

Czech Republic Successful in ESA

Catalogue Vol. 2020

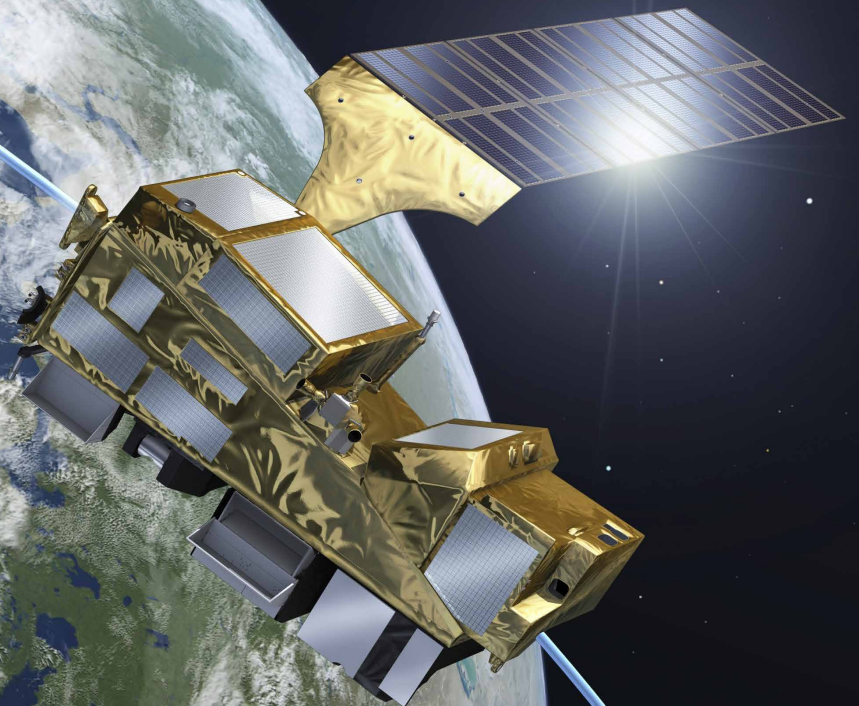


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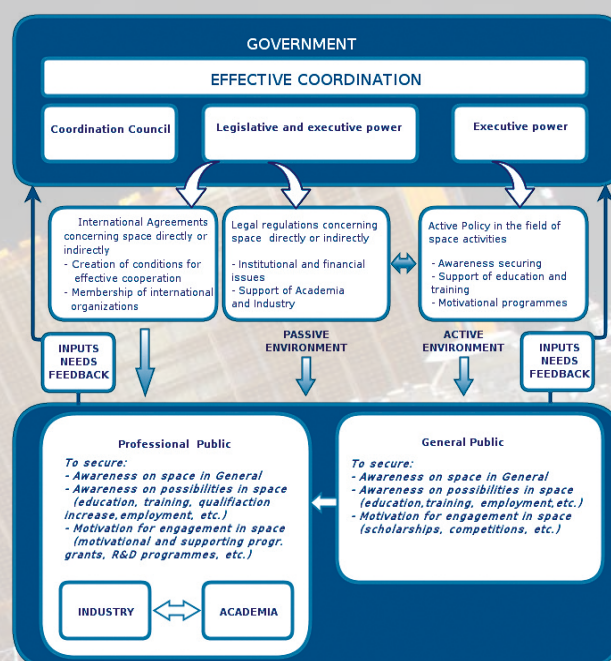




Czech Republic

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 has been 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) from 2021.



Scheme of National Space Implementation Plan

Space Strategy and major Programmes

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,

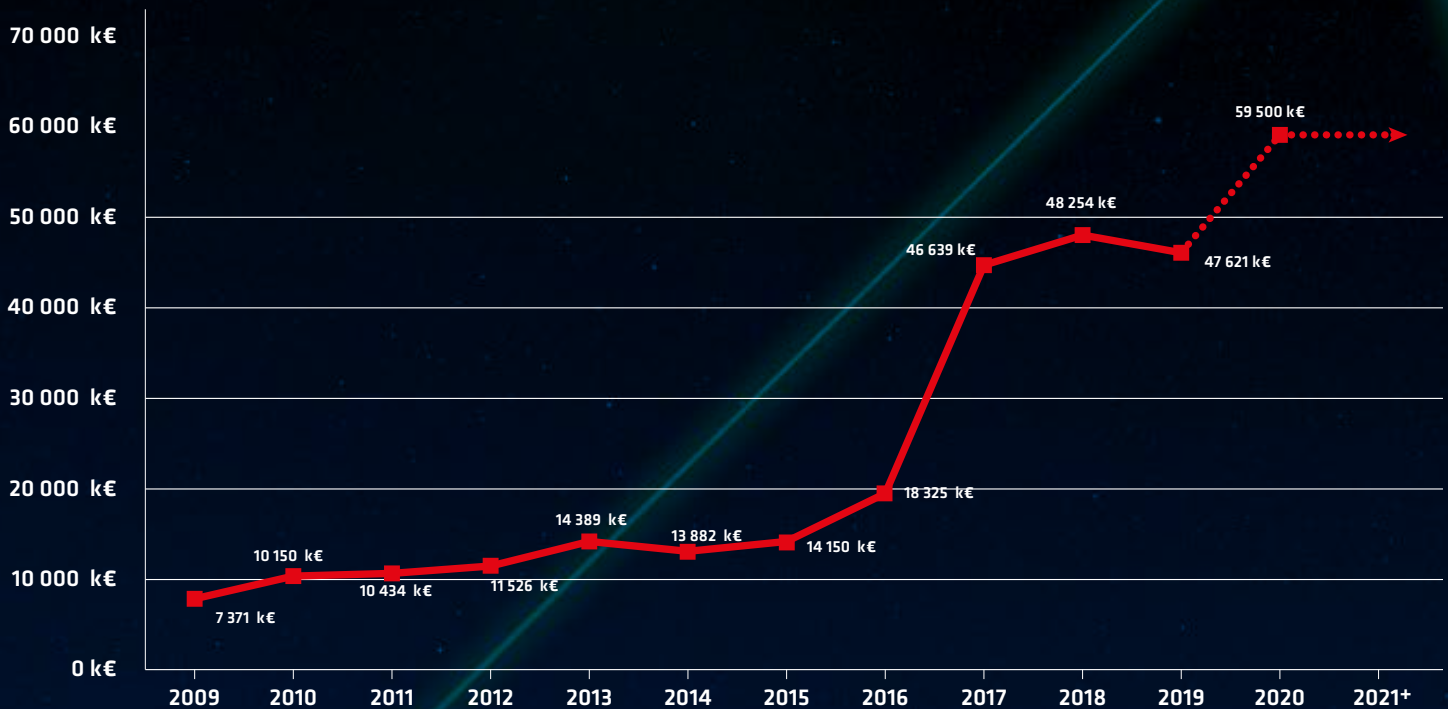
- be innovative and disruptive,
- foster excellence,
- create synergies between SMEs and large industries,
- increase the ratio of private investments,
- stimulate and accelerate technology and knowledge transfer.

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.
- 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.



Czech Contributions to ESA



ESA Optional Programmes

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

Earth Observation

- EOEP (Earth Observation Envelope Programme)
- GSC (GMES Space Component)
- MTG (Meteosat Third Generation) Development
- METOP Second Generation
- EarthWatch - InCubed

Satellite Navigation

- NAVISP (Navigation Innovation and Support Programme)

Launchers

- Ariane 6 Development
- Vega C Development
- Vega E Development
- FLPP NEO Core Component

Satellite Communication (ARTES Elements)

- Future Preparation
- Core Competitiveness

- Competitiveness & Growth
- ScyLight
- EDRS (European Data Relay Satellite System) GlobeNet
- Iris (Satellite Communication for Air Traffic Management)
- Neosat (Next Generation Platform)
- IAP (Integrated Applications Promotion)
- Partner Sub-Element Govsatcom Precursor

Human Spaceflight, Microgravity and Exploration

- Aurora MREP (Mars Robotic Exploration Preparation)
- E3P (European Exploration Envelope Programme)

General Support Technology Programme

- Element 1 "Develop"
- Element 2 "Make"
- Precise Formation Flying Component

Space Situational Awareness

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 19+



Credit: ESA - P. Sebirot

Once per three years, the ESA Council at Ministerial Level convenes to steer the direction of the agency for the next period. One of its most important roles is to set out new and ongoing optional programmes to be undertaken in the next years and to determine their level of funding through Member States' subscriptions.

At Space19+, Czech Republic plans to subscribe to the following new and ongoing ESA optional programmes:

Earth Observation:

- Future Earth Observation Programme
- EarthWatch - InCubed+
- EarthWatch - GDA (Global Development Assistance)
- CSC (Copernicus Space Component)

Satellite Navigation:

- NAVISP (Navigation Innovation and Support Programme)

Launchers:

- LEAP (Launcher Exploitation Accompaniment Programme)
- FLPP (Future Launcher Preparatory Programme): Studies and Core Technology Bricks, Prometheus
- Programme for Competitiveness Improvements: Ariane6/Vega C/P120C

Satellite Communication (ARTES Elements):

- Future Preparation
- Core Competitiveness
- Optical Communications Scylight - Hydron
- Space for 5G - Sunrise
- SAT-AIS (Satellite - Automatic Identification System) Sub-element 2B (Triton-X)
- BASS (Business Applications and Space Solutions)
- PPP QKD (Quantum Key Distribution) Sat
- PPP NovaCom
- 4S SAGA (Secure And cryptoGraphic) Mission

Human Spaceflight, Microgravity and Exploration:

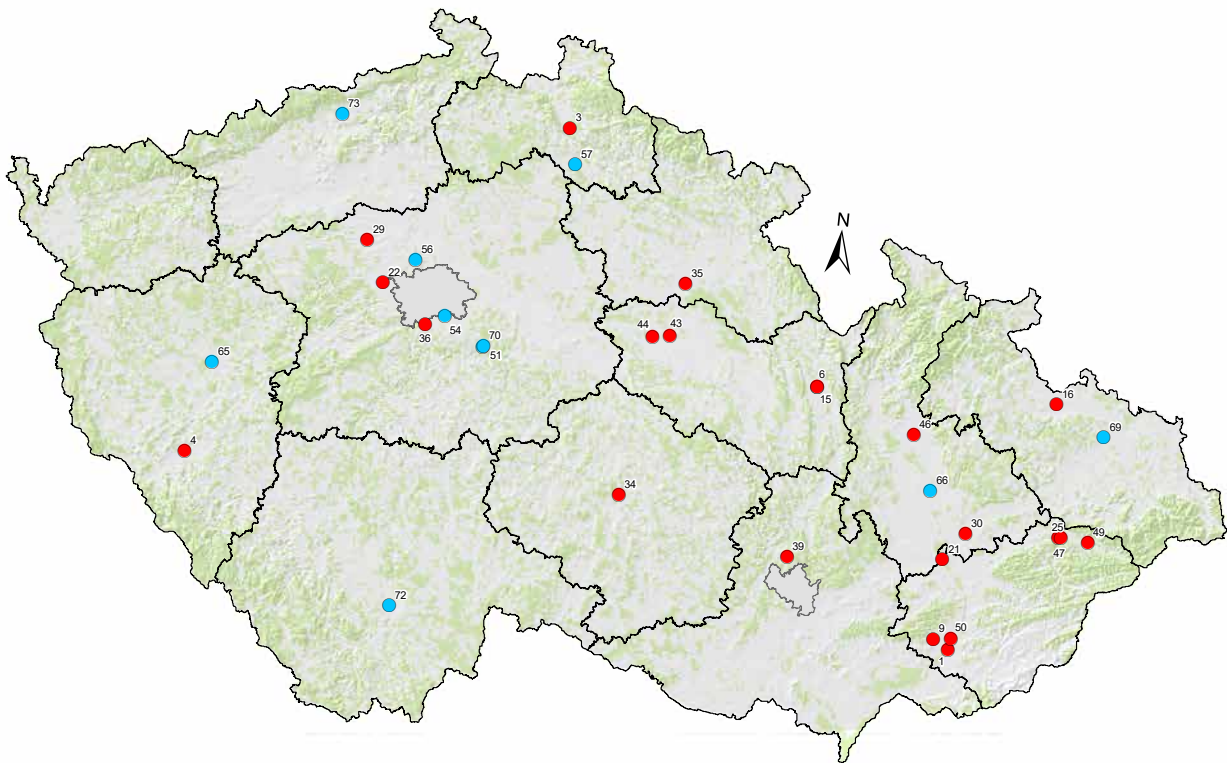
- E3P (European Exploration Envelope Programme)

General Support Technology Programme:

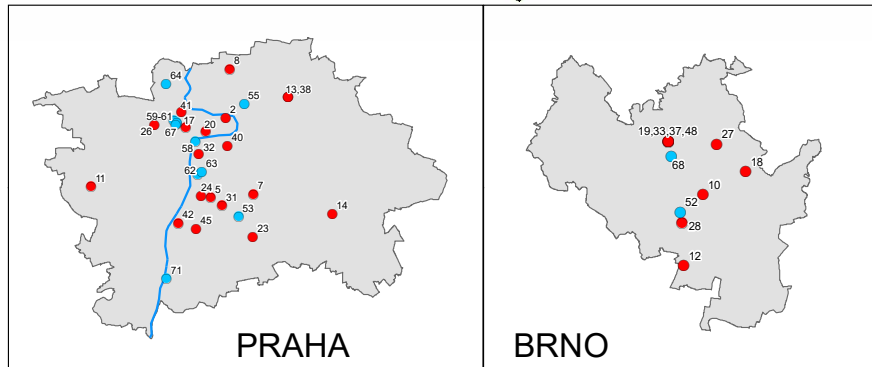
Space Safety Programme (S2P):

PRODEX (Scientific Experiment Development Programme):

Czech Industry and Academia Successful in ESA



INDUSTRY	
1	5M
2	ADVACAM
3	asphericon
4	ATC Space
5	ATOS (drive Siemens CVC)
6	AVX
7	AŽD
8	BBT
9	BD Sensors / CSRC divize
10	BizGarden
11	CGI
12	CleverFarm / CleverMaps
13	Czech Aerospace Research Centre - VZLU
14	daiteq
15	EGGO SPACE
16	Ekotoxa
17	esc Aerospace
18	Frentech
19	GINA Software
20	Gisat
21	G.L.Electronic
22	GNSS Center of Excellence
23	Honeywell
24	ICZ
25	IDEA-ENVI
26	Iguassu Software Systems
27	KB Micro
28	L.K. Engineering
29	MCE Slany
30	Meopta
31	Misterine
32	NG Aviation
33	OHB Czechspace
34	Optokon
35	Projectsoft HK
36	Rigaku
37	S.A.B. Aerospace
38	SERENUM
39	Sobriety
40	Space Know
41	Space Systems Czech
42	Sprinx Systems
43	SYNPO
44	TOSEDA
45	TTS
46	UNEX
47	UNITES Systems
48	World from Space
49	maxmechanik
50	Rayservice



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

Source: ©ArcČR, ARCDATA PRAHA, ZÚ, ČSÚ, 2016

Czech Space Capacities

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 analysis 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:

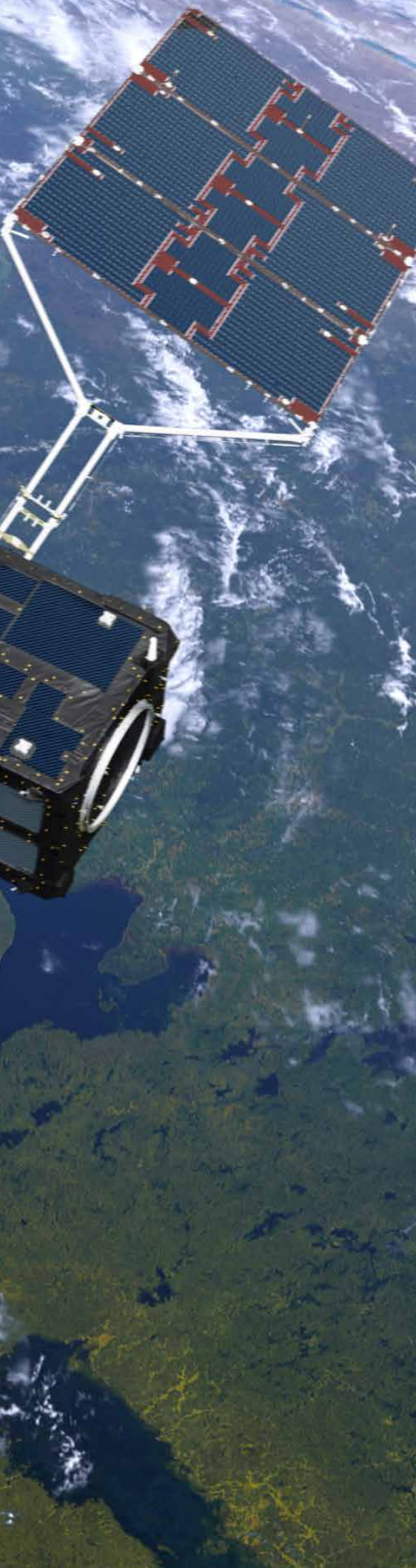
- For space physics: plasma and radiation environment near Earth and in solar system, solar research, meteorite research, objects in solar system, stellar research;
- For Earth sciences and EO data applications: gravitational research, space geodesy, magnetospheric and ionospheric research, planetary 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

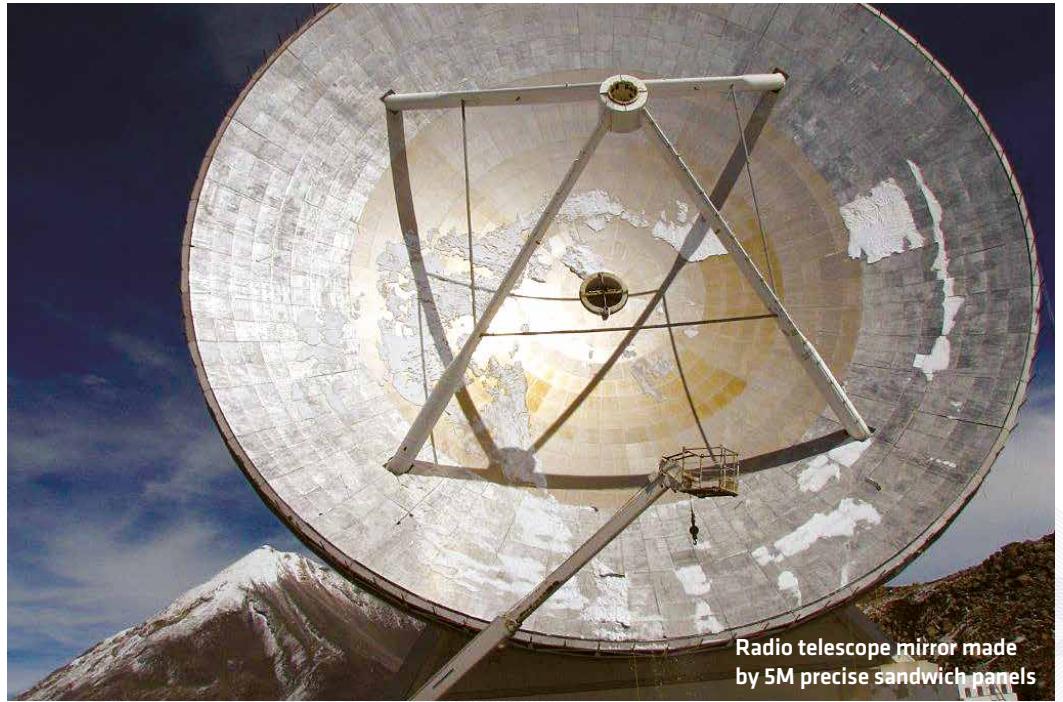


Credit: ESA

successful in ESA



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asphericon s.r.o.	12
ATC Space s.r.o.	13
Atos IT Solutions and Services, s.r.o.	14
AVX Czech Republic, s.r.o.	15
AŽD PRAHA s.r.o.	16
BBT Materials Processing, s.r.o.	17
BD Sensors s.r.o., CSRC Space Division	18
BizGarden, s.r.o.	19
CGI IT Czech Republic s.r.o.	20
CleverFarm, a.s.	21
Czech Aerospace Research Centre - VZLU a.s.	22
daiteq s.r.o.	23
EGGO SPACE s.r.o.	24
Ekotoxa s.r.o.	25
esc Aerospace s.r.o.	26
Frentech Aerospace s.r.o.	27
GINA Software s.r.o.	28
GISAT s.r.o.	29
G. L. Electronic s.r.o.	30
GNSS Centre of Excellence z.s.p.o	31
Honeywell International s.r.o.	32
ICZ, a.s.	33
IDEA-ENVI s.r.o.	34
Iguassu Software Systems, a.s.	35
KB micro s.r.o.	36
L. K. Engineering s.r.o.	37
MCE Slaný s.r.o.	38
Meopta - optika, s.r.o.	39
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Radio telescope mirror made by 5M precise sandwich panels

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>

Responsible for space
and ESA projects:

Ing. Richard Pavlica, Ph.D.
Phone: +420 572 433 740
Mobile: +420 731 616 350
E-mail: richard.pavlica@5m.cz

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. 5M has a wide range of customers from area of land vehicles transportation and electric insulating parts up to aerospace 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

Production and development of structural composite parts, pultruded profiles, structural epoxy adhesives, sandwiches, epoxy resins, aluminium honeycombs, foil adhesives, pre-impregnated fabrics (prepregs, semipreg), precise sandwich surfaces for optics, etc. Our materials and products fulfil ECSS standards.

Major Space Projects & References

- Programme: CZECH INDUSTRY INCENTIVE SCHEME
Name: Generic Adhesive for Space Application
Prime contractor: 5M s.r.o., cooperation with Airbus Defence and Space, Toulouse, France
Duration: 2013-2015
- Programme: CZECH INDUSTRY INCENTIVE SCHEME
Name: Technology Development of Flexible Tape Spring Boom for Large Appendages Deployment
Prime contractor: 5M s.r.o., cooperation with Thales Alenia Space, Cannes, France
Duration: 2013-2017
- Programme: TRP
Name: PCDU Radiation Shielding of the JUICE SSTS
Prime contractor: Airbus Defence and Space, Spain
Duration: 2017-2018
- 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: 2017-2018
- Programme: Third Party Project
Name: Composite Manufacturing for Space Applications
Prime contractor: 5M s.r.o.
Duration: 2018-2020

Space Related Equipment, Labs & Certificates

- AS/EN 9100:2009EN
- ISO 9001:2009

- POA PAR 21.G EASA 748/2012
- DIN 6701 A1
- IATF 16949

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
 - 50 m² clean room ISO 8
 - 200 m² of labs with controlled climate
- 240 employees

Equipment

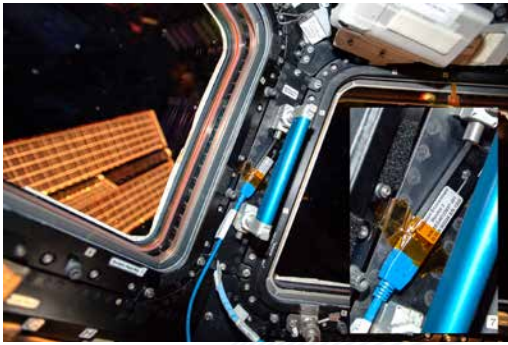
- Automated cutting of shapes from prepreg
- Ovens up to 250°C, dimensions of 6000 x 3000 x 2200 mm
- Presses up to 180°C, max. dimensions 3000 x 1700 mm
- Autoclave up to 250°C, diameter 2000 mm, length 4000 mm
- Pullpress up to 180°C for various diameters
- 9 pultrusion lines
- Laser positioning system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

Labs

- FTIR Spectrometer
- Rheometer Discovery HR1
- DSC 1 (Differential Scanning Calorimeter)
- DA (Dielectric Analyser)
- DMA (Dynamic Mechanical Analyser)
- TGA 2 (Thermogravimetric Analyser)
- DIL 822 (Dilatometer)
- ISOMET 2114 (Thermal Conductivity)
- Outgassing Measurement Device
- Universal testing machines, load cells up to 100 kN equipped with Environmental Chamber for temperature range from -60°C to +250°C

Quality Control

- 3D Measuring Device (Wenzel, max. part dimensions 3000 x 1500 x 1200 mm)
- Optical Microscopy and Defectoscopy
- Ultrasonic Non-destructive Testing



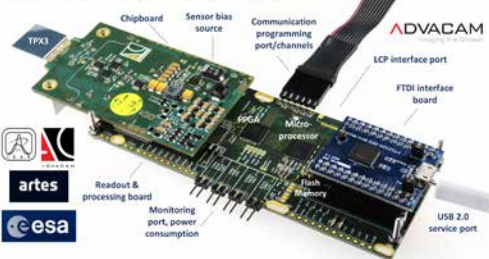
General Description

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.

MIRAM-Timepix3 ACQP Bread-Board

ESA-ARTES Telecommunication Satellites – GEO orbit



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.

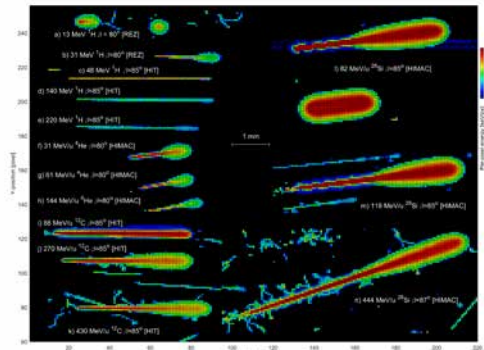
Testing, characterization and calibration of radiation detectors including in-house radiation lab sources. Know-how of radiation testing and calibration at particle beam/accelerator sources.

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 around 25 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, project MIRAM for ESA, together with the IEAP CTU Prague.
- “Space Radiation Capabilities, Technologies and Payloads”, project 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, together with IEAP CTU Prague.



Space Related Equipment, Labs & Certificates

- Manufacture, testing, production overall ISO 9001
- Manufacturing and production area 250 m² (microelectronics lab and assembly premises 100 m²)
- Clean room space 15m², packaging of semiconductor pixel detectors, wire-bonding, wafer and assembly testing and high-precision assembling and machining of components.
- X-ray lab 50m², 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



Industry

Manufacturing

Software

Services

R & D

Testing

Advacam s.r.o.

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Responsible for space
and ESA projects:

Doc. Ing. Carlos Granja, PhD.
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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 ($\leq 0,5$ 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 ≤ 1 fr

Project: Star Tracker

Description: Autonomous attitude determination

Realisation: Aspheric and spherical components with high-end surface form tolerances ($\leq 0,5$ fr) and surface roughness ($\leq 0,002$ μ m)

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 ($\leq 0,5$ fr) and surface roughness ($\leq 0,5$ 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





Industry

Manufacturing

R & D

Testing

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.

ATC Space s.r.o.



ATC Space s.r.o.
Schiffauerova 940
339 01 Klatovy
Czech Republic
Email: info@atc-space.cz

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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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.

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



Member of the Czech Space Alliance

Atos IT Solutions and Services, s.r.o.
Doudlebska 1699/5
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atos.net/ceska-republika

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General Description

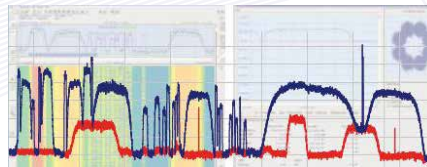
Atos is a leader in digital services with pro forma annual revenue of circa €12 billion and about 100,000 employees in 73 countries. Serving a global client base across Manufacturing, Retail & Transportation; Space, Public Sector & Health; Financial Services; Telco, Media & Utilities business sectors.

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

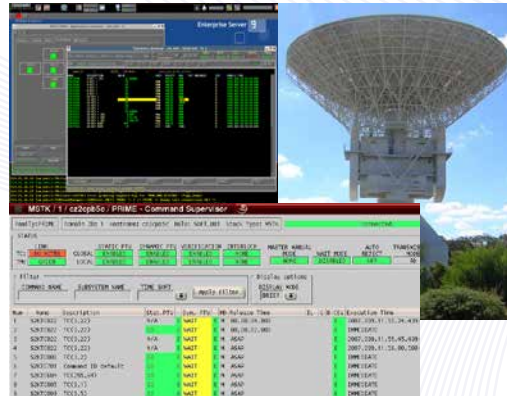
The Space department in the Czech Republic was established in 1998. Since its inception the Czech Space department group has cooperated on the development of various software and hardware solutions for ESA, German National Space Agency (DLR), and leading satellite operators.

- 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: Satellite Monitoring & Geolocation System

SkyMon is the satellite carrier monitoring and interference localisation system - proven, reliable and highly scalable. SkyMon is deployed at more than 10 sites around the world, managing 57 antenna 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 SCOE
- 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 Orbiter Power SCOE
- Galileo Payload Test System
- Galileo FOC and IOV TT&C SCOE



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 40 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 Protection 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 independent channels
- Nonvolatile threshold storage
- Self-test signal injection feature
- ETHERNET - TCP/IP remote control (SCPI)
- Puls control,
- Interlock

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 is publicly traded on the New York Stock Exchange (NYSE:AVX).

For nearly 50 years, AVX has successfully served the automotive, industrial, medical, space, military, consumer electronics, communications, and transportation markets for nearly 50 years.

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 electrolytic capacitors;
- Ceramic Division in Uherské Hradiště, which manufactures 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 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 solid electrolytic 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, cellular phones, 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, thermistors, varistors, and power capacitors, and serves key customers from the computer, automotive, telecommunications, and cell phone industries..

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 today is a major employer in the Pardubice region and maintains about 1,200 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 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 of up to 10,000 hours (Elektra award 2015); and the highest energy density. AVX's product portfolio also expands to include wet electrolyte tantalums and other special products, such as hermetically sealed solid electrolyte tantalums.

AVX is an established supplier of tantalum capacitors for the European Space Agency (ESCC Generic Specification No. 3012), and offers conventional surface mount tantalum capacitors, which were released in 1993 (ESCC 3012/001), and low ESR surface mount tantalum capacitors, which were released in 2013 (ESCC 3012/004).

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. The hermetically sealed packaging reduces the impact of humidity and oxidation on conductive polymers, and makes the capacitors ideal for-mission critical applications in aerospace, defense, and industrial circuits.

In cooperation with the ESA, AVX has released the new TAC microchip in case size 1206 with 10uF/6 and 3V for commercial purposes with an option for upgrading to space specification. 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. In 2018, a new qualification program for polymer multianode tantalum capacitors began with a support of the Czech Republic's Ministry of Transport.

SMD tantalum, niobium and conductive polymer capacitors, WET tantalum and special tantalum capacitors

- Space: ESCC3012, ESCC3012/001, ESCC3012/004
- Defense: COTS+

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
- MIL-PRF-790



A KYOCERA GROUP COMPANY

Industry

Manufacturing

R & D

Services

Testing

AVX Czech Republic S.r.o



Member of the
Czech Space Alliance

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P R A H A

Industry

Manufacturing

R & D

Services

Testing

Software

AŽD Praha s.r.o.



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 – UNISIG, CENELEC, UNIFE, ACRI, CAT, etc.

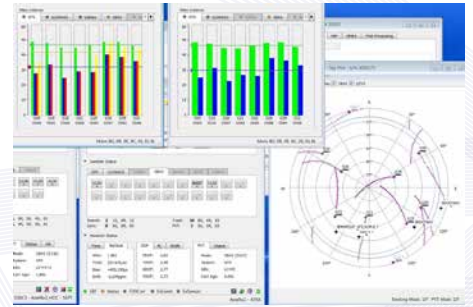
Competences & Capabilities

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 rail test tracks.

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-1 - Start-up activities for Advanced Signalling and Automation Systems” a Shift2Rail member’s project funded by EC in the H2020-S2RJU-2015-01 call (project Nr. 730640), 2016-2019
- „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-2015-01 call (project Nr. 730640), 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.

Space Related Equipment, Labs & Certificates

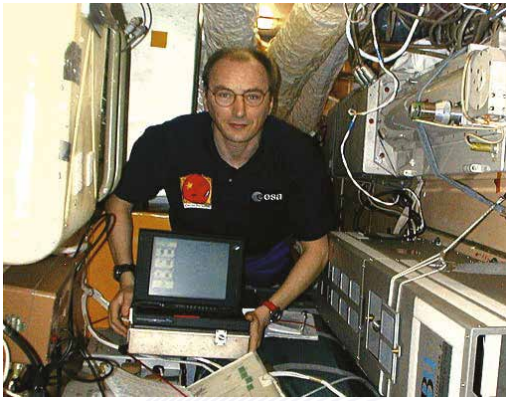
- GNSS SIS stationary and mobile test sets
- GNSS RF signal analyzers and recorders
- Measurement and test rail vehicle and train set
- Regional rail test tracks > 50 km
- Inertial systems test bed
- Odometry systems test bed
- Climatic and EMC test chamber

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 106 17 Praha 10,
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Responsible for space
 and ESA projects:

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TITUS space facility on board MIR operated by French astronaut Jean-Pierre Haigenere (Project MIR 99 - PERSEUS). (Photo CNES)

General Description

BBT-Materials Processing, s. r. o. was established in 1995.

Staff: Scientists and engineers which originally came from the Inst. of Physics, Univ. of Chemical Technology, Czech Technical Univ. and other academic institutions.

Main activities: Growth and application of Calomel single crystals (mercurous chloride, Hg_2Cl_2) and other mercurous halides. Development of infrared crystal optics, acousto-optics and related space and non-space devices.

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-YES**: A recalcination 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.



Calomel based Glan-Foucault polarizer for infrared region.

- **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

Competences & Capabilities

- Our group is the world's first to have discovered mercurous halides single crystals and their extraordinary properties. Mercurous chloride (Calomel, Hg_2Cl_2) is a unique material for IR optics, acousto-optics, polarizers, high power laser applications, etc. We are developing Calomel high efficiency infrared polarizers and acousto-optical tuneable filters (AOTF) for hyperspectral imaging in the thermal infrared.
- BBT's devices were operational on board Salyut 6 - Sojuz and MIR orbital laboratories for 17 years! - non-stop from 1984 up to 2001.
- Custom development and manufacturing of HW and SW for Space and on-ground applications.

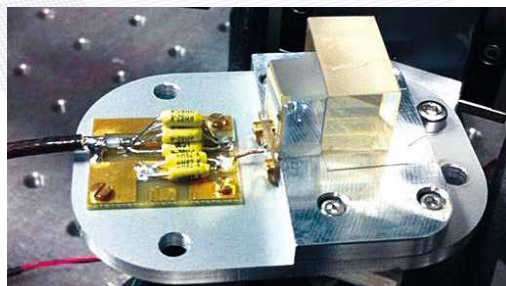
Space Related Equipment, Labs & Certificates

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 9,3 μ m CO_2 laser system (17W)
- Optical microscope
- Tyndall scattering
- 2D optical Fourier transform
- 2D depolarization imaging
- MTF/PSF



Prototype of Calomel based acousto-optical tuneable filter (AOTF) for hyperspectral infrared imager.

BBT

Industry

Manufacturing

R & D

Testing

BBT-Materials Processing, s.r.o.



Member of the
Czech Space Alliance

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Industry

Manufacturing

R & D

Services

Testing

BD SENSORS s.r.o. CSRC Space Division



Member of the
Czech Space Alliance

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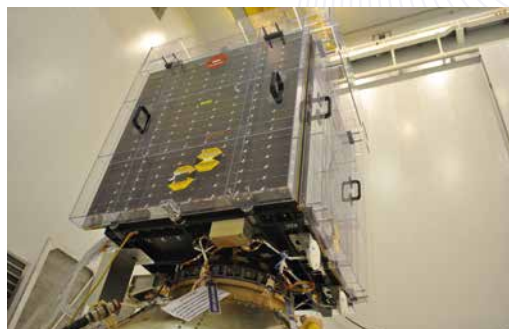


General Description

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 than 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 an 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), 170m² + 40m²
- 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



General Description

BizGarden s.r.o. (former BIC-R&D, s.r.o.) is a private non-profit research organisation. Since its foundation in the company was 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, work on their projects and new ideas.

We organise StartupWeekends in Brno and we do support this format of events in Czech Republic. Our enthusiastic associates are active members of the European Techstars community.

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.

We also offer partnership or services in management of ESA and H2020 projects.

BizGarden provides services extending from assessment (Audit) and development of internal corporate research, development, and innovations structures. We support clients in implementation of science and research management systems, or through management and administration of individual projects concerning research and technology development.

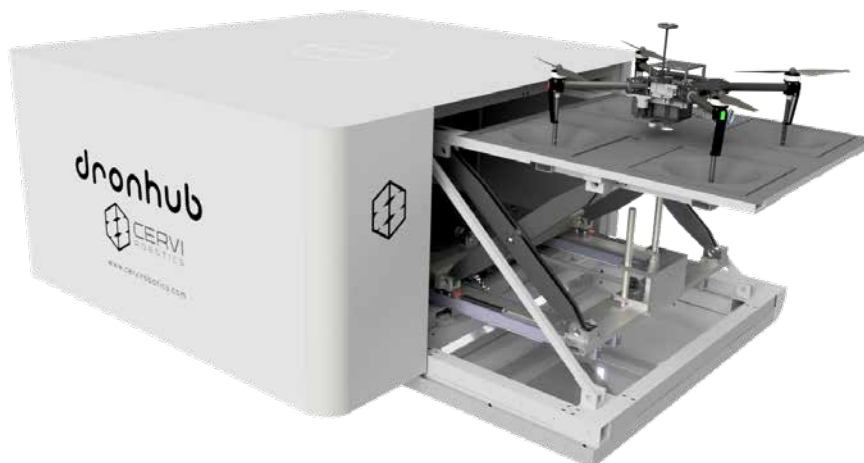


Our latest developments and business models are focused on fully autonomous UAV provided services in the BVLOS regime. There are many repeated routines in monitoring, surveillance, data gathering services where UAV's equipped with relevant cameras and sensors can provide high quality inputs into information and monitoring systems of industrial corporation and institutions. Autonomous systems optimise cost efficiency of the services. First services are actually being tested with European Oil&Gas and power generation and distribution companies.



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. 2015-2018 <https://artes-apps.esa.int/projects/sis-srem>
- Spin-off of SIS-SREM project Alpdest CEE, s.r.o. Mountain Rescue Team Management story was also published on <https://artes-apps.esa.int/projects/showcases/coordinated-support-for-mountain-rescues>



Industry

R & D

Services

Software

BizGarden s.r.o.

BizGarden s.r.o.
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Responsible for space
and ESA projects:

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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 700 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 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 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 GSA
- ESA InCubed: EO AUTOMOP (CGI SatSight): Earth Observation Monitoring Platform

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**

General Description

CleverFarm is an innovative company focused on agriculture software development for Europe and Worldwide. Cleverfarm is a member of CleverMaps family.

CleverFarm addresses an application of Sentinel and Landsat satellite data in order to plan variable targeted fertilization and plant preservation. Experimental verification (carried out in the selected farms' agricultural fields) and consequent calculations are showing positive impacts on farm management including savings of inputs, an increase in yields / revenue and a positive impact on the overall environment.

CleverFarm is also focused on development of combined IoT sensors enabling to measure conditions of vegetation and monitor weather as well as post-harvest storage areas on the farm. Requested information is provided on-line and allows farmers to manage their daily as well as seasonal activities in an efficient manner without the need of personal observation of conditions on the ground or in the storage areas. CleverFarm also aims to combine the IoT Sensors data with Satellite services and provide advanced historical analysis and predictions.

Competences & Capabilities

Our primary product is a web application for planning/ management and registration of agricultural activities on the farm that covers map window, farm activities,

storage management and strong reporting tool. As a second pillar we provide support to precision farming based on the Sentinel data that allows users to create their own variable application scenarios for fertilization. Farmer can evaluate different strategies based on the latest Sentinel images and then export the selected strategy in the requested format of the agricultural mechanism available on the farm. The file is then imported in the computer of the relevant machine and variable application is realized. Third pillar is the supply of IoT sensors such as meteo-station, soils sensors, post-harvest storage sensors and security sensors, where measured values are displayed on-line in the web application and provide necessary data for daily and seasonal planning on the farm.

Major Space Projects & References

- CleverFarm combines technologies for remote satellite survey of the Sentinel with IoT sensors.
- Successful implementation of CleverFarm solution among the clients in Czech Republic, Slovakia, Serbia, United Kingdom and Chile
- Successful participant of Ready2GO project under European Commission and Enterprise Europe Network
- CleverFarm is part of Sigfox Partner network

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



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www.cleverfarm.cz

Responsible for space
and ESA projects:

Adam Zloty, CEO
Phone: +420 776 111 859
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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.

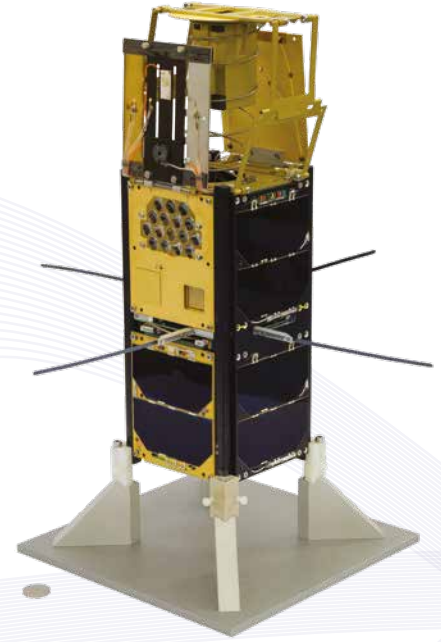
We are strong at: satellite equipment, aerodynamics, structure strength and durability, material and corrosion engineering, composite materials and technologies.

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 (1m³, -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 Airbus Defence and Space) as prime contractor. Within the project one engineering model and three flight units of capacitive microaccelerometer 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 ASIICS 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 (1m³, -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)

Industry

R & D

Design

Testing

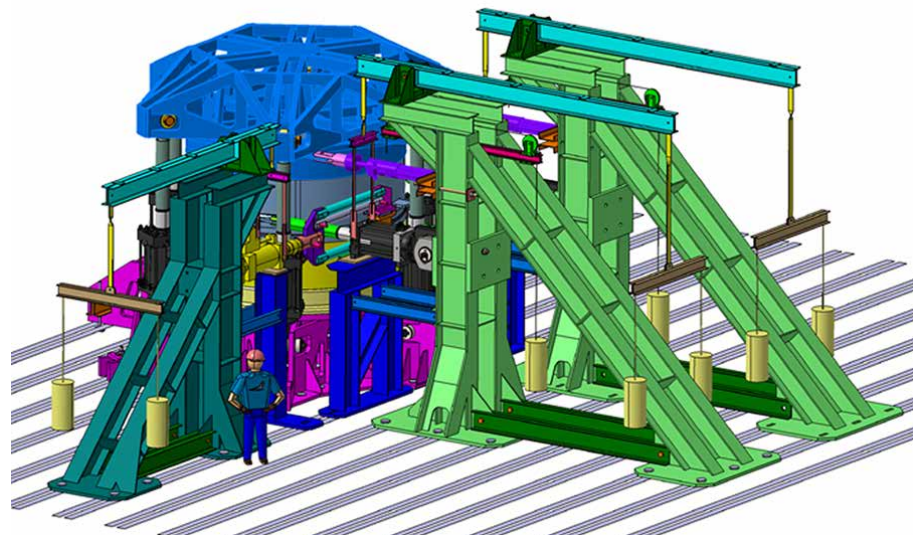
Czech Aerospace
Research Centre
– VZLU a.s.

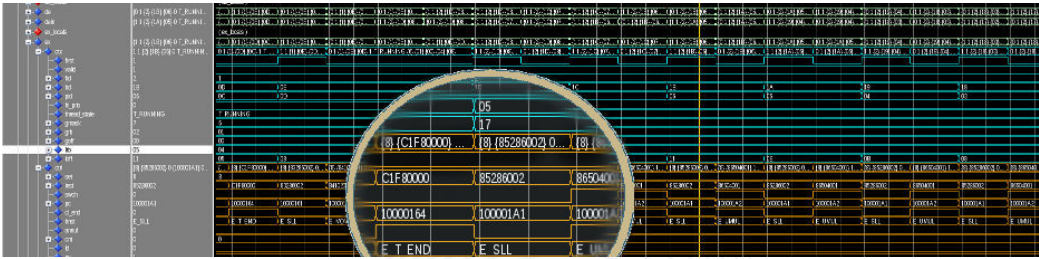
Výzkumný a zkušební
letecký ústav, a.s.
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Point of contact:

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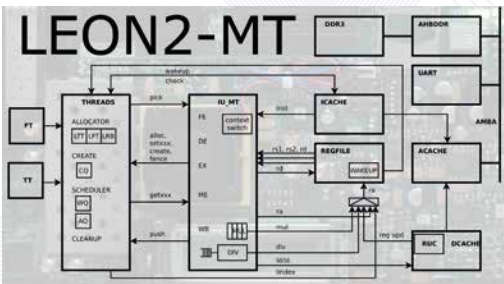


General description

daiteq provides optimized processors, accelerators and SoCs for image processing and satellite navigation. We design and implement dedicated hardware pipelines, as well as instruction set extensions for advanced data processing for embedded applications with specific requirements on the overall performance/power efficiency. We provide flexible solutions with configurable pipelines that can serve a group of applications, and single-purpose hardware solutions tailored to one concrete application. Our primary implementation technology is Xilinx and MicroSemi FPGAs.

For general-purpose processors we provide instruction set extensions for micro-threading. Micro-threading is a novel approach to task execution that combines classical von-Neumann sequential execution and data-flow synchronization. Key features include synchronizing memory and fast context switching, both supported directly in hardware. The ISE for micro-threading is currently embodied in the LEON2-MT processor, which is a customized version of the LEON2 processor.

For embedded applications we offer instruction set extensions for arithmetic computations, both in fixed-point and floating-point, that can be used for example to increase the performance of image processing or software defined radio algorithms executed in embedded processors.



Competences & Capabilities

SWAR extensions for LEON2FT

One area for improving processor performance is the support for sub-word arithmetic operations. This means simultaneous operations for several different operands coded on small number of bits and stored in one 32-bit data word. Such instruction extensions have already been introduced in modern desktop processors (e.g. MMX and SSE). The corresponding research paradigm is denoted as SWAR - "SIMD within a register". New SWAR instructions for LEON2FT reduce the overhead needed to process a large number of sub-32 bit words in a 32-bit architecture. On the programming level they are supported through new user-defined data types, implemented as extensions of the LLVM C compiler.

daiFPU

daiFPU is a family of medium performance FPUs that compute floating-point operations as specified in IEEE Std 754-1985. The supported operations are addition, subtraction, multiplication, division and square root together with integer and floating point conversions in an arbitrary precision, both for normal and subnormal numbers. daiFPU can act as a direct replacement of the Meiko FPU, supporting both single and double precision formats. In another configuration, daiFPU supports packed word operations in a selected precision where two floating-point words, stored in one register, are processed in one operation. All the four rounding modes are supported. The FPU comes with the necessary compiler and library sup-

port, implemented as extensions of the LLVM C compiler and the SoftFloat library.

Design services

Design and implementation of LEON-based systems in FPGAs, targeting Xilinx, MicroSemi, NanoXplore. Floating-point computations. Support for GNSS processing in LEON2FT. Hardware accelerators for image processing applications and other data-parallel applications. Design of FPGA-based controllers. Analysis of implementation characteristics of embedded processors and systems.



Major Space Projects & References

TRP/ITI: Multi-threaded processor for space applications.

Typically, two different kinds of on-board computers are used in spacecraft: the platform computers and the payload computers. The future for both lies in general-purpose processors or GPPs.

Some missions, like earth observation, only require generic on-board data compression for which ASIC based architecture are more suited; however scientific missions usually require more complex data processing and even on-board reprogramming capabilities that can only be implemented using general purpose processors. Natively radiation hardened solutions, if able to provide the needed performance, are always preferable as they are simpler to implement.

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. This way the platform's performance was benchmarked on a real application, together with an evaluation of the difficulty and cost of parallelising an application for this platform.

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 will be possible to further increase the efficiency of the user computation, visible through increased computation throughput, decreased power consumption and increased reuse value of designs. This goal will be achieved namely through custom-designed hardware extensions for LEON2-FT as well as software extensions for the LLVM compiler. The extensions will be validated namely through execution and profiling of core parts of a GNSS positioning algorithm.

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

Industry

R & D

Services

Testing

Software

daiteq s.r.o.

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Industry
Testing

EGGO SPACE
S.R.O.



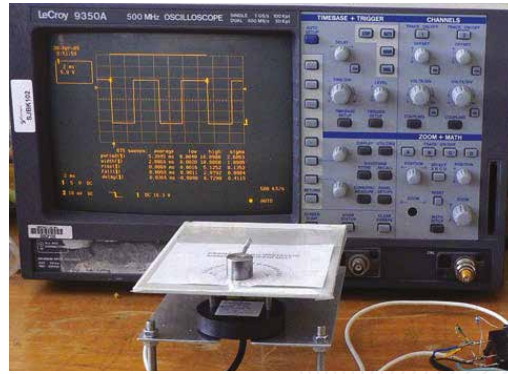
Member of the
Czech Space Alliance

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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 hybrid 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.

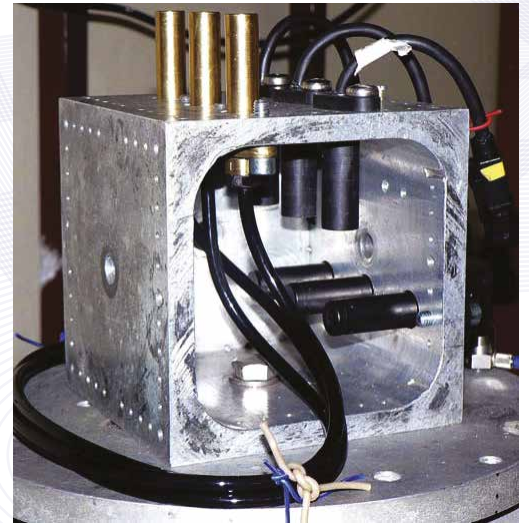
Competences & Capabilities

- 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

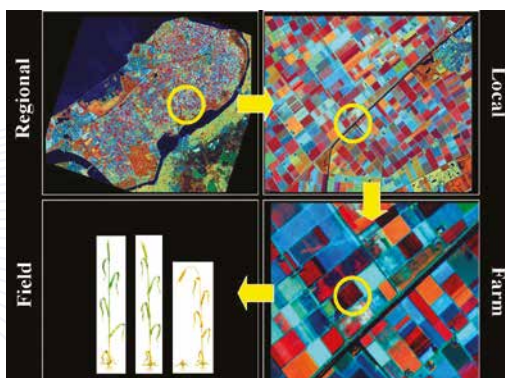
Space Related Equipment, Labs & Certificates

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

General description

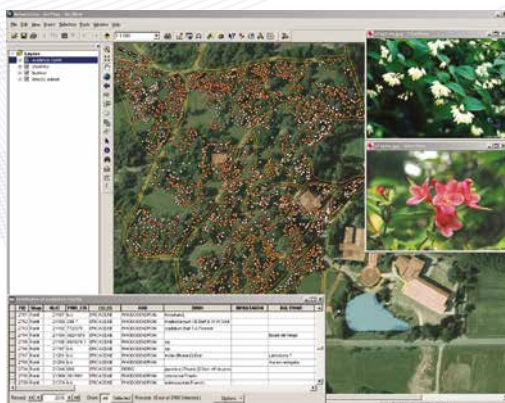
The company EKOTOXA s.r.o. is an expertise, research and consultancy centre providing services for rural development, water management, agriculture, forestry, environment, regional development and spatial planning. Most of company's activities are carried out on the interface of the mentioned areas. 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 significant 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 IIB, PHARE, MEDA, IPA, 6th and 7th FP).

- 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 GNSS 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.



Industry

R & D

Services



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

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Industry

Manufacturing

R & D

Testing

Software

esc Aerospace
s.r.o.

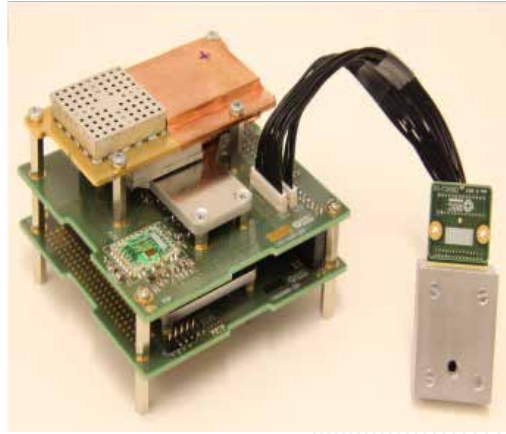


Member of the
Czech Space Alliance

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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.

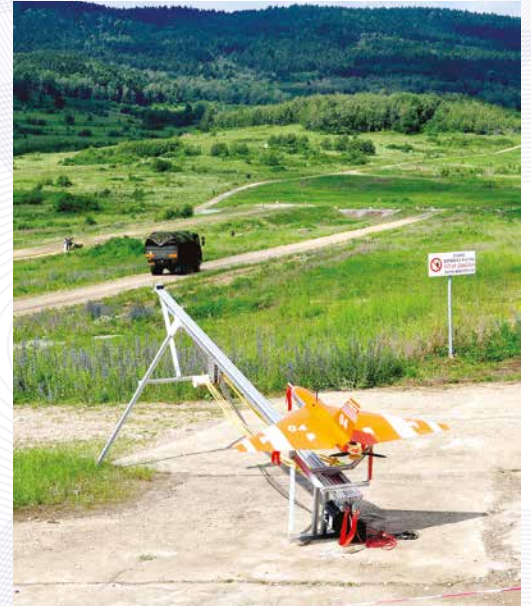
- On-board systems: Qualified flight software, Avionics & On-board Computer (OBC), Radiation monitor & sensor systems (Ionizing radiation hardened detector payloads)
- Applications: Secure & resilient communications leveraging SATCOM, Data analysis
- Test systems (EGSE/SCOE)
- Technologies (Concept, 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

- SpaceX – 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.

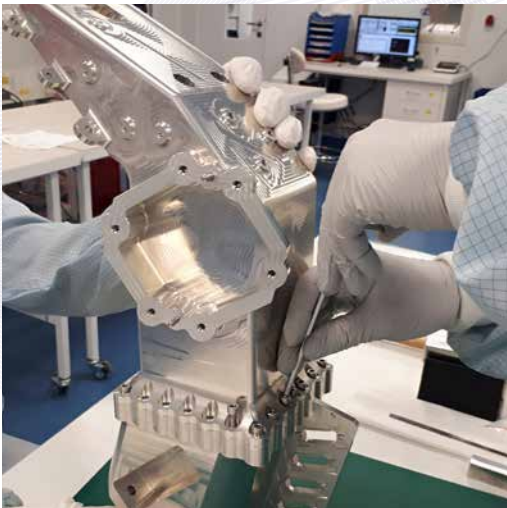


General description

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 A06647 (NEW GENERATION MULTIMEDIA ANTENNA DEPLOYMENT AND POINTING MECHANISM - FRA)
- ESA tender A010164 (Cryostat Structure for Meteosat Third Generation),
- ESA tender A07397 (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:

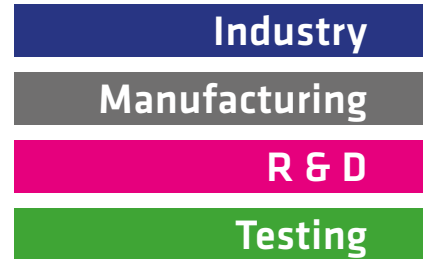
- Actuator simulator (2 different models) - cooperation with L.K. Engineering s.r.o. (CZ)
- Electro pumps for space engines - design and development Sobriety s.r.o. (CZ)
- Electro controlled valves for VEGA - design and development Sobriety s.r.o. (CZ)
- New Precision Actuator for Space application with using material AlBeMet - cooperation with Honeywell (CZ)
- Deployment system with using SMA material - cooperation with L.K. Engineering s.r.o. (CZ)
- J-Boom with SMA motorisation - development 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, Collins, 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/>

Space Related Equipment, Labs & Certificates

- Production area 2400 m²
- Assembly premises 400 m²
- 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 m³) 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).



Frentech Aerospace s.r.o.



Member of the
Czech Space Alliance

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Industry

R & D

Services

Testing

Software

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General description

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

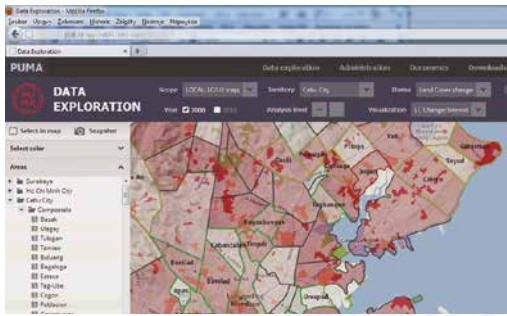
- European Satellite Navigation Competition: using systems of Galileo and EGNOS. Regional winner (2012)

- ACRIMAS: pilot and first ECML workshop on Mobile Interoperability for International Field Deployment (2012)
- Safety and information Services for Ski Resorts in Emerging Markets: GINA covers a part of project dedicated to safety on the slopes and mountain rescue services using GPS tracking devices and consequent proof of concept demonstration.
- Fire Brigades Czech Republic (South Moravia Region, Pardubice Region, Vysocina region, Olomouc Region, Liberec Region, Central Bohemia Region)
- Search and Rescue Operations (Haiti, Japan, 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)



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



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 International 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

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 airborne 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

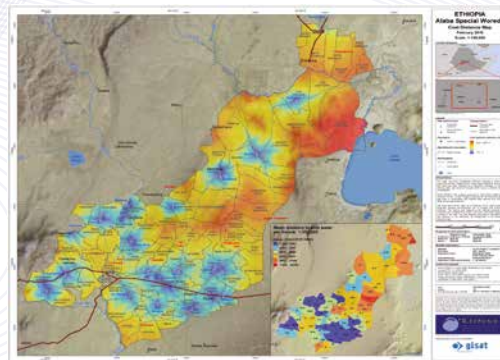
Copernicus (formerly GMES) is the European Programme for the establishment of a European capacity for Earth Observation. It is the principal European initiative to boost up European EO related business answering growing demand for various geo-spatial data and services from European and regional users. 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 as 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



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

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General description

G.L. Electronic is a privately held and independent Czech company operating in the space industry since 2008. We draw on professional experience gained in foreign companies engaged mainly in a production and an application for the aerospace technologies. We have more than 11 years of experience with realization of assembly activities and providing technical support for the design of flight devices in many various international space projects, both with Czech and foreign partners.

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). 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.
- Hi-Rel manufacturing - assembly of electronic boards
- Assembly of harnesses
- QA and PA for projects
- Bonding and conformal coating
- Final integration and installation of harnesses
- Functional test of the Boards & Final Units Projects

Manufacturing - PCB hand soldering assembly

- SOLAR ORBITER-TDS & SWA-PAS instruments: EM/ EQM/FM, with the Academy of Sciences (UFA) and Charles University, Department of Surface and Plasma Science, Faculty of Mathematics and Physics, Prague CZ
- ARGOS4: EQM/FM, Steel Electronique
- EXOMARS: EQM/FM, in cooperation with Leonardo
- PRISMA: FM, 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-LF: instrument, BB/EM/F, in cooperation with AV-UFA CZ
- ASIM: EQM/PFM, in cooperation with CGS, Italy

Harness manufacturing, testing and integration

- JUICE Medium Gain Antenna Subsystem: EQM, FM Sener
- Vega PoC SSMS, in cooperation with SAB Aerospace/ AVIO/ESA
- METOP SG-MWI, in cooperation with OHB-I/Space Engineering
- METIS: FM, in cooperation with OHB-I
- MTG: FM, in cooperation with OHB/OHB-I
- EDRS-C: FM cooperation with OHB/OHB-I
- AIS-RX-REBUILD: FM cooperation with LuxSpace
- S-GEO-(EGSE): FM, in cooperation with CGS-OHB
- SSIS - VERTA/VESPA: space vehicle separation system for satellites Proba V, final integration French Guyana, launched 4/2013, in cooperation with SAB Aerospace/ ASI/ ESA
- LARES: harness for instrument and CUBESAT, launched 2/2012 in French Guyana, in cooperation with CGS/ASI/ESA
- Vessel Sat.: FM1, launched in India, 6/2011 - FM2 launched in China, 1/2012, in cooperation with LuxSpace

Activities done in Kourou, French Guyana, 2008-2013

- Mangousta: electrical installation of security camera and IR system with Telematic Solution
- Vega & Soyuz launch facilities
 - technical support to CGS/Telematic Solution
 - electrical installation of phone, audio and video signalling, safety (gas leak)
 - partial integration of rack boxes

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 9001:2016
- ESA trained and certified technicians: CAT2&CAT3
- ECSS-Q-70-08, ECSS-Q-70-38, ECSS-Q-70-28, ECSS-Q-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, valid from 12/2017





Photo: ESA - J.Huart

Industry

R & D

Services

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

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

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Industry

Manufacturing

R & D

Testing

Software

Honeywell International S.r.o.

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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.



Industry

Software



ICZ a.s.

General description

ICZ Group belongs among the leading CEE suppliers of the integrated software and infrastructure solutions market.

Its portfolio consists of tailor-made application software products, services, and solutions to meet the needs of all areas of information and communication technology. Being based on a wide spectrum of platforms and technologies, the offered services are vendor independent. The company offer includes custom-made application development, featured by information protection and security projects. ICZ Group started its operations on the Czech IT Market in 1997 and since then acquired and successfully integrated over 30 companies.

Competences & Capabilities

Within the broader spectrum of company solutions, ICZ Group manages a wide service portfolio ranging from the classic information systems delivery up to entire network overhauls, including interdepartmental systems on the basis of outsourcing and managed services. ICZ Group's solutions customers come primarily from the sectors of government, healthcare, telecommunications, utilities, transportation, defence, finance, manufacturing and logistics in the following branches: applications software, system integration, security, communications, infrastructure, document administration and procedure. Consulting and analytic services are an integral part of the offering. Apart from the Czech Republic and Slovakia ICZ Group concentrates its effort on other territories as well, predominantly those in Eastern Europe, Africa and some countries of the Middle and Far East.

Major Space Projects & References

ICZ Group international expertise may be shown on series of contracts – e.g. Air Traffic Control for Fujairah Airport (United Arab Emirates) or Mobile Air Traffic Control towers (Ukraine) to name a few. Apart from these, ICZ Group is also successful with its special information system devoted for ground forces Command & Control used regularly on Czech Army combat missions. Regarding ESA projects, ICZ Group is involved in areas corresponding to its portfolio; as an example, the “Human Resources Personal File Digitisation and Automation Project” can be given.

Space Related Equipment, Labs & Certificates

ICZ Group's sole shareholder, ICZ GROUP N.V. is incorporated in the Netherlands. ICZ Group members may prove the following certifications and/or approvals: ISO 9001, ISO 13485, ISO 20000, ISO 27001, AQAP 2110, AQAP 2210, Czech NSA “Confidential / Top Secret”, Slovak NSA “Secret”, Facility Security Clearance Certificate “NATO Confidential”. Besides that, thanks to a high experience supported by specific certifications, ICZ Group maintains long lasting high-level partnerships with major international IT providers as well.

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Industry

Services

Software



IDEA-ENVI s.r.o.

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 customer'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.

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).

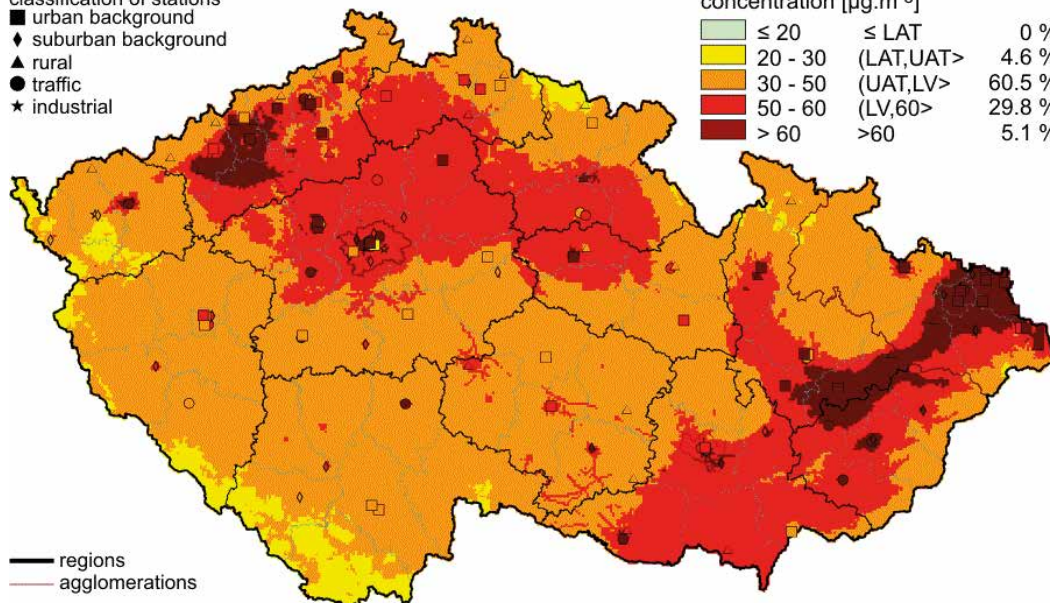


classification of stations

- urban background
- ◆ suburban background
- ▲ rural
- traffic
- ★ industrial

concentration [$\mu\text{g}\cdot\text{m}^{-3}$]

≤ 20	≤ LAT	0 %
20 - 30	(LAT,UAT>	4.6 %
30 - 50	(UAT,LV>	60.5 %
50 - 60	(LV,60>	29.8 %
> 60	>60	5.1 %



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General description

Iguassu Software Systems (ISS) providing software solutions to ESA, Eumetsat and other international customers since 1994. So 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 EVORA to Japan (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 telescope 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-NEO-XII: Telescope data processing chain, ISS prime, 3 subcontractors
- **SSA** - P3-SST-III - Robotic Telescopes Demonstration, ISS prime, 3 subcontractors
- **GNSS** - software defined receiver study
- **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)

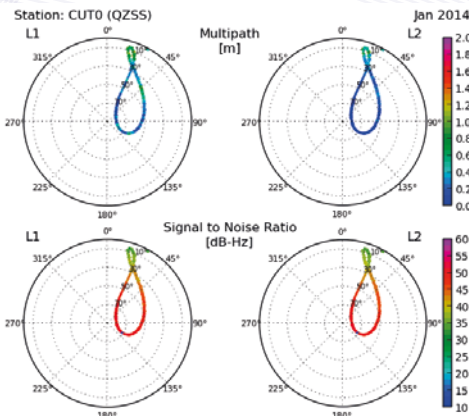
- 2015 **SatCom** ANTARES satcom for civilian air-traffic, AO6050, subcontracts to TAS-I and Indra
- 2014 **GNSS** Multi-Constellation Long-Term GNSS Assessment (SENDAI), AO6647 (ISS prime)
- 2014 **EGSE** Euclid SVM Electrical Simulator software design, AO7613 (CSRC prime for h/w)
- 2012 **GNSS** Interference Monitor System for GNSS Reference Stations, AO6149 (Airbus GmbH prime)
- 2011 **EO** Parallel Data Mining Components, AO6052 (ISS prime)

Successfully concluded PECS and Galileo projects (2005-2008)

- **Image Information Mining** in Time Series - ISS contributed its GRID experience (ACS prime)
- **EGNOS** educational tools, SISNeT, 1st CEE EGNOS monitoring station
- **Galileo** Search & Rescue subsystem for GJU, and ALGINT co-development for SciSys
- **Study** of SME needs in ESA - encompassing CEE/PECS countries (SME4space/AIPAS prime)
- porting of SAR algorithms to **GRID technologies** and co-development of "Grid of Demand"

Commercial products

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



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, Sybilla Technologies, Quasar Science Resources (EGNOS operator), TAS-F, ASEANA West African ANS, Romanian Space Institute, Japanese government institute (for QZSS SBAS), Telespazio and CNES.

We can also work in Spanish, German and Korean, and communicate to varying degree in French, Portuguese 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.



Iguassu Software Systems, a.s.



Member of the Czech Space Alliance

Iguassu Software Systems, a.s.

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Phone: +420 2 3535 1000

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Petr Bares, Managing Director

Mobile: +420 603 854 477

Jiri Doubek, chief engineer and deputy MD
E-mail: mailus@iguassu.eu

Industry

Manufacturing

R & D

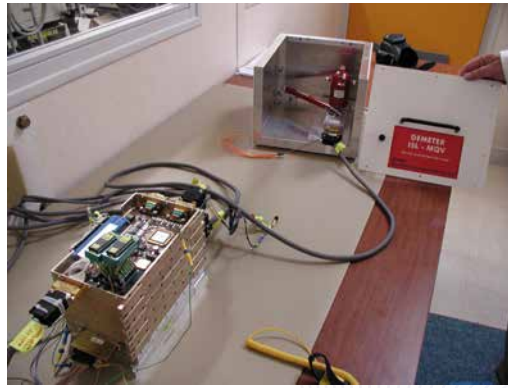
Testing

KB micro s.r.o.

KB micro s.r.o.
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Czech Republic
<http://www.kbmicro.cz>

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Ing. Zdenek Kozacek
email: zkozacek@kbmicro.cz
Phone: +420 534 008 248
Mobile: +420 732 202 581



General description

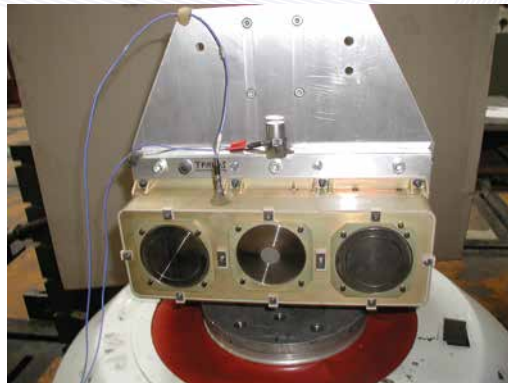
KB micro is privately owned Ltd. company, located in Brno, Czech Republic, and founded in 1991. It is specializing in the development of high reliability electronics hardware and software, mainly for space related projects.



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.

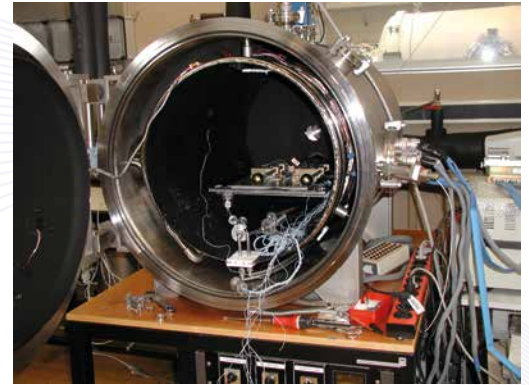
Main areas of activity include Hardware Design, Software Development, Design Verification, Project Management and Mechanical Design and Manufacturing.



Major Space Projects & References

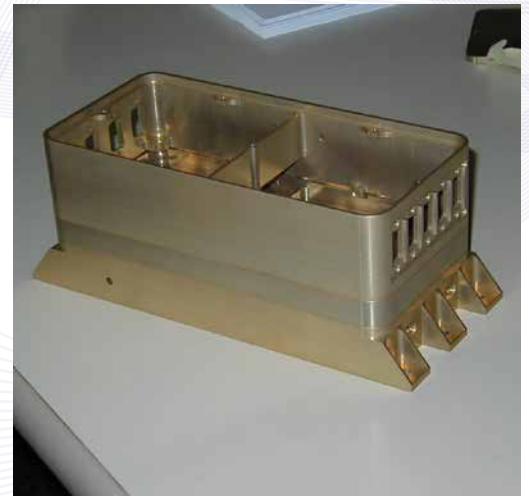
- Satellite INTEGRAL: PSAC Unit - design of DPU, HV PSU & HV Dividers, PCB Layout, FPGA design, Mechanical design and data preparation for testing and analysis
- Satellite SMART1: EPDP Unit - design of DPU, Analog Board, HV converter, PCB Layout, Mechanical design and data preparation for testing and analysis

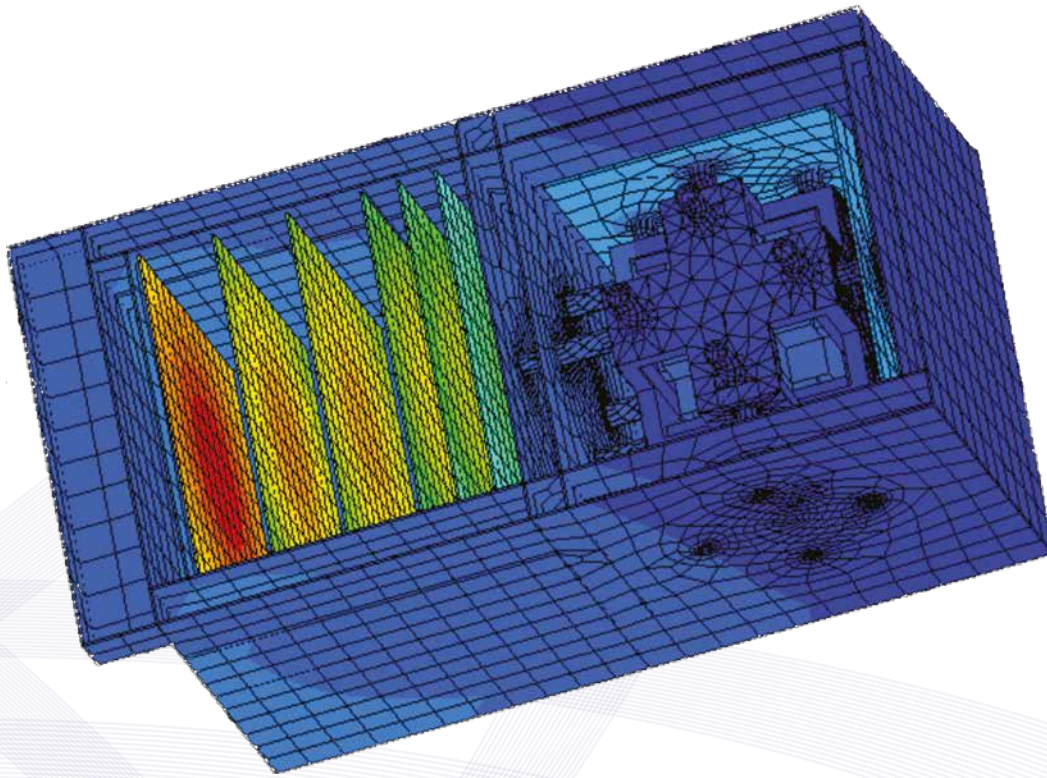
- Satellite DEMETER: I/V Converter - design of I/V Converter, PCB Layout, Design Testing and Attendance to qualification process
- Satellite PROBA2: DSLP Unit - design of DPU, PCB Layout, FPGA design, Mechanical design and data preparation for testing and analysis



Space Related Equipment, Labs & Certificates

- Cleanroom (Class 100 000)





Industry
R & D
Services
Testing

General description

L.K. Engineering (LKE) provides engineering services in all mechanical areas. The core activities are focused on design and analysis using advanced engineering computations. LKE can offer a solution to companies with product R&D activities in each part of the design process such as innovative design proposal, conceptual study and detailed design evaluation. We use the most advanced computational techniques, technologies and knowledge available to satisfy challenging requirements of today's products. These techniques and our experience help to reduce the cost and time during the development period and contribute to product competitiveness. 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, aerospace, transportation, architecture, etc.

Major Space Projects & References

- Thermal and thermo-elastic analysis of micro-accelerometer unit 2006-2007
- Thermal analysis of European Extremely Large Telescope enclosure 2009-2010
- Temporal Extrapolation Methods in Thermal Testing 2010
- Thermal and structural analysis of ACES/ELT unit 2011
- Simulation of flutter response on launcher VTI panel 2011
- Structural optimization and thermo-elastic analysis of Lunar Lander spacecraft structure 2012
- Design of Spacecraft Components for Additive Manufacturing 2013
- Euclid PLM Thermal analysis 2014
- Numerical rebuilding of Acoustic loads on the Vega payload fairing 2014

L.K. Engineering S.r.o.



Member of the Czech Space Alliance

Space Related Equipment, Labs & Certificates

- ISO 9001, 14001



Competences & Capabilities

Main areas of activity include:

Thermal design and analysis of the spacecraft subsystems

Structural evaluation of spacecraft components

Launcher aerodynamics, aeroelasticity, acoustics

Additive Layer Manufacturing

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Industry

Manufacturing

R & D

Services

Testing

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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.

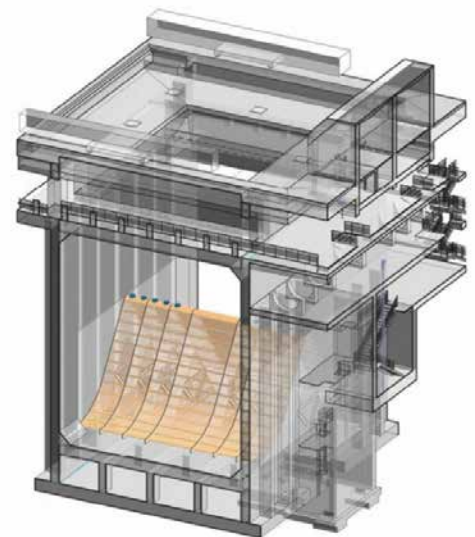
Major Space Projects & References

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 m² 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





- Industry**
- Manufacturing**
- R & D**
- Services**
- Testing**
- Software**

General description

- Global manufacturer of precision optics.
- Specialized 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).



Meopta - optika s.r.o.

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 58.000m².
- 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

Over 2500 highly qualified professionals
More than 85 years of experience
Based in the Czech Republic

Meopta - optika, s.r.o.
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Industry

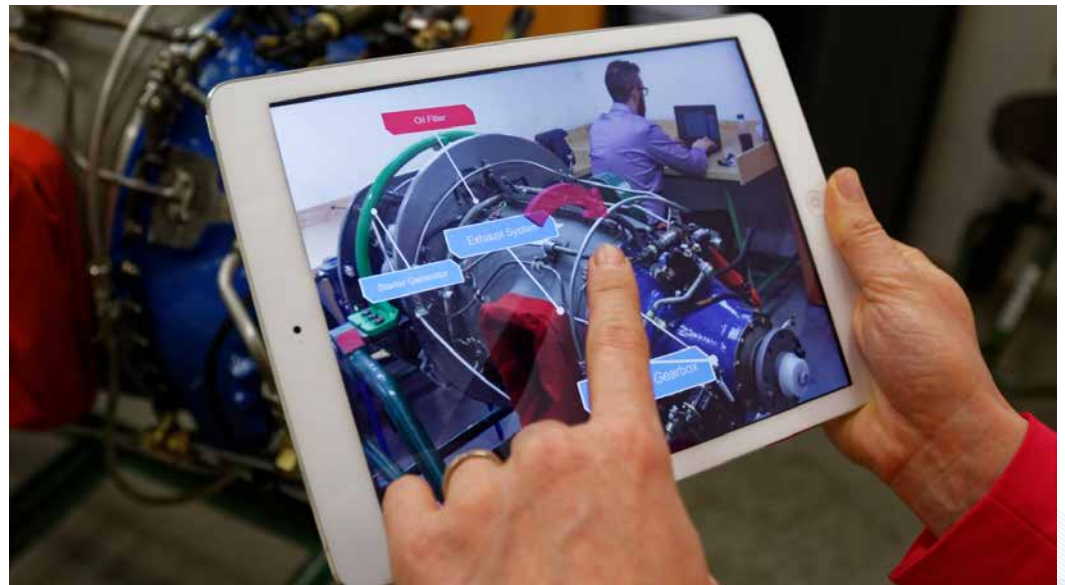
Manufacturing

R & D

Services

Testing

Misterine s.r.o



General Description

Misterine s.r.o. is a small Czech company working in the field of augmented and mixed reality in the space and aviation industry. Our mission is to empower people with information to perform complex and novel work tasks. The users experience a seamless combination of the real world and computer-generated assistance when performing tasks. The company transforms cutting edge technologies in the area of context sensitive behavior, visualization and computer vision into a revolutionary new way of working. Misterine has two offices, one in Prague and one in Ostrava. One of the priorities is close collaboration with universities; it is not a coincidence that 45% of our technical staff has a Ph.D. degree.

Competences & Capabilities

Our primary competence is industrial application of AR (Augmented Reality) and VR (Virtual Reality). We have been focusing on aviation and space industry, namely on assembly and service procedures. Our solution is particularly beneficial in situations people struggle with complicated processes that are difficult to memorize or that are unique for different products.

We currently offer:

- Data analytical tools that are able to automate the creation of 3D AR presentation and related authoring processes.

- Visual presentation on multiple platforms including iOS, Android, MS Windows, MS HoloLens, and custom-built systems like a combination of a data projector and a camera.
- Special tools for AR service manual creation using industry standard data formats.
- Consultations for AR usage and implementation into existing setups in aviation industry.
- Specialized setup to facilitate inspection of specialized equipment and its subsequent workflow incl. statistics.

Major Space Projects & References

We currently offer:

VIPER – Visualization of Industry Processes in Enhanced Reality. ESA ESTEC supervised project in collaboration with GE Aviation Czech s.r.o., whose goal is to create augmented reality service manuals for aerospace complex systems (tested on new engine). The system is able to create AR instruction manual presentable on HoloLens and on iOS tablets from S1000D service instruction data in a combination with CAD 3D engine models.

Blade – AR supported aerospace parts quality inspection. A joint project with a Japanese company supporting the quality of visual and dimensional inspection of refurbished aerospace parts.



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Responsible for space
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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 Eurocae ED-99B/RTCA DO-272B standards and Obstacle management in accordance with Eurocae 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

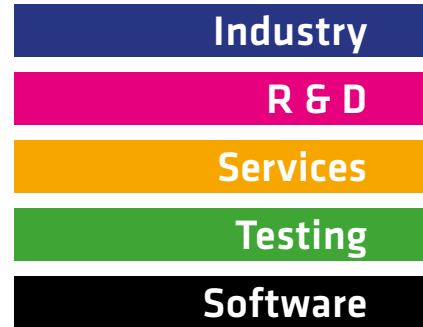
NG Aviation delivered NG AIME system for the initial implementation. NG Aviation created Aerodrome mapping database for UAE airports: Dubai International Airport, Abu Dhabi international airport, Sharjah, Al Ain, Ras Al Khaimah airport.

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 session was focused on setting up strategic plan for the implementation digital products and procedures for digital environment.



NG Aviation SE

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Industry

Manufacturing

R & D

Services

Testing

OHb Czechspace S.r.o.

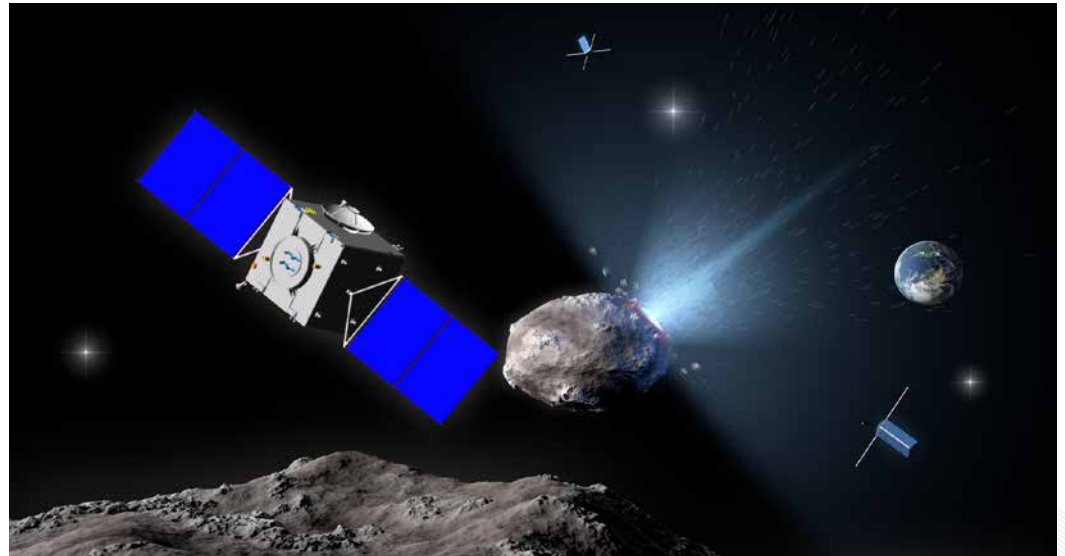
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Phone: +420 777 999 582
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General Description

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)



SPACE SYSTEMS	
100 %	OHb System AG Bremen & Oberpfaffenhofen, Germany
100 %	OHb Italia S.p.A. Milan, Italy
100 %	LuxSpace Sàrl Betzdorf, Luxembourg
100 %	Antwerp Space N.V. Antwerp, Belgium
100 %	OHb Sweden AB Stockholm, Sweden
100 %	OHb Czechspace s.r.o. Klatovy & Brno, Czech Republic
100 %	OHb Hellas mon.E.P.E Athens, Greece



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.



OPTOKON, a.s.

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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Industry

R & D

Services

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astro@projectsoft.cz

General description

ProjectSoft was founded in 1990 in Hradec Králové as an automation and engineering company. Dynamic growth enabled the extension of provided services by additional fields – machinery-technologies and information technologies. The company also started its own electronics production. In 1998 ProjectSoft became a joint 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 Bardón (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 obsolescence. 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

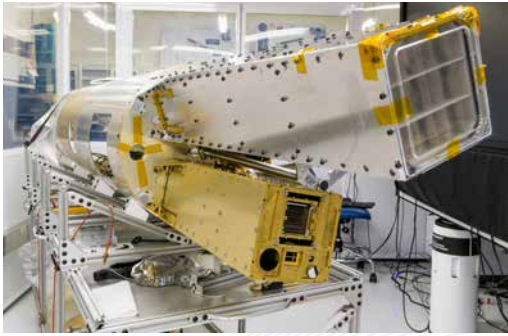
On ultraspeed Alt/Az installation (speed of moving is up to 90°/sec) a RC optical system telescope with diameter of the mirror of 0.6m is installed. The installation which is exclusively based on industrial components including PLC Beckhoff is equipped with most modern direct-drive control. A special 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.

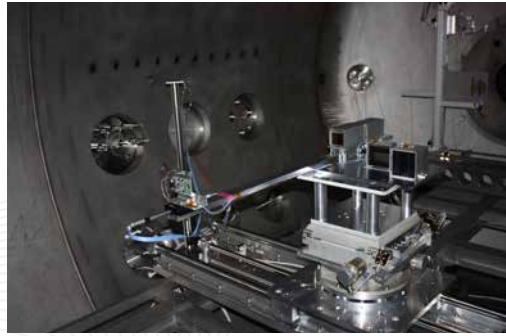
We expect more other ways of usage by future customers. A turnkey delivery of the observatory includes complete installation.

Space Related Equipment, Labs & Certificates

- Certificates: ISO9001



Rocket experiment - Wide X-ray System for X-ray imaging with detector Timepix (launch 2018).



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

General description

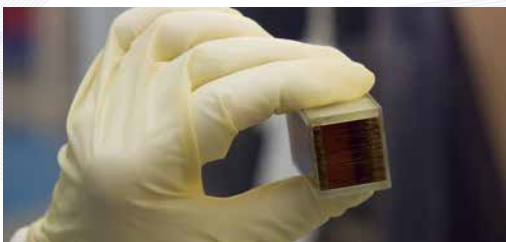
Rigaku Innovative Technologies Europe s.r.o. (RITE) belongs to the Rigaku Corporation group (Tokyo, Japan). RITE was established in 2008 as European center of excellence for the design, development and manufacturing of X-ray optics, X-ray detectors and X-ray sources, as well as other related scientific 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.

Major Space Projects & References

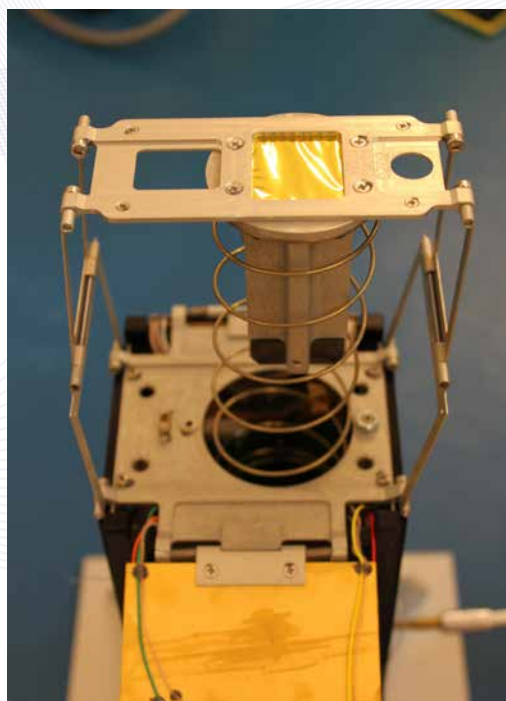
- VZLUSAT1 mission - Experimental verification of space products and technologies on nanosatellite, project is linked to European QB50 project - Wide-angle X-ray imaging system with Timepix detector (see www.vzlsat1.cz), on orbit since June 2017
- Wide X-ray System for X-ray imaging with detector Timepix – 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 banch
- X-ray optical vacuum test banch
- Microfocus X-ray sources
- Metrology X-ray matrix detectors
- Laboratory equipment for X-ray detectors and X-ray optics



Industry

Manufacturing

R & D

Testing

Rigaku Innovative Technologies Europe, s.r.o.



Member of the Czech Space Alliance

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Industry

R & D

Services

Testing

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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."

EXOBIOLGY Facility:

The EXOBIOLGY 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

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 ASPHICS coronagraph.

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

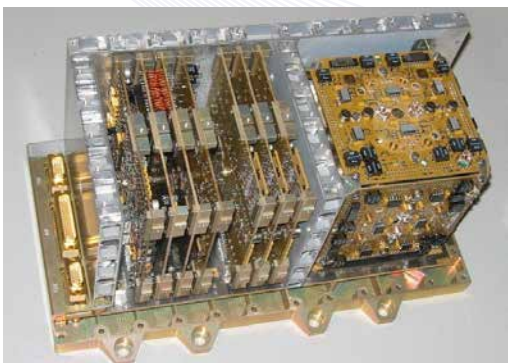
EUCLID (ITT/AO/1- 7628) (2014-2016): Vibration analyses and tests supply.

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.

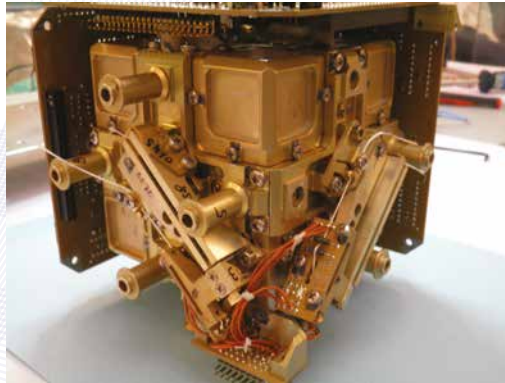
TT III-TX (2014-2015): Digital version, both transmit and receive, of TimeTech's modem for ranging and time transfer.

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.

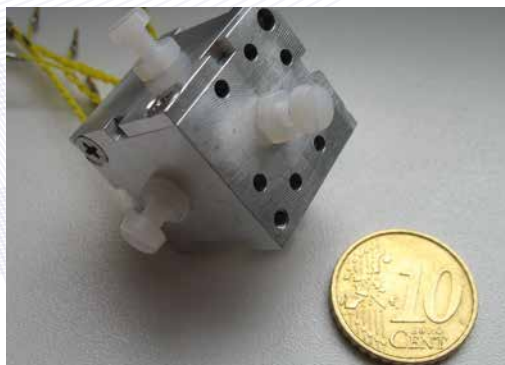


Space Related Equipment, Labs & Certificates

Thermovacuum chamber in clean room class 100 000, (1m³, 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)



Industry

R & D

Services

Testing

Software

SERENUM, a.s.

SERENUM, a.s.
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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.

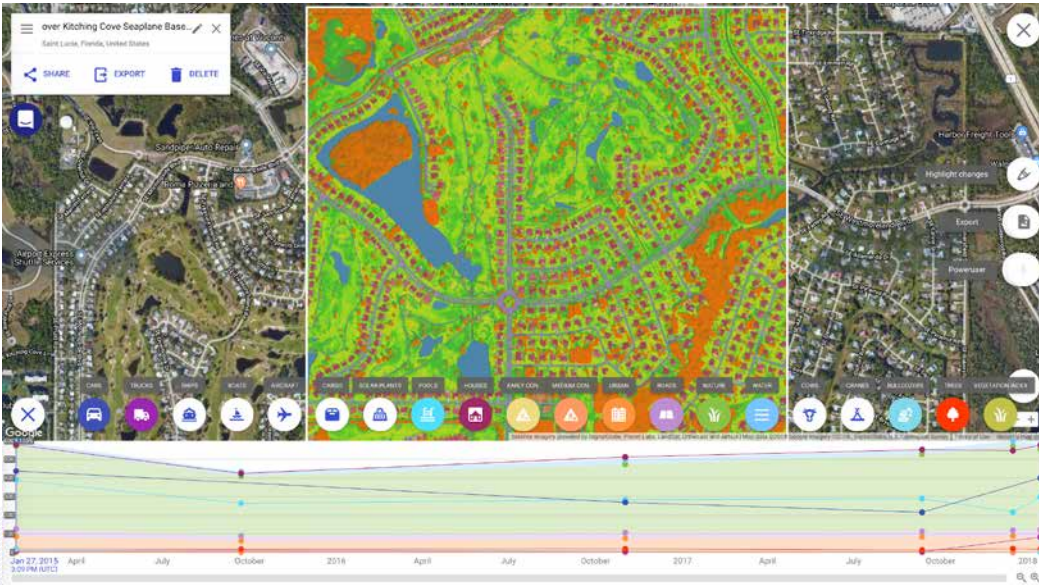
The company is certified according to ISO 9001:2015 (Quality), ISO 14001:2015 (Environmental) and ISO/IEC 27001:20013 (Information security).

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



- 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



SPACEKNOW

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.

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Industry

Testing

Software

Space Systems Czech s.r.o.



General description

Space Systems Czech (SSC) is a software engineering company specialised in safety-critical software, complex data processing, AI, computer vision and mobile apps development. SSC was established as a sister company of SSF fully adopting its culture, practices and quality standards. SSC is especially prominent in industries where lifecycle, quality management as well as security and safety are critical. Working together with our customers, we can ensure that risks are managed and products fulfil safety and market demands.

Competences & Capabilities

SSC 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. We focus on mission-critical solutions for demanding environments, such as satellite on-board software, Software Verification Facilities, autonomous systems and smart manufacturing.

In space, SSC is active in the fields of on-board software, embedded Hard Real-Time software, ground processing software, mission control, testing and validation, visually augmented navigation and GNSS receiver development. Besides space, we also serve our customers who need advanced scheduling, machine learning or blockchain in healthcare and retail.

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). SSC engineers participated in the core development team.
- **Data Analytics Platform for Climate Resilience (DAP4CR)** - Data Analytics Platform for Climate Resilience is a pilot project by ESA/ESRIN aiming to combine satellite EO data with in-situ real-time data from three different countries. SSC contributed to the implementation of the data distribution platform and integrated data sources in the Czech Republic.

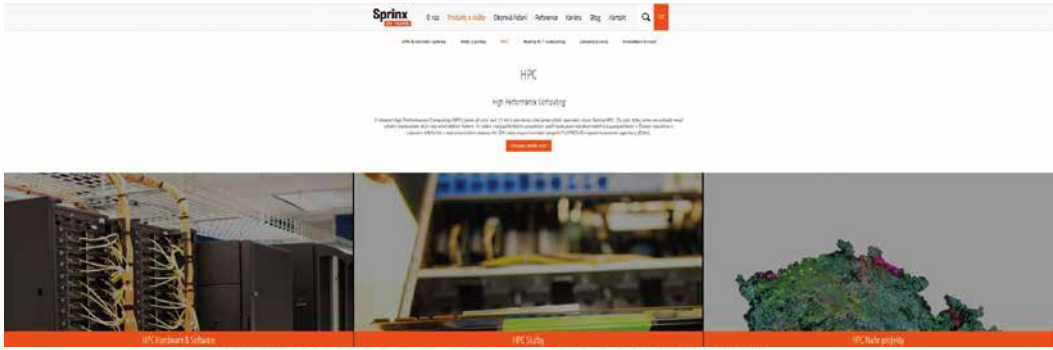
- **SCA - The MetOp-SG Scatterometer** is intended as a follow-up to the MetOp ASCAT and a wind mode of the Active Microwave Instrument (AMI) on the ESA Earth Remote Sensing satellites ERS-1 and ERS- 2. SSC developed the DCU ASW together with the Prime (Airbus DS). Implementation, including Detail Design, Coding and extended Unit testing, was done at SSC 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. SSC 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. SSC 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, SSC 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.
- **Ground Segment as a Service for nanosatellites** is a service hosted in a cloud, accessible globally available for rent just for the period of the users' mission. We offer connection to existing ground stations by providing the reference design and open-source implementation of all necessary interfaces.

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Industry

Testing

Software

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.

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.

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)

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 Systems, a.s.

Sprinx HPC

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



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Industry

Manufacturing

R & D

Testing

SYNPO, akciová společnost

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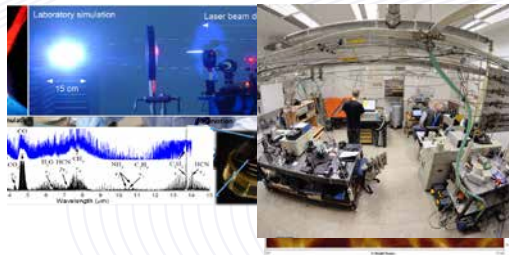
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General description

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





General Description

TOSEDA s.r.o. is an SME providing contract research and development, small scale production, consultation services in the field of polymer chemistry and nanotechnologies. TOSEDA closely collaborates with the major EU space industry partners and European Space Agency. 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 Applications (2014-2015)
- Nano-Hybrid Transparent Materials (2014-2016)
- Thermal Joint (2014-2016)
- Design of Inner Wetted Thermal System for LH2 Metallic Tank (IWTI) (2014-2016)
- Carbon Nanotube Technology and Engineering for Various Space Applications (NATAP) (2016-2018)
- Electrically Conductive "Black" Primer (2017-2018)
- Development of "Green" Polyurethane Materials for Use in Spacecraft and Launcher Applications (2017-2019)
- Thermal Joint Development for Neosat - Phase C (2017-2019)
- Extended Pot Life Resins for Out of Autoclave Processing for Large and Complex Part (2018-2020)



Outputs/prototypes

- Nanohybrid transparent polyimide film
- Thermally and electrically conductive pastes and pads
- One component epoxy adhesive (latent and encapsulated)
- LH2 protective coating
- Expandable low temperature cure adhesive

Space Related Equipment, Labs & Certificates

Analytical and testing services

- AFM, SEM, optical microscopy, DMA, DSC, TGA, rheology, electrical, thermal and thermo-mechanical properties

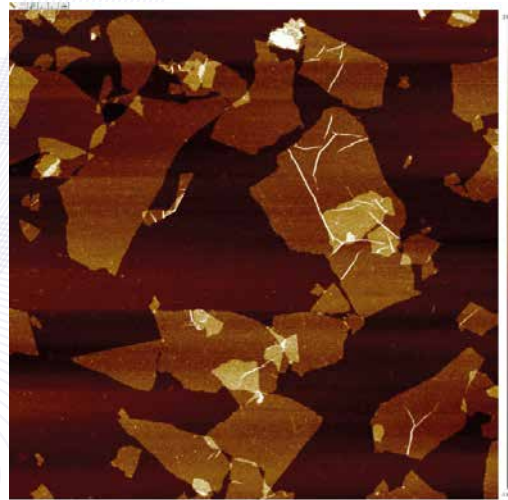
Competences & Capabilities

Main activities

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

R&D

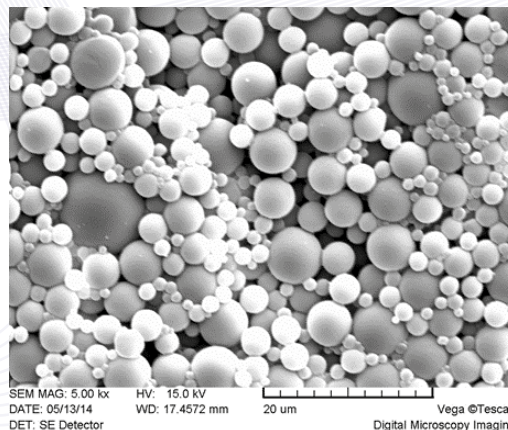
- **Nanotechnologies**
- Synthesis of nanostructures (organic, inorganic and hybrid)
- Tailored surface modification of nanostructures
- Dispersion of nanostructures in various media
- **Polymeric systems**
- Synthesis of special monomers and polymers
- Design and formulation of polymeric and nanocomposite systems
- Bio and environmentally friendly technologies
- Encapsulation



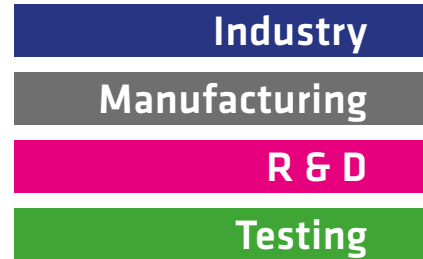
- Composites, adhesives, elastomers, coatings, foams, aerogels, sensors etc.

Small scale production of specialties

- Additive masterbatches (dispersions of nanostructures in selected environment)
- Polymeric premixes
- Pre-pregs



SEM MAG: 5.00 kx HV: 15.0 kV
DATE: 05/13/14 WD: 17.4572 mm
DET: SE Detector Vega ©Tescan Digital Microscopy Imaging



TOSEDA s.r.o.



Member of the
Czech Space Alliance

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Industry

Manufacturing

R & D

Services

TTS, s.r.o.



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Czech Space Alliance

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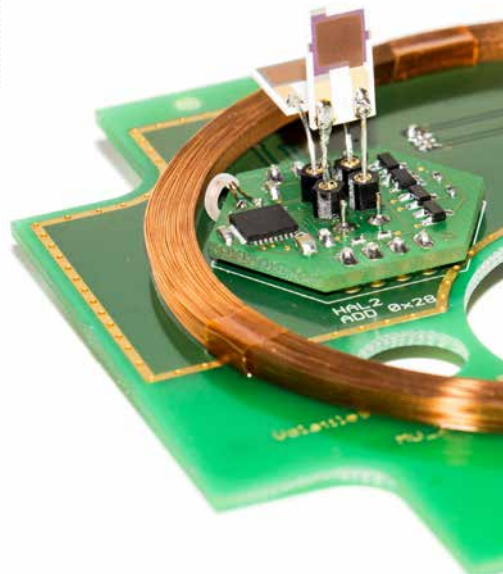


General description

TTS (Thin Film Technological Service) is a small privately owned Czech company established in 1992 to provide comprehensive service in the field of thin film deposition by PVD technologies. It specializes 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.

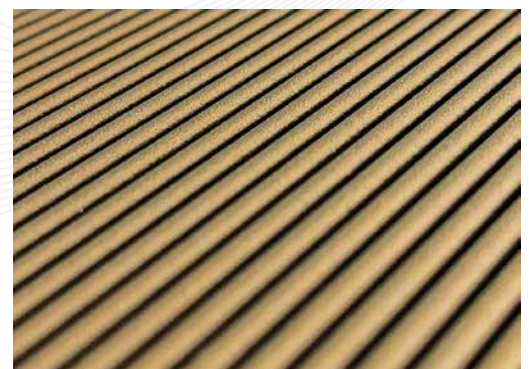
Radiation analysis: Computer simulations of transport of particles through matter with the focus on space radiation environment and its effects on spacecraft (primarily used for the design of coatings enhancing radiation properties)

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

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





UNEX[®]

Industry

Manufacturing

Services

Testing



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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 been helping more than 69 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.



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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.



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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

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UNITES

Designed to test

Industry

Manufacturing

R & D

Services

Testing

Software

UNITES Systems a.s.



Member of the
Czech Space Alliance

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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 successful 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 successful 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.

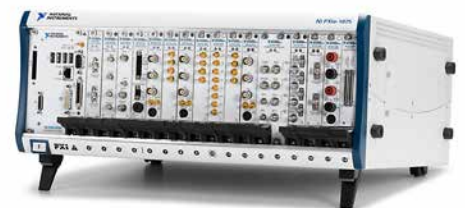
Notable development concepts

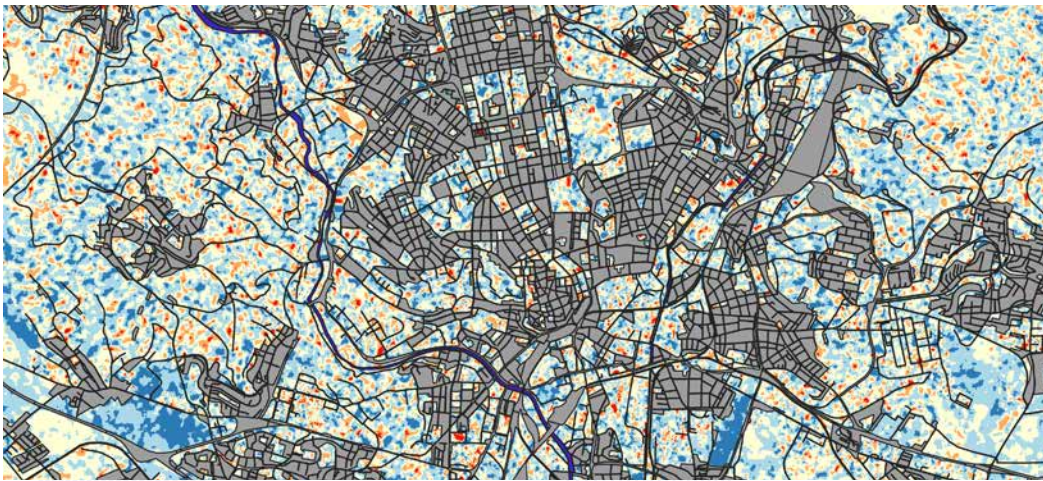
UNITES Systems a.s. in beginning of 2019 made proof-of-concept for Hardware In-The-Loop (HIL) universal tester of

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 capabilities

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.





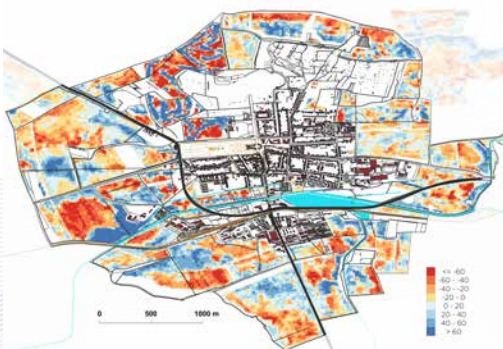
General description

World from Space is a young and agile space startup from Brno, Czech Republic. It focuses on developing downstream applications based on Earth Observation data, especially from the EU Copernicus programme. Smart cities and smart agriculture are two priority sectors for the company. World from Space is building web-based tools for decision making based on spatial and temporal analysis with use of machine learning.

In urban environment, 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, mitigation and adaptation measures and monitoring their results.

The surface moisture monitoring is a main focus within the smart agriculture sector. Current drought stress, maps for variable applications based on moisture zones, and smart scouting are delivered to end users via WMS and API.

- EO DynaCrop (H2020 SME Instrument phase 1, national funding, 2019) - drought and vegetation dynamics monitoring for farm management softwares
- Copernicus Masters (winner, 2018) - Government Challenge Winner
- Copernicus Hackathons (2019-?) - co-organizers responsible for EO data & analysis + technical mentoring
- Copernicus Support Office (2019-?) - second-level contact point for the Copernicus Support Office for tech questions, satellite images and technical articles



Competences & Capabilities

- Copernicus data analysis
- Automated cloud-based EO data analysis (SentinelHub, AWS, CreoDIAS, etc.)
- Urban EO monitoring - vegetation, temperature, air quality
- Climate change adaptation strategies for towns and cities
- Surface moisture measuring based on Sentinel 1 and Sentinel 2 data fusion
- Drought stress analysis and classification
- Interactive web-based map applications for public
- Interactive dashboards showing KPIs based on EO data
- Python, QGIS, SNAP
- Pixel-based machine learning methods

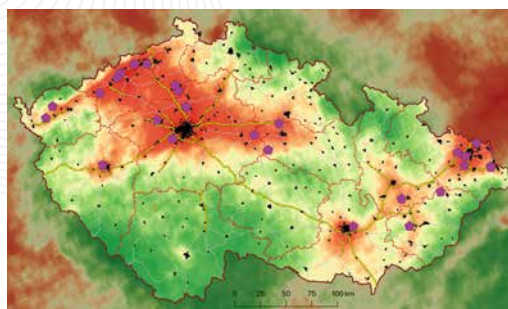
Major Space Projects & References

- DroughtMeasure (ESA BIC, 2019-2021) - developing drought monitoring system for cities and agriculture in context of climate change
- EO Clinic (ESA, 2019-2021) - a rapid-response mechanism for small-scale and exploratory uses of satellite EO information in support of a wide range of projects specific to International Development.

Space Related Equipment, Labs & Certificates

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

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



Industry

R & D

Services

Testing

Software

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Industry

Manufacturing

R & D

Testing

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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: 100014088

Industry

Manufacturing

R & D

Testing

Ray Service, a.s.

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General description

ENGINEERING AND PRODUCTION OF CABLE HARNESES 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.

Selected Space Projects of Czech Space Alliance

Example of project	Tender reference	Programme	Establishment	Award year	Prime	Subcontractor
SEN-4 Performance Assessment Tool GSJ.ASG.UVN.RFQ.00003			ESA ESTEC	2013	Astrium GmbH	esc.Aerospace
European Ground System Common Core Technologies Proof of Concept	AO7273		ESA ESTEC	2013	CS Systems D'Information	Siemens Convergence Creators, s.r.o.
Euclid SVM Electrical Simulator	AO7613		ESA ESTEC	2013	CSRC	Iguassu Software Systems, TAS-I
Adhesive Bonding of Thermoplastic Composites	Direct negotiations		ESA ESTEC	2013	EireComposites	SM s.r.o.
Solar Orbiter STIX C,D	Direct negotiations		ESA ESTEC	2013	esc. Aerospace	esc. Aerospace
Sentinel-4 UVN Data Evaluation EGSE (S4 UDEE) ESA Direct negotiations			Astrium GmbH	2013	Siemens Convergence Creators GmbH	Siemens Convergence Creators, s.r.o.
Meteosat Third Generation Data Handling SCOE (MTG DHS SCOE) MTG-ITT 16-3			OHB System AG	2013	Siemens Convergence Creators GmbH	Siemens Convergence Creators, s.r.o.
Meteosat Third Generation Payload Data Distribution SCOE (MTG PDD SCOE) MTG-ITT 16-5			OHB System AG	2013	Siemens Convergence Creators GmbH	Siemens Convergence Creators, s.r.o.
Ground Station Automation and Off-line Operations (GSAO)	AO7024		ESA ESOC	2013	Siemens Convergence Creators GmbH	Siemens Convergence Creators, s.r.o.
Parallel computing for fast Telemetry processing during short passes (FAST)	AO7113		ESA ESOC	2013	Siemens Convergence Creators GmbH	Siemens Convergence Creators, s.r.o.
Euclid Power SCOE	AO7612		ESA ESTEC	2013	Siemens Convergence Creators, s.r.o.	TAS-I, Siemens Convergence Creators GmbH
SM composite technology evaluation	Direct negotiations		ESA ESTEC	2013	TAS-F	SM s.r.o.
ASHLEY Avionics	Airbus/Thales	EU FP7	EU	2013	Thales	Iguassu Software Systems
Development of Epoxy Based Syntactic Foam Encapsulant	AO/1-7397/13/NL/EL	CZ incentive	ESA ESTEC	2013	TOSEDA s.r.o.	Thales Alenia Space
Development of Epoxy Based Syntactic Foam Encapsulant	AO7397		ESA ESTEC	2013	TOSEDA s.r.o.	TAS-F
Design of Inner Wetted Thermal System for LH2 Metallic Tank	ESA Direct Negotiations	FLPP3	ESA ESTEC	2014	Airbus Safran Launchers GmbH	TOSEDA s.r.o.; LSIWC; Microvista; Becker Photonics; ET Energie Technologie; Freudenberg
EVORA evolution and industrialisation	AO7397	GNSS	ESA ESTEC	2014	Iguassu Software Systems	TAS-F
SBAS Simulator upgrade	Direct negotiations	GNSS	ESA ESTEC	2014	Iguassu Software Systems	
Thermal Joint	ESA Direct Negotiations	NEOSAT	ESA ESTEC	2014	Thales Alenia Space	TOSEDA s.r.o.
Resin Development for Cryogenic Applications	ESA Direct Negotiations	FLPP3	ESA ESTEC	2014	TOSEDA s.r.o.	MT Aerospace GmbH
Nano-Hybrid Transparent Materials	AO/1-7482/13/NL/Fe	TRP	ESA ESTEC	2014	TOSEDA s.r.o.	MAPRad Srl.
ELISA – Laser Head – Power Supply and Modulator Driver			ESA	2014	Lusospace	CSRC s.r.o.
ACES ELT Ground Station Calibration			ESA	2014	CSRC s.r.o.	
Generic Adhesive for Space Application	AO/1-7397/13/NL/EL	CZ incentive	ESA ESTEC	2015	SM s.r.o.	Airbus Defence and Space, toulouse, France
NEOSAT – Test Bench for satellite thermal vacuum validation			ESA	2015	Astrium	CSRC s.r.o.
METOP SC-3M1 / FWC (Filter Wheel Controller)			ESA	2015	Airbus Defence and Space	CSRC s.r.o.
BOSQC - Generic Space Qualification of 10F Nesscap Supercapacitors			ESA	2015	CSRC s.r.o.	
TITAN - The fabrication of 40 pcs Space Titanium FM PressureSensors MEMS			ESA	2015		CSRC s.r.o.
Support Observations and Sensor Qualification SSA-P2-SST	AO8477	SSA	ESA ESOC	2016	e-GEOS	Iguassu Software Systems, Teplice observatory
Carbon Nanotube Technology and Engineering for Various Space Applications (NATAP)	ESA Direct Negotiations	GSTP	ESA ESTEC	2016	HPS GmbH	TOSEDA s.r.o.; HPS Lda.; AAC GmbH; INEGI; INVENT GmbH; Future Carbon GmbH
ARS - Angular Rate Sensor for PROBA 3			ESA	2016		CSRC s.r.o.
MPET - On-Board Implementation of the Multi-Purpose Event Timer			ESA	2016	Eventech	CSRC s.r.o.
JUICE - APME for MGAMA Subsystem Procurement + MAIT + Qualification /Acceptance campaign			ESA	2016	Airbus Defence and Space	CSRC s.r.o.
JUICE - EGSE for APME / MGAMA Subsystem Procurement + MAIT			ESA	2016	Airbus Defence and Space	CSRC s.r.o.
Technology Development of Flexible Tape Spring Boom for Large Appendages Deployment	AO/1-7397/13/NL/EL	CZ incentive	ESA ESTEC	2017	SM s.r.o.	Thales Alenia Space France
Ariane 6 Telemetry software	AO560051	Launchers	Ariane Group	2017	Iguassu Software Systems	
EVORA long term maintenance and upgrades	TAS-F	GNSS	TAS-F	2017	Iguassu Software Systems	
VEGA-E VUS Program Engine Valves RV, TV and FMV development	ESA Direct Negotiations		Avio S.p.A.	2017	Sobriety s.r.o.	Frentech Aerospace s.r.o., L.K. Engineering, s.r.o.
Ariane 6 ground segment - SETTERS	AO50110	Launchers	CNES	2017	Telespazio F	Iguassu Software Systems
Electrically Conductive „Black Primer“	AO/1-8701/16/NL/KML	TRP	ESA ESTEC	2017	TOSEDA s.r.o.	Freizite High Performance Lda.
Development of „Green“ Polyurethane Materials	AO/1-8698/16/NL/KML	TRP	ESA ESTEC	2017	TOSEDA s.r.o.	ArianeGroup GmbH; Latvian State Institute of Wood Chemistry
Thermal Joint Development for NEOSAT - Phase C	Direct negotiations	ARTES NEOSAT	ESA ESTEC	2017	TOSEDA s.r.o.	
PCDU Radiation Shielding of the JUICE SSTS	AO/1-7809/14/NL/SW	TRP	ESA ESTEC	2018	Airbus Defence and Space, Spain	SM s.r.o.
Telescope data processing chain P3-NEO-XII	AO9071	SSA	ESA ESOC	2018	Iguassu Software Systems	Sybilla, GMV PL, GMV RO
Robotic telescope demonstration	AO9061	SSA	ESA ESOC	2018	Iguassu Software Systems	Sybilla, GMV PL, GMV RO
CCSDS Graphical Editor	AO7634		ESA ESOC	2018	Iguassu Software Systems	
GNSS s/w defined receiver	AO9018	CZ incentive	ESA ESOC	2018	Iguassu Software Systems	
E-pump for rocket propellants demonstrator	Direct negotiations		ESA ESTEC	2018	Sobriety s.r.o.	Frentech Aerospace s.r.o.
Application and feasibility study for a Large Scale Zero-G Test Platform	Direct negotiations		ESA ESTEC	2018	Sobriety s.r.o.	
Critical Review & Assessment on CFRP & Polymeric Material Usage for Crew Compartments and Manned Transport Systems	AO 1-8798/16/NL/KML	TRP	ESA ESTEC	2018	Thales Alenia Space, Italy	SM s.r.o.
Extended Pot Life Resins for Out of Autoclave Processing for Large and Complex Part	AO/1-9024/17/NL/KML	GSTP	ESA ESTEC	2018	TOSEDA s.r.o.	MT Aerospace GmbH
Infrared Advanced Polarizer for Space and Other Applications – 2. (IAPETHOS-1)	Direct negotiations	GSTP	ESA ESTEC	2018	BBT-Materials Processing	CTU
Calomel-based TIR Optical AOTF Breadboarding (CALIOPE)	Direct negotiations	GSTP	ESA ESTEC	2018	BBT-Materials Processing	CTU
SR-CTP - Space Radiation Capabilities, Technologies and Platforms for Small Spacecraft and CubeSats (SR-CTP) / AO9018			ESA	2018		BD SENSORS s.r.o. / CSRC Space Division
SMT3 - Implementation of SMT Soldering Technology for increasing national competitiveness in ESA space programmes / AO9018			ESA	2018	BD SENSORS s.r.o. / CSRC Space Division	
TANTAL2 - Testing of the Hermetic Tantal Capacitors for Space Application			ESA	2018		BD SENSORS s.r.o. / CSRC Space Division
HERACLES High Performance Engine	Direct negotiations		ESA ESTEC	2019	Nammo Raufoss AS	Sobriety s.r.o.
POST - Polish SST Small Telescope Assessment and Prototyped Operations	AO9838	SSA	ESA ESOC	2019	Sybilla	Iguassu Software Systems, Delmos, Teplice Observatory, GMV
LID - Release Mechanism for EXOMARSEGE for Ignition System			ESA	2019		BD SENSORS s.r.o. / CSRC Space Division
EGSE.SLB - EGSE Hinge Tester / Solarbus Solar Array			ESA	2019		BD SENSORS s.r.o. / CSRC Space Division
EGSE.SA - Development and MAIT activities for EGSE Solar Array			ESA	2019		BD SENSORS s.r.o. / CSRC Space Division
Composite Manufacturing for Space Applications	AO/1-9018/17/NL/GLC/hh	CZ incentive	ESA ESTEC	2020	SM s.r.o.	Thales Alenia Space France
Flexible Solar Array Mechanical Subsystem	AO/1-9018/17/NL/GLC/hh	CZ incentive	ESA ESTEC	2020	SM s.r.o.	Frentech Aerospace, s.r.o., L.K. Engineering, s.r.o., Výzkumný a zkušební ústav, a.s., Thales Alenia Space France
Infrared Advanced Polarizer for Space and Other Applications – 1. (IAPETHOS-1)	Direct negotiations	GSTP	ESA ESTEC		BBT-Materials Processing	CTU
Development and test batch production of Calomel IR polarizer prototype with demonstration of the critical functions in relevant environment (ECLIPSE)	Direct negotiations	TRP	ESA ESTEC		BBT-Materials Processing	
Infrared Advanced Polarizer for Space and Other Applications – 1. (IAPETHOS-1)	Direct negotiations	GSTP	ESA ESTEC		BBT-Materials Processing	CTU
Development and test batch production of Calomel IR polarizer prototype with demonstration of the critical functions in relevant environment (ECLIPSE)	Direct negotiations	TRP	ESA ESTEC		BBT-Materials Processing	

The Czech Space Alliance (CSA)

CSA is an SME association of 15 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, established and honed by ESA over decades. Therefore, the apparent challenge of the stricter bidding process was in fact an advantage - resulting in transparency and easing of former barriers. Whereas the 4 years of PECS attracted one or two 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 of the international bidding challenges 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 results in the subsequent 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 achieving the same industry/institutions balance of participation as in more established ESA states.

This Industry Incentive Scheme ended in 2014. Since then 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 budget increase at the ESA Ministerial Council in 2016. From 7M € in 2009 to 47M € in 2017. Subsequently the government 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

This result of the effort of our politicians and of the government commissioner for Galileo, Karel Dobeš, also boosted the interest of the stakeholders and industry in space technologies. Czech industry has been contributing to the Galileo development through the participation in international consortia, and developing EGNOS/GNSS technologies, since 2005. For instance, all but one of the EGNOS tools on ESA website www.navipedia.net/index.php/GNSS:Tools had been developed or upgraded by Czech industry. Czech GNSS software is now running in TAS-F EGNOS simulator SPEED. Commercial software GNSS products have been sold to Spain, West Africa, Romania, and recently even to Japan.

Our equivalent of a national space agency - the Space Activities Coordination Council of the Minister of Transport

The process of preparation of the first National Space Plan 2010-2016 was a breakthrough on several fronts. Hitherto competing parties sat down to discuss and agree a common plan and ways to share 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!



Czech space industry visiting DLR for B2B in February 2017

In the National Space Plan 2014-2019 Czech Space Alliance was responsible for drafting the sections relevant to the industry. The Government approved this strategic document in October 2014. 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 National Space Plan 2020, along with a budget increase for ESA programmes, has been approved by the government in October 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 director, professors and a member of Japanese parliament. Among recent international events were the meeting with the president of the Mexican space agency and his key staff to discuss possible co-operation, and participation of Czech companies at the Japan Aerospace 2016 exhibition and conference, instigated and co-organised by CSA. CSA was given a large slot to present Czech industry and space policy in SJAC (Society of Japanese Aerospace Companies) seminar. The Czech national stand was kindly financed by the Ministry of Foreign Affairs and Czechinvest. Similar scheme was repeated in 2018, this time with strong financial backing from our Ministry of Defence. CSA exhibitors at the Japan Aerospace 2018 were invited for a VIP tour of the JAXA space technology centre in Tsukuba, including meetings with engineering teams from the areas of our specialisations. 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 Korea and China.



Meeting new JAXA president Professor H. Yamakawa at IAC Bremen 2018

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. MOU draft is prepared. We are also looking at synergies with the UAE Space Agency, the Thai GISTDA and others.

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
November 2019

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Czech Space Alliance
petr@czechspace.eu
www.czechspace.eu



ESA INITIATIVES **in the** **Czech Republic**

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ESA Technology Transfer Broker	66
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General description

ESA Business Incubation Centres (ESA BICs) are located in 17 European countries, to date 20 centres have been set-up with more already in the planning. Together, they work regionally to inspire entrepreneurs to turn space-connected business ideas into commercial companies. More than 700 start-ups have been supported by the network to this day. ESA BICs offer an extensive support package to entrepreneurs and young start-ups with innovative ideas for downstream and upstream applications. With branches in Prague and Brno, the ESA BIC in the Czech Republic targets companies using space technologies for general non-space industrial, scientific and commercial uses or using non-space technologies in products and services for the space sector.

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 start-ups
- Business development

Major Space Projects & References

- **Astropreneurs:** acceleration programme to support start-ups 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 start-ups 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

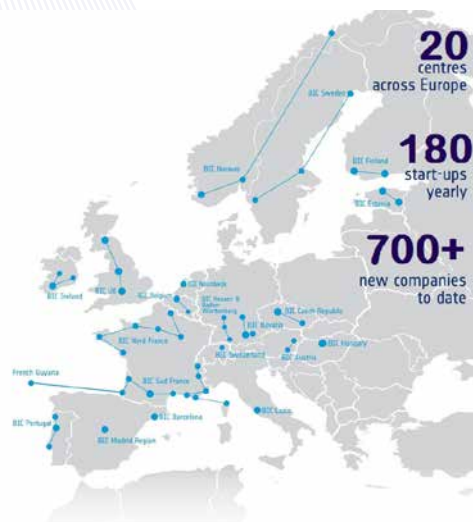
Incubated start-ups

- **Dronetag** – Developing an IoT device that can identify drones in real time and extend their functionality and the use
- **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.
- **Let's Earth** – Analytical tool "MeteoInsight" providing analysis of suitable renewable resources for developers based on satellite data and data from meteorological stations.
- **Neuron Soundware** – Using audio recordings and artificial intelligence to detect unusual and possible failure behaviour of machines
- **OctoGeo** – 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
- **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, the first cubesat skCUBE was launched in 2017
- **Stratosyst** – Developing High Altitude Pseudo Satellite (HAPS) that can offer many applications from the stratosphere, Earth observation, telecommunication, infrared astronomy etc.
- **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
- **UptimAI** – Probability software for simulating engineering processes, the software was developed to model hypersonic flows of space objects.
- **World from Space** – Monitoring of the condition of vegetation, temperature and ground moisture for the cities, regions and farmers
- **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** – Sport bikes with frames based on the most advanced technology of carbon composite used in the space industry.
- **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.
- **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.



ESA Initiatives

ESA BIC Prague

CzechInvest

CzechInvest
Štěpánská 567/15
120 00 Praha 2
Czech Republic

ESA BIC Prague
Prague Startup Centre - Palace Adria
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Czech Republic

Responsible for space
and ESA projects:

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marek.aldorf@czechinvest.org
Mobile: +420 721 375 143

→ ESA BIC PRAGUE | THREE YEARS

→ We started

PRAGUE 05/2016

17 start-ups

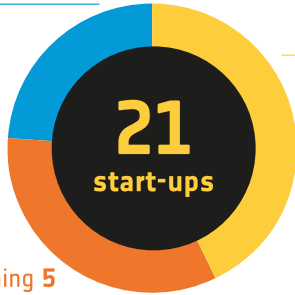


BRNO 03/2018

4 start-ups

Incubatees 9

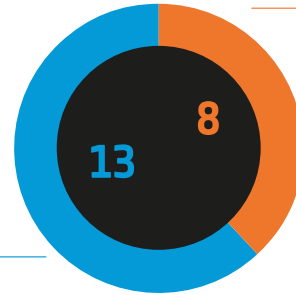
currently incubated start-ups



Alumni 7
start-ups that have completed incubation

Newly incoming 5

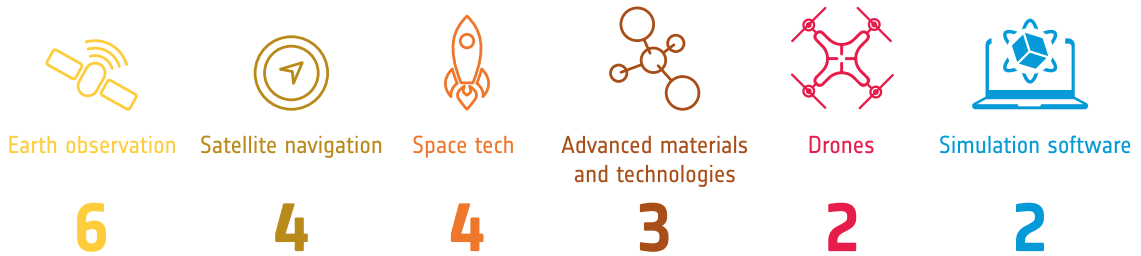
Foreign firms with operations in the Czech Republic



Slovakia
Switzerland
France
United States
Egypt

Czech firms

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



8 start-ups have received investments

value of investments: more than **CZK 75 million**

Possible discovery of a new Van Gogh | **InsightArt**

Collaboration with Orlando Bloom | **Festka**

Victory in Copernicus Masters | **OctoGEO a World from Space**

Application for Czech Railways | **Triphood**

Winning of an ESA tender | **NG Aviation**

One of the first applications for the Iridium System | **Strafos**

ESA BIC Prague Incubated start-ups



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.



dronetag

Dronetag

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

Festka

Sport 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.



Let's Earth

Analytical tool providing analysis of suitable renewable resources for developers based on satellite data and data from meteorological stations.

NaviRider

Navigation and safety application for motorbike riders using satellite navigation.



Neuron Soundware

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

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.

SKYMAPS

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



SMUP-UQ

SMUP-UQ

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

Spacemanic

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



Strafos

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

Stratosyst

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



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.

Triphood

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



TuddyTuddy

Entertainment mobile application for tourists using satellite navigation.

WORLD FROM SPACE

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



Zetjet Technologies

New generation of electrical turbines for High Altitude Pseudo Satellites.

ESA Initiatives

**ESA Technology
Transfer Broker**

**ESA Innovation
Partner**

**Technology
Centre
of the CAS**

Technology Centre of the CAS
Ve Struhach 1076/27
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Responsible for space
and ESA projects:

Ing. Pavel Habarta
Phone: +420 725 570 455
E-mail: habarta@tc.cz



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 Research and Development 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

Incubation / 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 Technology Transfer Network
- Direct link to ESA Technology Transfer Prime Contractor



General Description

The European Space Education Resource Office Czech Republic (ESERO) is the key project of the European Space Agency (ESA) to support primary and secondary education in Europe.

Nowadays a decreasing number of young people decide to take up STEM-related (Science, Technology, Engineering and Mathematics) studies and careers. ESERO's mission is to use space-related topics to support pupil's interest in studying STEM subjects. Space, in particular, becomes not just a place of inspiration and future dreams, but also an everyday fact of modern life.

Major Space Projects & References

ESERO offers an annual series of national or regional training sessions for both primary and secondary school teachers. These are offered in collaboration with national partners who are already active in STEM education. Teacher training events are, wherever possible, officially accredited as part of continual professional development qualifications.

ESERO also organize dozens of national and international competitions and project. Such as CanSat: Build your own satellite, AstroPi: Send a code on the ISS, Climate Detectives: Investigate a climate problem in local environment and do something to decrease the problem, and many others.

Competences & Capabilities

ESERO Czech Republic is based in the city of Prague, it is operated by SCIENCE IN and co-funded, at national level, by Charles University in Prague, Czech Technical University in Prague, Palacky University in Olomouc, Astronomical

Institute of the Academy of Sciences of the Czech Republic, Tereza Association and IQ Landia Science Centre.

ESERO cooperates with several Institutes of the Academy of Sciences of the Czech Republic so it has the access to the professional feedback from the scientists.

The ESERO project also help stimulate young people's awareness of Europe's space programme and of its importance for modern society and economy.



ESA Initiatives

ESA-ESERO Czech Republic SCIENCE IN



→ MOON CAMP



→ CLIMATE DETECTIVES



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ESA-ESERO Czech Republic
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118 00 Prague 1
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www.esero.sciencein.cz

Responsible for space
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Lukas Holman
E-mail: holman@sciencein.cz
Phone: 776 041 039

ACADEMIA of the Czech Republic



successful in ESA

Astronomical Institute, CAS	70
Global Change Research Institute CAS	71
Institute of Atmospheric Physics, CAS	72
Institute of Botany, CAS	73
J. Heyrovsky Institute of Physical Chemistry, CAS	74
Nuclear Physics Institute, CAS	75
Institute of Plasma Physics, CAS (TOP TEC)	76
Department of Physical Electronics, CTU	77
Faculty of Civil Engineering, CTU	78
Faculty of Electrical Engineering, CTU	79
Faculty of Mechanical Engineering, CTU	80
Institute of Experimental and Applied Physics, CTU	81
Faculty of Mathematics and Physics, Charles University in Prague	82
Faculty of Agrobiolgy, Food and Natural Resources, Czech University of Life Sciences Prague	83
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IT4Innovations National Supercomputing Center	88
Research Institute of Geodesy, Topography and Cartography, Geodetic Observatory Pecny	89
Czech Hydrometeorological Institute	90
Klet Observatory	91
Teplice Observatory, North-Bohemian Observatory and Planetarium (NBOP)	92

Academia

R&D

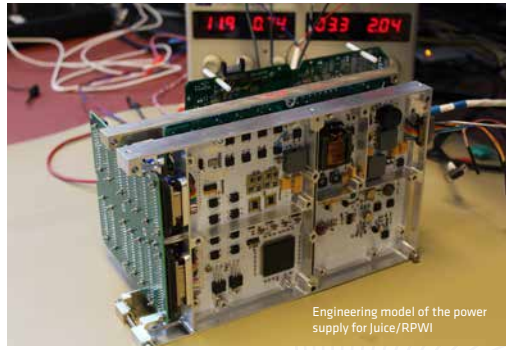
Design

Testing

Astronomical Institute, CAS

**Astronomical Institute,
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<http://www.asu.cas.cz>

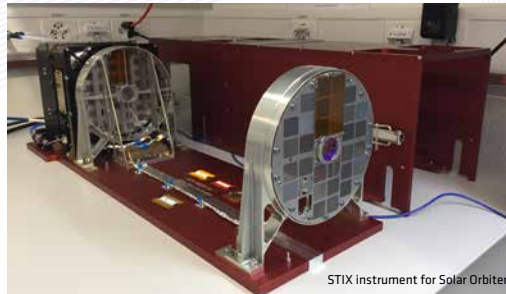
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Mobile: +420 777 214 434
E-mail: jiri.svoboda@asu.cas.cz



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

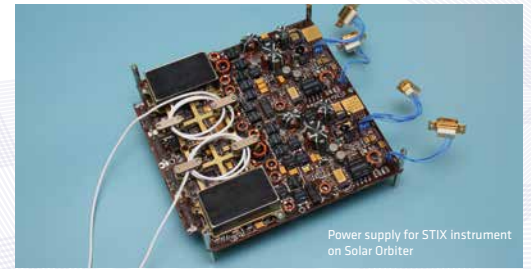
Large international collaborations represent a significant part of the research activities of the Astronomical Institute. Scientists from the Institute are involved in many international projects of new-generation astronomical instruments for ground-based as well as space-based telescopes, the latter 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 Remote Terminal Unit for the warm front-end 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



Academia

Testing

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)

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

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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.

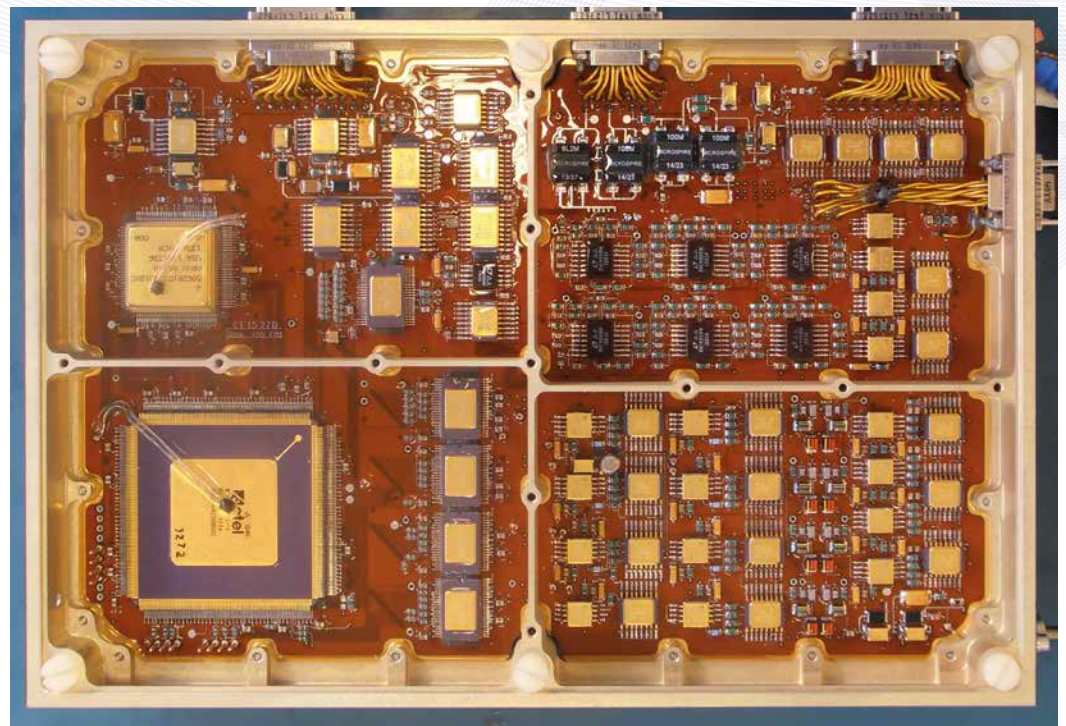


- JUICE space probe: IAP develops a new wave analyzer and onboard processing module for low-frequency electromagnetic waves. It will be a part of the Radio and Plasma Waves Instrument for which IAP has a responsibility of a Co-Principal Investigator institution.
- TARANIS satellite: Development and implementation 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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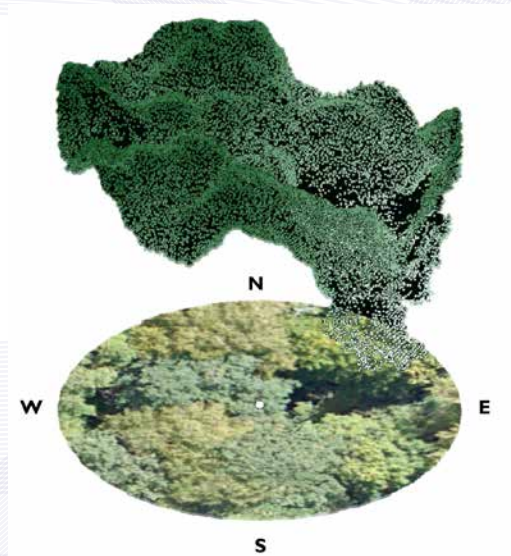


General description

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 employees 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.

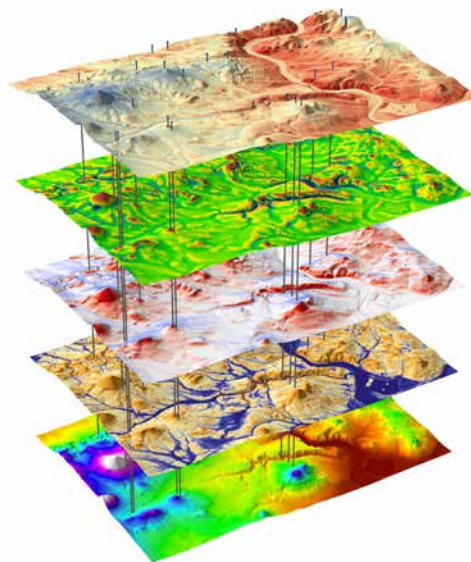


Major Space Projects & References

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.

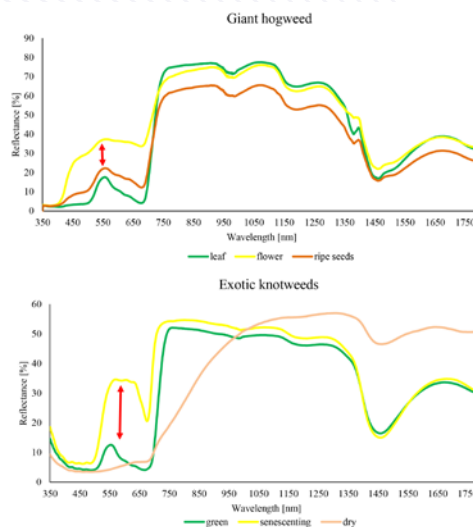
Space Related Equipment, Labs & Certificates

- 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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Academia

R&D

Testing



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, plasmachemistry, 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 continuously scanning interferometer.
- Echelle emission spectrograph.
- Laser spectrometers.
- Equipment for vacuum operation, sampling, analytical techniques such as GC-MS, high resolution spectroscopy, LIBS.
- Software development.

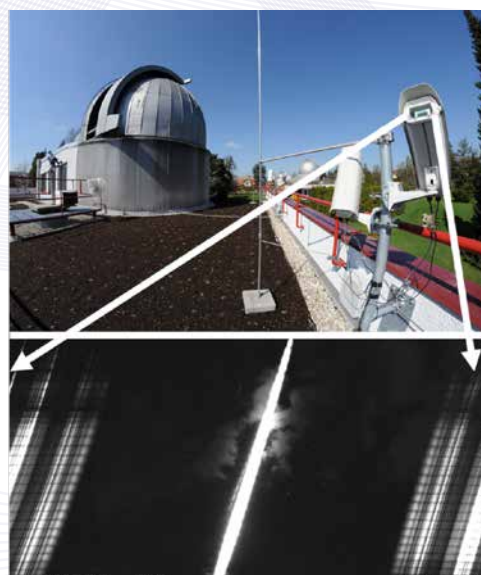
J. Heyrovsky Institute of Physical Chemistry, CAS

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Academia

R&D

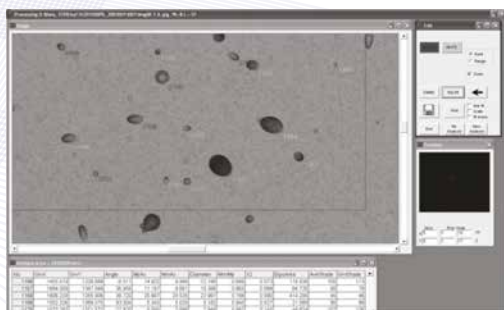
Design



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.

- 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).



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.



Nuclear Physics Institute of the CAS, public research institution

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TOPTEC, Institute of Plasma Physics, CAS

Research Centre for Special Optics
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TOPTEC

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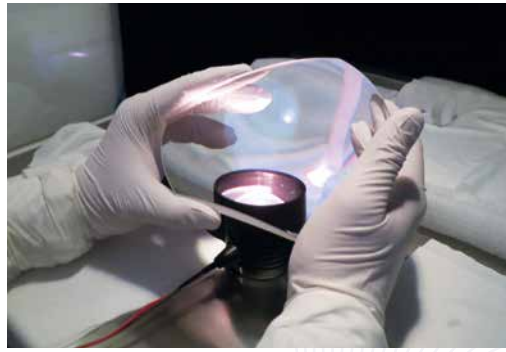
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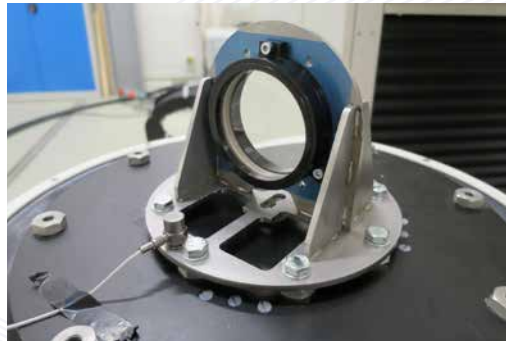
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General Description

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.).

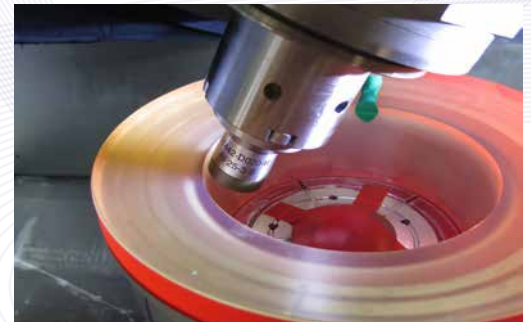
Major Space Projects & References

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.



Space Related Equipment, Labs & Certificates

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



Academia

R&D

Design

Testing

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Academia

R&D

Design

Testing

Faculty of Civil Engineering, CTU

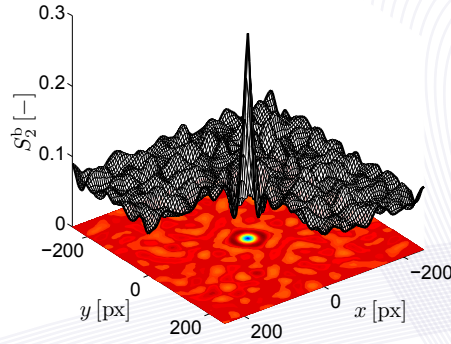
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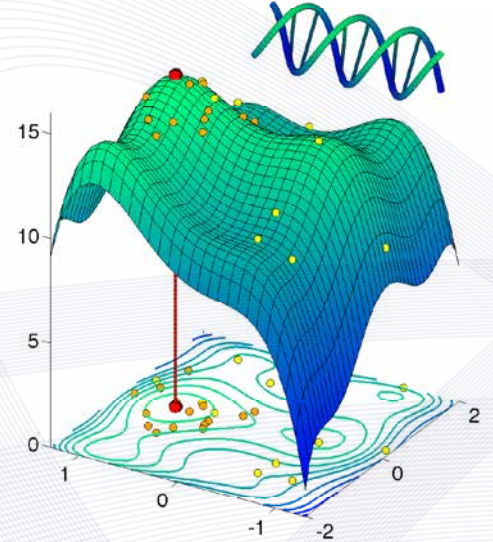
General description

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.



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.



Competences & Capabilities

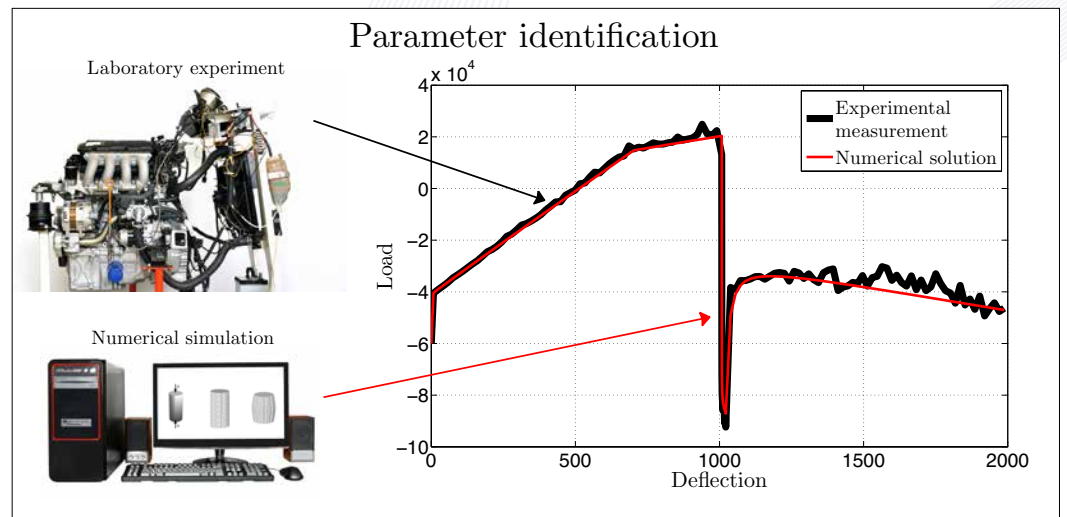
The key activities fall into the category of basic and applied research. The team consists of experts in the field of (i) materials modelling including development of robust non-linear multi-physics constitutive models, multi-scale modelling, analysis and compression of complex microstructural systems, (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.

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



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 Contract No. 4000105298/12/NL/CLP, Propagation Models for Frequency Coordination and Interference Analyses, 2012-2013 and participation in the DEMON ESA GSTP program "Development of Quality Evaluation Methods for Calomel Optical Elements" No. 4000104863/11/NL/PA.

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.

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 Hinfinit 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)
- Test laboratories
- Electronics and optical laboratories
- Equipment for magnetic testing and calibration of magnetometers
- Anechoic chambers: acoustics and electromegnetic



Academia

R&D

Design

Testing

Faculty of Electrical Engineering, CTU

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

Development

Testing

Faculty of Mechanical Engineering, CTU

Department of Machining,
Process Planning and Metrology
Faculty of Mechanical Engineering
Czech Technical University in Prague
(CTU)

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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, postprocessing 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 picosatellite.



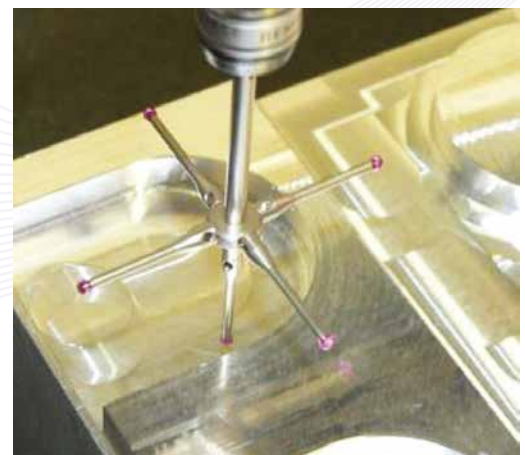
Major Space Projects & References

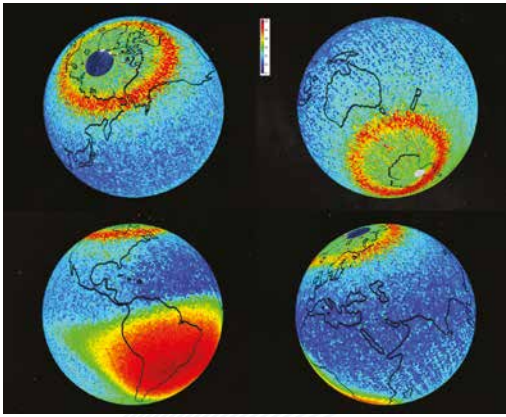
- Rigid frame for picosatellite: Design of very stable frame for Cubesat using new approaches to design of frame. Project realized for CzechTechSat, Satellite team of CTU Prague
- Light cubesat frame (LCF): Experimental research and testing of new variants of frames for CubeSat focused on weight reduction. Project realized for CzechTechSat, Satellite team of CTU Prague
- Cubesat frame assembly machining optimisation: CAM programming and toolpath strategy optimization for CNC framework production. Material and tool utilization for fast&cheap production methods. Material consumption optimization. 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



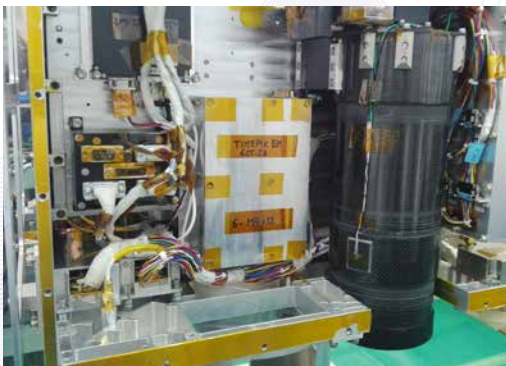


General description

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.

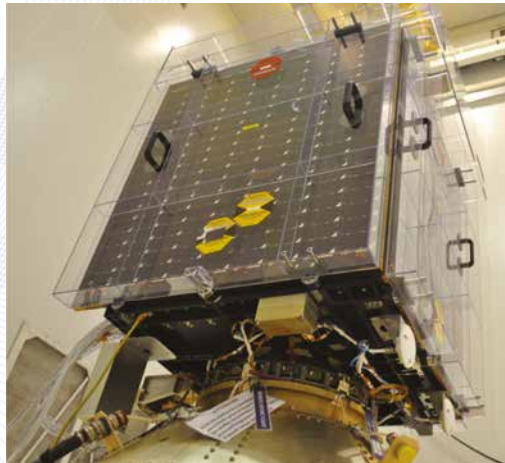


Major Space Projects & References

- 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

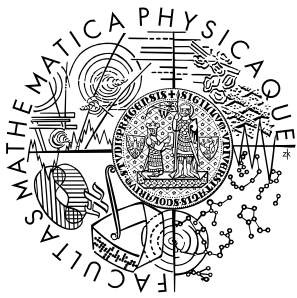
Testing

Institute of Experimental and Applied Physics, CTU

**Institute of Experimental and Applied Physics (IEAP)
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Responsible for space and ESA projects:

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Academia

R&D

Design

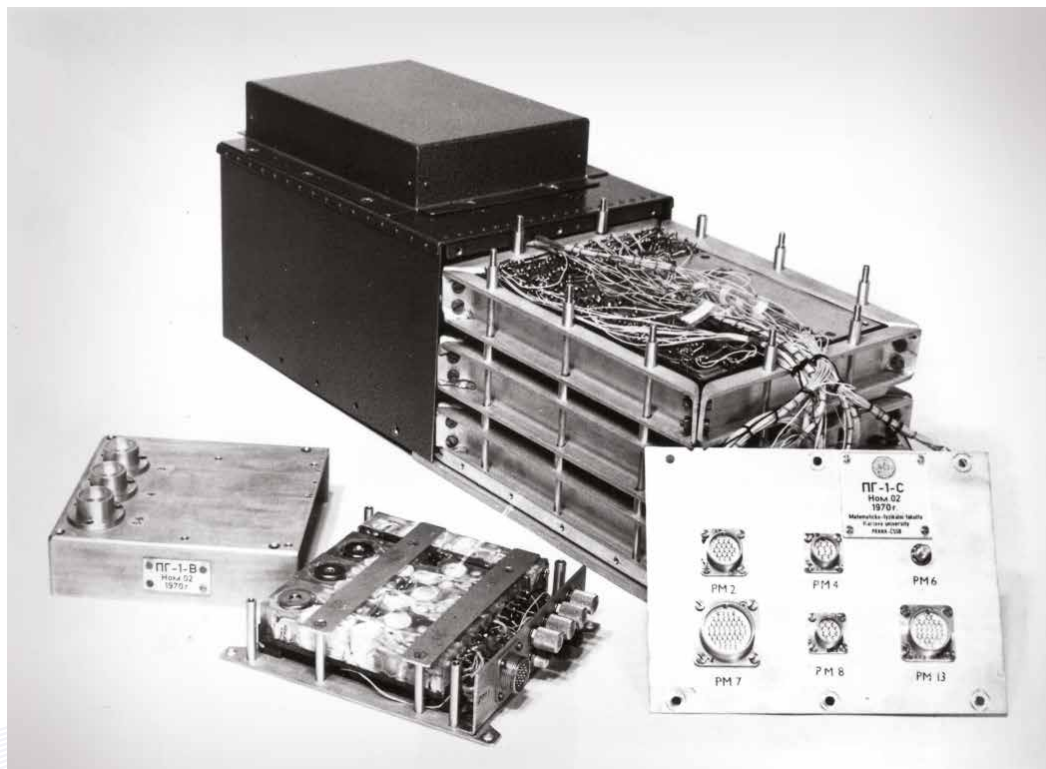
Testing

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

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

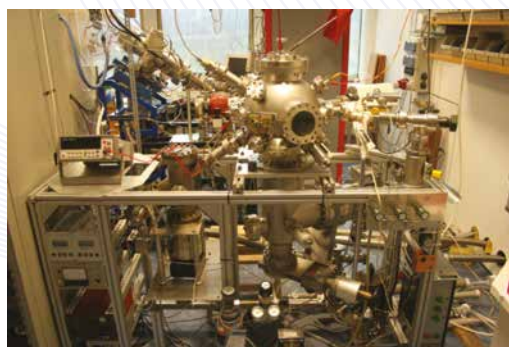
Responsible for space
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General description

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



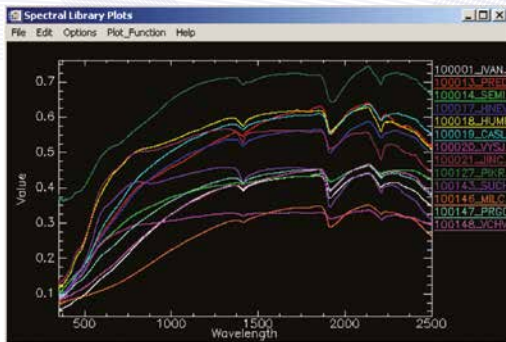
Space Related Equipment, Labs & Certificates

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



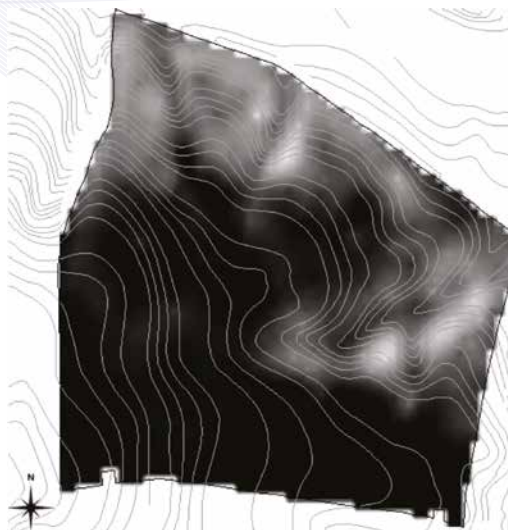
General description

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).



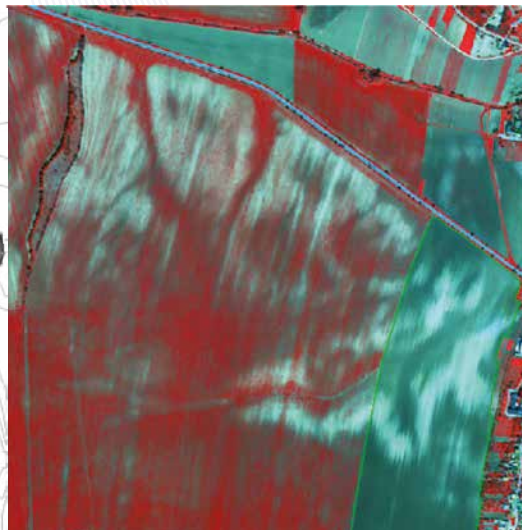
Major Space Projects & References

- 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



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

Department of Soil Science and Soil Protection (3SP)
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 Czech University of Life Sciences Prague (CULS)
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Faculty of Applied Sciences (FAS), University of West Bohemia in Pilsen (UWB)

Faculty of Applied Sciences (FAS)
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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.

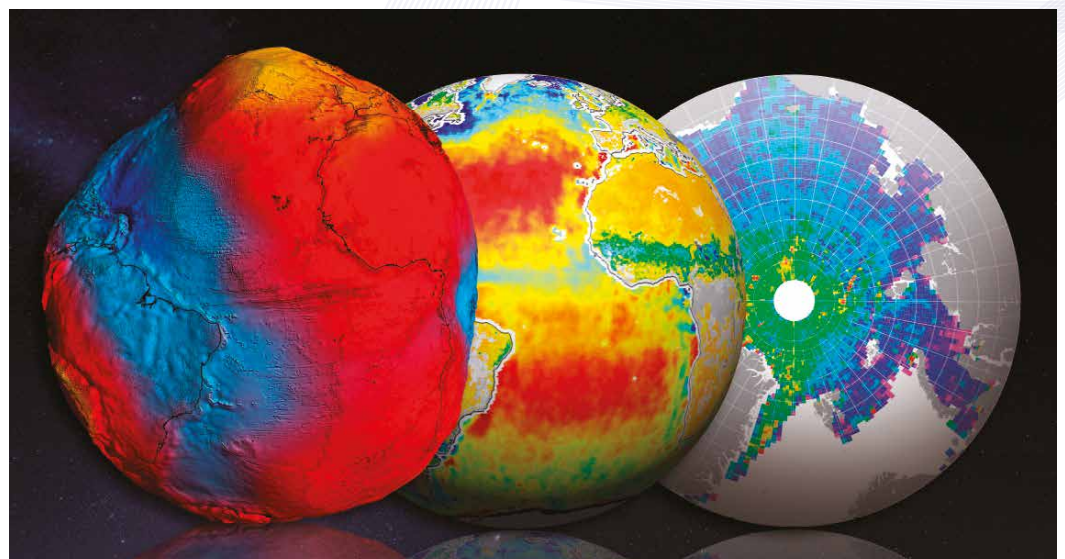
Competences & Capabilities

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 Science

Academia

R&D

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.

- Super-Resolution via Spatial Mode Demultiplexing and its Applicability to Observational Astronomy: ESA Ariadna project realized in 2018. The team of Palacký 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.

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.

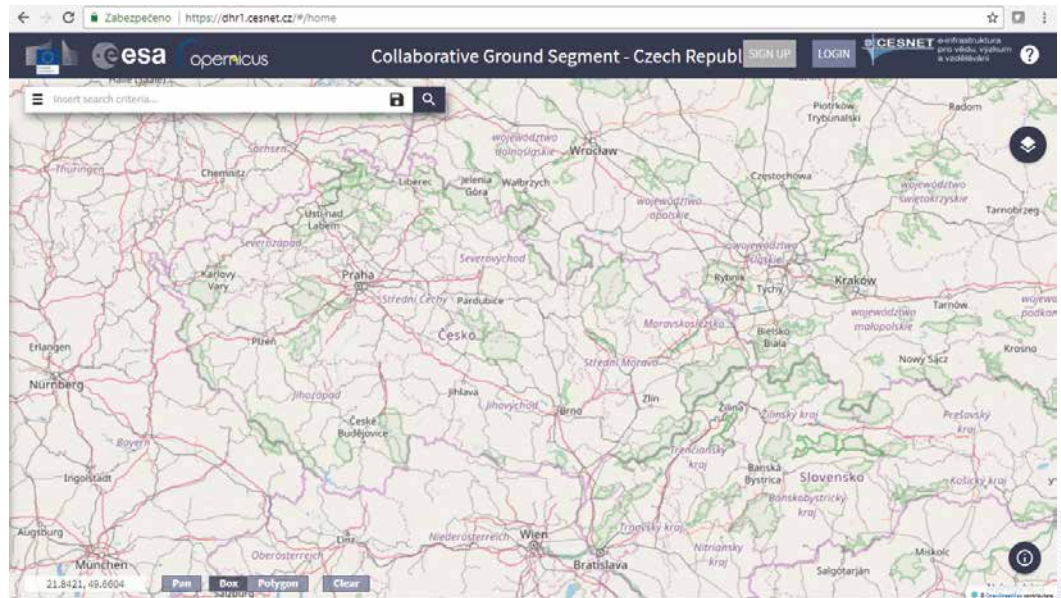
The Faculty of Science has a lot of creative potential and it can be proud of its abundant profile of original scientific results, which push the limits of our findings, as well as of its multilateral international cooperation. Some of our research teams rank significantly on the international scale 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 Palacký University is a part of an international consortium led by SES. The team of Palacký University is responsible for information-theoretical security analysis of quantum cryptography protocol to be developed and implemented within the project.

Faculty of Science,
Palacký University
Olomouc

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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.



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Responsible for space and ESA projects:

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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 to 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.

- 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

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



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.

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

**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
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General Description

IT4Innovations National Supercomputing Center at VSB-TUO is a strategic research infrastructure in the Czech Republic. In the framework of IT4Innovations, the most powerful supercomputing facilities in the Czech Republic are built, and excellent research in High Performance Computing (HPC), High Performance Data Analysis (HDDA), and Artificial Intelligence (AI) technologies is performed. The centre provides state-of-the-art technology and expertise in HPC and makes it available to Czech and international research teams from academia and industry.

IT4Innovations is part of the National Roadmap for Large Infrastructures for Research, Experimental Development and Innovations, prepared by the Ministry of Education, Youth and Sports of the Czech Republic, as one of the three large e-infrastructures in the country.

At present, IT4Innovations runs four supercomputers: Anselm (94 TFlop/s, installed in 2013), Salomon (2 PFlop/s, installed 2015), Barbora (849 TFlop/s, installed 2019) and a special system for AI computation, DGX-2 (2 PFlop/s in AI, installed in 2019). A petascale EURO_IT4I system will be installed at the centre in 2020 as part of the EuroHPC project.



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. IT4Innovations is also the only Intel Parallel Computing Center (IPCC) in new member states of the European Union. Its research activities are distributed into 5 laboratories:

- Parallel algorithms research lab
- Advanced data analysis and simulations lab
- Modelling for nanotechnologies lab
- Big data analysis lab
- Infrastructure research lab

Major Space Projects & References

IT4Innovations National Supercomputing Center 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.

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.



Space Related Equipment, Labs & Certificates

IT4Innovations National Supercomputing Center operates four systems with the following technical parameters:

Salomon

- 2,011 TFlop/s theoretical performance,
- 1,008 compute nodes,
- 24,192 CPU Cores of Intel Xeon E5-2680v3,
- 129 TB of RAM.

Barbora

- 849 TFlop/s theoretical performance,
- 192 compute nodes,
- 8 compute nodes with GPU accelerators,
- Infiniband HDR 200 Gb/s,
- 310 TB SCRATCH data storage.

Anselm

- 94 TFlop/s theoretical performance,
- 209 compute nodes,
- 3,344 CPU Cores of Intel Sandy Bridge,
- 15 TB of RAM.

DGX-2

- 130 TFlop/s theoretical performance, 2 PFlop/s in AI,
- 2 x Intel Xeon Platinum CPUs,
- 16 x NVIDIA Tesla V100 32GB HBM2 GPUs,
- 30 TB NVMe, Up to 60 TB Storage.



Academia

R&D

Design

Testing

IT4Innovations National Supercomputing Center

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

Responsible for space and ESA projects:

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Managing director
E-mail: vít.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:

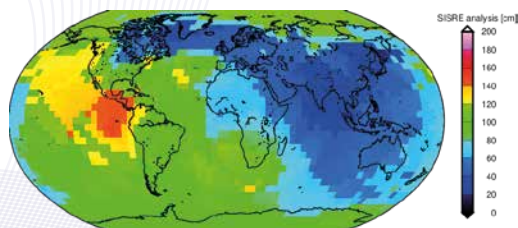
- GNSS (Global Navigation Satellite Systems) – data collection, data quality control, data dissemination, precise analysis of regional and global data,
- DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellites) – precise analysis of global data,
- Gravity field modelling – ground data 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

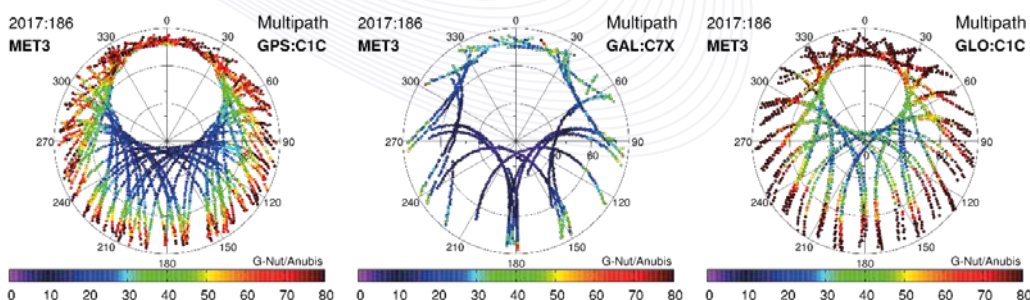
Research Institute of Geodesy, Topography and Cartography, p.r.i., Geodetic Observatory Pecný

Research Institute of Geodesy, Topography and Cartography, Geodetic Observatory Pecný, 251 65 Ondřejov 244 Czech Republic <http://www.vugtk.cz/>

Responsible for ESA and space projects:

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E-mail: jan.dousa@pecny.cz

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Phone: 323 649 235
E-mail: jakub.kostecky@pecny.cz





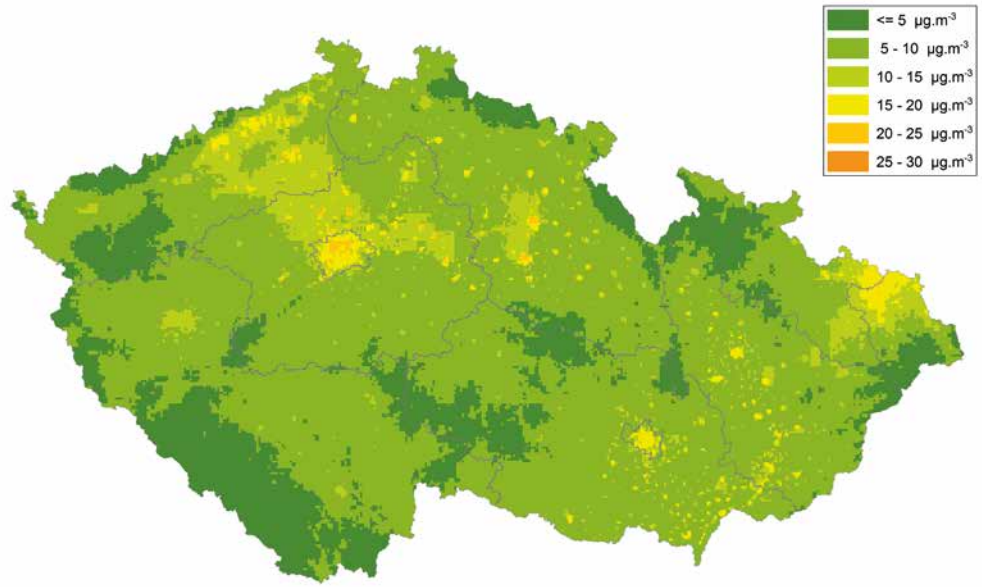
Academia

R&D

Design

Testing

NO₂ – daily average 8.6.2014, urban and rural background



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) is 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, PM_{2.5}), 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
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Responsible for ESA projects:

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





General Description

The Klet 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 sixties. The Headquarter of Klet Observatory is located at the Observatory in České Budějovice.



Major Space Projects & References

Near Earth Object follow-up astrometry as Cooperating Sensor of SSA-NEO segment (2014-2018 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:

- 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)
- 2015: together 2350 positions of 231 NEOs (21 Atens, 124 Apollos, 86 Amors;incl.17 PHAs)
- 2014: together 825 positions of 96 NEOs (6 Atens, 42 Apollos, 48 Amors; including 7 PHAs)

Reference:

Minor Planet Circulars(ISSN 0736-6884) and Minor Planet Electronic Circulars (ISSN 1523-6714), (2013-2017)

- 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)
- Tichy, M., Ticha, J., Kocer, M.: KLENOT PROJECT - NEAR EARTH OBJECTS FOLLOW-UP PROGRAM (Asteroids: New Observations, New Models, Proceedings of the International Astronomical Union, IAU Symposium, Volume 318, pp. 319-320, 2016)

Competences & Capabilities

- 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 1.06-m KLENOT Telescope)
- Recoveries of NEOs in the second opposition
- Follow-up astrometry of poorly observed NEOs - especially Virtual Impactors and PHAs, target of space missions or radar targets
- Follow-up astrometry of other unusual objects, i.e. Centaurs, transneptunian objects with lim. mag. about $V = 22$ mag.
- Cometary features, especially analysis of possible cometary activity of newly discovered bodies.
- Search for new asteroids as a by-product



© 2016, KLENOT Project, Klet Observatory (<http://www.klet.org>)

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, equipped with CCD camera
- FLI ProLine 230. Limiting magnitude of $mV=22.0$ mag.
- 0.57-m reflector equipped with SBIG CCD devoted to brighter objects.
- 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.



Academia

R&D

Klet Observatory

Klet Observatory
Zátkovo nábřeží 4
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<http://www.klet.org>

Responsible for space and ESA projects:

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Phone: +420 380 711 242
E-mail: klet@klet.cz

North-Bohemian Observatory and Planetarium in Teplice

Teplice Observatory,
North-Bohemian Observatory
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Responsible for space
and ESA projects:

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Mobile: +420-604 944 523
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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).

Field of Activities

Industry

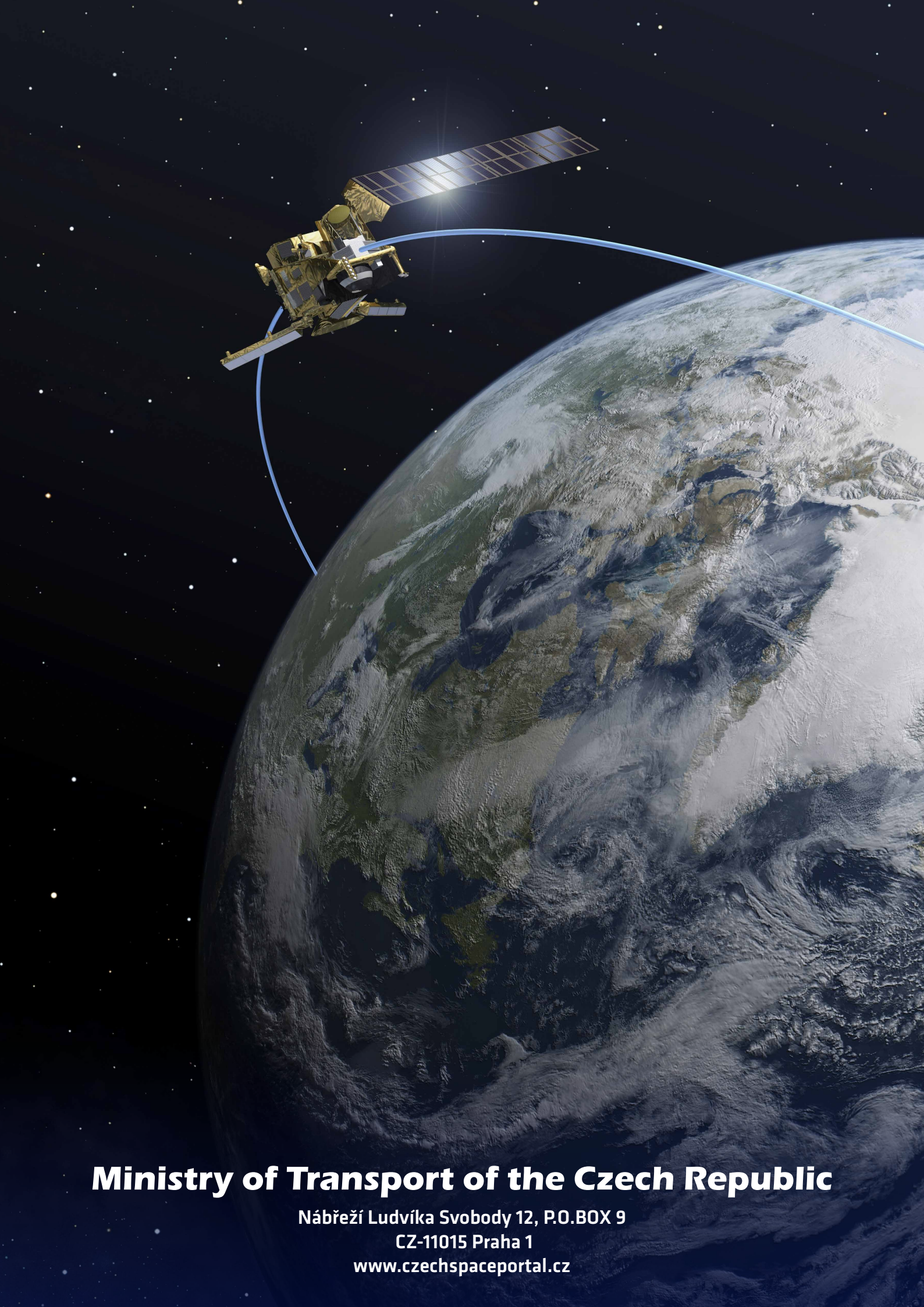
Company	Manufacturing	Software	Services	R&D	Testing
5M	▲▲▲▲▲▲			▲▲▲	▲▲
Advacam	▲▲▲▲	▲▲▲	▲▲▲	▲▲▲	▲▲▲
asphericon	▲▲▲▲		▲▲▲	▲▲▲	▲
ATC Space	▲▲			▲▲	▲▲
ATOS IT Solutions and Services	▲	▲▲		▲▲	▲▲▲
AVX Czech Republic	▲		▲	▲	▲
AŽD Praha	▲▲	▲▲	▲▲▲	▲▲▲	▲▲▲
BBT-Materials Processing	▲▲▲▲			▲▲▲	▲▲▲
BD Sensors, CSRC Space Division	▲▲▲▲	▲	▲	▲▲▲	▲▲▲
BizGarden		▲	▲	▲	
CGI IT Czech Republic		▲▲▲	▲	▲	▲▲
CleverFarm		▲	▲	▲	
Czech Aerospace Research Centre - VZLU	▲▲	▲	▲▲▲	▲▲▲	▲▲▲
daiteq		▲	▲	▲	▲
EGGO Space					▲▲
Ekotoxa			▲	▲▲	
esc Aerospace	▲▲▲▲	▲▲▲▲	▲	▲▲▲▲	▲▲▲▲
Frentech Aerospace	▲▲▲▲			▲▲▲▲	▲▲▲▲
GINA Software		▲▲▲	▲▲▲	▲▲▲	▲▲▲
Gisat		▲▲	▲▲	▲▲	▲
G.L. Electronic	▲▲▲		▲▲▲		▲▲▲
GNSS Centre of Excellence			▲	▲	
Honeywell International	▲▲▲	▲▲▲		▲▲▲	▲▲▲
ICZ		▲			
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		▲	▲	▲	▲
Space Systems Czech		▲▲▲	▲▲	▲▲	▲▲
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 Agrobiolology, 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	▲



Ministry of Transport of the Czech Republic

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