

"CRYOGENIC AND VACUUM SYSTEMS", SIA

- www.cvsys.eu
- info@cvsys.eu

• Vacuum equipment • Cryogenic equipment

Brief entity description

"CRYOGENIC AND VACUUM SYSTEMS" SIA was established by vacuum and cryogenic engineers in July 2014. The aim of the company establishment – research activities, development and creation of innovative equipment using vacuum and cryogenic technologies, coming up with innovative and state-of-the-art technical solutions. The company specializes in vacuum and cryogenic equipment development and production for aerospace and other industries.

The team of the company has had vast experience in creation and operation of space environment simulation technologies working in the area of Space Research and High-Tech.

Key technologies and technical facilities

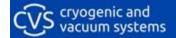
- Vacuum and cryogenic technology
- Vacuum and cryogenic laboratory

- Aerospace equipment thermal vacuum testing technology
- Thermal vacuum chamber

Current and planned developments with potential for use in space

- Mobile space testing facility
- Experimental testing facility to determine the influence of the thermal insulation helium saturation on the thermal conductivity of heat-insulating materials at low temperatures (for Latvian State Institute of Wood Chemistry)
- Universal measuring system that meets the requirements of the ECSS standards system (together with Ventspils University of Applied Sciences)

- Partner 1: ESA thermal vacuum facilities, thermal vacuum testing team, including stakeholders in helium temperature tests of optics, antennas, etc.
- Supplier 1: not required
- Customer 1: Aerospace industry small and medium companies, who are interested in space simulators and other space testing equipment, concerning, liquid nitrogen and helium temperatures, high vacuum, Sun simulation, leak detection etc.





Latvian State Institute of Wood Chemistry, Polymer Department

- www.kki.lv
- cabulis@edi.lv
 - Polyurethane materials from renewable resources
 - Rigid PU foams as cryogenic insulation material

Brief entity description

LSIWC founded in 1946 is a State R&D Institute providing research and testing in the field of wood and wood component chemistry and technology, polymer chemistry and biotechnology.

The Polymer Department, where proposed activity will be carried, has the responsibility for specification of raw materials for PUR and PIR, including biodegradable and recyclable foams, coatings and elastomers, PUR foam synthesis, calculation of thermal economy and environmental impact and consultation of end user of foams. The 2 topic of Polymer Department is development of PUR foam materials as cryogenic insulation. In the field of polyurethane LSIWC is leading Institute in Baltic. This position has been achieved by a number of international – EU FP7 projects FORBIOPLAST, BIOCORE, EVOLUTION and BIOPURFIL; bi-lateral commercial projects (incl. project with Ariane Group about R&D of external and inner wetted cryogenic insulation for the next generation Ariane launchers) and nationally funded research programs, mainly oriented on North Europe renewable raw materials such as rape seed oil or tall oil.

Key technologies and technical facilities

• PU materials from renewable resources

Rigid PU foams as cryogenic insulation material

• PU synthesis and production equipment

Cryogenic test equipment

Current and planned developments with potential for use in space

Development of foams with new generation blowing agents and environmentally friendly catalysts

Development of foams from renewable resources with cellulosin nanofibers as reinforcement

Desired contacts

We have already cooperate with Ariane Group (Bremen, Germany) and ESTEC (Noordwijk, the Netherlands)





Institute of Electronics and Computer Science

http://www.edi.lv/en/info@edi.lv

Research and development

Brief entity description

Institute has about 60 years of experience in development of HW and SW for different key applications: space, health, mobility, society, production, etc.

Main competence in space field includes:

- · extremely precise event timing, development of units for earth and space domains,
- supervised and automatic satellite image land cover classification, creation of dedicated algorithms and software tools to cluster, classify and detect changes in the optical satellite imagery. Developed approach is selected in Copernicus Masters Smart Farming Challenge by BayWa and is being prepared for an early warning system for crop protection. We have been accepted for the Copernicus Accelerator Program,
- compact electronically steerable antenna array systems for networking and data transfer.

Key technologies and technical facilities

- Universal Event timer producing extremely high measurement resolution
- monopulse radar, linear phase systems
- Unsupervised satellite imagery classification
- Key technical facility: laboratories of the institute with corresponding equipment

Current and planned developments with potential for use in space

- Current development 1: Event Timer devices for earth and space domains
- Current development 2: Classifying land cover in semi-automated mode from just the satellite imagery, without any training data
- Planned development 1: Fully automatic land cover classification; extending correct land cover (LC) classification with other data, e.g. emission calculations/attribution to particular LC type; adding altimetry models for biomass calculations.
- Planned development 2: 5.6 GHz electronically steerable antenna array based communication channel receiver/transmitter.

- Partner 1: for new applications of extremely high resolution timers
- Partner 2: working in EO downstream application area. We are looking for companies who have industry/application specific knowledge for integrating classified land cover data (including automatic change detection) in decision support models (agriculture, forestry, wetlands, greenhouse gas emissions, insurance)
- Partner 3: who want to implement antenna array secured radio link
- O Suppliers: RF chipmakers, FPGA and PCB manufacturers
- Customers: CubeSat and nanosatellite manufacturers





RD Alfa microelectronics

- www.rdalfa.eu
- lev.lapkis@rdalfa.eu

HiRel and RadHard EEE componets

Brief entity description

RD ALFA Microelectronics has 50 years of experience in design and production of HiRel, RadHard & ITAR free for EU, analogue IC's for aerospace and defense as well as special purpose microcircuits.

Originally founded in 1962, the company has always been a pioneer in Electronics.

The company's production includes:

- Operational amplifiers;
- Comparators;
- Amplifiers;
- Analog switches;
- Sample and hold circuits;
- Circuits for general application in electronics;
- Photodetectors:
- MIL. 1553 transceivers;
- Video systems for long distance transmission.

Key technologies and technical facilities

- Design and the manufacture of certified high reliability and radiation hardened microelectronics components for aerospace and defense equipment as well as special purpose microcircuits;
- Full design & production cycle of Integrated Circuits;
- All products are ITAR free, made in Latvia;
- Operational Temperature 60°C to +125°C.

Current and planned developments with potential for use in space

- Current developments:
- 1. Development of Operational Amplifier IC αRD108A (Contract Nr. 4000115491/15/NL/NDe CCN.01)
- 2. Development of QUAD Operational Amplifier IC aRD124A (Contract Nr. 4000119098/16/NL/SC)
- 3. Development of QUAD Comparator IC αRD139A (Contract Nr. 4000124213/18/NL/SC)
 Planned developments:
 - 1. Qualification of QUAD Operational Amplifier IC aRD124A for use in ESA space applications

- Prime contractors, buyers of hirel radhard components
- Customers of custom designed ICs
- Research institution for common developments







Engineering Research Institute "Ventspils International Radio Astronomy Centre" of Ventspils University of Applied Sciences

- www.virac.eu, www.venta.lv
- <u>romass@venta.lv</u>
 - Satellite Communication Subsystems
 Ground Station Services

Brief entity description

Satellite Communication – Subsystems

- -Space Segment Subsystems. Nanosatellite Communication Payload, e.g. High-Speed Communication Module (HSCOM)
- -Earth Segment Subsystems, e.g. Ground Station Modem for HSCOM

Ground Station Services (planned in the future)

- -Ground Station at Irbene RT-16 (new RT-12)
- -Ground Station Control Facilities and Services, e.g. Data Centers Storage and Processing, NOC's and Control Centers

Key technologies and technical facilities

RF PCB Design and Layout

Antenna Design

FPGA/VHDL programming

SDR programming (GNU Radio, Phyton, C)

Current and planned developments with potential for use in space

- Current/planned development 1: Development and production of the High-Speed Communication Module (HSCOM) for ESTCube-2.
- Current/planned development 2: Development and production a universal measuring system that meets the requirements of the ECSS standards system for Cryogenic and Vacuum Systems Ltd.

- Partner 1: Cryogenic and Vacuum Systems Ltd
- Supplier 1: Cryogenic Temperature Sensors for Space Application, e.g. supplier from www.qlobalspec.com.
- Customer 1: Latvian State Institute of Wood Chemistry









Riga Technical University

- www.rtu.com
- Kaspars.Kalnins@rtu.lv
- Composite structures: design, testing, prototyping
- NDT for space structures based on Vibration correlation technique

Brief entity description

The Institute of Materials and Structures (IMS) shares 15 years of experience in cooperation within EU industrial and academic partners within Framework Programme. This is based on experience and proven expertise accumulated from twenty-five FP research and coordination projects in fields of transport (including aeronautics) and material research. Most recent research projects granted within FP-6 and FP-7 for R&D in composite materials field: MAPICC 3D, DESICOS, INNOPIPES ALCAS, FRIENDCOPTER, COCOMAT, CASSEM, POSICOS, HYCOPROD, SANDWICH and others.

Key technologies and technical facilities

- Composite material testing and mechanical behavior characterization
- Testing equipment

- Composite material concept design, analytical and numerical analysis
- Software's

Current and planned developments with potential for use in space

- Design of launcher and satellite structures
- NDT for space structures based on Vibration correlation technique

Desired contacts

- Partner 1: Space structure manufacturer
- Supplier 1: Space asset insurance provider

RIGA TECHNICAL UNIVERSITY





Faculty of Civil Engineering



Fiber Optical Solution

- www.opticalsolution.lv
- <u>blumental@opticalsolution.lv</u>
 - Integrated Optic Elements (based on LiNbO₃) Fiber Optical Fiber and components FOGs, IMU and INS

Brief entity description

Research and Production Company

Currently SIA "Fiber Optical Solution" has a set-up production process for navigation grade Fiber Optic Gyroscopes (FOG) as well as FOG based Inertial Measurement Units (IMU) and Strapdown Inertial Navigation Systems. The company is vertically integrated. The production line includes:

- Division for fabrication of LiNbO₃ based Integrated Optic Elements
- Division for fabrication Polarization Maintaining Fibers (PANDA) and fiber optical components
- Division for assembling and calibration of FOGs, IMU and INS

A unique combination of all the technologies essential for FOG and FOG based systems production which considerably cuts net cost of the final devices.

Key technologies and technical facilities

Fabrication of LiNbO3 based Integrated Optic Elements

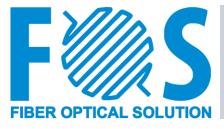
Fabrication of Polarization Maintaining Fibers (PANDA) and fiber optical components

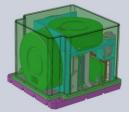
Production site

Laboratory (Clean Room up to ISO4)

Current and planned developments with potential for use in space

- Current/planned development 1: Space grade three axis fiber-optic gyro SpaceFOS
- Current/planned development 2: Other FOGs, IMU and INS for related application











HEE Photonic Labs

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Science ● Photonic

Brief entity description

Photonic is a spin-off of the University of Latvia, to commercialize optical systems for high resolution surveillance applications. The company is specialised in photonic engineering for space applications, covering SLR and space observation cameras.

Photonic Ltd leverages more than forty years of experience of its staff members. The team of Photonic Ltd has designed and produced laser ranging instruments since 1970s, including 1 m aperture instrument (LS-105) installed in Metsähovi (Finland), Potsdam (Germany), Ukraine (4) and Riga (Latvia). In 1995, the team demonstrated a portable SLR (PSLR), which was successful tested and delivered to Curtain University (Perth) in Australia.

Key technologies and technical facilities

Satellite laser ranging High resolution multispectral (VIS-SWIR) optical Systems High resolution and improved optical throughput hyperspectral (VIS-SWIR) optical systems

HEE Photonics has workshop, facilities and infrastructure to support its nominal operation. Workshop is equipped with rare and highly specialized apparatus

Current and planned developments with potential for use in space

Current/planned development 1: Satellite Laser Ranging
Current/planned development 2: High resolution multispectral (VIS-SWIR) optical systems
Current/planned development 3: High resolution and improved optical throughput hyperspectral (VIS-SWIR) optical systems

Desired contacts

Civilian, law enforcement and military high definition video surveillance on the land, sea and air, including piloted and unmanned aerial vehicle, in space industry and air optical communications customers





Foundation "Institute for Environmental Solutions" (IES)

- www.videsinstituts.lv
- dainis.jakovels@videsinstituts.lv
 - Earth Observation Remote Sensing Data-based Environmental Solutions

Brief entity description

IES is a privately established research and development institution based in Latvia. Environmental Remote Sensing (RS) and Earth Observation (EO) are IES's key focus areas. IES is a multi-disciplinary team of specialists in ecology, limnology, forestry, agriculture, chemistry, physics, technologies, and innovation management who apply EO and RS to develop data-based solutions in their particular fields of expertise.

Key technologies and technical facilities

- Automated workflows for the classification and change monitoring in different land cover classes
- Wide network or potential end-users and an approach for their need analysis
- ARSENAL an airborne laboratory consisting of multiple sensors (hyperspectral, thermal and a laser scanner)

Current and planned developments with potential for use in space

- Elaboration of the end-user focused needs-based approach for the definition of requirements for different EO-based solutions.
- Designing and implementation of a custom-made training program for business owners and top-level managers to demonstrate EO's political, operational, economic and environmental benefits.
- Development of automated workflows for the classification and change monitoring in different land cover classes (e.g. grasslands) to support the decision-making for sustainable management of natural resources.
- Development of the EO-based service for monitoring of lakes to support the decision-making for the improved management of lake ecosystems.
- Development of the EO-based support tool for rural spatial planning.

Desired contacts

- Partner with an expertise in data processing and development of data-based solutions for cooperation in further development and upscaling of current IES technologies
- Costumers interested in the above-mentioned EO-based solutions

INSTITUTE FOR ENVIRONMENTAL SOLUTIONS



Baltic Satellite Service

- www.baltsat.lv, www.ForestRadar.com
- ilze@baltsat.lv

• Forestry • Gas/utilities (transmission lines)

Brief entity description

Baltic Satellite Service is satellite imagery analytics company. It has developed fully automated technology for Sentinel-1 and Sentinel-2 imagery processing to provide immediate access to each image for further analysis, implementation in any ICT application and use in machine learning platforms. We provide weekly change detection, complete image history and the most frequently updated cloud-free basemap.

Key technologies and technical facilities

- Fully automated Sentinel-1 and Sentinel-2 data processing for further analysis
- Weekly change detection of clear-cuts, wind-falls, fires and artificial objects
- Cloud server & imagery archive (Latvia&Estonia)
- Cloud server & imagery archive

Current and planned developments with potential for use in space

• Current development 1:

ForestRadar Change Detection

- Detects clear-cuts, wind-falls, fire burnt areas, artificial objects
- Weekly change alerts (SMS, WhatsApp, e-mail)
- Small detection areas starting from 0.25 ha
- Very high accuracy 95%
- Result polygons delivered in any vector format
- Validated technology and accuracy

Current/planned development 2:

ForestRadar Cloud-free Basemap

- Completely cloud-free imagery
- Weekly updates for areas without clouds
- Metadata (date, time, satellite, etc.) available
- Extensive history with easy-to-use slider function
- Imagery basemap service to add in any Desktop or Web GIS application



European countries are sought, especially from Lithuania, Poland and the Nordic countries.

• Partner 1:

We are looking for a partner - forest GIS/ITC company interested to integrate ForestRadar in the forest GIS system to provide the most actual, unique forest analytics information about the forest. Partners form other European countries are sought, especially from Lithuania, Poland and the Nordic countries.

- Supplier 1: n/a
- Customer 1:

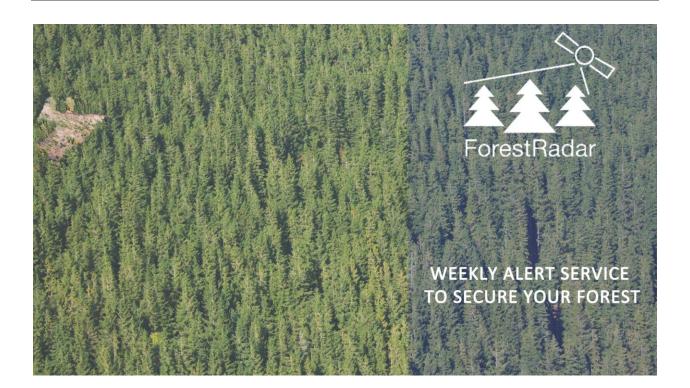
state and private big forest management and control companies

• Customer 2:

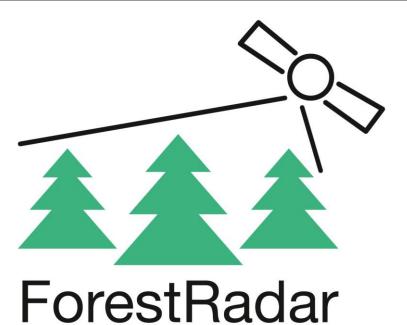
private forest owners including timber, pulp&paper companies, concession holders - highlighting global growth perspective $\frac{1}{2}$

• Customer 3:

transmission gas network management companies







C Baltic Satellite Service



University of Latvia

- www.lu.lv
- ingus.mitrofanovs@lu.lv

Higher educationResearch

Brief entity description

University of Latvia (UL) is Higher education and research institution. UL has a long-time experience in ground-based space observations e.g. GNSS RTK and postprocessing, Reference networks, GNSS observations analysis for Earth crust movement monitoring, Space weather etc. As well UL has constructed several SLR systems (one in Australia and two in Latvia) and performs SLR observations. UL has developed original instrument – Digital zenith camera with control and data postprocessing software for observation of Earth vertical deflections.

Key technologies and technical facilities

- Control and postprocessing software for astrogeodetic instruments
- Development of astrogeodetic instruments

Two SLR stations

Several GNSS instruments and gravity meter

Current and planned developments with potential for use in space

- Current development 1: Current ESA Project «Ground Station for Optical Observations of near-Earth Objects – Preparatory Study».
- Current development 1: Current project on Data processing software development for ESA laser location system
- Planned development 1: ESA Project «Ground Station for Optical Observations of near-Earth Objects».
- Planned development 2: Project on Ionospheric characterization by statistics analysis by of Latvian GBAS 11-year selective daily observations

- Partner 1: Institutions with expertise in anomalous refraction in atmosphere with aim to improve accuracy of digital zenith cameras
- Partner 1: Institution with expertise in spectral analysis of white light with aim to analyze atmospheric pollution
- Suppliers: Suppliers of high precision CCD matrices, high stability laser systems, lightweight telescopes
- **Customers:** Customers interested in SLR, digital zenith cameras, GNSS observations and GNSS reference networks infrastructure monitoring and analysis of GNSS (including GALILEO) data





SIA AXON CABLE

- www.axon-cable.com
- ipechonka@axoncable.lv

spaceaeronautics

Brief AXON CABLE description

Axon designs and manufactures innovative cables, interconnect solutions, connectors, mini-systems for high tech application, as well as an expert in plastic overmoulding technologies. It is a French company consists of worldwide subsidiaries. Axon' Cable offer custom designed solutions for the most requiring markets including aeronautics, automotive, electronics, energy, offshore, industry, medical, military, research and space. In Latvia it was founded in 2000, at moment there are 550 workers, turnover consider 29 mil Eur in 2018.

Key technologies and technical facilities

Micro/Nano D technology

 Low MassSpacewire , Bus Bar technology, MIL 1553 Databus

Satellite constellation cabling

Weight saving and reliable connection

Current and planned developments with potential for use in space

• Current/planned development 1: Building capacity and equipment for satellite constellation.

- Partner 1:
- Supplier 1:
- Customer 1:





Baltic Scientific Instruments

- www.bsi.lv
- office@bsi.lv
- Key current market area 1: X- and Gamma Ray Detectors (both single and pixel) and Spectrometers
- Key current market area 2: X- and Gamma Activation Analyzers for Materials Non-Destructive Analysis

Brief entity description

Baltic Scientific Instruments specializes in the development and fabrication of devices for spectrometric analysis based on semiconductor and scintillation radiation detectors. Our products are applied in multiple industries: nuclear power; environmental monitoring; geophysics and the mining industry; medicine and healthcare; research including space sciences; security systems and customs control and other spheres.

Key technologies and technical facilities

Key technology 1:

Semiconductor detectors development and fabrication

• Key technical facility 1:

In-house BSI has the following technologies for semiconductor detectors:
Slicing, dicing, drilling, lapping, polishing, etching, diffusion, vacuum evaporation, micro assembling, clean rooms, clean boxes, glow boxes

Key technology 2:

Analytical devices design and manufacturing

Key technical facility 2:

In house BSI has the following departments fully equipped: semiconductor detectors designer bureau spectrometry vacuum cryogenic electronics material analysis mechanical workshop

Current and planned developments with potential for use in space

- Current/planned development 1: CdZnTe pixel detectors, HPGe pixel detectors, HPGe segmented detectors
- Current/planned development 2: XRF analyzer for material analysis

- Partner 1:
- Supplier 1:
- Customer 1:







Eventech

- www.eventechsite.com
- katrina@eventechsite.com

• Space LiDAR, altimetry • Time transfer and synchronization

Brief entity description

Eventech is a Latvian success story being a technology leader and covering >50% of World market in Satellite Laser Ranging application with its extremely high accuracy event timing equipment, that provides unique measurement accuracy up to 2-3 picoseconds, and is equivalent to <1 mm in spatial resolution. Company was established in 2011 and holds 40+ years of technology development heritage. Eventech was awarded with ESA contract No. 4000115326/15/NL/NDe in 2016 for space hardware development "On-board implementation of the multi-purpose Event Timer". Project was co-developed with partner MDA UK Ltd. for resulting space grade equipment to be used in ESA Moon mission Luna-27 lander. 2 licences of initial product version were already sold to MDA UK Ltd. for commercial SpaceDrone mission, and Eventech is looking for next technology development and finance round. Our space grade technology provides extreme accuracy single-shot measurements for space LiDAR, 3D altimetry, as well as is adjustable for data transfer and synchronization for satellite constellations which replaces atomic clock. All functions in 1 device allow for minimization of costs and weight, increase payload options and significantly increase performance of satellites of all sizes.

Key technologies and technical facilities

Extremely accurate digital signal processing
 Time-tagging

Single shot 5-7 picosecond accuracy of space HW
 Environment and Rad-Hard tolerant

Current and planned developments with potential for use in space

- Space grade Event Timer: current ESA project is finalized and reported in February delivering EQM model of the space grade Event Timer board co-developed with MDA UK Ltd. for the needs of space altimetry/LiDAR tasks. Next stage is FM development with partner and mission launch.
- Other space applications: Eventech are looking for partners to develop technology for other space applications like:
 - Time transfer and synchronization (atomic clock replacement)
 - Satellite communications
 - Data transfer (Deep Space Optical Communications)
 - o Space drones / LiDAR
- Ground station network expansion: In April 2018 Eventech was invited to participate in ESA contract as subcontractor to DiGOS Potsdam GmbH to supply Event Timer equipment for new Satellite Laser Ranging station project in Tenerife, Spain. Eventech is looking to participate in more projects to develop SLR and communications network with satellites in ground segment as well.

- Owners of satellite constellations: our offer is to enhance functionality of all constellation with synchronization features to reduce costs on atomic clocks and other necessary technology for accurate time synchronization, and we can develop additional functionality depending on the tasks of the constellation (space LiDAR, altimetry, data transfer) thus providing an all in one solution to reduce costs and weight of the individual systems onboard;
- Producers for satellite constellation owners: our offer is to provide the producers with the working system, which is currently unavailable at the market, which we know not only from market



research, but also from support of our development by ESA, who introduce us to current EU and international level missions, where Eventech space technology is necessary and there's no alternative for the tasks described in point 1 above. This allows external producers (not working inhouse) to offer their ready solution against call or order of the satellite constellation owner;

- Suppliers of satellite subsystems for producers: since very rarely all subsystems are developed in-house either by constellation owner production department or external producer, very often there are multiple subsystem suppliers in one project, this is where we can also offer to be one of subcontractors not taking part in the project directly, but supplying the necessary technology license or equipment according to the technical specification. We have previous successful experience in selling already 2 space licenses for space LiDAR systems for SpaceDrone mission by Effective Space and MDA UK Ltd.;
- Producers of single satellite systems (universities, startups, research projects, specific space missions): Eventech is open for different types of collaboration including smaller projects or individual missions, where combination of current industrial and scientific knowledge can be combined with partners to develop additional features, which can then be introduced to commercial space, or to design a specific system for a smaller company, which wants to launch an satellite with specific functionality and/or to build own constellation in the future.
- Ground segment satellite communications: being a leader in SLR ground segment with its timing equipment Eventech is looking to establish new cooperation relationships with companies and groups operating in this field to ensure full network in both ground and space segment for satellite communications.



