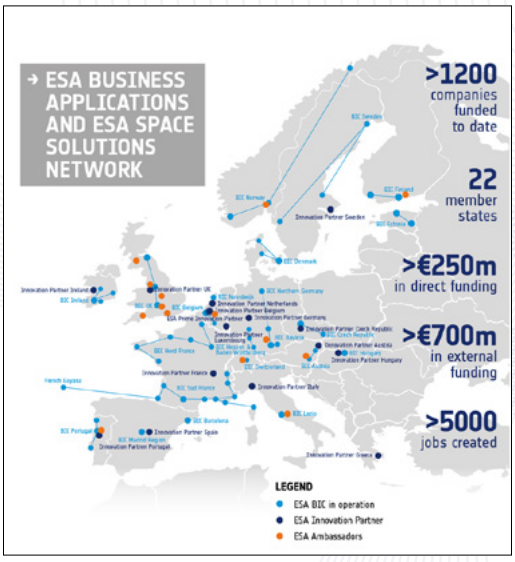
General Description

The Technology Centre of the Czech Academy of Sciences (TC CAS) was founded in 1994 and has quickly become an important national institution for research and innovation infrastructure which supports participation of the Czech Republic within the European Research Area.

The TC CAS offers technology transfer support for firms through the international Enterprise Europe Network and through ESA Technology Transfer Broker Programme. This includes both identifying suitable foreign technologies and offering Czech technologies that have been developed by firms, research institutions or on the basis of private activities of our inventors.



Major Space Projects & References

- The National Information Centre for European Research (NICER) organizes information events about the opportunities involved in EU Framework Programmes for research and development, publishes specialized publications and an electronic newsletter and operates an information portal www.fp7.cz about the 7th Framework Programme for Reserach and Developmnet and also about the successor EU Framework Programme for Research, Development and Innovation - Horizon 2020 - www.h2020.cz
- National ESA Technology Transfer Broker
- National annual space conference Gate2Space organizer

Competences & Capabilities

Our mission is to support the participation of the Czech Republic in the European Research Area, prepare analytical and conceptual studies for research and development, perform international technology transfers and support the creation and development of small innovation firms.

TC CAS organisation scheme

National Information Centre for European Research

Department of Business Development

Department of Strategic Studies

Czech Liaison Office for Research, Development and Innovation (CZELO) in Brussels

Economic-Administration Department

Acceleration programme Business Runway

Space Related Equipment, Labs & Certificates

- Member of Czech space community
- H2020 Space projects advisory
- Access to ESA Technology Transfer Database
- Member of ESA Space Solutions Network

Czech Republic esero

ESA Initiatives

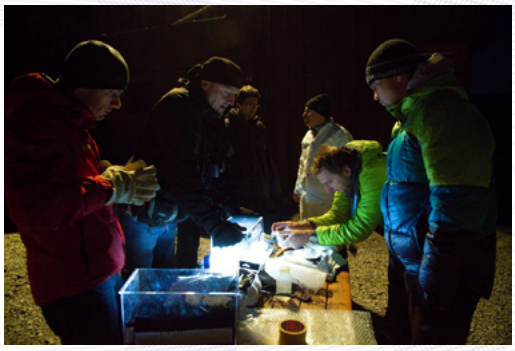
ESERO Czech Republic

SCIENCE IN

General Description

The European Space Education Resource Office (ESERO) is the key project of the European Space Agency (ESA) to support primary and secondary education in Europe. Its mission is to use space-related topics to initiate pupils´ interest in studying STEM subjects, and to support teachers by offering comprehensive portfolio of educational resources and trainings.

From 2021, ESERO consortium extends its operation to **Czech Space Academy**, taking up the role of a national contact point (NCP) for university space studies as well as the contact point of the ESA Academy in the Czech Republic. This guarantees a coherent and comprehensive approach to the ESA supported programmes throughout the whole primary education.



Major Space Projects & References

ESERO organizes annual series of national as well as regional trainings for primary and secondary school teachers. The trainings are, wherever possible, officially accredited as part of continual professional development qualifications and are focused on introduction of ESERO and ESA Education resources. ESERO also coordinates national rounds of ESA's competitions, such as CanSat: Build your own satellite, AstroPi: Send a code to the ISS, Climate Detectives: Investigate a climate problem in local environment and do something to improve it, and others.

Competences & Capabilities

ESERO Czech Republic is operated by SCIENCE IN and co-funded by Charles University, Czech Technical University in Prague, Palacky University in Olomouc, Astronomical Institute of the Academy of Sciences of the Czech Republic, Tereza Association and iQLandia. It collaborates with its national network of more than 300 primary and secondary schools where programmes are piloted and their implementation evaluated.

ASTRO PI · CANSAT · CADSAT · → CLIMATE DETECTIVES · → MOON CAMP · MISSION X

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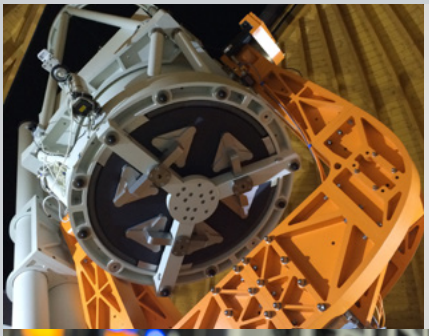
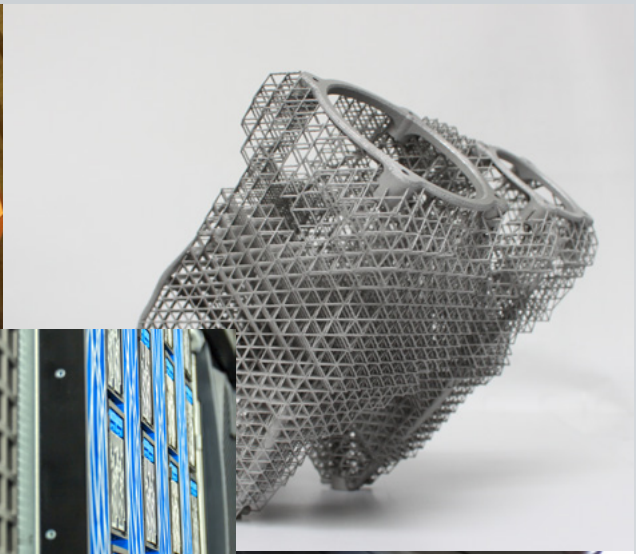
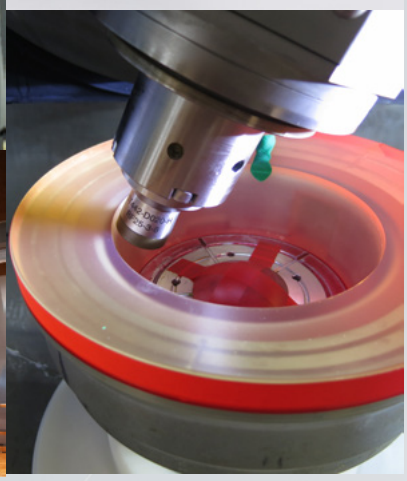
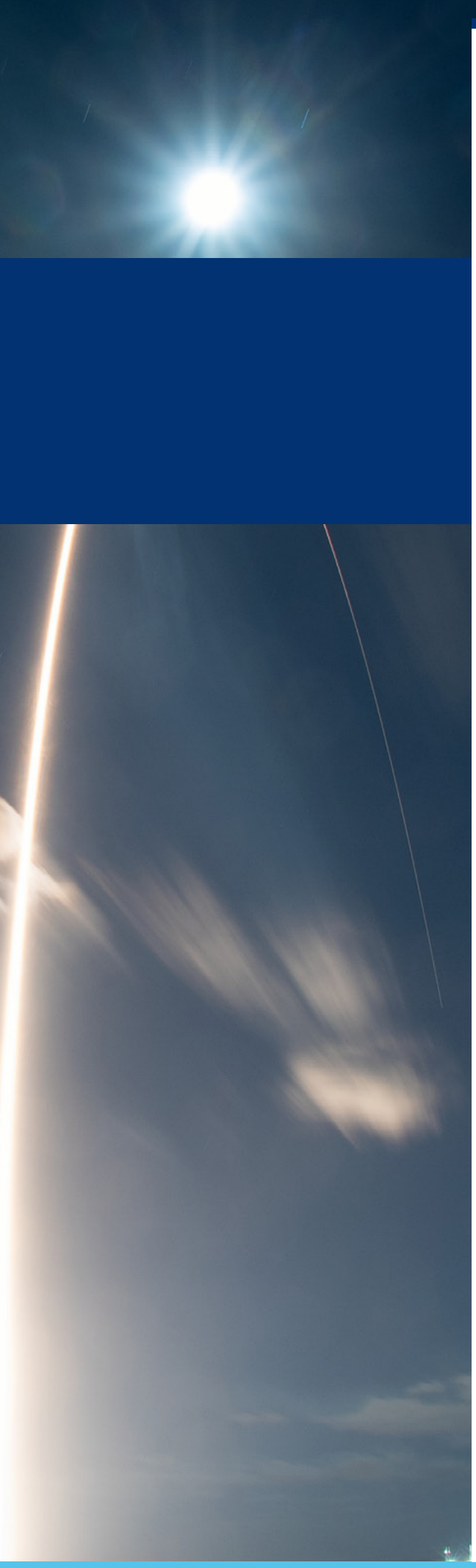
Academia of the Czech Republic

Successful in ESA









Credit: ESA - S. Corvaja

Astronomický ústav AV ČR

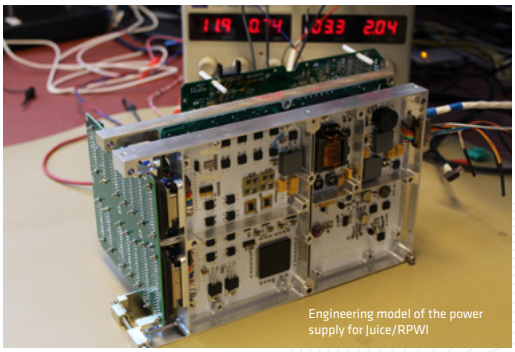
Academia

R&D

Design

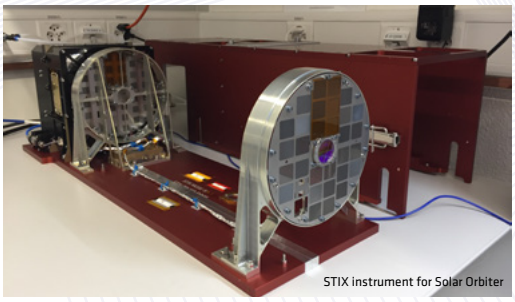
Testing

Astronomical Institute, CAS


Engineering model of the power supply for Juice/RPWI

General description

Astronomical Institute of the Academy of Sciences of the Czech Republic is a professional research institution with focus on a wide range of research topics; from the immediate environments of the Earth to distant galaxies and black holes in their cores. The research activities are carried out in four scientific departments: Dept. of Solar Physics, Dept. of Stellar Physics, Dept. of Interplanetary Matter, and Dept. of Galaxies and Planetary Systems. Main areas of research activities include physical processes in the Sun, especially in solar flares, physical processes in stars, interaction of the interplanetary matter with the Earth atmosphere, asteroids and comets, dynamics of the Solar System bodies, formation and evolution of galaxies, and relativistic astrophysics.


STIX instrument for Solar Orbiter

Competences & Capabilities

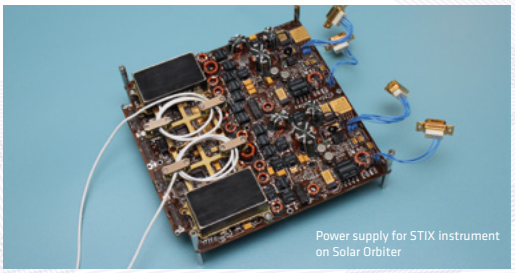
Large international collaborations represent a significant part of the research activities of the Astronomical Institute. Scientists from the Institute are involved in many international projects of new-generation astronomical instruments for ground-based as well as space-based telescopes, the latter usually done in a close co-operation with the European Space Agency (ESA).

Besides many renowned scientists, a group of specialized technicians work in the institute. They are developing electronic components for scientific instruments within the projects of the ESA science program (STIX and RPW at Solar Orbiter, RPWI at Juice).

The Astronomical Institute takes the coordinating role in the programme 'Space for Mankind' of the Strategy AV 21 project of the Czech Academy of Sciences (www.vesmirprolidstvo.cz). This programme involves several other institutes of the Czech Academy of Sciences, prime universities and industry

Major Space Projects & References

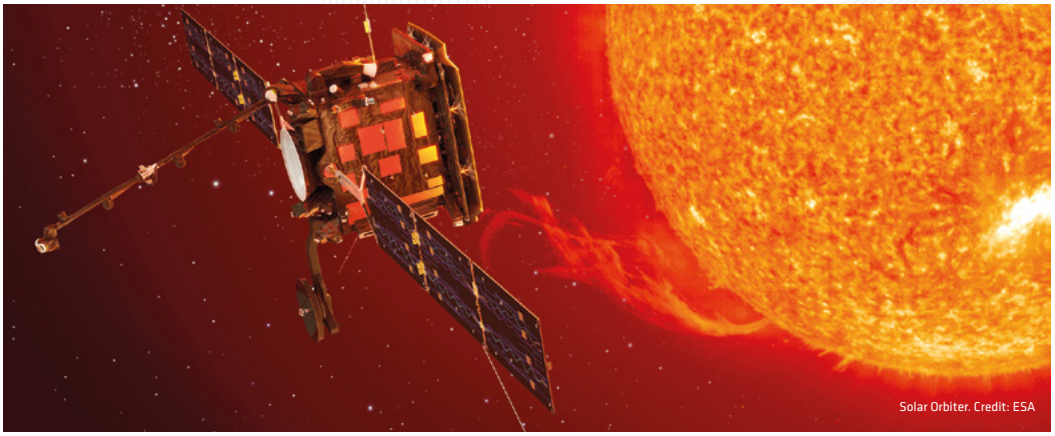
- Design and development of multi-channel low voltage power supply for Radio and Plasma Wave experiment (RPW) on the Solar Orbiter mission.
- Design and development of low- and high-voltage power supplies for Spectrometer-Telescope In X-rays (STIX) on the Solar Orbiter mission.
- Development and manufacturing of crucial optical elements of METIS - main M1 and M2 mirrors. Project realized in co-operation with IPP - TOPTEC.
- Coordination and the scientific part of the project "Front Door Assembly and Primary Objective together with Relay Optics" - done by national industrial partners, including participation in setting of the scientific requirements for the ASPIICS coronagraph onboard Proba 3.
- Design, development and delivery of radiation hardened low-voltage power supply for Radio and Plasma Wave Instrument (RPWI) on the JUICE mission (ESA).


Power supply for STIX instrument on Solar Orbiter

- Lunar Dusty Environment and Plasma Package (L-DEPP) experiment for Lunar Lander: design study for complex instrumentation for dust and plasma analysis in the lunar near surface environment. Experiment was proposed as a potential payload for Lunar Lander mission (ESA). Project was funded under ESA open ITT contract.
- Athena X-ray Integral Field Unit (X-IFU) – scientific and project management, collaboration with the Institute of Atmospheric Physics on development of a row-adressing module of the Digital Readout Electronics of the instrument.
- eXTP (enhanced X-ray Timing and Polarimetry) – scientific and project management, collaboration with the industrial partners on mechanical design of the Detector and Collimator Frames
- LISA (Laser Interferometry Space Antenna) - scientific and project management of the Czech contribution to the international consortium developing the first space-based telescope for detection of gravitational waves
- Most of the above-mentioned activities are funded by PRODEX Experiment Agreement with ESA.

Space Related Equipment, Labs & Certificates

- Electronic lab equipped for breadboarding and testing activities related to space H/W development


Solar Orbiter. Credit: ESA

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Academia

Testing

Global Change Research Institute CAS (CzechGlobe)

General description

Global Change Research Institute of the Czech Academy of Sciences (CzechGlobe) is a public research institution, European centre of excellence investigating the ongoing global change and its impact on the atmosphere, biosphere and human society through the use of the latest techniques and instrumentation. The research focuses primarily on the development of climate and its future scenarios, on the carbon cycle and the effects of changing conditions on the production and biodiversity of ecosystems and on the impacts on the future development and behaviour of our society.

Competences & Capabilities

Department of Remote Sensing of CzechGlobe primarily focuses on research of spatio-temporal changes of natural and man-managed ecosystems using modern remote sensing techniques. To address research questions, the department analyses spectral satellite data (mainly obtained from Sentinels within the Copernicus programme) in combination with own airborne hyperspectral and laser scanning data that are acquired synchronously with the CzechGlobe's airborne Flying Laboratory of Imaging Systems (FLIS). Special emphasis is put on development of methods for quantitative assessment of biochemical and structural properties of plants, biomass assessment, as well as thermal regimes of various landscape systems such as forests, agricultural and urban ecosystems.

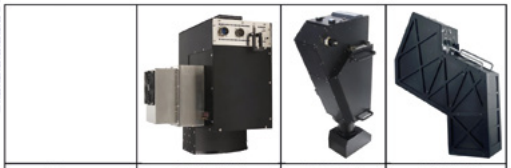
Major Space Projects & References

The Remote Sensing Department successfully finished following ESA funded projects: HyPlant Processing Experiment for development and testing of a processing chain for data from the airborne fluorescence demonstrator HyPlant, Red edge positioning techniques for Earth observation optical missions that analysed the red-edge spectral region in Sentinel-2 data and Hyperspectral analysis and heterogeneous surface modelling. At the moment Dep. of climate change impacts on agroecosystems contributes to Black Sea and Danube regional initiative project that aims to improve seasonal forecast of drought impacts on vegetation using Sentinel data.

During 2018 and 2019 summer the CzechGlobe's aircraft joined an extensive, international ESA campaign that aimed to collect supportive field and airborne measurements for the future Earth Explorer mission FLEX (Fluorescence Explorer). Our aircraft acquired simultaneous data from hyperspectral HyPlant system, thermal TASI spectroradiometer and laser scanner over various study sites in Italy, Germany, France Switzerland and Spain.

Space Related Equipment, Labs & Certificates

- Aircraft Cessna 208B Grand Caravan
- Airborne hyperspectral sensors (CASI-1500, SASI-600, TASI-600)
- Aircraft is certified to carry HyPlant, an imaging spectroradiometer for vegetation fluorescence monitoring
- Airborne laser scanner (Riegl LMS – Q780) and terrestrial laser scanning system
- Laboratory and field spectroscopy equipment (ASD field spectroradiometers, integrating spheres, thermal spectroradiometer)
- Laboratory and field instruments for measurements of plant ecophysiological properties, fluorescence ect.
- Mapserver: http://mapserver.czechglobe.cz



Sensor	CASI-1500	SASI-600	TASI-600
Region	VNIR	SWIR	LWIR
Spectral range [nm]	380 - 1050	950 – 2450	8 000 – 11 500
Number of spatial pixels	1500	600	600
Max. spectral resolution [nm]	3.2	15	110
FOV [°]	40	40	40

Global Change Research Institute CAS (CzechGlobe)
http://www.czechglobe.cz

Responsible for space and ESA projects:

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Academia

R&D

Design

Testing

Institute of Atmospheric Physics, CAS

General Description

The Institute of Atmospheric Physics (IAP) is a public research institution established in 1964 in the frame of the former Czechoslovak Academy of Sciences, now the Czech Academy of Sciences. IAP is oriented toward basic research of the atmosphere, ionosphere and magnetosphere of the Earth, ionospheres and magnetospheres of planets of the Solar system, and of the solar wind. One half of the total number of approximately 80 employees of IAP is organized in departments whose areas of expertise are related to space research in the domains of space plasma physics and space weather, including design and development of scientific instruments, in-situ experimental measurements, data analysis, theory, and numerical simulations.

Competences & Capabilities

Mostly young group of researchers and technicians at IAP takes advantage of a strong heritage originating from scientists and engineers who designed, built, and operated the first Czechoslovak spacecraft, Magion 1, launched in 1978. The series of Magion spacecraft was run until the end of the Magion 5 mission in 2002. The scientific and technical personnel of IAP continue to work in experimental and theoretical research areas, participating in projects and spacecraft missions of the European Space Agency (ESA), other space agencies, and working on ground-based measurements related to space research.

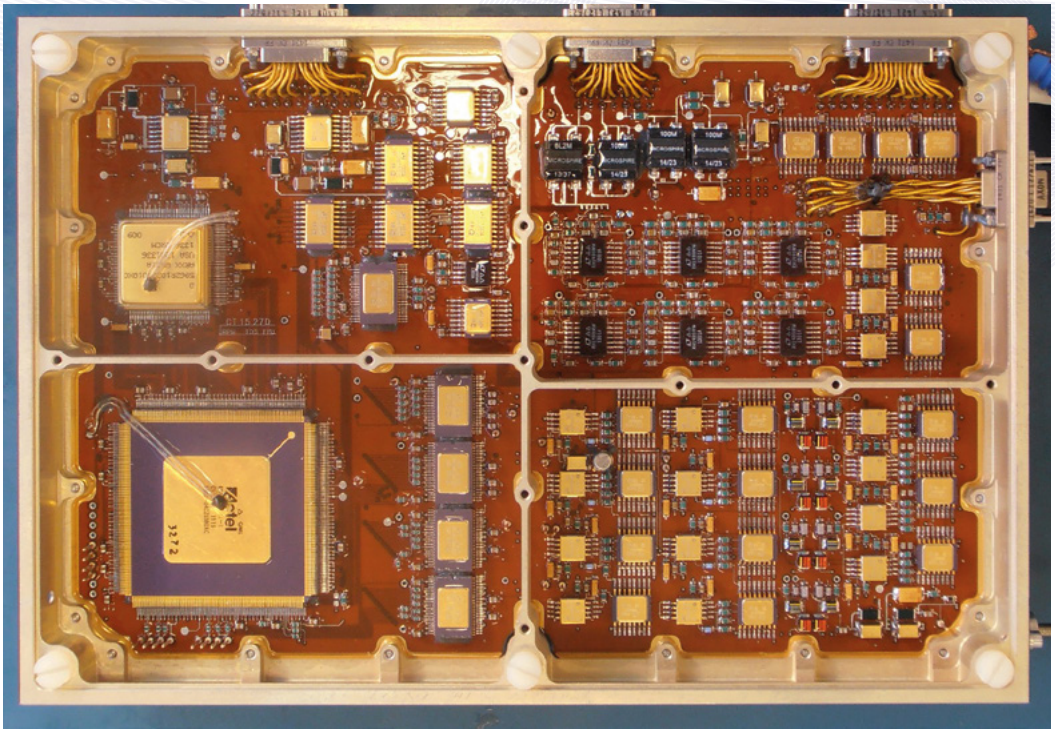
Space Related Equipment, Labs & Certificates

- Electronics laboratory for development of spacecraft instrumentation
- Vibration testing device, Thermal chamber, Vacuum chamber, ISO 7 clean room
- Computer equipment including the Amalka supercomputer and data storage

Major Space Projects & References

- The Solar Orbiter space probe: Development and implementation of the Time Domain Sampler (TDS) module for Radio and Plasma Wave instrument. The TDS module will be responsible for measurements of electromagnetic field oscillations in the interplanetary space.

- JUICE space probe: IAP develops a new wave analyzer and onboard processing module for low-frequency electromagnetic waves. It will be a part of the Radio and Plasma Waves Instrument for which IAP has a responsibility of a Co-Principal Investigator institution.
- TARANIS satellite: Development and implementation of an extremely fast wave analyzer for the IME-HF instrument, to study electromagnetic radiation from lightning and transient luminous phenomena observed at altitudes up to 100 km.
- ExoMars 2020 probe. IAP has a Principal Investigator responsibility for the Wave Analyzer Module which will be placed on the Mars surface to investigate, for the first time, the local electromagnetic environment.
- Analysis of data collected by previously launched spacecraft instruments where IAP personnel participate as Co-Investigators or collaborators in scientific teams (Cluster, Polar, Stereo, DEMETER, Double Star, Themis, Van Allen Probes, Cassini, Juno, Arase).
- Spacecraft telemetry reception at the Panska Ves station: The station is equipped with various types and diameters of receiving antennas. Routine reception of scientific telemetry from the Cluster (ESA, NASA) mission and space weather data from the Van Allen Probes (NASA) mission is currently carried out.
- Ground-based measurements related to space research: Ionospheric station Pruhonice equipped with a digital ionosonde measures ionospheric drift and density profiles, continuous Doppler sounding systems, broadband electromagnetic measurements of lightning discharges.



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prof. RNDr. Ondrej Santolik, Dr.
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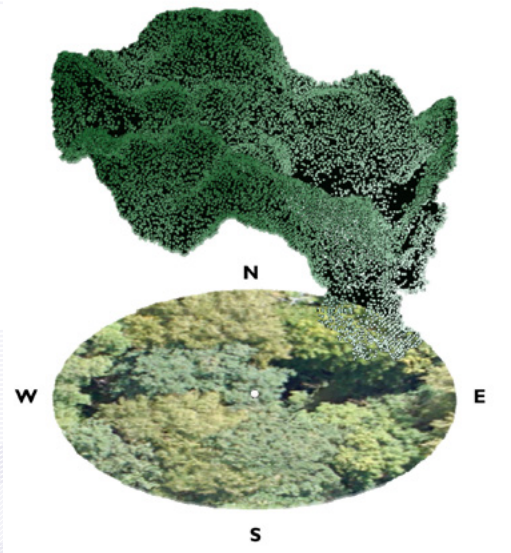
General description

The Institute of Botany (IBOT) is a leading national institution in research on plant species, populations and communities. Currently, the strongest research topics are biodiversity and evolutionary trends among plants, ecology of invasive species, responses of plants and vegetation to environmental change and the mechanisms that enable species to coexist in ecosystems. Currently, the Institute has ca 300 employers with over 130 scientist and PhD students, and is involved in over 60 national and international projects from both fundamental and applied research.

Competence & capabilities

Geoinformatics and space activities at the Institute are covered mainly by Department of GIS and Remote Sensing. Research is related to long-term changes in populations and communities and their spatial structure at different spatial scales using combination of remote sensing data and field measurements processed in a GIS environment and by spatially explicit modeling. The remote sensing approach (analyses of satellite, aerial imagery and unmanned aircraft imagery) combined with robust field data provides information on vegetation changes in relation to human activities and global change. Advance processing and analyses of spatial data result in applications in plant detection and mapping, study of relationships between vegetation and environmental factors such as microclimate, and analyses of spatial patterns and relationships and spatio-temporal changes.

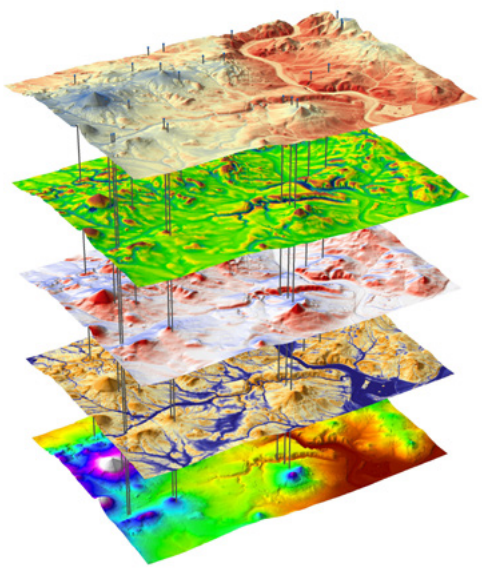


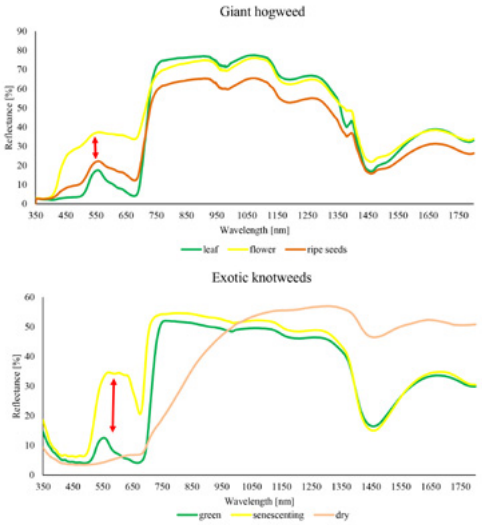
Major Space Projects & References

Institute is currently working on several projects employing variety of remote sensing data, from satellite and aerial imagery to unmanned aircraft and near ground remote sensing in combination of in-situ measurements and surveys. Project are related to spatio-temporal patterns of vegetation and underlying biological processes at different spatial scales using in-situ measurements, GIS, remote sensing and spatially explicit modelling. IBOT takes part in development and is running large network of microclimate stations measuring near ground and soil temperature and moisture, and is part of the SoilTemp global database. In the past, IBOT participated at ArtEMISS project providing evaluation of growth requirements of cyanobacteria for MELiSSA programme.

Space Related Equipment, Labs & Certificates

- Software for vector and raster data processing and analyses (ArcGIS - ArcInfo and selected extensions; PCI Geomatica with Orthoengine module; eCognition Developer
- Equipment for position measurements (GNSS Trimble; mapping tool Field-Map)
- Spectral Evolution Full Range Portable Spectroradiometer
- Laboratory equipment for evaluation of physiological status of photosynthetic organisms; fluorescence and electron microscopes
- Large network of soil moisture and temperature probes providing continuous measurements





Academia
R&D
Design
Testing

Institute of Botany (IBOT), CAS

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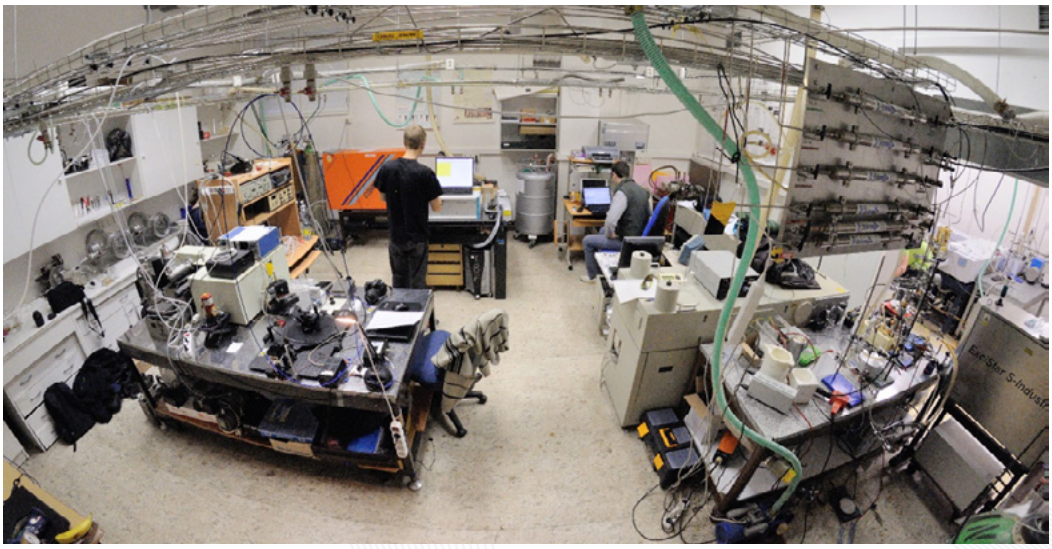
J. Heyrovský Institute of Physical Chemistry

Academia

R&D

Testing

J. Heyrovsky Institute of Physical Chemistry, CAS



General Description

J. Heyrovský Institute of Physical Chemistry was established in 1972 through the merger of the Institute of Physical Chemistry (established 1955) and the Institute of Polarography (established 1950); both being parts of the former Czechoslovak Academy of Sciences. The institute is a public research organization of the Czech Academy of Sciences, v.v.i. It represents a professional research centre of fundamental research in physical chemistry, spectroscopy, nanotechnology, electrochemistry and chemical physics. Department of Spectroscopy was established as in 1963 (as the Department of Chemical physics) and currently is, within the Czech Republic, the leading centre of applied and fundamental research of spectroscopic techniques used in a segment of astrophysics, astrochemistry, industry and security. We explore a development of high power lasers for space applications, testing of optics for space missions, development of sensitive laser sensors and their arrays, exploration of new materials for hi-tech solid state high power light sources, material chemistry, optics and photophysics, and development of new analytical techniques for forensic applications. In fundamental research, our department is oriented on the application of spectroscopic techniques in astrochemistry, plasmochemistry, exploration of planetary and exoplanetary chemistry and physics, simulation and observation of extraterrestrial body atmospheric entry and impact and exploration of physics and chemistry under extreme conditions, e.g. new high-energy Rydberg transitions of metals in stellar or shock wave spectra. We are directly employed in preparation of the ARIEL telescope mission.

Competences & Capabilities

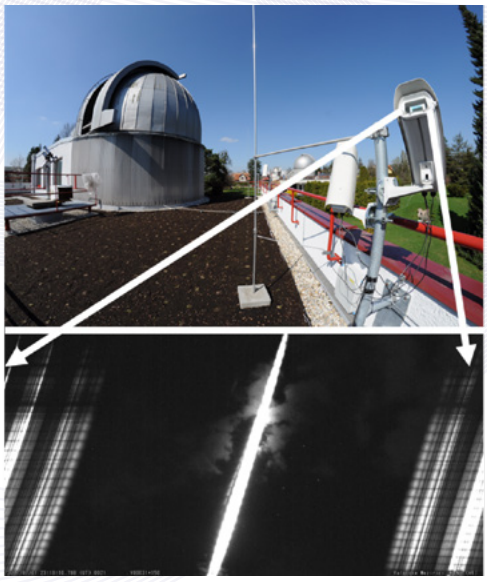
We are directly involved in the project of ARIEL telescope, in development of its optical parts and exploration of exoplanetary physics and chemistry using spectroscopic techniques. In cooperation with our foreign partners, we explore extreme chemical processes in early planetary chemistry and we provide a simulation of the transition spectra of exoplanets. We operate a network of ground-based stations for meteor spectroscopy and observation. The main focus of our research is exploration of early planetary chemical evolution and origin of prebiotic compounds. Our department is directly involved in Breakthrough initiatives, mainly development of high power lasers for space applications.

Major Space Projects & References

- ARIEL – optics design and fundamental science.
- Meteor observation network – simulation of atmospheric entry, spectroscopy (in cooperation with Observatory Valasske Mezirici, Czech Republic).
- Exoplanets – high energy density events, planetary chemistry and physics.
- Breakthrough Initiatives – cooperation on development of high power laser sources for space applications.
- Prebiotic chemistry – exploration of early planetary evolution.

Space Related Equipment, Labs & Certificates

- High resolution interferometers.
- Wide range of laser facilities connected to vacuum interaction chambers.
- Time resolved high resolution emission spectroscopy with continueously scanning interferometer.
- Echelle emission spectrograph.
- Laser spectrometers.
- Equipment for vacuum operation, sampling, analytical techniques such as GC-MS, high resolution spectrosopy, LIBS.
- Software development.



J. Heyrovsky Institute of Physical Chemistry, Czech Academy of Sciences (CAS)
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Responsible for space and ESA projects:

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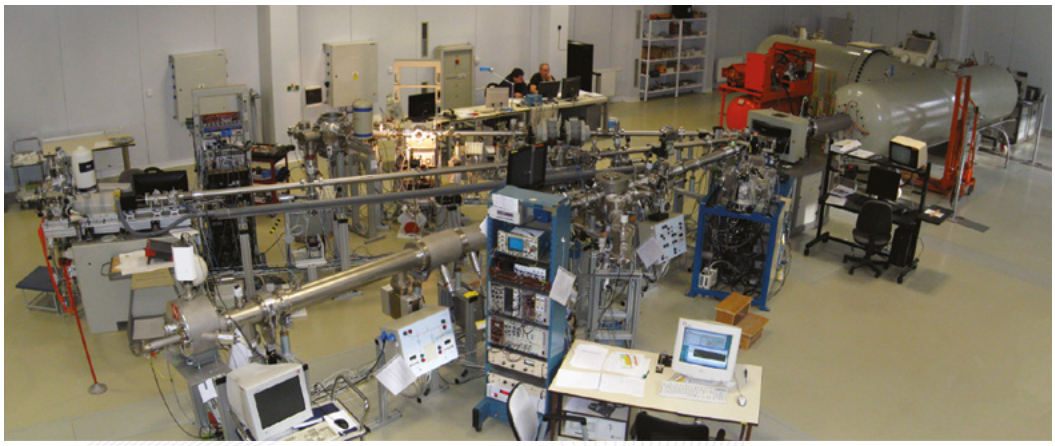
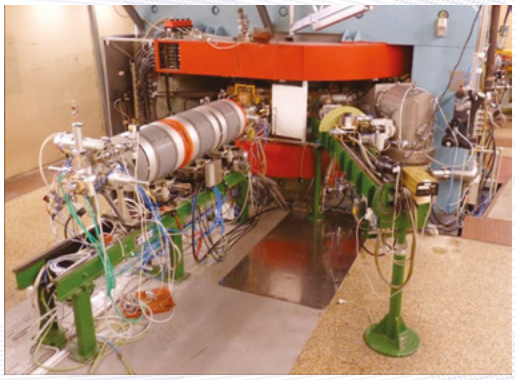


General description

Nuclear Physics Institute of the CAS, public research institution, conducts research in a broad field of nuclear physics, experimental as well as theoretical. The largest experimental facilities of the institute are the cyclotron U-120M (employed for nuclear physics experiments and the production of radioisotopes), the tandem electrostatic accelerator Tandetron TN 4130MC (ion beams with energies from 400 keV to 24 MeV used for the interdisciplinary and applied research by means of ion beam analysis), Microtron accelerator BMT25 (electron beams up to 24 MeV), laboratory equipped for neutron diffraction and scattering, radiocarbon dating laboratory. The institute employs about 110 researchers and PhD students.

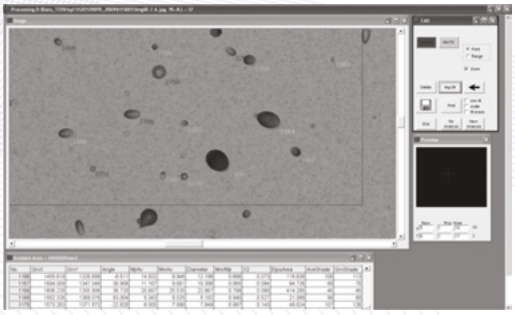


Competences and capabilities

The main activity is a basic research in the field of nuclear physics and the use of the nuclear physics methods and procedures in interdisciplinary fields of science and research. Our current research projects related to space focus mainly to: simulation and measurements of cosmic radiation at high-mountain observatories, onboard aircraft and spacecraft application of active and passive detectors, radiation protection, individual monitoring of aircraft crew. Other research projects in nuclear physics include astrophysically important nuclear reactions and compressed hadronic matter – quark gluon plasma, similar to the state of matter early after the Big Bang – in the heavy ion collisions.

Major space projects and references

- DOBIES – Dosimetry for biological experiments in space (PECS). Project financed by ESA.
- COST 724: Developing of Scientific Basis for Monitoring, Modeling and Predicting Space Weather – detection and dosimetry of particles onboard space and aircraft. Project financed by the Ministry of Education, Youth and Sports of the Czech Republic.
- Exposure to cosmic radiation at near-Earth vicinities: Space weather influence and radiation protection issues. Research project of GACR.
- Determination of neutron component contribution to the exposure level onboard of spacecraft. Research project of Grant Agency of the CAS.
- Individual monitoring of aircraft crew – commercial service for Czech and Slovakian aircraft companies.
- Participation in the ESA project "DOSIS-3D (Dose Distribution Inside the International Space Station – 3D)".



Space related equipment and laboratories

- Passive and active detectors for dose characteristics measurements onboard aircraft, International Space Station, and satellites.
- Laboratory equipment for evaluation of various detectors (readers for thermoluminescent detectors, high speed wide area imaging microscope HSP-1000 manufactured by SEIKO Precision and HspFit software for the analysis of plastic nuclear track detectors).

Academia

R&D

Design

Nuclear Physics Institute of the CAS, public research institution

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toptec

Academia

R&D

Design

Testing

TOPTEC, Institute of Plasma Physics, CAS

Research Centre for Special Optics and Optoelectronic Systems
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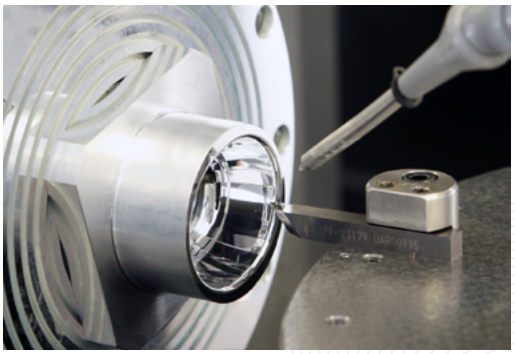
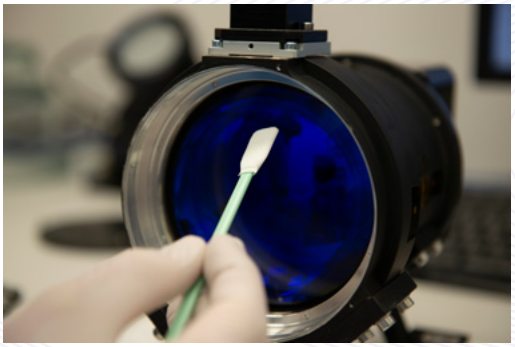


General Description

The TOPTEC Research Centre for Special optics and Optoelectronic Systems continues an almost 50-year-long tradition of research and development of special optics in the optical department of the Institute of Plasma Physics of the CAS. The TOPTEC Research Centre is engaged in the R & D of unique and application-specific systems (using the application of aspheric optics), development of ultra-precise mechanical components for optical systems, and development of thin films and measurement methods, all for scientific and industrial purposes.

The TOPTEC Centre has at its disposal new laboratories equipped with state-of-the-art technologies for research, development, machining, and measurement of special and ultra-precision optics and fine mechanics. It is staffed by a research team of 50 highly qualified and experienced specialists.



Competences & Capabilities

For several decades, unique optical components for various applications (including astronomy) have been developed and manufactured at the Turnov department of the Academy of Sciences, and its researchers have participated in space projects since the 1980s (Interkosmos).

The combination of many years of research experience and state-of-the-art technologies as well as equipment supporting our capabilities in opto-mechanical design, simulation, construction, manufacturing, and measurement of special optics, enables the TOPTEC Centre to provide comprehensive R & D solutions in the field of optics.

In addition, the TOPTEC Centre researchers carry out dozens of contractual research projects every year, both for commercial entities and scientific institutes from various fields of expertise (aerospace, automotive, astronomy, biomedicine, engineering etc.).

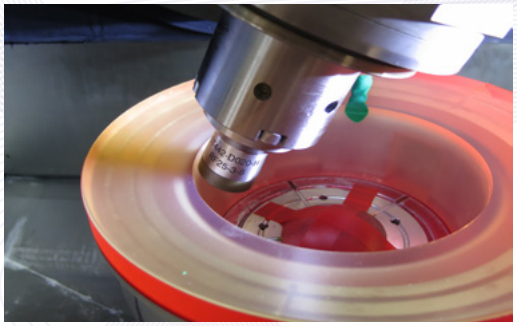
Major Space Projects & References

Optical Parts of the Coronagraph METIS on the Solar Orbiter Mission (for ESA) – the production of two main lightweight mirrors. The biggest challenge of the project lays in the necessity to meet the requirements on the optical quality of the mirrors – surface form (120 nm PV) and microroughness (0.3 nm) – while keeping their combined total weight below one kilogram.

Optics of the Coronagraph ASPIICS on the Proba-3 Mission (for ESA) – the overall optical design and tolerancing of the entire optical system (primary objective imaging the solar corona on the internal occulter and relay optical system re-imaging the corona on a detector), and its final production. Both optical systems have been designed and toleranced with respect to maximum performance while keeping a robust design.

Optical Elements for the "Fly-eye" Telescope NEOSTEL (for CGS S.p.A) – the development and production of polygonal aspheric lenses, the development of the system for rough adjustment of the telescope using laser beams, and the development of temperature-compensated autocollimator for the final adjustment with a diameter of 700 mm. The telescope is supposed to detect objects the size of a tennis ball on the low Earth orbit.

Optical design of TIRI (Thermal InfraRed Imager) (for Airbus Defence &Space) - optical design of the system and a detailed analysis of its characteristics in order to achieve its optimization with respect to its manufacturability. The project is focused on verifying the possibility of the use of uncooled microbolometer sensors for Earth observation. The goal is to develop an optical system that enables high resolution infrared imaging of the Earth from the low orbit.



Optical elements of FLORIS telescope for FLEX (FLuorescence EXplorer) mission (for Leonardo S.p.A.) – complex optical analysis of the system, assembly of individual optical and mechanical elements and their further integration into a fully functional system. The analysis and tests include characterization of optical surface scattering functions, bonding of opto-mechanical interfaces to minimize vibration shocks on optics, vibration and thermal tests and final full optical characterization of the system. The aim of the mission is to map vegetation fluorescence to quantify photosynthetic activity which will improve the understanding of carbon movement between plants and the atmosphere.

Space Related Equipment, Labs & Certficates

The TOPTEC Centre is able to ensure the implementation of many R & D tasks related to requested projects ranging from design, analysis, and simulation, through very precise production to the testing of the results. For this purposes the TOPTEC Centre is equipped with:

- laboratories complying with standards for optical development incl. a clean room;
- a metrology lab with a wide range of measuring instruments, for example aspheric interferometer, 3D stitching profilometer, microscopes using different observation techniques, AFM microscopy, White Light Interferometer microscopy, goniometers etc.;
- software tools for design, numerical simulations, and topological optimization.

General Description

Department of Physical Electronics is a technical university department with a long heritage in space related projects under various roofs of Interkosmos, NASA and other space agencies. The department was coordinating the world satellite laser ranging (SLR) network for 20 years, it contributed to planetary missions to Mars and to laser time transfer missions of CNES, NASA, China, and ESA mostly with detectors based on Single Photon Avalanche Diode (SPAD). The ground segment of the world SLR network located on 5 continents in more than 25 stations is relying on our photon counting technology. In a field of EUV and soft x-ray optics the research is focused on single quantum imaging and grazing angles reflection methods.

Major Space Projects & References

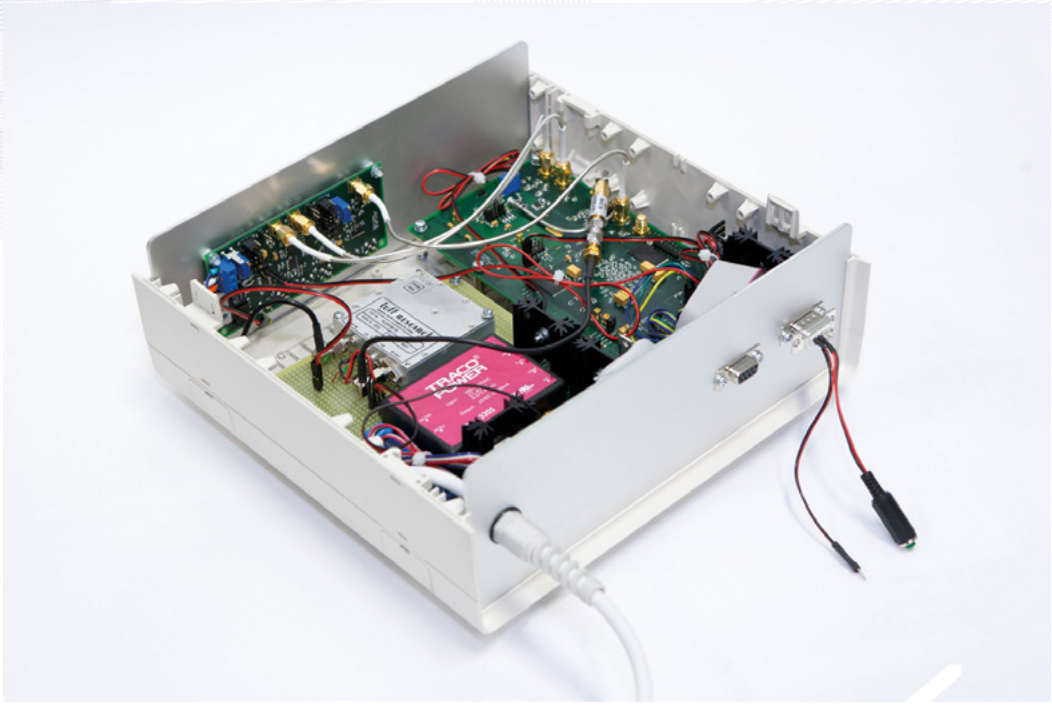
- Satellite Laser Ranging (SLR) – ground segment network (Interkosmos)
- Portable Calibration Standard for SLR network – (Czech and various national grant agencies)
- Mars 92, Mars Polar Lander 98 – planetary altimeter & LIDAR (Russia, NASA)
- T2L2 @ Jason2 – on-board detector for laser time transfer (CNES, NASA)
- LTT @ BeiDou 2 / Compass – on-board detectors for picosecond laser time transfer (China)
- X-ray Optics and Diagnostics – research activity (FP7Space)
- European Laser Timing (ELT) – on-board SPAD based detector for ISS module ACES – (ELIPS 3)

Competences & Capabilities

In pure space segment the department capabilities cover single photon counting in space (from EUV to near IR), single photon laser altimetry and LIDAR in space, X-ray optics and diagnostics. In the ground segment the department has a long term experience with picosecond instrumentation for SLR. It means to be competent in picosecond photon counters, picosecond laser sources, sub-pico-second event timing focused on long-term stability measurement, and in on-site timing calibration of SLR stations worldwide. Several versions of portable calibration standards has been developed and put into operation during SLR calibration campaigns. Recent SLR calibration for laser time transfer missions opens new tasks regarding absolute delay of SLR measurement vs. UTC. The research of group of x-ray optics is focused on a field of single x-ray quantum detection, x-ray optics, and imaging methods for EUV and soft x-ray radiation.

Space Related Equipment, Labs & Certificates

- Solid state single photon detectors with picosecond temporal resolution
- Picosecond laser systems (407, 531, 532, 778, 1550 nm)
- Optical test-bench for single photon detectors diagnostics, optical filters, telescopes. Basic cryogenics.
- Picosecond and femtosecond event timers, UTC GPS receivers, frequency sources, multipliers and distributors
- Instrumentation for picosecond signals diagnostics (GHz oscilloscopes, spectral analyzers, special cables, ...)
- EUV tabletop source and single quantum detectors
- EUV spectrometers and imaging detectors



CTU
CZECH TECHNICAL UNIVERSITY IN PRAGUE

Academia
R&D
Design
Testing

Department of Physical Electronics, CTU

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dept. of Physical Electronics
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Responsible for space and ESA projects:

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Academia

R&D

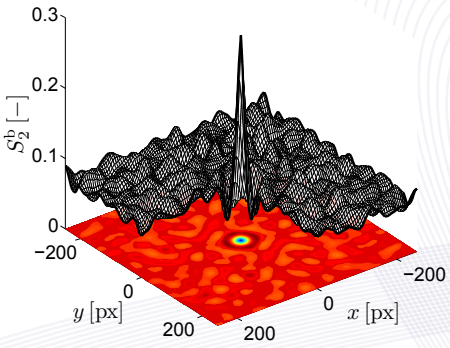
Design

Testing

Faculty of Civil Engineering, CTU

General description

Department of Mechanics of the Faculty of Civil Engineering at Czech Technical University (CTU) in Prague is one of the top research institutions in the Czech Republic and according to CTU self-evaluation record, it is currently its seventh most productive part out of 130 departments. Its expertise falls in the field of computational mechanics, applied mathematics, reliability of structures, testing of composites and is supported by a large network of high-caliber academics from around the globe. From 2015 on, the team members involved in previous ESA projects will provide their services within the new start-up KnowFlex s.r.o.

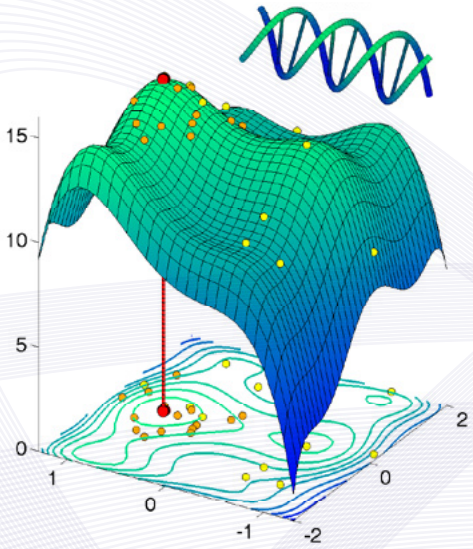


Competences & Capabilities

The key activities fall into the category of basic and applied research. The team consists of experts in the field of (i) materials modelling including development of robust non-linear multi-physics constitutive models, multi-scale modelling, analysis and compression of complex microstructural systems, (ii) reliability and optimisation with focus on uncertainty quantification using stochastic spectral analysis, Bayesian statistics, inverse analysis, robust optimisation using evolutionary single- or multi-objective algorithms and (iii) accelerating of complex computations through model reduction, massive parallelisation on multi-processor clusters, GPU's, or within the GRID environment and/or acceleration through approximation techniques based on artificial neural networks, polynomial chaos etc.

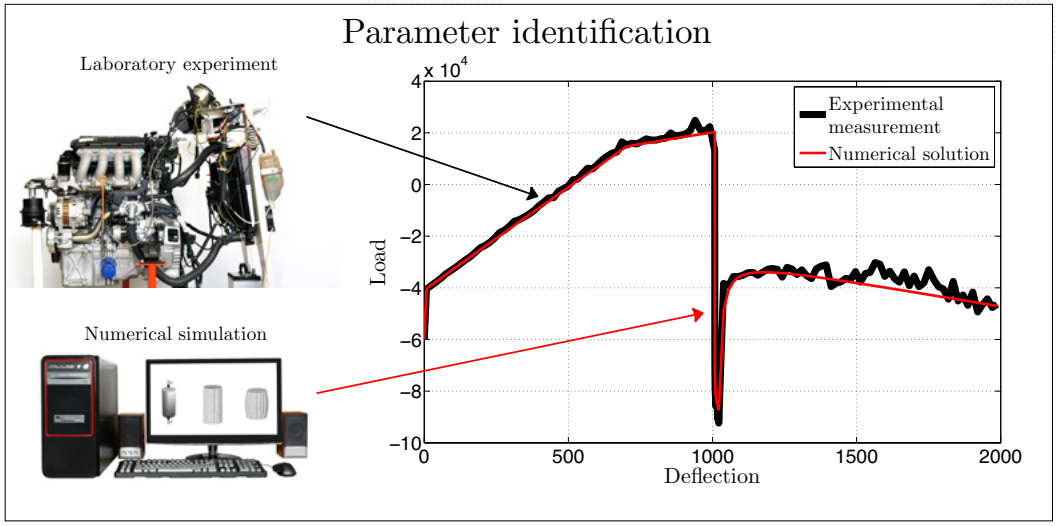
Major Space Projects & References

- Reliability Analysis and Life Prediction with Probabilistic Methods. A joint project with AIRBUS Defence & Space (formerly Astrium GmbH), Germany, funded under contract by ESA.
- Thrust Chamber Life Prediction based on Survival Analysis. A joint project with AIRBUS Defence & Space, Germany, funded under contract by ESA.
- Advanced Nozzle Extension Design Methodology. A joint project with AIRBUS Defence & Space, Germany, funded under contract by ESA.
- Optimization as a tool of sustainability and competitiveness of Czech building industry. A joint project with Nemetschek Scia s.r.o., CZ, funded under a grant of Ministry of Industry and Trade of the Czech Republic.
- Integrated tools for generative design. A joint project with CUBESPACE s.r.o., CZ, funded under a grant of Ministry of Industry and Trade of the Czech Republic.



Space Related Equipment, Labs & Certificates

- In-house Analytical, FEM and Meshless computational platforms
- Nanoindentation facility with climate controlled chamber
- ESEM with EDX analysis, AFM
- Concrete laboratory with mechanical testing equipment from 30 to 2500 kN
- Porosimetry Hg, He, N
- Isothermal calorimetry



Department of Mechanics, Faculty of Civil Engineering Czech Technical University in Prague
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http://mech.fsv.cvut.cz/web/

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General description

CTU (founded in 1707) is the leading technical university in the Czech Republic. In 1950, the Department of Electrical Engineering became an independent faculty. Its 17 departments are located in two buildings: Dejvice (in the main CTU campus) and Karlovo namesti, both within the centre of Prague. The Faculty of Electrical Engineering (FEE) offers first-class education in the fields of electrical engineering, telecommunications, radio engineering, automation, informatics and computer science and engineering. All study programmes are closely linked to research activities. The FEE alone ranks among the top 5 research institutions in the Czech Republic. It generates about 30% of the research output of the whole CTU.

Competences & Capabilities

The FEE has extensive research collaboration with top universities and research institutions worldwide. It offers innovative solutions to industrial partners, military and security institutions and security institutions, including participation in space research and work for governmental agencies. The faculty offers the following study programmes taught in English: Electrical Engineering, Power Engineering and Management (BSc and Ing.), Communications, Multimedia and Electronics (BSc and Ing.), Cybernetics and Robotics (BSc and Ing.), Open Informatics (BSc and Ing.), Biomedical Engineering and Informatics (Ing. only), and Aerospace Engineering (Ing. only). The PhD programme is divided into 16 study branches. Graduates find top jobs in industry, research institutions, and at universities in the Czech Republic and worldwide.

Major Space Projects & References

- MIMOSA - Triaxial magnetometer for Czech satellite: design, manufacture, calibration and testing.
- Space stations - cooperation with DLR Germany - Design and implementation of scientific experimental device at the orbital stations Mir and the ISS. Projects in collaboration with DLR. The device was designed for ESA.
- ESA - direct participation in the ESA satellite projects - Participation (in the consortium) on ESA INTEGRAL - the onboard experiment OMC (Optical Monitoring Camera) and the satellite data center ISDC and INTEGRAL Science Data Centre (ESA, since 2002).
- Participation in the project of large satellite ESA ATHENA, M mission candidate THESEUS, and ESA-CAS mission SMILE.

ESA PECS projects - ESA PECS project No. 98069 "Building Penetration Measurement and Modelling for Satellite Communications at L, S and C-Band" and currently (2012-2013) in the framework of the project Artes 5.1 "Propagation Models for Frequency Coordination and Interference Analyses ", ESA Contract No. 4000105298/12/NL/CLP.

Direct ESA contracts - ESA Artes Contract No. 4000105298/12/NL/CLP, "MOFINT - Propagation Models for Interference and Frequency Coordination Analyses", 2012-2014 and participation in the DEMON ESA GSTP program "Development of Quality Evaluation Methods for Calomel Optical Elements" No. 4000104863/11/NL/PA. ESA Artes Contract No. 4000115277/16/UK/AD "DIGITUR - Reference Procedure for Adoption of Software Tools and Digital Products as ITU-R Recommendations", (from 2017). Collaboration with the Space Debris Team at ESOC ESA on effective algorithms for detection of poorly visible space debris.

Cooperation with NASA – USA - Czech-American project AMVIS focused on cooperation with NASA and the development of innovative technologies based on active X-ray optics for the proposed NASA mission Generation X (2008-2012) and in the field of wide-angle X-ray optics for satellite experiments (from 2013). Rocket experiment proposal with X-ray optics.

Other contracts - Tester for micro accelerometer in collaboration with VZLU. The device is used within the satellite project SWARM.

Satellite navigation – Development of multiconstellation receiver designed with a focus not only on the GPS and GLONASS systems, but also on the Galileo system, QZSS and Beidou 2. Positioning is supported by terrestrial radio means. Project is supported by TA CR Agency. Past activities were supported by the projects MSM 6840770014 "Research Prospective Information and communication technologies' (2005-2010) and Ministry of Transport project 802/210/112 'Participation of the Czech Republic in the GALILEO project (2001-2006)

Nano and Picosatellites - The project "The CzechTechSat Project - Experimental University 1U-format Picosatellite" based on student participation. Project NANOX and cooperation in the field of picosatellites and its payloads. Faculty staff members and student participation in Czech cubesatellite VZLUSAT1 (still in operation) which team was granted an award by the Czech Parliament . Participation in the X-ray detector for VZLUSAT-1 satellite, both hardware and software. For VZLUSAT-2 satellite, involvement on PCB design for the whole satellite, and also in the radiation spectrometer.

EU projects in connection with space activities –

- International project FP-7 Global Robotic telescopes Intelligent Array. The aim of the project is to create a unique network of robotic telescopes with free access.
- Project FP7-SPACE In Space Propulsion first development of a new cryogenic drive - testing and diagnosis of a new cryogenic fuel pumps, including its new electric drive. Cooperation with SNECMA, EADS Astrium, CNES, DLR, ONERA, etc.
- FP6 project "Garda" (Coordinator Laben, Italy, 2004-2006). Development of the Galileo receiver.
- ACFA 2020: Active Control for Flexible Aircraft. European FP7 project, 2008-2011, coordinated by EADS Innovation Works, Munich.
- Robust Hinfinity controller for VLT telescope in Atacama, Chile. Design and assessment of robustness and performance. In cooperation with ESO.
- EU IST-034026: FRESCOR - Framework for Real-time Embedded Systems based on Contracts. European FP6 project. 2006-2009.
- EU NMP4-CT-2006-033211: GOLEM - Bio-Inspired Self-Assembly Process for Mesoscale Products and Systems. EU FP6. 2006-9.
- EU IST-004527: ARTIST 2 - Embedded Systems Design, 2004-8 (European Network of Excellence for embedded systems).
- Project FP7-SPACE-218814 ProVisG - Planetary Robotics Vision Ground Processing (2008-2012) developed image processing tools for future robotic missions to Mars, the Moon and other planets.
- Project FP7-SPACE-241523 - PRoViScout - Planetary Robotics Vision Scout (2010-2013) developed and tested robot navigation and mapping for future planetary robotic missions.
- Project FP7-SPACE-2012-312377 - PRoViDE - Planetary Robotics and Vision Data Exploration (2012-2014) processes image data from robotic missions to the Moon, Mars and other planets
- H2020 Project AHEAD Integrated Activities in High Energy Astrophysics with emphasis on development of novel and alternative X-ray optics for ESA ATHENA space mission.

Educational activities

- In 2010, the FEE accredited Master study degree programme "Air and Space Systems", which is part of the Cybernetics and Robotics
- In 2016 the FEE accredited Aerospace Engineering Master study degree programme
- SpaceMaster: Joint European Master in Space Science and Technology. ERASMUS-MUNDUS Programme, since 2004. Direct participation in the educational program of the European Space Technology Master's program.
- Space technology and related systems are studied in the Master degree study programme Aerospace Engineering in the course Space Engineering and in Radio systems. New PhD Study programme: Aeronautical and Space Engineering.

Space Related Equipment, Labs & Certificates

- Equipment for simulation of GPS and GLONASS constellations.
- Receivers of signals of navigation systems (GPS, GLONASS, Galileo, QZSS, EGNOS, MSAT, WAAS)
- Materials testing designs and laboratories
- Electronics and optical laboratories
- Equipment for magnetic testing and calibration of magnetometers
- Anechoic chambers: acoustics and electromagnetic
- Satellite data / image acquisition and processing

Czech Technical University in Prague
FACULTY OF ELECTRICAL ENGINEERING
Combining Electrotechnics and Informatics

Academia

R&D

Design

Testing

Faculty of Electrical Engineering, CTU

Faculty of Electrical Engineering
Czech Technical University in Prague (CTU)
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Czech Technical University in Prague
Faculty of Mechanical Engineering

Academia

Development

Testing

Faculty of Mechanical Engineering, CTU

General description

General research and development topic of Department is manufacturing technology. Department is focused on research in field of machining, theory of cutting, process planning and metrology. Using advanced knowledge of machining technology and using top level CAD/CAM technologies and CNC machines we are able to perform experimental machining and testing of manufacturing methods to produce parts of space objects from various materials, including precise 3D coordinate metrology and residual stress analysis.

Competences & Capabilities

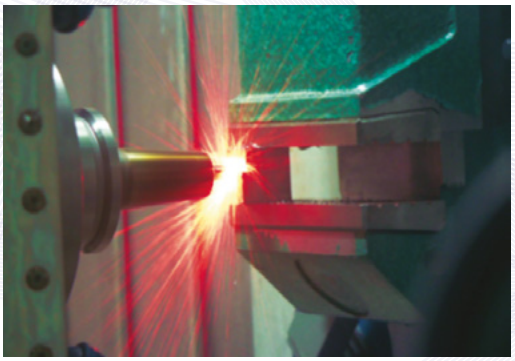
Main areas of research are CAD/CAM technologies, postprocesing a CNC machining. New methods and tool are developed and tested for machining of special and experimental parts. Resulting properties of machined part can be tested for mechanical, geometrical and physical properties including durability and residual stress tests. Our current project for space objects are design and manufacturing process of mechanical parts of satellites, mainly frame assembly of cubesat picosatelite.

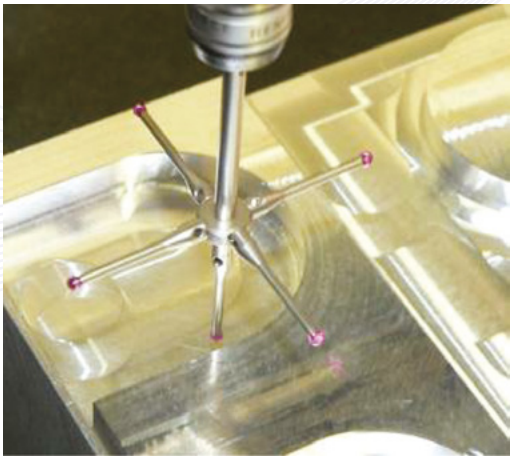
Major Space Projects & References

- Rigid frame for picosatelite: Design of very stable frame for Cubesat using new aproaches to design of frame. Project realized for CzechTechSat, Satelite team of CTU Prague
- Lighgt cubesat frame (LCF): Experimental research and testing of new variants of frames for CubeSat focused on weight reduction. Project realized for CzechTechSat, Satelite team of CTU Prague
- Cubesat frame assembly machining optimalisation: CAM programming and toolpath strategy optimalization for CNC framework production. Material and tool utilization for fast&cheap production methods. Material consumption optimalization. Master thesis project realized on Dept. of Machining, Process planning and Metrology. Project realized for CzechTechSat team.

Space Related Equipment, Labs & Certificates

- 5 axis CNC Milling machines, CNC lathe, Multiple CNC grinding machines
- Staff has certified training for Siemens Tecnomatix Software – Production process and systems simulation
- Certified training from Carl Zeiss Industrial Metrology for 3D metrology





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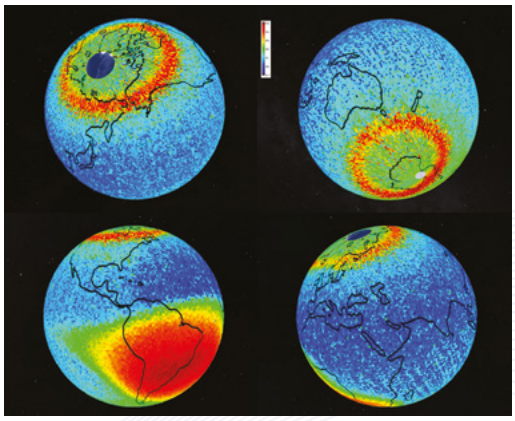
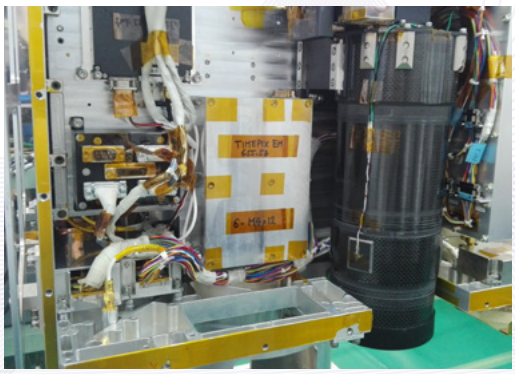


General description

The institute is a research center founded in 2002 at the CTU devoted to fundamental and applied science on sub-atomic physics. The institute possesses a light-ion electrostatic accelerator Van de Graaff which provides a monoenergetic source of protons, deuterium and helium nuclei as well as a tuneable monoenergetic source of fast neutrons. The institute is equipped with detector and radiation imaging laboratories together with a staff of over 80 people most of whom are PhD students and recent graduates from Czech and also foreign universities.

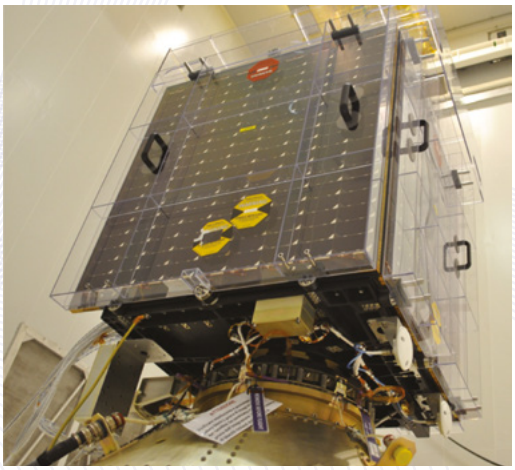
Competences & Capabilities

Main areas of activity include R&D on semiconductor detectors and advanced instrumentation for radiation detection and imaging, novel methods of radiation imaging and spectroscopy and their applications in different fields such as medical imaging, material science and space. Our current projects in space focus on high resolution detection, visualization and characterization of mixed radiation field onboard the ISS and on three satellites by means of highly miniaturized and high-resolution radiation detectors.



Major Space Projects & References

- Space Application of Timepix Radiation Monitor (SATRAM): payload onboard ESA satellite Proba-V in operation since 2013 for high-sensitivity detection and monitoring of the mixed radiation field in low-Earth orbit (LEO). Project realized in cooperation with BD Sensors, funded under contract by ESA.
- Highly miniaturized quantum dosimeters onboard the International Space Station (ISS): integrated radiation cameras of reduced dimensions (60 mm x 15 mm) for visualization and detailed dosimetry of radiation onboard the ISS. Five such devices were deployed and are in operation since 2012. Project realized in cooperation with the University of Houston and NASA.
- Detector for miniaturized X-ray telescope onboard the Czech satellite VZLUSAT-1: launched in 2017 for X-ray observation and for high-sensitivity detection and monitoring of the mixed radiation field in LEO. Project realized in cooperation with VZLUSAT-1 collaboration (see www.vzlusat1.cz) and funded by TACR.
- Space Radiation Micro-Tracker RISEPix: scientific payload for tracking and visualization of energetic radiation onboard the Japanese satellite RISESAT launched in 2019. Project realized in cooperation with Tohoku University and funded by ERDF.
- Highly Miniaturized and Sensitive Thermal Neutron Sensor: development of compact and space-wire compliant prototype for highly sensitive thermal neutron detector for space applications. Project funded by ESA.
- Portable Calibration Gamma-Ray Source: A portable compact unit of a wide-dynamic range source of discrete gamma rays for remote testing of gamma-ray sensitive devices/payloads at test space centers. Project funded by ESA.
- Laboratory Wide Dynamic Range Gamma-Ray Calibration Facility: Laboratory station of a configurable and wide-dynamic range gamma-ray source for testing and calibration of gamma-ray detectors for space. Project funded by ESA.
- Neutron Facilities for Calibration and Testing of ESA-Compliant Neutron-Sensitive Devices: Evaluation and characterization of neutron source facilities in



the Czech Republic for testing and calibration of neutron sensitive devices for space. Project realized in close cooperation with the Nuclear Physics Institute, Rez near Prague and the Czech Metrology Institute. Project funded by ESA.
- Detectors for two miniaturized X-ray telescopes onboard NASA sounding rocket: designed for X-ray observation during ballistic flight of the NASA rocket, launched in 2018. Project realized in cooperation with VZLUSAT-1 collaboration (see www.vzlusat1.cz) and Penn State University, funded by TACR.
- Project for development of a prototype of Miniaturised Radiation Monitor capable of broad sensing of energetic charged particles for commercial use on GEO telecommunication satellites. Project realized in cooperation with Advacam and funded by ESA.

Space Related Equipment, Labs & Certificates

- Clean room class ISO 5
- Accelerator VdG (p, d, ESA approved source of tagged neutrons)
- 2 ESA-approved gamma-ray calibration sources
- Tuneable source of electrons (0.2 – 1.5 MeV)
- Central detection and analytical lab equipped with HPGe detectors, Si, GaAs and CdTe pixel detectors
- Heated chamber

Academia

R&D

Design

Testing

Institute of Experimental and Applied Physics, CTU

Institute of Experimental and Applied Physics (IEAP)
Czech Technical University in Prague (CTU)
Husova 240/5
110 00 Praha 1
http://www.utef.cvut.cz

Responsible for space and ESA projects:

Mgr. Robert Filgas, Ph.D.
Phone: +420 775 868 789
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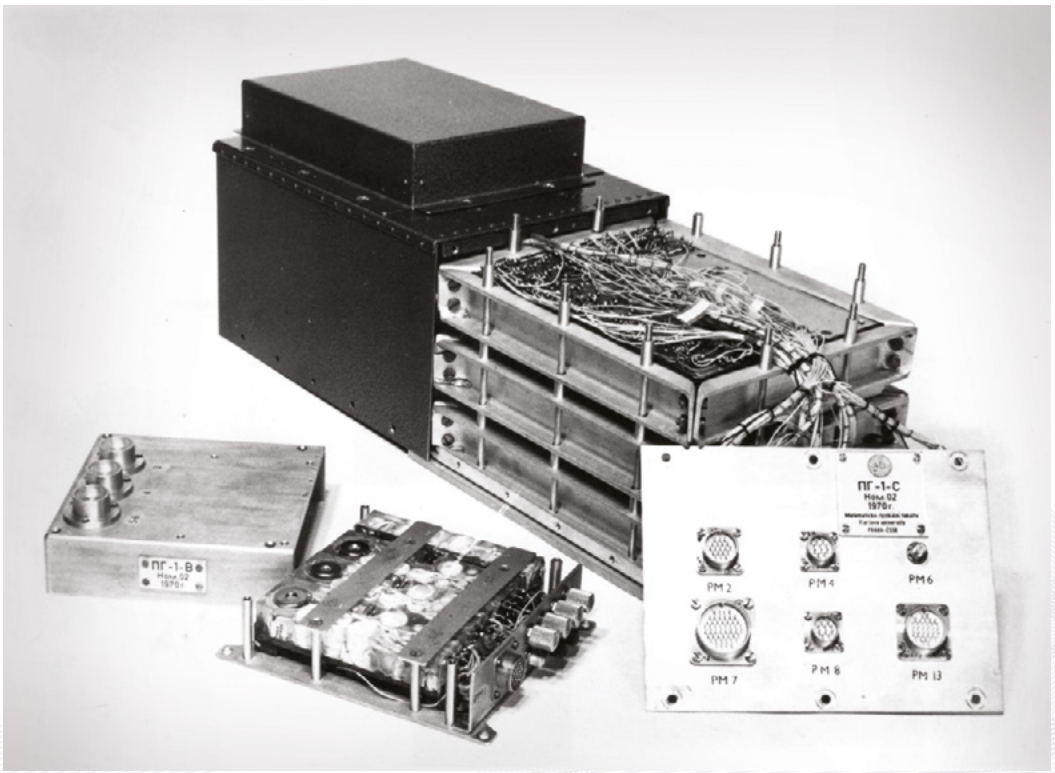
Academia

R&D

Design

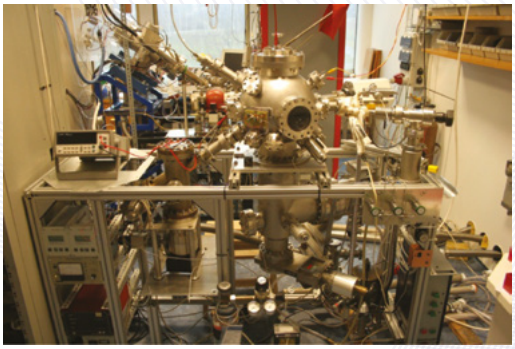
Testing

Charles University, Faculty of mathematics and physics (MFF UK)



General description

The Space Physics Laboratory (SPL) at Faculty of Mathematics and Physics was established in 1990 but the space research activities date down to 1970. The laboratory participated in numerous projects in frame of the former Intercosmos activity and the cooperation within the Russian space program continues. From 2007, the laboratory participates in ESA projects directed toward investigations of processes in the interplanetary space.



Competences and capabilities

SPL is oriented on the fundamental research of processes in space plasma and the R&D activities are strongly coupled to these topics. We have developed or we are engaged in the development of ion and electron spectrometers, energetic particle detectors and frequency analyzers for electromagnetic and/or plasma waves. This development is mainly focused on high-speed measurements in the solar wind and planetary magnetospheres.

Major space projects & references

- BMSW-LG - fast (32 ms) measurements of the moments of the ion distribution in the lunar environment; in preparation for the Russian Luna-Resource 1 mission planned for launch in 2022 in co-operation with ESA.
- PG1 – launched in 1970 as a part of Intercosmos 3 payload, exploration of radiation belts.
- PG1A – launched in 1971 onboard Intercosmos 5 satellite, to exploration of radiation belts
- ESA (Electrostatic Analyzer) - launched in 1976 as a part of the Intercosmos 17 mission, energy spectrometer for magnetospheric plasma study
- MONITOR – launched in 1980 onboard Prognoz 8, fast monitoring of the solar wind parameters
- BIFRAM – launched in 1985 in frame of the INTERSHOCK mission, a complex plasma spectrometer for investigations of shock waves
- MONITOR – 3, VDP, MPS, VDPS – a complex of plasma spectrometers for four satellites of the INTERBALL mission, launched in 1995/1996
- BMSW (Bright Monitor of the Solar Wind) – launched in 2011 in frame of the Spektr R mission
- IDEE (Instrument Détecteur d'Electrons Energétiques, IDEE) - processor unit for fast electron spectrometer, under preparation for the French TARANIS project, in cooperation with IRAP, Toulouse, France
- SWA – (Solar Wind Plasma Analyzer) - detector unit for plasma spectrometer planned for the ESA Solar Orbiter mission, in cooperation with IRAP, Toulouse, France

Space Related Equipment, Labs & Certificates

- Experimental set up for investigations of space dust charging
- Facility for vacuum tests

Space Physics Laboratory (SPL)
Faculty of Mathematics and Physics
Charles University
Ke Karlovu 3
121 16 Praha 2
http://www.mff.cuni.cz

Responsible for space and ESA projects:

Prof. Jana Safrankova
Phone: +420 221 912 301
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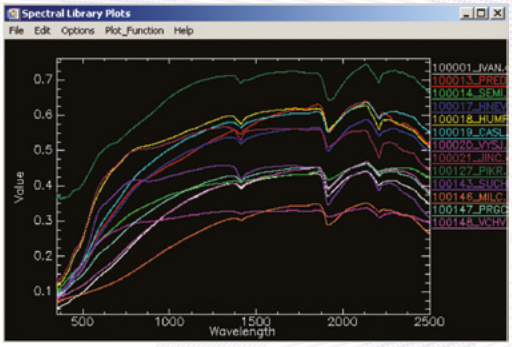
General description

Department of Soil Science was established in 1965. The name Department of Soil Science and Soil Protection was accepted in 2008 and reflects current research and teaching topics of the department. Principle research of the department covers number of topics such as soil pollution, soil degradation by sealing and erosion, soil water dynamics, digital soil mapping using laboratory analysis, remote and proximal sensing. The department possess number of state-of-the-art laboratory instruments for wet chemistry, soil physics, and field survey instruments for soil moisture, soil spectroscopy and GNSS tools.



Competences & Capabilities

The Department contributes actively to the research of up-to-date problems related to soil degradation, conservation and protection. The main areas of activity related to space research include remote sensing of soils (soil erosion detection and topography mapping), imaging spectroscopy and VNIR field and laboratory spectroscopy. Given the suit of instruments the department is capable of field reference measurements of soil moisture, soil and canopy spectroscopy measurements (calibrated reflectance and radiance).

Major Space Projects & References

- Agricultural Drought Monitoring and Assessment driven by Satellites: DROMAS project is based on an innovative approach for monitoring and assessment of the risk and prevention of damage caused by agricultural drought. Integration of meteorological data, vegetation canopy indicators based on satellite imagery and targeted collection of ground truth soil moisture data allow identification and operational monitoring of agricultural drought throughout the growing season. DROMAS project is supported by the ESA ARTES Integrated Applications Programme (IAP – ARTES element 20). The project team is coordinated by Gisat s.r.o.
- Correlation of soil spectral features with soil characteristics and their exploitation in digital soil mapping: The aim of the project was to scan the field soil spectra and model the relationship between soil characteristics and soil spectral features as a basis for digital soil mapping. A Czech soil spectral library was developed. Identification code: GA526/09/1762.

Space Related Equipment, Labs & Certificates

- Spectroscopy lab: FieldSpec-3 (ASD, 350-2500 nm) with field accessories
- GNSS with sub-meter accuracy: DGPS (ProMark-2)
- Soil moisture sensors:
- SM200 with HH2 Moisture Meter
- PR2 Soil Moisture Profile Probe with HH2 Moisture Meter
- TMS2 field soil moisture devices for continuous monitoring

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

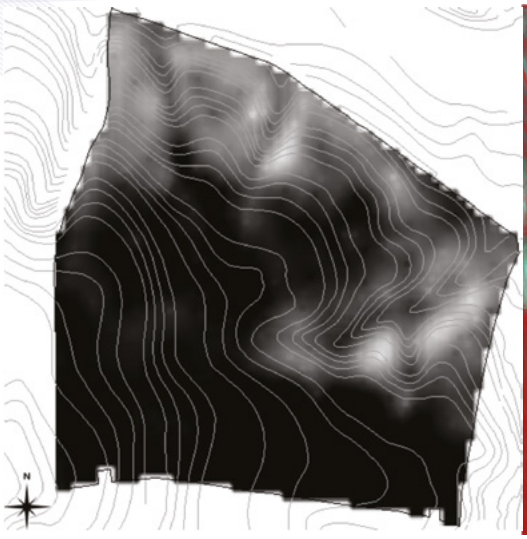
Academia

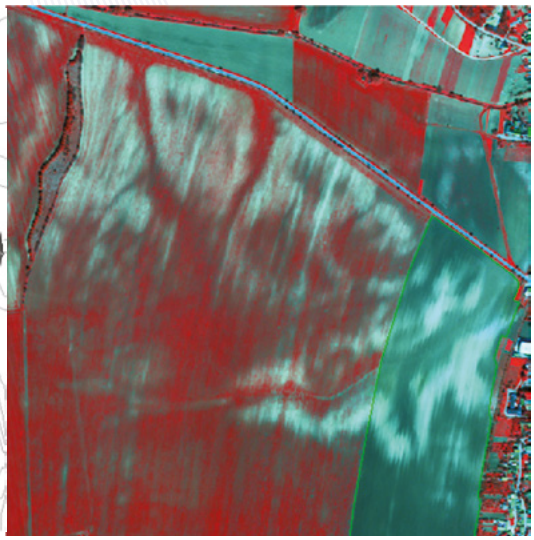
R&D

Design

Testing

Department of Soil Science and Soil Protection (3SP), Czech University of Life Sciences Prague (CULS)





Department of Soil Science and Soil Protection (3SP)
Faculty of Agrobiology, Food and Natural Resources (FAFNR)
Czech University of Life Sciences Prague (CULS)
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http://www.af.czu.cz/en/?r=2352

Responsible for space and ESA projects:

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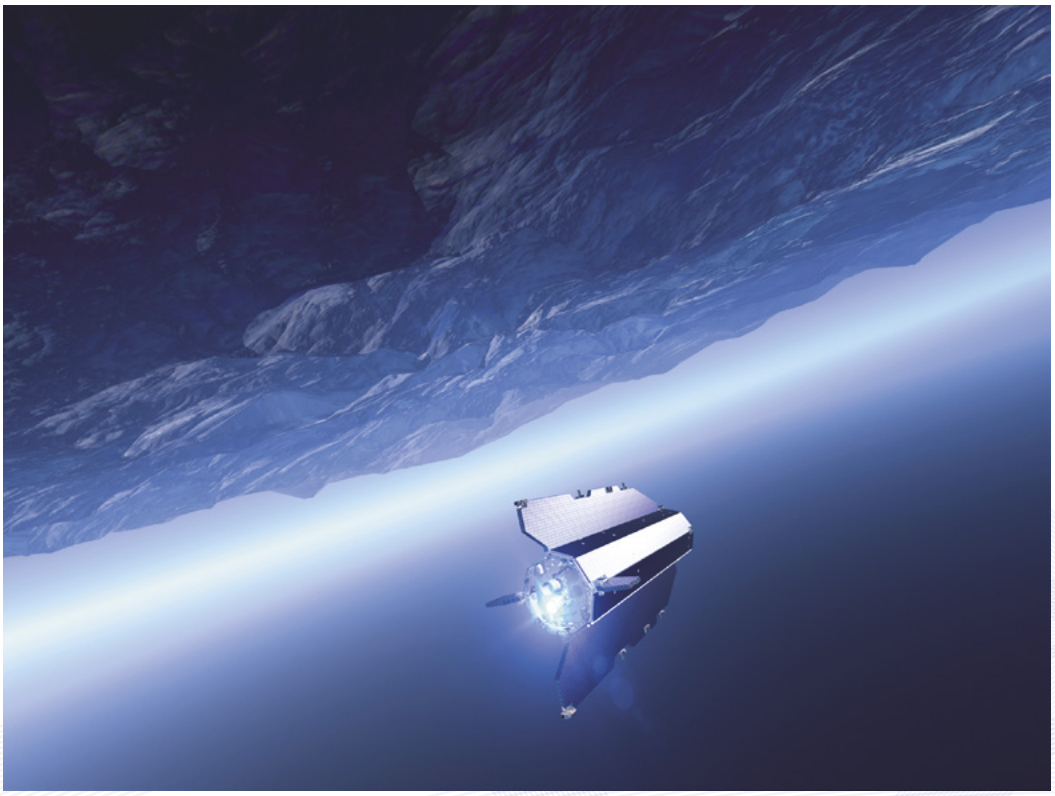
Fax: +420 234 381 836
E-mail: brodsky@af.czu.cz

UNIVERSITY
OF WEST BOHEMIA

Academia

R&D



Faculty of Applied Sciences (FAS), University of West Bohemia in Pilsen (UWB)

General description

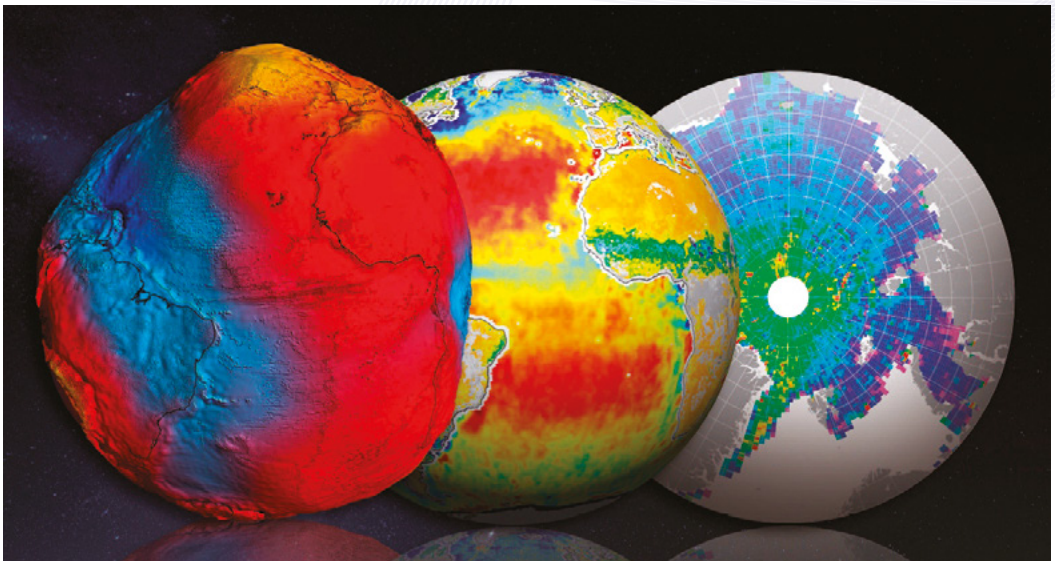
The Faculty of Applied Sciences is devoted to fundamental and applied research in the fields of mathematics, physics, cybernetics, information technologies, computer science, mechanical engineering and geomatics. The faculty possesses various instrumentation and labs. Approximately 260 (FTE) employees work at the faculty (2015). During 2010-14 a new research centre (European Centre of Excellence) "NTIS – New Technologies for the Information Society" was established at the faculty with the state-of-the-art equipment acquired and new building of the faculty constructed. The centre is fully operational since January 2015 with 180 (FTE) R&D employees.

Competences & Capabilities

The research team of the faculty is competent in the area of development of cybernetic control systems, identification, intelligent decision-making and communication systems; advanced computer and information systems; research and modelling of heterogeneous materials and mechanical and biomechanical structures; novel nanostructured thin-film materials prepared using plasma processing; qualitative and quantitative investigation of mathematical models and geospatial data analysis. The faculty cooperates closely with the partner – Research Institute of Geodesy, Topography and Cartography that is also involved in ESA's activities and projects.

Major Space Projects & References

- Towards a better understanding of the Earth's interior and geophysical exploration research "GOCE-GDC". Project STSE GOCE+ 4000103566/11 of the European Space Agency, 2011-2014 (UWB as the main contractor and coordinator of 6 European institutions)
- GOCE: specific tasks on fine gravity field structure of the Earth. PECS Project 98056, European Space Agency, 2007-2011 (member of the consortium)



Faculty of Applied Sciences (FAS)
University of West Bohemia,
Pilsen (UWB)
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306 14 Plzeň
http://www.fav.uwb.cz

Responsible for space and ESA projects:

prof. Ing. Pavel Novak, PhD.
Phone: +420 377 632 676
Fax: +420 377 632 002
Mobile: +420 728 383 486
E-mail: panovak@kma.zcu.cz

Faculty of Science

Academia

R&D

Faculty of Science, Palacký University Olomouc

General description

Palacký University in Olomouc is a university with long-standing tradition. Founded in the 16th century, it is the oldest university in Moravia and the second-oldest university in the Czech Republic. Today it is a modern higher education facility with a wide range of study programs and copious scientific and research activities. Almost 22 000 students are enrolled at its 8 faculties. Palacký University is one of the very top Czech universities, and ranks among the best universities of the world, according to international rankings.

Competences & Capabilities

The space-related research is being carried out at the Faculty of Science, which is a research-based faculty that offers Bachelor's, Master's, and Doctoral studies in various branches of Mathematics and Computer Science, Physics, Chemistry, Biology and Ecology, and Earth Sciences. Since 2009, the majority of its worksites have been located in a newly constructed building not far from the city center. Biological worksites and some laboratories are located on the south-eastern edge of the city, where you can also find new research centers. Currently, the Faculty has about 4 000 students.

The Faculty of Science has a lot of creative potential and it can be proud of its abundant profile of original scientific results, which push the limits of our findings, as well as of its multilateral international cooperation. Some of our research teams rank significantly on the international scale as well. According to the Methodology of the Research, Development, and Innovation Board, in 2011, the Faculty of Science ranked fifth among all the faculties and scientific institutions in the Czech Republic. According to a study conducted by the National Economic Institute in August 2012, the Faculty is the most efficient scientific worksite in the field of optics in the entire Czech Republic.

Major Space Projects & References

- QUARTZ : ESA Scylight project aimed at development of satellite-based quantum key distribution system and service architecture, including core technologies and ground end-to-end testing. Project duration is 2018-2020, Faculty of Science of Palacky University is a part of an international consortium led by SES. The team of Palacky University is responsible for information-theoretical security analysis of quantum cryptography protocol to be developed and implemented within the project.
- Super-Resolution via Spatial Mode Demultiplexing and its Applicability to Observational Astronomy: ESA Ariadna project realized in 2018. The team of Palacky University explored the concept of indirect super-resolution imaging based on spatial mode demultiplexing, performed theoretical and experimental assessments of the method and studied its applicability to observational astronomy, with special reference to binary star systems and exoplanet detection.

Faculty of Science, Palacký University Olomouc
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771 46 Olomouc
www.prf.upol.cz
Tel.: +420 585 634 060
E-mail: dekanat.prf@upol.cz

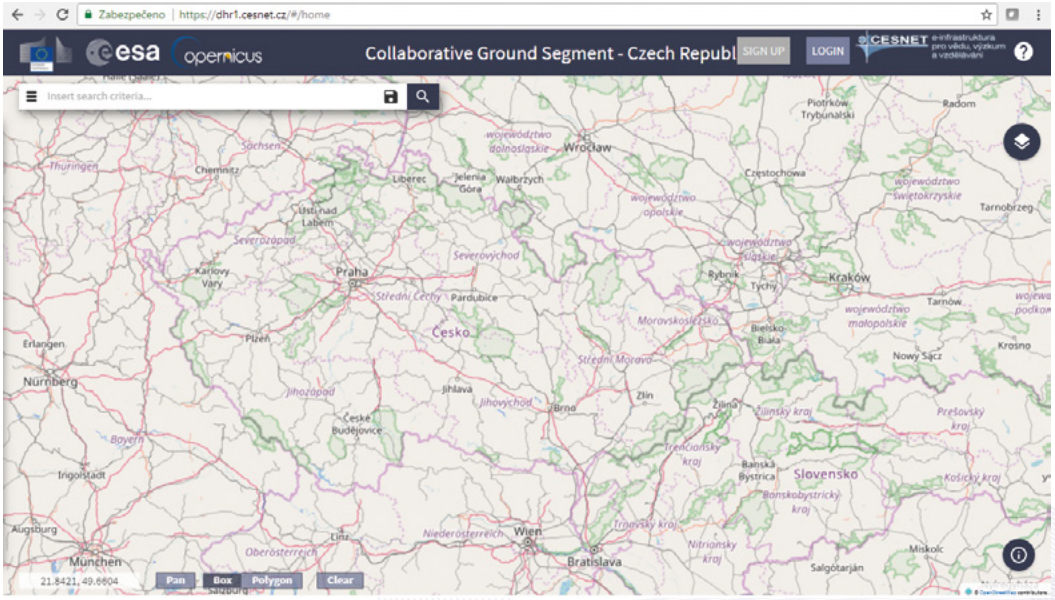
cesnet

Academia

R&D

Design

CESNET z. s. p. o.



General description

CESNET is an association of universities of the Czech Republic and the Czech Academy of Sciences. It operates and develops the **national e-infrastructure for science, research and education** which encompasses a computer network, computational grids, data storage and collaborative environment. E-infrastructure provides services to **transfer, process and store data** for the needs of Research and Educational community.

Since its foundation, the CESNET has been an operator of a national research and education network (NREN). In 1999 it expanded into the area of providing computing services and since 2012 it provides large-scale data storage services. This services are complemented with tools and for managing access to resources, communication security and data protection tools, and services for efficient collaboration between distributed users and teams.

In addition, the Association has a status of a research organisation and over its twenty-year history it has reached significant milestones in the area of research. of advanced network technologies and applications from hybrid networking, cyber-security, programmable hardware, metacomputing to middleware and video transmissions.

Competences & Capabilities

- Network data transfer (100 Gbps)
- Data processing and data storage services
- High-performance computing
- Monitoring and security services
- Forensic analysis, penetration and infrastructure stress testing
- Online collaboration tools & Multimedia
- Identity management & Middleware
- Research and development in the field of information technology

Major Space Projects & References

CESNET operates national Data Hub system, which enables users fast and reliable transfer and access to the Sentinel mission's data (products).

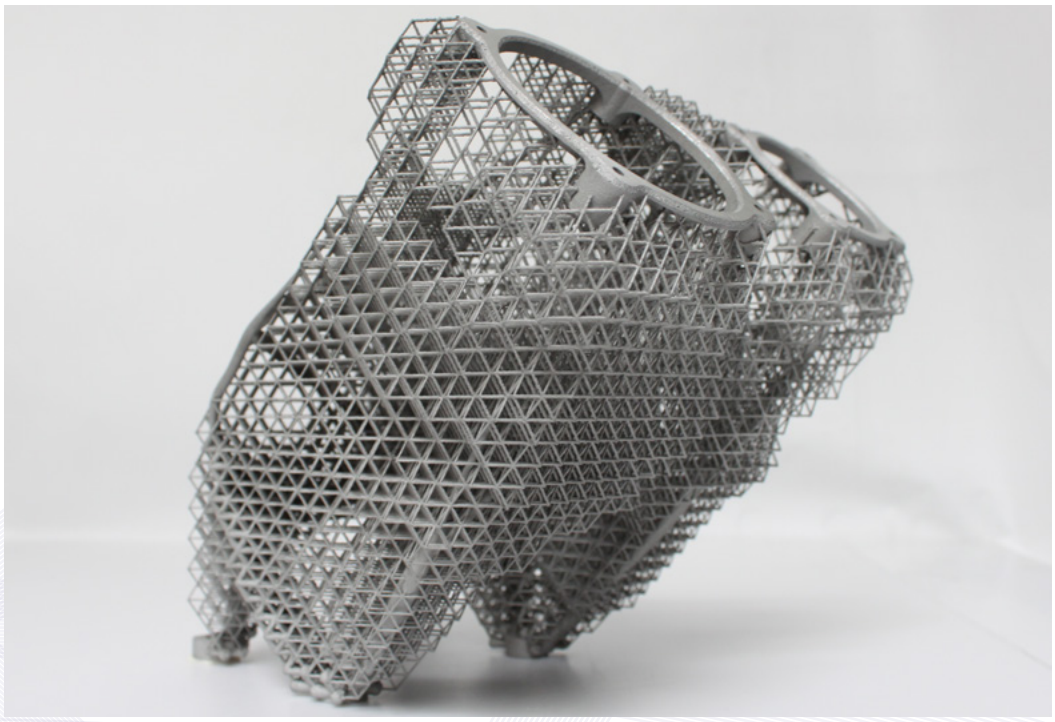
Located at CESNET, the Data Hub Relay is able to capitalize CESNET's high speed connection to GÉANT as well as CESNET's extensive experience in operating distributed infrastructures, storages and high throughput computing.

The choice of data sets distributed through the Relay is driven by the needs of partners involved in the relay network, and by the needs of users active in the Czech Republic and surrounding regions.

CESNET z. s. p. o.
Zikova 4
CZ-16000 Prague 6
www.cesnet.cz
http://collgs.czechspaceportal.cz/
https://dhr1.cesnet.cz/

Responsible for space and ESA projects:

Ing. Zdeněk Šustr
E-mail: datahub@cesnet.cz



NETME Centre

Academia

R&D

Design

Testing

General description

NETME Centre – New Technologies for Mechanical Engineering – is a regional research and development Centre based on high quality research and development conducted at the Faculty of Mechanical Eng. at Brno University of Technology. NETME Centre is divided into five divisions according the research focus. The Division of Virtual Machine Design and Testing (VMDT) is focused on research, education and complex services in the field of new products development. Activities aim to integrate latest knowledge in basic research and applied sciences and multidisciplinary approach of computer, information and communication technologies in design process. Research mainly focuses on universal use of computer aided design and numerical simulation (Virtual Prototyping and Virtual Testing) and real testing in developing process of new products. Main activities are focused on all aspects of product lifecycle in production sector and include development and design, engineering analysis, prototyping, optical diagnostics and digitization and testing of mechanical systems and materials.

Competences & Capabilities

- Additive Manufacturing by Selective Laser Melting
- AM prototype fabrication from titanium, aluminium and ferrous alloys, up to 280x280x350 mm
- Ongoing development of new materials for AM - pure iron, copper alloy, magnesium alloy
- Ongoing development of AM dual material processing – Al/Cu, Al/Fe, Fe/Cu
- Design for AM, redesign of components for AM, topology optimization, lattice structures
- Post processing of 3D printed parts (heat treatment, sand blasting, ultrasonic cleaning etc.)
- 3D optical digitization of industrial components
- Evaluation of geometric tolerances
- micro Computed Tomography analysis
- Magnetorheological damping (world fastest magnetorheological damper)
- Tribology fundamentals, in-situ lubrication film thickness measurement, friction measurement, development of own tribometers for special contact conditions
- Experimental noise and vibration analysis
- Experimental modal analysis
- Strain gauge measurement
- Testing of mechanical components using shakers and hydraulic actuators

Major Space Projects & References

Design of Spacecraft Components for Additive Manufacturing (2014-2015) ITT: AO /1-7397/13/NL/EL Project partners: LK Engineering (prime), Brno University of Technology, Thales Alenia Space France. The primary objective of the project was development of design methodology, which allows implementation of AM correction parameters (based on individual machine, component geometry, etc.) into the design process of space components with respect to the stiffness and Eigen frequency requirements.

Additive Design for Aerospace Applications Capabilities (2018-2019) ITT: 4000123317/18/NL/GLC/hh Project partners: GE Aviation Czech (prime), Brno University of Technology. The objective is to develop and implement methodologies to identify suitable components that can benefit from additive manufacturing compared to conventional manufacturing and implement additive design approach in order to reduce complexity, cost and weight.

NETME Centre, Division of Virtual Machine Design and Testing, Brno University of Technology (BUT)

NETME Centre
Brno University of Technology (BUT)
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616 69 Brno
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http://www.netme.cz

Responsible for space and ESA projects:

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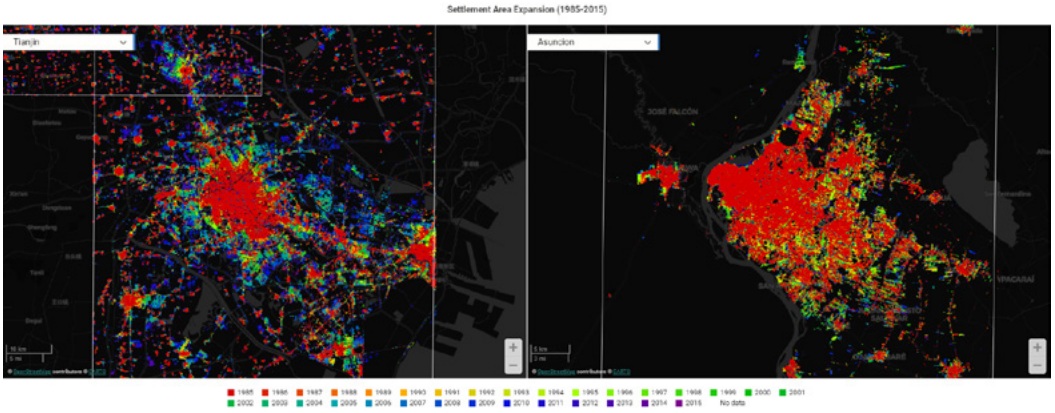
VSB TECHNICAL UNIVERSITY OF OSTRAVA | IT4INNOVATIONS NATIONAL SUPERCOMPUTING CENTER



Academia

R&D

Design

Testing

IT4Innovations National Supercomputing Center

General Description

IT4Innovations National Supercomputing Center at VSB – Technical University of Ostrava is a leading research, development, and innovation center active in the field of high-performance computing (HPC) and data analysis (HPDA). IT4Innovations operates the most powerful supercomputing systems in the Czech Republic, which are provided to Czech and foreign research teams from both academia and industry. Together with the CESNET and CERIT-SC institutions, IT4Innovations constitutes e-INFRA CZ, a strategic research infrastructure of the Czech Republic.

IT4Innovations currently operates four supercomputers – Anselm (94 TFlop/s, installed in the summer of 2013), Salomon (2 PFlop/s, installed in the summer of 2015), Barbora (849 TFlop/s, installed in the autumn of 2019) and a special system for artificial intelligence computation NVIDIA DGX-2 (130 TFlop/s and 2 PFlop/s in AI, installed in the spring 2019). A petascale EURO_IT4I system with computing power approximately 15.2 PFlop/s will be installed at the center in 2021 as part of the EuroHPC Joint Undertaking.

Competences and Capabilities

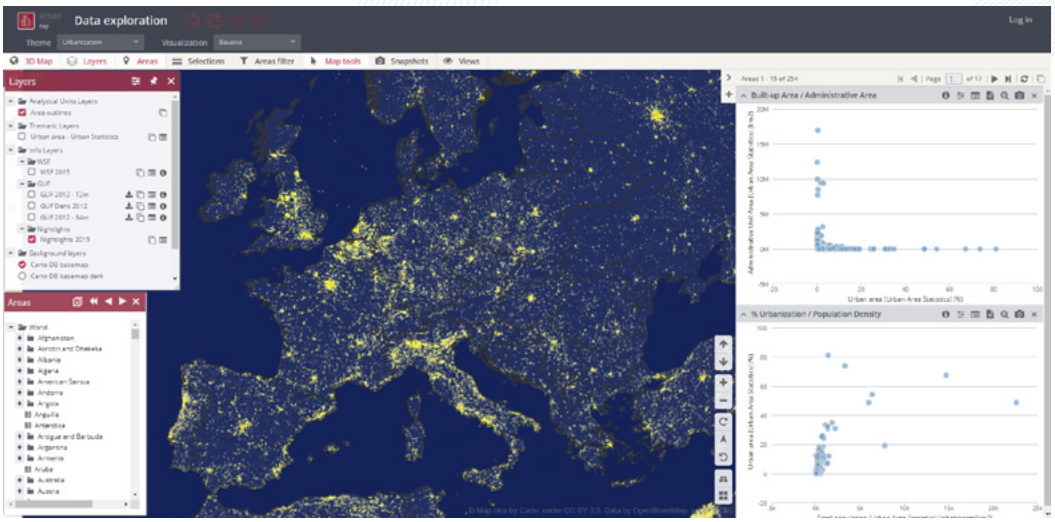
Besides being the large infrastructure, IT4Innovations is also R&D center with strong international links. The center currently participates in dozen of international project, mostly FP7 and H2020 with top academic and industrial partners. The key research areas of IT4Innovations include big data processing and analysis, machine learning, development of parallel scalable algorithms, solution of computationally demanding engineering problems, advanced visualization, virtual reality, modelling for nanotechnologies, and material design.

Major Space Projects & References

IT4Innovations is involved in an ESA project named Urban Thematic Exploitation Platform (Urban TEP). The main goal of the project is the implementation of an instrument that helps addressing key research questions and societal challenges arising from the phenomenon of global urbanization. The main role of the IT4Innovations center in the project is to provide state-of-the-art technology and expertise in high performance computing. Thus, the center provides the platform with the processing services and data storage services needed to access, analyse and visualize geospatial data and derived products. The Urban TEP platform currently focuses on use-case and user driven development of new tools and services.

From 2020 IT4Innovations started to work on another ESA project – the Blockchain Enabled Deep Learning for Space Data (BLENDED). The objective of the project is to evaluate technologies allowing secure, valuable, and efficient interconnection of data and technologies. The project will aim to use neural networks for a case study: Analysis and prediction of time series to monitor the growth of urban agglomerations using Earth Observation data. To train neural networks, for three selected cities, different sources of satellite as well as non-satellite data will be used. In this project, IT4Innovations is in charge of developing a Deep Learning model aimed at processing remote Earth observation data in order to analyze and predict the growth of urban agglomeration in the monitored cities.

IT4Innovations is also involved in the Czech Copernicus Collaborative Ground Segment developing a system for an effective nation-wide processing of Sentinel-1 satellite data by interferometric and polarimetric techniques for geodetic, geologic or forestry applications.



VSB – Technical University of Ostrava
17. listopadu 15
708 00 Ostrava – Poruba
Czech Republic
http://www.it4i.cz

Responsible for space and ESA projects:

Dr. Vít Vondrák
Managing director
E-mail: vit.vondrak@vsb.cz
Phone: +420 597 329 590

General description

The Research Institute of Geodesy, Topography and Cartography ("Institute") is a public research institution of the Czech Office of Surveying, Mapping and Cadastre (ČÚZK). The Institute founded in 1954 as a branch research institute is responsible for basic and applied research in geodesy, surveying, mapping and cartography in the Czech Republic. It consists of four research departments including the Department of Geodesy and Geodynamics, where space activities are realized at the Geodetic Observatory Pecný (GOP) located at Ondřejov, about 40 km south-east of Prague. The GNSS Test and Calibration Base serving as a 3-D position reference standard for the Czech Republic is a part of GOP.

Competences & Capabilities

Through observations and analyses, the Institute has been systematically contributing to international scientific services for more than 20 years. Most of the services are operated under the umbrella of the International Association of Geodesy (IAG) such as the International GNSS Service (IGS), International DORIS Service (IDS), International Geodynamics and Earth Tides Service (IGETS), International Gravity Field Service (IGFS) and Sub-commission for the European Reference Frame (EUREF).

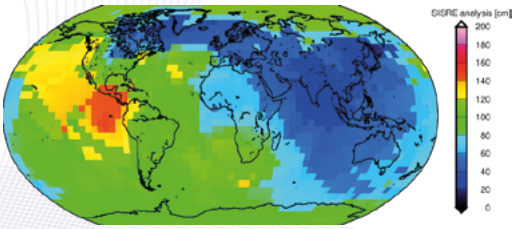
Research activities of the Institute are focused in four domains:

- GNSS (Global Navigation Satellite Systems) – data collection, data quality control, data dissemination, precise analysis of regional and global data,
- DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellites) – precise analysis of global data,
- Gravity field modelling – ground data collection and analyses, processing of data from Low-Earth Orbiter missions and satellite altimetry,
- Interdisciplinary research including software development – models and precise products for different applications in autonomous positioning, meteorology and climatology, geophysics and geodynamics, metrology and others

Main expertise consists in

- continuous collection, dissemination and data quality control from networks of GNSS stations for geodetic and multi-disciplinary applications,
- gravity observations, data processing and signal analysis for geodetic and geodynamics applications,
- precise analyses of GNSS observations in post-processing, re-processing and (near) real-time modes for precise orbit determination (IGS), for maintenance of the European Reference Terrestrial System (ETRS), for solid Earth sciences (EPOS), for atmosphere monitoring (E-GVAP), for signal-in-space monitoring (IGMA) and others,
- processing of DORIS data for global international reference frame realization and for orbit determination,
- development of software for GNSS real-time precise positioning, data quality control, troposphere monitoring and correction modelling and other related applications.

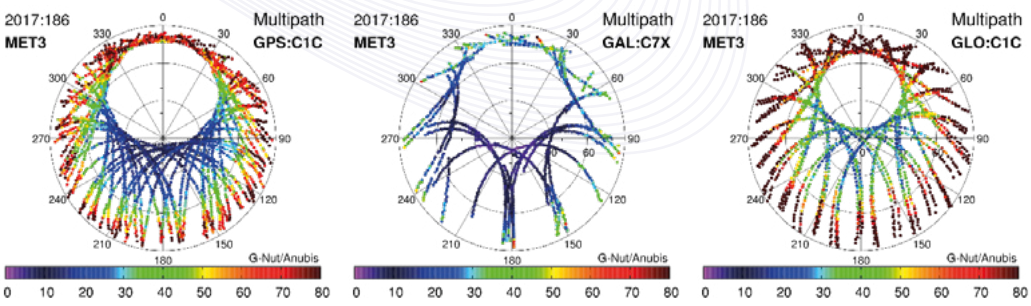
Major Space Projects & References



- E-GVAP – The EUMETNET EIG GNSS Water Vapour Programme (2005–2019, EUMETNET service)
- DARTMA – Development and Assessment of Regional Augmentation Tropospheric Model for GNSS Positioning (2014–2016, ESA prime contract)
- Trop4LAS – Assessment Techniques of Tropospheric Effects for Local Augmentation Systems (2012–2014, ESA contract)
- EPOS – European Plate Observing System, Implementation Phase (2015–2019, H2020)
- SPMS – EGNOS Service Performance Monitoring (2015–2018, GSA)
- GRC-MS - Galileo Reference Center - Member States reference GPS and Galileo orbit and clock products for key performance indicator monitoring (2018-2021, GSA)
- IGMA – International GNSS Monitoring and Assessment, task force of the International Committee on GNSS, ICG (2017–2020, UN)
- GNSS4SWEC – Advanced GNSS Tropospheric Products for Monitoring Severe Weather Events and Climate (2013–2017, EU)
- SWIRLS – Galileo Professional Receiver Development (2005–2008, EU FP 6)

Space Related Equipment, Labs & Certificates

- precise (geodetic) GNSS receivers, atomic Cs-clock, passive H-maser,absolute and relative superconducting gravimeters,
- various meteorological and environmental sensors,
- test and calibration base for 3-D positioning using GNSS (national reference standard).



Academia

R&D

Design

Testing

Research Institute of Geodesy, Topography and Cartography, p.r.i., Geodetic Observatory Pecný

Research Institute of Geodesy, Topography and Cartography, Geodetic Observatory Pecny, 251 65 Ondrejov 244 Czech Republic
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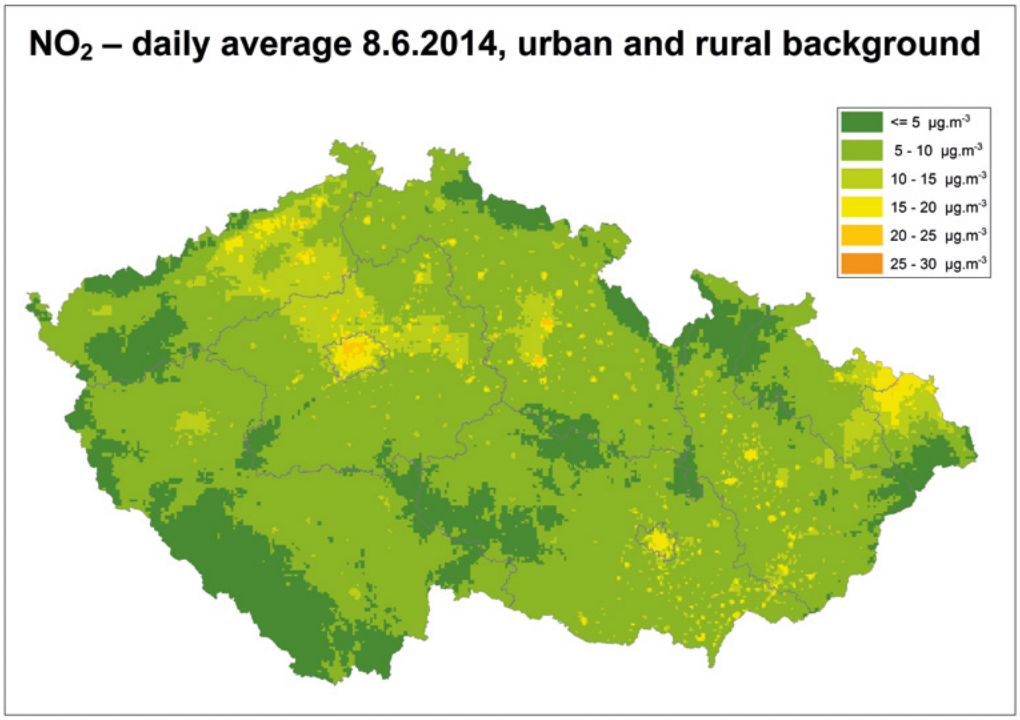
Ing. Jakub Kostelecky, Ph.D.
Phone: 323 649 235
E-mail: jakub.kostelecky@pecny.cz

Academia

R&D

Design

Testing



Czech Hydrometeorological Institute (CHMI)

General Description

Czech Hydrometeorological Institute (CHMI) is a central state institute of the Czech Republic in the fields of air quality, meteorology, climatology, hydrology, and water quality. The objective of CHMI's activity in the above fields is to establish and operate monitoring stations with the aid of a telecommunications networks. The related activities include building national networks for monitoring the atmosphere and hydrosphere, to assess observations, measurements and monitoring data and to create and maintain databases in a unified information system, to provide information to the public and to report to regional and national authorities/ institutions as well as to the EU bodies. CHMI consists of five divisions, including Meteorology and Climatology, Air Quality, and Hydrology Divisions.

Competences & Capabilities

The CHMI is authorized by the Ministry of the Environment to operate the State air quality monitoring network of the Czech Republic. It is also authorized to ensure in the long term the operation and development of the Air Quality Information System including the national air quality database. Among all of the core products of the Air Quality Information System Department, air quality maps play a particularly important role. The maps are constructed both using near real time data (up-to-date) and annual average data, with the underlying methodology based on the data fusion of the monitoring, modelling and other supplementary data.

Major Space Projects & References

SAMIRA (SAtellite based Monitoring Initiative for Regional Air quality) was a project funded by the European Space Agency. In the project, seven organizations from four counties (Norway, Czech Republic, Poland, and Romania) are involved, including CHMI. The overall goal of the SAMIRA project is to improve regional and local air quality monitoring through synergetic use of data from present and upcoming satellites, traditionally used in-situ air quality monitoring networks and output from chemical transport models. The examined pollutants are Particular Matter (PM10, PM2.5), Nitrogen Dioxide (NO2), and Sulphur Dioxide (SO2). The time steps are hourly, daily, and annual data.

Czech Hydrometeorological Institute
Na Šabatce 17
143 06 Praha 4
Czech Republic
http://www.chmi.cz

Responsible for ESA projects:

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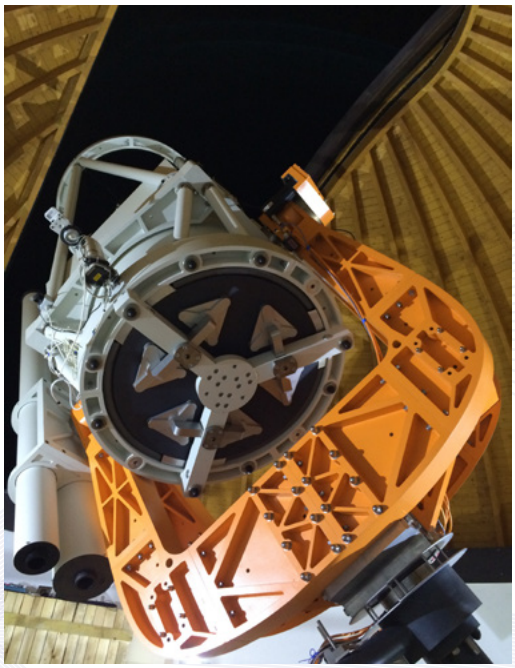
Fax: +420 244 032 468
E-mail: jan.horalek@chmi.cz



General Description

The Kleť Observatory is a research institution belonging to few natural science centers of Southern Bohemia in the Czech Republic, supported by the South Bohemian Region and various grants. The observatory is situated south of the top of Klet mountain (at altitude of 1070 m), southwest from the town of České Budějovice. There are one hundred and fifty clear nights per year with a good astronomical seeing on the average, as shows data from photographic observations of minor planets and comets since 1968. The Headquarter of Kleť Observatory is located at the Observatory and Planetarium in České Budějovice.

Major Space Projects & References

- Near Earth Object follow-up astrometry as the Cooperating Sensor of ESA-SSA-NEO segment (2014-2017 ESA contract).
- Observational support from collaborating observatories with DEIMOS SPACE S.L.U, Madrid, Spain as the main contractor with ESA - further sub-contractors are from Germany and Spain (since 2019).

Observation statistics:

- 2019 together 1394 positions of 154 NEOs (14 Atens, 81 Apollos, 59 Amors; incl.11 PHAs)
- 2018 together 2051 positions of 172 NEOs (18 Atens, 90 Apollos, 64 Amors; incl.17 PHAs)
- 2017: together 2865 positions of 274 NEOs (22 Atens, 148 Apollos, 104 Amors; incl.15 PHAs)
- 2016: together 3765 positions of 324 NEOs (40 Atens, 142 Apollos, 142 Amors;incl.24 PHAs)
- 015: together 2350 positions of 231 NEOs (21 Atens, 124 Apollos, 86 Amors;incl.17 PHAs)

References:

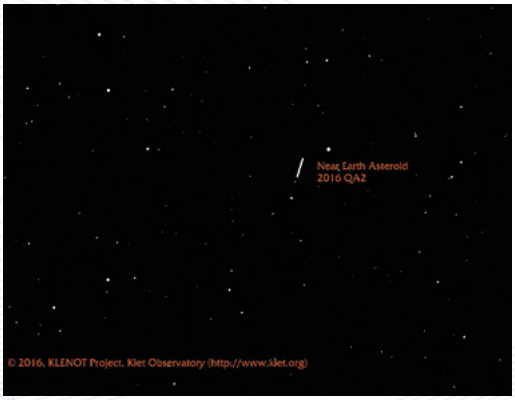
Minor Planet Circulars(ISSN 0736-6884) and Minor Planet Electronic Circulars (ISSN 1523-6714), (2013-2019)

- Ticha, J., Tichy, M.,Honkova, M. KLET OBSERVATORY PREPAREDNESS AND PLANS FOR PLANETARY DEFENCE (Proceedings 1st NEO and Debris Detection Conference, 22 January 2019 - 24 January 2019, Darmstadt, Germany, published by ESA Space Safety Programme Office)
- Ticha, J., Tichy, M., Kocer, M.: KLENOT NEO FOLLOW-UP PROGRAM IN EUROPEAN FRAMEWORK (2015 IAA Planetary Defense Conference, Frascati, Italy, 2015)

Competences & Capabilities

Ground segment for Space Safety Programme -Near Earth Objects (NEO):

- Confirmatory observations of newly discovered NEO candidates, especially fainter and fast moving objects as well as NEO candidates having larger ephemeris uncertainty (both lim. mag. about V = 22 mag. and larger FOV are benefits of 1-m KLENOT Telescope)
- Recoveries of NEOs in the second opposition
- Follow-up astrometry of poorly observed
- NEOs - Virtual ImpactorsĚ and PHAs, target of space missions or radar targets
- Cometary features. Analysis of possible cometary activity of newly discovered bodies.
- Search for new asteroids as a by-product.- Educational and public outreach activities in related field (asteroid hazard, space safety)



Space Related Equipment, Labs & Certificates

- 1.06-m KLENOT telescope with 4-lenses corrector to obtain a plane FOV 0.63 x 0.63 degrees, computer controlled equatoreal mount, equipped with CCD camera
- FLI ProLine 230. Limiting magnitude of mV=22.0mag.
- The hardware and software equipment for KLENOT project consists of local network, servers and workstations for operating CCD camera, instantaneous visual detection, image processing, data reduction, identification of moving objects, ephemeris calculations and orbit computations. The Klet Software Package has been continually upgraded.
- In order to increase tracking accuracy of the KLENOT telescope mount the main gearbox was upgraded. New feature: HW + SW system for sidereal off-set tracking was installed in order to increase limiting magnitude of observed moving objects

Academia

R&D

Kleť Observatory

Kleť Observatory
Zátkovo nábřeží 4
370 01 České Budějovice
Czech Republic
http://www.klet.org

Responsible for space and ESA projects:

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Phone: +420 386 352 239
Mobile:+420 604 856 349
E-mail: klet@klet.cz
jticha@klet.cz

HVĚZDÁRNA
A PLANETÁRIUM
TEPLICE

Academia

R&D

North-Bohemian Observatory and Planetarium in Teplice

General Description

Teplice Observatory is a part of the North-Bohemian Observatory and Planetarium (NBOP). NBOP is a non-profit organisation funded by the Regional Authority of the Usti Region and primarily it is focused on popularisation of astronomy and science. The observatory is located atop of the Sand Hill situated in the south-east part of the Nord Bohemian town Teplice (CZ) with a moderate light pollution and almost unobstructed view of the whole sky.

Major Space Projects & References

SSA P2-SST-X: Support Observations and Sensor Qualification
SSA P3-SST-III: Robotic Telescopes Demonstration

Competences & Capabilities

We are a regional public observatory and planetarium with the main assignment to promote space sciences to public. Scientifically we specialise in observations of artificial satellites and space debris, astrometry of minor bodies in the solar system and occultations of stars by asteroids.

Space Related Equipment, Labs & Certificates

Two 5.5-m (diameter) domes are available: the Nord-West (NW) dome and South-East (SE) dome. The SE dome (E 13 50 48.3, N50 38 18.0, altitude 275 m) is equipped with the Sand Hill Optical Telescope (SHOT). SHOT is dedicated to the ESA SST activities based on the ESA contracts P2-SST-X and P3-SST-III. SHOT is a 0.43-m f/6.8 corrected Dall-Kirkham telescope (Planewave CDK17) with a precise German equatorial mount (10micron 3000HPS). For observations of satellites and space debris the CCD camera Apogee Aspen CG9000 and focal reducer is used, the resulting FOV is 63 x 63 arcminutes (1.1 square degree).

Teplice Observatory,
North-Bohemian Observatory and Planetarium (NBOP)
Koperníkova 3062,
415 01 Teplice
Czech Republic

Responsible for space and ESA projects:

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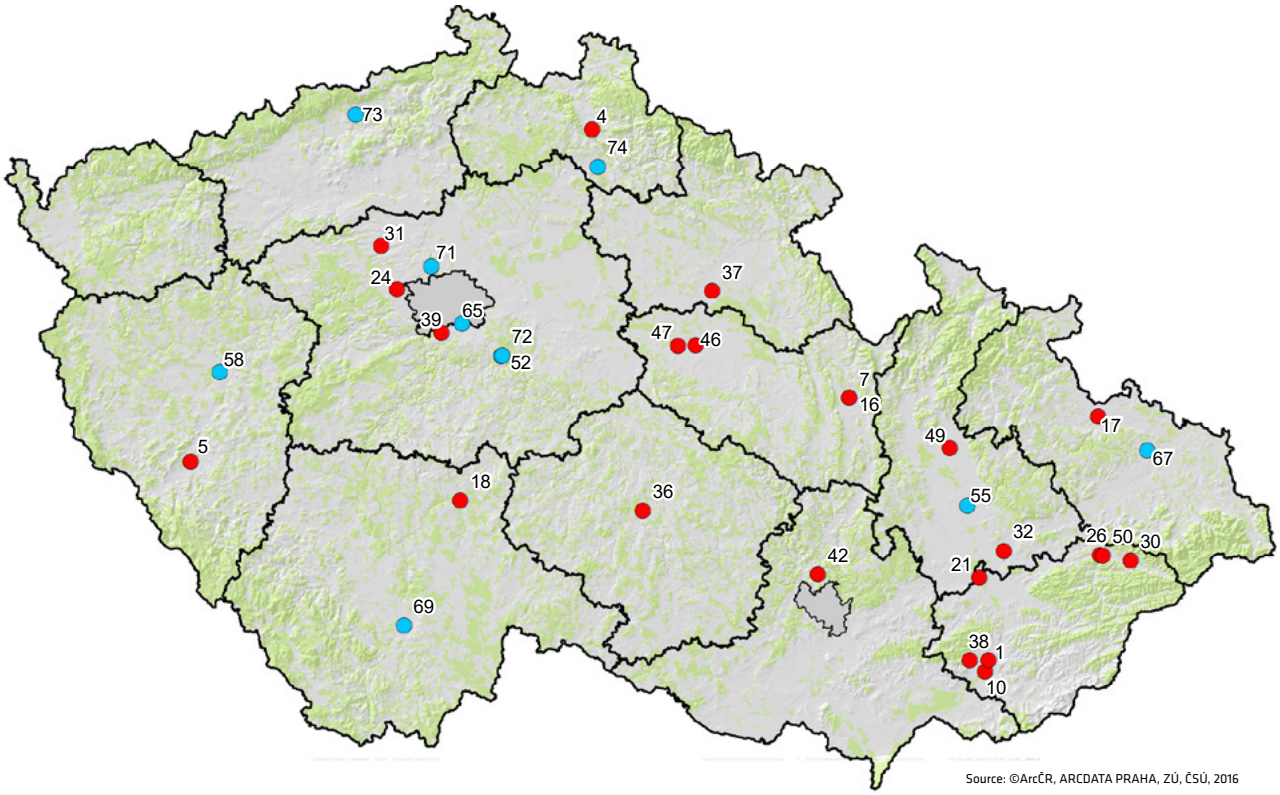
Mobile: +420-604 944 523
E-mail: moravec@hapteplice.cz

Entity Code: 1000022779

Czech Industry and Academia Successful in ESA



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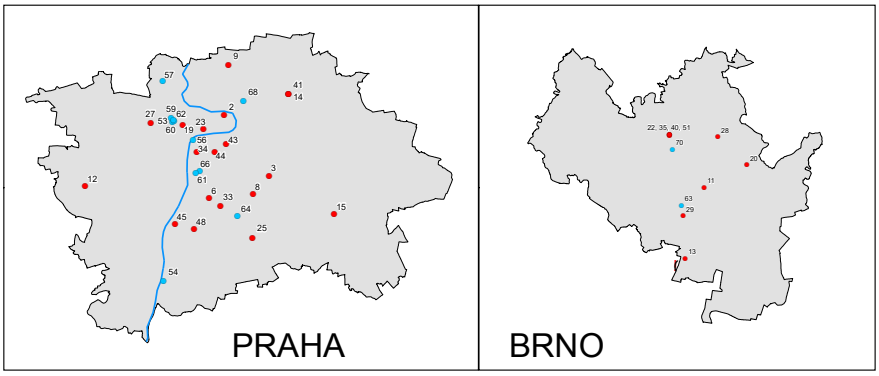
	INDUSTRY
1	5M
2	Advacam
3	Aleego
4	Asphericon
5	ATC Space
6	ATOS
7	AVX
8	AŽD
9	BBT
10	BD Sensors/CSRC Space Division
11	BizGarden
12	CGI IT
13	CleverFarm / CleverMaps
14	Czech Aerospace Research Centre - VZLU
15	daiteq
16	EGGO SPACE
17	Ekotoxa
18	Eltvor Instruments
19	esc Aerospace
20	Frentech Aerospace
21	G. L. Electronic
22	GINA Software
23	GISAT
24	GNSS Center of Excellence
25	Honeywell International
26	huld
27	IDEA-ENVI
28	Iguassu Software Systems
29	KB micro
30	L. K. Engineering
31	maxmechanik
32	MCE Slaný
33	Meopta - optika
34	Misterine
35	NG Aviation
36	OHB Czechspace
37	OPTOKON
38	ProjectSoft HK
39	Rayservice
40	Rigaku Innovative Technologies Europe
41	S. A. B. Aerospace
42	SERENUM
43	Sobriety
44	Space Know
45	Sprinx Systems
46	SYNPO
47	TOSEDA
48	TTS
49	Unex
50	Unites Systems
51	World from Space



	ACADEMIA
52	Astronomical Institute, CAS
53	CESNET
54	Czech Hydrometeorological Institute
55	Department of Optics, Palacky University Olomouc
56	Department of Physical Electronics, CTU
57	Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague
58	Faculty of Applied Sciences, University of West Bohemia in Pilsen
59	Faculty of Civil Engineering, CTU
60	Faculty of Electrical Engineering, CTU
61	Faculty of Mathematics and Physics, Charles University in Prague
62	Faculty of Mechanical Engineering, CTU
63	Global Change Research Institute, CAS
64	Institute of Atmospheric Physics, CAS
65	Institute of Botany, CAS
66	Institute of Experimental and Applied Physics, CTU
67	IT4Innovations National Supercomputing Center
68	J. Heyrovsky Institute of Physical Chemistry, CAS
69	Klet Observatory
70	NETME Centre, Brno University of Technology
71	Nuclear Physics Institute, CAS
72	Research Institute of Geodesy, Topography and Cartography, Geodetic Observatory Pecny
73	Teplice Observatory, North-Bohemian Observatory and Planetarium (NBOP)
74	TOPTEC, Institute of Plasma Physics, CAS

Field of Activities

Industry

Company	Manufacturing	Software	Services	R&D	Testing
5M	▲▲▲▲▲			▲▲▲▲▲	▲▲▲▲
Advacam	▲▲▲	▲▲▲	▲▲▲	▲▲▲	▲▲▲
Aleego		▲	▲	▲	
asphericon	▲▲▲		▲▲▲	▲▲▲	▲
ATC Space	▲▲			▲▲	▲▲
ATOS IT Solutions and Services	▲	▲▲		▲▲	▲▲▲
AVX Czech Republic	▲		▲	▲	▲
AŽD Praha	▲▲	▲▲	▲▲▲	▲▲▲	▲▲▲
BBT-Materials Processing	▲▲▲			▲▲▲	▲▲▲
BD Sensors, CSRC Space Division	▲▲▲▲	▲	▲	▲▲▲	▲▲▲
BizGarden		▲	▲	▲	
CGI IT Czech Republic		▲▲▲	▲	▲	▲▲
CleverFarm		▲	▲	▲	
Czech Aerospace Research Centre - VZLU	▲▲	▲	▲▲▲	▲▲▲	▲▲▲
daiteq		▲▲	▲▲	▲▲	▲▲
EGGO Space					▲▲
Ekotoxa			▲	▲▲	
Eltvor Instruments, s.r.o.	▲▲▲	▲▲▲	▲▲▲	▲▲▲	
esc Aerospace	▲▲▲	▲▲▲▲	▲	▲▲▲▲	▲▲▲
Frentech Aerospace	▲▲▲▲			▲▲▲▲	▲▲▲▲
GINA Software		▲▲▲	▲▲▲	▲▲▲	▲▲▲
Gisat		▲▲	▲▲	▲▲	▲
G.L. Electronic	▲▲▲		▲▲▲	▲▲	▲▲▲
GNSS Centre of Excellence			▲	▲	
Honeywell International	▲▲▲	▲▲▲▲		▲▲▲▲	▲▲▲▲
Huld s.r.o.		▲▲▲▲	▲▲▲	▲▲▲	▲▲
IDEA-ENVI		▲	▲		
Iguassu Software Systems		▲▲▲		▲▲▲	
KB Micro				▲	▲
L.K.Engineering			▲▲▲	▲▲	▲
MCE Slaný	▲▲		▲▲	▲▲	▲▲
Meopta – optika	▲▲▲▲▲	▲▲	▲▲	▲▲▲	▲▲▲▲▲
Misterine		▲▲▲▲	▲▲	▲	▲
NG Aviation		▲▲▲	▲▲▲	▲▲▲	▲▲▲
OHB CZECHSPACE	▲▲		▲▲▲▲▲	▲▲	▲▲▲
OPTOKON	▲▲	▲▲	▲▲▲	▲▲	▲▲▲
ProjectSoft HK		▲▲	▲	▲	
Rigaku Innovative Technologies Europe	▲	▲▲	▲▲	▲▲	▲▲
S.A.B. Aerospace			▲▲▲	▲▲▲	▲▲▲
Serenum		▲	▲▲▲	▲▲▲	▲▲▲
Sobriety	▲▲▲	▲▲▲	▲▲▲▲	▲▲▲	▲▲▲▲
Space Know		▲	▲	▲	▲
SPRINX SYSTEMS		▲▲		▲	▲
Synpo	▲			▲	▲
Toseda	▲			▲	▲
TTS	▲		▲	▲	
Unex	▲▲		▲▲		▲▲
UNITES Systems	▲	▲▲▲	▲▲▲	▲▲▲▲	▲▲▲▲
World from Space		▲	▲	▲	▲
maxmechanik	▲▲			▲▲	▲▲
Rayservice	▲		▲	▲	▲

Academia

Entity	R&D	Design	Testing
Astronomical Institute, CAS	▲	▲	▲
Global Change Research Institute CAS	▲	▲	▲ ▲
Institute of Atmospheric Physics, CAS	▲ ▲ ▲ ▲	▲ ▲ ▲ ▲	▲ ▲ ▲ ▲
Institute of Botany, CAS	▲ ▲ ▲	▲ ▲ ▲ ▲	▲ ▲ ▲ ▲
J. Heyrovsky Institute of Physical Chemistry, CAS	▲ ▲		▲ ▲
Nuclear Physics Institute, CAS	▲	▲	
TOPTEC, Institute of Plasma Physics, CAS	▲ ▲ ▲	▲ ▲ ▲	▲ ▲
Department of Physical Electronics, CTU	▲ ▲ ▲ ▲	▲ ▲ ▲ ▲	▲ ▲ ▲ ▲
Faculty of Civil Engineering, CTU	▲ ▲		▲ ▲
Faculty of Electrical Engineering, CTU	▲	▲	▲
Faculty of Mechanical Engineering, CTU	▲	▲ ▲	▲ ▲
Institute of Experimental and Applied Physics, CTU	▲	▲	▲ ▲
Faculty of Mathematics and Physics Charles University	▲ ▲ ▲ ▲	▲ ▲ ▲ ▲	▲ ▲ ▲ ▲
Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague	▲	▲	▲
Faculty of Applied Sciences, University of West Bohemia in Pilsen	▲		
Faculty of Science, Palacký University Olomouc	▲		
CESNET z. s. p. o.	▲	▲	
NETME Centre Brno University of Technology	▲	▲	▲
IT4Innovations National Supercomputing Center	▲		▲
Research Institute of Geodesy, Topography and Cartography	▲ ▲	▲ ▲	▲ ▲
Czech Hydrometeorological Institute (CHMI)	▲ ▲	▲ ▲	▲ ▲
Klet Observatory	▲ ▲ ▲		
Teplice Observatory	▲		

Parts and Materials	▲
Subsystems and Equipment	▲
Instruments and Payloads	▲
Ground Segment	▲
Education and Capacity Development	▲
Downstream, Applications, Data processing	▲

Parts and materials	▲
Subsystems and equipment	▲
Instruments and Payloads	▲
Ground Segment	▲
Downstream, applications	▲

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