

# SPACE DIRECTORY 2020

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SPACE DIRECTORY 2020

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# **D1** LUXEMBOURG, A EUROPEAN HUB FOR COMMERCIAL SPACE

The space industry has entered a new phase of development. No longer the province of nation states alone, the next generation of space technologies is being designed and built by a steadily growing community of entrepreneurs, scientists, researchers and engineers. Luxembourg is proving to be the European focal point for this 'new' space industry, and for good reason.

Today's space entrepreneurs do not only need to be supported, they need access to research, finance and technical services. But, crucially, they also need to be connected with one another, so they can collaborate on new and rewarding projects. The kind of work that will lead to the next generation of space technologies.

This directory is designed to aid that process of discovery and connection. It showcases the capabilities of the space industry already established in Luxembourg and extends an open invitation to potential partners from around the world. An invitation to explore the rich potential for international research and business relationships which exist in Luxembourg.

The space industry in Luxembourg is driven by a dynamic, multilingual and international work force. Many of the players presented here are well known beyond the borders of the Grand Duchy, their capabilities acknowledged by the international space community. And their numbers are steadily growing. In fact, since its first edition, this directory has charted the constant expansion and consolidation of the space industry in Luxembourg.

# A GROWING SPACE ECO-SYSTEM

For more than three decades, Luxembourg has been at the forefront of commercial and co-operative initiatives that have shaped a vibrant space economy.

Today, the Grand Duchy is home to approximately 60 companies and research labs, employing more than 840 people. The space sector's contribution to the nation's GDP is among the highest ratios in Europe.

Luxembourg's first foray into space came in 1985, with the creation of the Société Européenne des Satellites (SES), a landmark for satellite telecommunications and a global leader in this sector today. Further space-related services and businesses have developed alongside SES giving birth to an entire space industry in Luxembourg.

A second, important factor in positioning the country in the space sector was Luxembourg's accession to the European Space Agency (ESA), exactly 15 years ago, on 30 June 2005.

From then on, the space industry in the Grand Duchy has continued to grow and diversify, with three identifiable segments:

- The space segment, manufacturing of satellite and instrument structures, system integration of micro-satellites, electric propulsion for satellites, robotic payloads, in-space manufacturing, composites, RF payloads, FPGA.
- The ground segment, ground stations development, mechanical and electrical ground support equipment, communication networks, operations.
- The service segment, teleport services, satellite-based media and telecommunications services, risk management services, data analytics, environmental applications and services, aeronautical information services, analytics platform.

# RESOURCES FOR SPACE

The accelerating pace of technological progress and the emergence of privately-funded commercial start-ups in the space sector have encouraged Luxembourg to explore more deeply the long-term economic potential of space. Launched in February 2016 and led by the LSA, the <u>SpaceResources.lu</u> initiative positions Luxembourg as a pioneer in the exploration and utilization of space resources. With this initiative, Luxembourg has defined a framework to promote and support the exploration and commercial utilization of resources from 'celestial bodies' such as the Moon and asteroids.

The Grand Duchy is the first European country, and the second worldwide, to offer a legal framework on the exploration and use of space resources, ensuring that private operators can be confident about their rights on resources they extract in space.

In years to come, the focus on space resource exploration and utilization will generate attractive opportunities in areas including materials science, additive manufacturing, remote sensing, communications, robotics, data analytics and artificial intelligence.

In November 2019, at the ESA's Ministerial Council Space19+, it was agreed that Luxembourg will establish the European Space Resources Innovation Centre, to create additional opportunities for European and international innovation. The centre's initial focus will be on space resource extraction, processing and manufacturing to advance sustainable space exploration. ESA will join the Space Resources Innovation Centre as a strategic partner, broadening the scope of the activities started under the SpaceResources.lu initiative and giving it a European reach.

The SpaceResources.lu initiative also brings an ethical dimension to the project, seeking to ensure that space resources under its jurisdiction serve a peaceful purpose. It aims to ensure these resources are gathered and used in a sustainable manner, compatible with international law and for the benefit of humankind.



# CONNECTING SPACE AND NON-SPACE

Another key element of Luxembourg's strategy is to broaden access to space-related data.

Huge data sets, gathered from space, represent an essential source of insight and opportunity for the space industry. Meanwhile, these self-same data sets are being used by non-space businesses searching for better ways to work on planet Earth. Data is the point of intersection for many high technology businesses.

The Luxembourg Space Agency Data Center was created in 2019 to support businesses in Luxembourg with reliable, fast and intuitive access to data streams from the European Copernicus Earth Observation programme.

The detailed optical and radar imaging data which this project makes available can help us manage the environment, understand and mitigate the effects of climate change, and ensure civil security.

New products which make use of this data are of interest to businesses in many sectors including the environment, maritime, meteorology, agriculture, mobility, aviation and health, thus leading to a massive uptake of satellite-based products by end users.

# FINANCING THE SPACE INDUSTRY

As well as human resources and innovation, space development requires serious financial input.

No business is going to get very far without funding. Luxembourg's unique cross-border expertise in international finance and the development of dedicated funding resources, have been crucial factors in the creation of a sustainable space industry.

The country is the global hub for fund distribution and 19 out of 20 of the largest Private Equity firms have a presence in Luxembourg. Moreover, private-equity firms with focus on space and space-related industries, such as NewSpace Capital, have a presence in the country as well.

Together with a group of private and public investors, the Luxembourg Government has invested a stake in Orbital Ventures, an investment fund focused on early stage companies engaged in space activities.

Anchored in Luxembourg, the venture capital investment fund will provide equity funding for early stage space companies with ground-breaking ideas and technologies.

At the European level, Luxembourg contributes to the European Space Agency programs, which support the development of technology and of products, services and infrastructure in areas such as Telecommunications and Earth Observation.

These contributions open the door for players in Luxembourg to access the space market in Europe. This has stringent technical requirements but also involves questions of legitimacy, with access only being granted to those recognized by established players in the field.

ESA budgets also allow for the implementation of a national space program (LuxIMPULSE) and for young graduates from Luxembourg to enter the ESA training program (LuxYGT).

There are also projects of bi-lateral and multilateral cooperation with major space actors from outside Luxembourg.

# TALENT FOR SPACE

The Space industry needs a huge array of skills and talent. That's why, in fall 2019, the University of Luxembourg launched a two-year Interdisciplinary Space Masters program.

Set up in collaboration with the Luxembourg Space Agency, this Masters study program provides students with the engineering skills required by the burgeoning space industry, along with an in-depth knowledge of how to manage space-related business activities.

Using a project-based learning approach, graduates obtain a fundamental understanding of the scientific and technical basis, as well as business requirements of successful space missions. Courses touch upon space systems engineering, space operations, space resource utilization, space data mining and intelligent systems, satellite communications, and robotics.

# • THE FUTURE

The pace of innovation in space related technology continues to accelerate year on year. To make tomorrow's technical possibilities a reality requires practical support today.

In Luxembourg, the space industry finds a nurturing and supportive environment with an established community of high tech businesses, researchers, and entrepreneurs along with access to the necessary services and facilities.

This catalogue is intended to play a small part in that story, helping to connect potential collaborators from around the globe in Luxembourg, the place for space development in Europe.







AdwäisEO is a provider of data and information services for space agencies, companies, public institutions and research centers. Its mission is to provide secured and clever geo-intelligence source and repository. The company is your partner to make the best of the Luxembourg ICT infrastructure of data centers, HPC and networks:

- EO (Earth Observation from satellites) "user segment" infrastructure for environmental monitoring dedicated to governmental policy makers and enforcers as well as to economic operators to task environmental crisis reactions.
- Geographical Information Systems, by adjunction of systems for georeferenced data crowdsourcing, access to surveys' outputs, internet data mining, data analytics & data processing, edition & publication of information (references and alerts).

AdwäisEO is a subsidiary of ACRI-ST, a French company with other subsidiaries in UK and Canada.

# PRODUCTS & SERVICES

- Data collection, storage and management, long-term archiving, data hub, (pre-)processing, access and distribution (incl. portals and geo-catalogs), with focus on data security
- Development of georeferenced data system architecture and software
  EO service provider

# • TECHNICAL MEANS

- Storage and computing resources housed in a TIER IV data center in Luxembourg and TIER II-IV in the group
  - Cloud-Storage and Cloud-Computing for flexible and powerful processing and storage services using hybrid cloud solutions, cloud arrays and pools, elastic cloud storage...
  - A team of ICT specialists, remote sensing experts, data engineers in the team corroborated by environmental scientists in the Group.
  - A library of EO data processors tuned to the analysis of long-term series of geo-physical/chemical/biological/ecological data of the global world.
    Partners in the European, American and Australian scientific communities and space agencies.

# MAIN CUSTOMERS

Space agencies, European Ctommission, public institutions, private companies, research centers.

# MAJOR SPACE PROJECTS

- Setup, management and operation of all EO data (except Copernicus) long term archiving service for ESA;
- Setup, management and operation of the Collaborative Sentinel Ground Segment for Sentinel data for Luxembourg Space Agency;
- Deployment, management and operation of dissemination unit for Marine Forecast Products in the framework of Copernicus Marine Environment Monitoring Service (CMEMS);
- Processing and delivery of global ocean colour products in the framework of Copernicus Marine Environment Monitoring Service (CMEMS);
- Processing and dissemination of Coastal Erosion products;
- Development of a software framework for EO data processing (open source).

CEO Philippe Mettens CREATION DATE 2015 ORGANIZATION TYPE SME EMPLOYEES Total: 11

# R&D INTERNAL INVESTMENTS

€ 2.500.000 including hardware equipment and development of innovative EO data processing solutions in the cloud. QUALIFICATIONS & APPROVALS ISO 9001 under way

ADDRESS

adwäisEO 11, rue Pierre Werner L-6832 Betzdorf Luxembourg CONTACT direction@adwaisEO.eu



Aistech Space makes geospatial intelligence accessible for the real needs of monitoring and control, that both administrations, international organizations and companies have in a globalized world. Aistech Space hereby provides greater insight and understanding of what is happening anywhere on the Planet.

The company uses space and its ability to capture, manage and transform data from Earth, obtained through its own constellation of satellites; into continuous, recurring and accurate information to help improve the quality and standard of living on the Planet. The protection of the environment and the fight against climate change, the management of hydrological resources, the contribution to the development of agriculture in developing countries, the protection of the resources of the seas and oceans ... are some of the vectors that mark the identity and company values, as well as the technological developments.

# PRODUCTS & SERVICES

Aistech Space provides data fusion and analytical techniques to discover new synaptic connections between undiscovered patterns of information related to human beings, wildlife, business, etc.

Services include: aviation; agriculture; environment; energy and critical asset management; mining; fishing; security, defence and land control.

Some of the products are:

- · Space-based air traffic monitoring system.
- · Exploration and selection of new regions of interest for new activities and investments
- Critical asset monitoring system
- Crops monitoring
- · Predictive models for fishing and agriculture business
- · Land and coast monitoring system: presence and movements detection

#### CEO Carles Franquesa &

Guillermo Valenzuela **CREATION DATE** 2015 (Spain) 2017 (Luxembourg) ORGANIZATION TYPE SMF **EMPLOYEES** 

Total: 30 (in the group) Space: 30 (in the group) **R&D INTERNAL INVESTMENTS** € 3 M

#### **ADDRESS**

Aistech Space 9. Avenue des Hauts-Fourneaux L-4362 Esch-sur-Alzette Luxembourg www.aistechspace.com CONTACT **Carles Franquesa** info@aistechspace.com

# TECHNICAL MEANS

A 120-nanosatellite constellation will give Aistech Space in 2023 freedom to access to up-to-date imagery and data in near-real time.

The current technical means of the company are:

- · Two satellites of the first phase constellation in orbit and operative since 2018
- Own IoT communication system, onboard on satellites
- Own multispectral telescope internally designed
- Clean room for integration
- Electronic and optical laboratory
- 2 own ground stations
- 2 mission control systems, from where satellites are operated
- · Internal platform to manage and fusion several sources of space data
- Geospatial intelligence generation systems

# MAIN CUSTOMERS

- · Agriculture companies
- Mining companies
- Fishing companies
- Energy companies
- Administrations and Governments
- International organizations

# MAJOR SPACE PROJECTS

The company will have a constellation of more than 300 satellites in 2022. This will enable Aistech Space to provide high-quality space data which is affordable, accessible, reliable, and recurrent.

Aistech Space is developing internally its own software based on specific models that allow managing and processing a huge and recurrent volume of space data. This is the source of our new geospatial information that we can provide to have a better knowledge of the Earth. Aistech Space is designing as well its own satellites to ensure a high performance to provide the best service to customers with the constellation. In addition to the satellite platform, Aistech Space has also developed its own multispectral space telescope and bi-directional communication system, the basis to get a critical Earth data.

Since its creation, Aistech Space has the support of the European Space Agency.



Amphinicy Technologies (AT) is a valued provider of complex, tailor-made software solutions and all-round software support for the satellite industry. AT has been on the market for 20 years, with its Luxembourg office established in 2002. Amphinicy Luxembourg has high expertise in the fields of SatCom and Earth Observation. It provides enterprise solutions for big commercial and governmental projects.

Our primary field of expertise is in the ground segment solutions – Monitor and Control, Mission Operations, Simulations, Validation and Verification, EO data acquisition, Telemetry and protocol analysis.

# PRODUCTS & SERVICES

#### Products:

- Monica: a modern monitoring and control built on the latest industry standards. It comes in two versions – as M&C solution for local ground station (e.g. broadcasting teleport), or as ultra-scalable NMS solution for monitoring huge networks (e.g. VSAT networks, IoT, ...)
- Blink: an innovative software solution for ultra-fast EO telemetry acquisition and processing, using today's top-of-the-line commercial CPUs and GPUs and radically reduces costs, improves flexibility and maintenance.
- **SatScout:** an a handy, white-label mobile application, helps end users and professional installers in commissioning satellite VSAT terminals on site. It utilises augmented reality and mobile phone sensors.

#### Services:

Tailor-made software engineering and consulting services and all-round software support for the satellite and space industry.

# TECHNICAL MEANS

AT employs top-notch, highly-qualified ICT and space engineers with expertise in following ground segment domains:

#### SatCom solutions:

- Monitor and control systems
  - Ground segment simulations
  - In-orbit testing systems
  - Mission Operations,
  - Mobility beam roaming and load balancing
  - Embedded systems for ground segment
  - Secure optical communication (Quantum encryption)

#### Mobile solutions:

- · Antenna site survey and alignment (Augmented reality based)
- VoIP over satellite solutions
- Solar cells
- Professional UX visualization

#### Humanitarian projects:

- SatLearning
- SatMedicine
- Space Technologies / standards:
- ECSS compatible
- CCSDS protocol and standards expertise
- SPELL language and standard

Extensive and valuable experience working on demanding ESA projects as well as on solutions for industry leaders in fields of satellite operations, satellite services and satellite networks.

# MAIN CUSTOMERS

- International space and humanitarian agencies (ESA, DLR, UNHCR),
- Leading satellite operators and global satellite service providers/ integrators (SES, O3b, Qinetiq, Airbus DS)
- Teleports and space mission operation centres (RSS) and
- Satellite equipment manufacturers (OHB, Newtec, iDirect).

# MAJOR SPACE PROJECTS

Amphinicy Luxembourg provided software engineering services in following flagship projects:

- GOVSATCOM MOC
- Partneship with SES Networks
- Architecture and implementation of MOC
- Ground segment simulation

#### EDRS MOC

- System Orchestration
- Monitor and Control
- Simulation
- AG1

SPELL procedures and translations

#### COPERNICUS

AIV for Sentinel communications modules

#### GHOST

Embedded system for spread spectrum modem

#### NEWTEC

Validation platform and services for VSAT networks

CEO Frane Miloš

2002

SME

EMPLOYEES Total: 13

**TURNOVER 2019** 

Total: € 894.248

Space: € 894.248

**R&D INTERNAL INVESTMENTS** 

**Amphinicy Technologies** 

74. rue du Dix Octobre

L-7243 Bereldange

www.amphinicy.com

Tel: +352 691 754500

frane.milos@amphinicy.com

Luxembourg

CONTACT

Space: 13

€ 90 K

**ADDRESS** 

**CREATION DATE** 

**ORGANIZATION TYPE** 



Arspectra is specialized in the design and supply of Augmented Reality (AR) technology, with an initial focus on data visualization, teleassistance, and navigation in various applications. Arspectra's fully see-through AR data glasses and software project relevant data, instructions, and 3-dimensional images in the direct sight of the user. It allows to stay focused on the actual target and action while improving the performance of the professional user by the most natural and efficient integration of information and navigation data. This in-sight guidance naturally improves the precision, time-efficiency, cost, and outcomes of the various procedures.

By merging digital data and images into the real sight of its users is Augmented Reality set to bring important changes in current visualization, training, and navigation solutions. Yet to truly benefit of the advantages brought by merging digital data seamlessly into the reality, must the platforms also perfectly fit to the performance and physical parameters demanded by the applications and users.

Arspectra designs modular Augmented Reality hardware and software platforms, delivering the most performant and adapted solutions to its partners and customers. From lightweight Augmented Reality glasses for visualization and communication, up to high-performance navigation platforms, Arspectra's partners can select from various available solutions, to fully customizable developments. Supporting software plugins enable them to flexibly integrate their own software and applications.

# • PRODUCTS & SERVICES

Proprietary glasses are developed in close collaboration with end users and enable a very flexible integration of various sub-technologies. Arspectra offers adapted solutions leading to increased performances, lower costs, and better procedure outcomes to different applications and usage scenarios. Due to the technologic novelty, current procedure standards can be disrupted by unprecedented advantages and very competitive prices.

#### Arspectra's hardware developments:

- Design of medical AR glasses with adapted form factor and sensor technology
- Setup of intra-operative 3D tracking systems
- Design of mobile processing units for various AR-supported use cases

Arspectra's AR devices run a proprietary software platform that serves as base layer on which partners can develop their own AR software and algorithms. Next to the standard platform several functional plugins are available:

- Gesture tracking
- Voice control
- Cellular communication
- Up to military grade cybersecurity & encryption

Arspectra's team is highly experienced in the flexible co-development and integration of AR capabilities for visualization and navigation in existing or in-development technologies and operations.

# MAIN CUSTOMERS

- Medical technology companies and distributors
- Medical specialists and institutions
- · Industries with healthcare-related applications
- Research institutions
- Industries in need of AR-based remote assistance platforms
- Industries in need of AR-based visualization and navigation platforms

CEO Cédric Spaas CREATION DATE 2018 ORGANIZATION TYPE SME EMPLOYEES Total: 5-10

#### ADDRESS

Arspectra Technoport Admin Rue du Commerce L-3895 Foetz Luxembourg www.arspectra.com **CONTACT** Roman Brunner Tel: +352 691 722 744 oman.brunner@ arspectra.com

20

# ARVICOM

# • CORE BUSINESS

ArViCom Sarl develops cellular and satellite-based communication technologies and services into mobile Augmented Reality (AR) platforms in order to enable global remote collaboration based on AR visuals and interaction.

Classic verbal and video-based communications are often difficult to interpret by the remote expert and can be obtrusive to the action of the mobile agent. ArViCom enables remote visual validation, communication, expert overview, and senior interdisciplinary assistance through a secure, reliable communication, and access to expertise. It hereby offers improved procedure outcomes, a higher time efficiency, and reduced cost to unnecessary displacements of multiple agents and experts.

A first focus is placed on enabling a global reach to medical expertise for remote and mobile agents in humanitarian and remote medical use cases. Further applications to other industries are being developed through various partnerships. Each design transforms the end-user requirements and the technical and economic parameters into highly performant and adapted collaboration solutions with global access.

# PRODUCTS & SERVICES

The ArViCom devices are a combination of AR glasses, its mobile communication and processing units, and tailored software integrating global connectivity management.

As visual communication tool, it shares the same point-of-view observation as the mobile agent, but especially allows remote instructions and support to be delivered in the direct sight of the agent in action. It offers the user real-time visual interaction and support of remote experts, regardless of geographical location.

It offers a more natural interpretation of the discussion subject and case by the remote expert, and a hands-free visualization of the instructions by the user. It significantly improves the focus, comprehension, and success of active professionals.

These advantages are delivered on a high-performance technology with market-leading visualization, global and secure connectivity, designed to perfectly fit to the specific user actions and requirements.

# MAIN CUSTOMERS

- Humanitarian and remote healthcare agencies
- Telemedicine companies and agencies
- Ambulance agencies and services
- Research institutions
- Industries in need of AR-based remote assistance and collaboration platforms
- Industries in need of outdoor AR-based visualization and navigation platforms

# MAJOR SPACE PROJECTS

TeleAssist ESA project: Globally connected healthcare delivery for emergency and humanitarian needs ArViGuard ESA project: Space in response to the Covid-19 outbreak.

CEO Cédric Spaas CREATION DATE April 3th, 2020 ORGANIZATION TYPE SME EMPLOYEES Total: 1-10 Space: 1-10

#### ADDRESS

ArViCom Sarl Technoport Admin 20 Rue du Commerce L-3895 Foetz Luxembourg www.arvicom.eu CONTACT

Roman Brunner Tel: +352 691 722 744 r.brunner@arvicom.eu



Life science technologies and services in space, on planets and Earth.

# • PRODUCTS & SERVICES

- Revitalisation of deserted areas on Earth
- Bio Reactors
- Earth Observation
- Micro Gravity Experiments
- Support to manned missions to other planets
- Terraforming

# • TECHNICAL MEANS

In cooperation with national research we have various technical means available

MAIN CUSTOMERS

• Ministry of Foreign Affairs

- Luxembourg (LUXDEV)
- ESA
- LSA
- EU
- Private industry

MAJOR SPACE PROJECTS

Available upon request

ADDRESS

€ 200 K

CEO Jochen Harms

2018

5

**CREATION DATE** 

Large Enterprise

**TURNOVER 2019** 

Total: € 300.000

Space: € 300.000

**R&D INTERNAL INVESTMENTS** 

**EMPLOYEES** 

**ORGANIZATION TYPE** 

Blue Horizon 11, rue Pierre Werner L-6832 Betzdorf Luxembourg www. bluehorizon.space CONTACT Jochen Harms

Tel: +352 267890 4021 jochen.harms@bluehorizon.space



#### 24

25

Bradford Deep Space Industries develops technologies to export the NewSpace philosophy – and the increased value proposition it has already offered in LEO – to new applications in GEO, lunar and interplanetary space. This accelerates the cadence of scientific exploration and enables new business uses beyond LEO.

We offer **affordable**, **high-performance avionics for deep-space and Earth-orbiting smallsat** missions. The robust and performing nature of these makes them well suited for both deep-space and demanding LEO applications.

These avionics are a core part of the **Bradford Deep Space Explorer**, a multi-mission bus that can take payloads of 30kg from the ground to anywhere in the inner solar system for an order of magnitude lower cost than, and less than half the development time of, traditional deep space missions.

# PRODUCTS & SERVICES

- An avionics solution a modular system suitable for deep-space or high-performance smallsats in the 10-100kg (dry) mass range with a 5+ year lifetime, consisting of any combination of:
  - robust flight computer
  - high performance computational platform (with full-scale OS)
  - power control and distribution unit (that supports high-power loads such as electric propulsion, radar payload or drive motors)
  - high-power radio transponder with navigational ranging that works out to 1AU
  - an attitude control system (easy-to-deploy reaction control actuator for non-magnetic environments)
  - An affordable deep space platform, Explorer, that can take over 30kg of payload from the ground to anywhere in the inner solar system within 3 years from start of project to arrival at destination.

# MAJOR SPACE PROJECTS

Design and developments of deep-space avionics.

CEO

Alexander Finch CREATION DATE 2016 ORGANIZATION TYPE SME EMPLOYEES Total: 10 (in Luxembourg this year) Space: 10 R&D INTERNAL INVESTMENTS

Bradford Deep Space Industries

9 Avenue des Hauts-Fourneaux L-4362 Esch-sur-Alzette

www.bradford-space.com

€170 K

**ADDRESS** 

Luxembourg

CONTACT Alexander Finch Tel: +352 691 240985 alexander.finch@ bradford-space.com

Belval Technoport

Founded in 1976, CGI is among the largest independent IT and business consulting services firms in the world. With 77,500 consultants and other professionals across the globe, CGI delivers an end-to-end portfolio of capabilities, from strategic IT and business consulting to systems integration, managed IT and business process services and intellectual property solutions.

CGI delivers secure, mission-critical space systems including data processing and exploitation, satellite communications, orbit determination, command and control, ground segment engineering, navigation and situational awareness.

CGI's desire remains more than ever to **help space players in Luxembourg** increase the value of their investments and, more specifically, to use space data to solve their business challenges and drive business opportunities.

# PRODUCTS & SERVICES

Our end-to-end services provide industry and technology expertise, solutions, frameworks and tooling to enable our clients to drive business agility, competitive advantage, transformation and cost efficiencies. At CGI, we believe that having a deep understanding of our clients' business is absolutely fundamental to us being able to deliver the best possible service.

We are supported by a large group, with 40 years of experience, composed by more than 1000 experts in the space industry. We are able to **capitalize on this global experience locally** 

- We've helped ensure navigation systems are secure, reliable and fit for purpose.
- We provide network, service and business management systems to many of the world's communications satellite operators; commercial and military.

# MAIN CUSTOMERS

European institutions, financial sector, private & public sectors, space agencies, industries...

# MAJOR SPACE PROJECTS

#### In Luxembourg:

- Support the development of custom gateways for GomSpace's Autonomous Operations Platform
- Implementation of a tool that controls satellites

#### **Global references:**

- 200+ satellite missions supported by CGI software
- Designed and delivered the security solution for Europe's future space-enabled Air Traffic Control Network
- Largest independent supplier of security systems for Europe's Galileo satnav program
- Delivered the Galileo satellite constellation control facility that will control all of Galileo's 30 satellites
- Support the European Space Agency's (ESA's) climate change initiative
- European leader in military satellite communications ground segment systems
- Manage the maintenance and evolution of ESRIN's earth observation ground systems
- Designed, delivered and deployed the core infrastructure for Galileo Public Regulated System (PRS)

Guillaume Schott CREATION DATE 2020 ORGANIZATION TYPE Large entreprise EMPLOYEES Total: 77500+ Space total: 1000+ Luxembourg: 200+ Space in Luxembourg: 5 TURNOVER 2019 Global: 11.5 billion \$CAD QUALIFICATIONS, APPROVALS

ISO 9001, ISO 14001 under way

# ADDRESS

CEO

CGI 7, zone d'activité de Bourmicht L-8070 Bertrange Luxembourg www.cgi.com/luxembourg CONTACT Guillaume SCHOTT Tel: +352 265 147 1

guillaume.schott@cgi.com



Established in January of 2015, CONTEC is a spin-off company from KARI (Korea Aerospace Research Institute) and is offering Space Ground Station Services and Satellite Image Processing & Application Services as well as a whole ground integration solution. At CONTEC, we strive for excellence and we think that it is only with talented people that this goal can be achieved. Currently, 33 engineers in two different offices in Korea and Luxembourg as subsidiary, and half of them have a superior education degree, along with great experience in the space industry. With these services and powerful manpower, we are trying to provide a meaningful value for prospective customers in the New Space Age.

#### CEO

Dr. Sunghee Lee, CONTEC HQ in Rep. of Korea GENERAL DIRECTOR

Mr. David Johansson, CONTEC Space Sarl in Luxembourg

### CREATION DATE

2015 (Rep. of Korea) 2019 (Luxembourg) ORGANIZATION TYPE SME

### EMPLOYEES

Total: 33 in HQ / 3 in luxembourg including board member TURNOVER 2017 Total: €1.9M in HQ R&D INTERNAL INVESTMENTS

€ 200,000 (2018) and € 250,000 (2019) in HQ

QUALIFICATIONS & APPROVALS

City of Esch prize for innovation 2006

#### ADDRESS

#### CONTEC

9, Avenue des Hauts-Fourneaux L-4362 Esch-sur-Alzette

Luxembourg www.contec.kr

#### CONTACT

Mr. David Johansson (General Director of CONTEC Space Sarl) Tel: +352 661 513 300 david@contec.space

# PRODUCTS & SERVICES

At CONTEC, we are currently providing space ground station services through our own ground station and partners' ground stations all over the world. Our engineers also created CONTEC ONE, a platform where satellite communications become child's play.

In addition, we offer satellite imagery analysis and application services based on raw satellite image data by applying deep learning algorithms in order to detect several specific objects depending on the needs of our customers. We especially focus on applications for urban change detection of Smart Cities and try to provide the best service possible for local governments and therefore participate to urban development.

# • TECHNICAL MEANS

#### Hardware

- Design and integration of ground station
- Small antenna manufacturing for ground station
- Whole MRO service for ground station

#### Software

- Monitoring and Control Software for ground station
- Multi-mission operation system for ground station
- · Web-based platform and cloud technology for ground station service
- High-speed satellite image processing
- Calibration and validation (CAL/VAL) of satellite imagery
- Object detection on standard satellite image data

# MAIN CUSTOMERS

As the number of satellite (especially small-sized satellites) launches has continuously increased, the space market is open to many new businesses and its scale is growing simultaneously. CONTEC is taking advantage of this opportunity and aims at those satellite operators and satellite launchers who need to connect with their satellites.

As for its satellite imagery application service, CONTEC is especially working with local governments but does not restraint to this category.

In conclusion, we can summarize our current and potential customers as below:

- KARI (Korea Aerospace Research Institute)
- Agency for defense department in Republic of Korea
- Several government research institute and commercial companies
  in Republic of Korea
- Sejong local government (1st world smart city) city in Republic of Korea
- KSAT in Norway
- RBC Signals in USA
- Perigee Aerospace and South Launch in Australia (for launch mission)

# MAJOR SPACE PROJECTS

CONTEC's own ground station is located in South Korea, more precisely in Jeju Island and benefits from an ideal environment (antenna picture). However, as it is showed on the map below, our plan is to rapidly scale up our network by building new ground stations all around the world. Especially in:

- Northern Europe, North America and South America
- CONTEC will make the 2nd ground station in Finland by the end of this year.



CREACTION group is an engineering office dedicated to industrial innovation and in particular integrating Space and innovating technology in non-space industrial sector. Its main assets are creativity to develop new concepts with strong added values and technology transfer, mainly through ESA Technology Transfer. The original approach of CREACTION is to consider four management sectors (marketing, techniques, finance and IPR) at the same time development for innovative success. And since three years, CREACTION is managing the ESA TTPO program of the Grand Duchy of Luxembourg. CREACTION has a proven expertise in the innovative development of complex information systems and products. It relies on scalable and reliable components. CREACTION can develop fast interfaces between existing components and data sources to allow quick early stage system validation. Sometimes the demonstrator structure is robust enough to be kept for definitive use.

# PRODUCTS & SERVICES

- Management of innovation advise and follow-up of companies new development projects strategic audit, integration of technological skills and the accompaniment of an innovative idea to a commercial product.
- Management of technology transfer audit of the owner or the request, implementation of TT specification: nuclear, medical, automotive, cybersecurity... and new materials sectors.
- Management of private/public research centre assessment of R&D areas for the purpose of commercialization and spin-off activities.
- Study conception of new products (modelling 2D-3D, prototyping and pre-series) to have a better vision of the future commercial product.
- "Calculate the risk, save on time and money, your objective is our own".
- The Creativity Centre's objective is to create sustainable commercial business, focussed on high quality processes and products. It addresses on space and non-space customers, offering short-term creative immersion.

# • TECHNICAL MEANS

- Rapid prototyping competencies
- Validation and optimization tools for new applicative markets
- Space Creativity Centre for ESA BICs and industrial sectors

# MAIN CUSTOMERS

- Private entreprises: Renault, Beckaert, John Zinck, Areva and other SMEs
- ESA/TTPO, ESRIN/EAC
- R&D centres

# MAJOR SPACE PROJECTS

- ESA/TTPO since 2013
- The Technology Transfer Network consists of brokers across Europe who are working to identify novel uses for technology that has been developed as part of the ESA space program. They are also interested in identifying technologies in other sectors that could benefit the exploration and utilization of Space.
- EM-SAT IAP -DEMONSTRATOR 2018: Integrated Secured Crisis Management & Information Platform for Hazardous Industrial Facilities.
   EM-SAT is a monitoring, supervision and managing crisis center sold as a service, offering a complete toolbox of features for SEVESO sites.
- Improvement of new nuclear cask.
- HIGHT TEMPERATURE SMAs to reinforce the security in transport Improvement of new nuclear cask.
- FIT4GROW program. Project stock energy. Creativity sessions in the field of transport with the aim to help think, identify, create and validate a new path of diversification in the utilities sector.
- ERASMUS: Utop' Textile. Stimulation of ideas through innovative sessions, using high space technologies/process available during school training
- INTERREG PROGRAMME PUSH GR: SHAPE YOUR PRODUCT DESIGN Accelerator program to optimize and validate project/idea/service by integrating high value-added space technology. Organization of 2 workshops by year.

Jean-Paul Henry CREATION DATE

CEO

1993 ORGANIZATION TYPE SME EMPLOYEES Total: 1+3 in-house consultants Space: 1 TURNOVER 2018 € 191.815 of which € 180.315 in the space field R&D INTERNAL

# **INVESTMENTS 2018**

€ 45.000

#### ADDRESS

CREACTION 67, rue du Château L-1329 Luxembourg Luxembourg www.creaction.eu CONTACT

Jean-Paul Henry Tel: +352 42 77 21 jp.henry@creaction-int.eu



Cybercultus focuses on providing the entertainment, cultural heritage and sustainable tourism sectors with innovative digital communication and content solutions by inventing the RAMO "Reactive and Adaptive Multimedia Objects" semantic layer that insulates content producers from the technical complexity of interactive communication and user immersive applications. The Cybercultus "eBusiness Solutions for the Art industry (eBSA)" aim at valorising entertainment, educational, cultural and tourism assets, as well as fostering human creativity through interactive, social and immersive technologies. Today, Cybercultus works with large industries and organisations in Europe and develops partnerships with public and private actors specialised in social / immersive applications (for TV programmes, cultural heritage, travel portals) and in GIS technologies (for spatial and temporal mapping of cultural, environmental and tourism geo localised multimedia assets).

#### CEO

Farid Meinköhn CREATION DATE 1999 ORGANIZATION TYPE SME EMPLOYEES Total: 5 TURNOVER 2017 Total: € 330.000 R&D INTERNAL INVESTMENTS 2017 € 90.000

#### QUALIFICATIONS & APPROVALS

City of Esch prize for innovation 2006

#### **ADDRESS**

#### Cybercultus

12, avenue du Rock n Roll L-4361 Esch-sur-Alzette Luxembourg www.cybercultus.com **CONTACT** Farid Meinköhn Tel: +352 265 456 54 Fax: +352 265 456 24 farid@cybercultus.com

# • PRODUCTS & SERVICES

#### Culture

- eBSA expo suite (editor & run-time): 2D/3D organisation & display of cultural assets in virtual spaces
- eBSA museum suite (editor & run-time): cultural assets and art collections management, valorisation and geolocalisation

#### Tourism

 eBSA travel suite (editor & run-time): customised travel offers, virtual visits and planning, onsite support and on the move LBS application
 Entertainment

#### ntertainmen

- eBSA iTV suite (editor & run-time): immersive TV quiz show, immersive travel TV magazine, community TV content making
- eBSA iTV libraries: advanced interactivity enactment based on the RAMO model

# TECHNICAL MEANS

RAMO (Reactive and Adaptive Multimedia Objects): based on the MPEG 7 open standard, development of platform independent software editors targeting "web, mobile and iTV" social & immersive applications. **Open standards and technologies** HbbTV, HTML5, MPEG 2, MPEG 7, XML, Java, PHP, Android, iOS 23

# MAIN CUSTOMERS

#### Entertainment, culture and travel partners

SES, ARD / RBB (Germany), ORF / TW1 (Austria), RTBF (Belgium), ORT(France), Musée Albert Kahn (France), Instituto Latin America de Museos (Costa Rica), Agence culturelle luxembourgeoise (Luxembourg), European centre for eco agro tourism (The Netherlands), Siel Canada (Luxembourg), SAN Parks (South Africa), Peneda-Geres National Park (Portugal), Sense Inverse (Belgium)

#### Industrial partners

Thomson Multimedia (France), Philips (The Netherlands), GeoVille (Austria)

#### **Public research partners**

LIST (Luxembourg Institute of Science and Technology), ESA, INRIA Lorraine (France)

# MAJOR SPACE PROJECTS

#### **Entertainment & cultural applications**

- Real Time Immersive TV Show (RTI-TVS): enables TV viewers to participate from their homes, via avatar representations, to an aired TV quiz show
- Immersive Satellite TV (IMSATV): allows TV viewers, via an avatar representation and using the remote control, to discover the rich content associated with an aired tourism TV documentary or magazine
- Community TV Content Making (COTV): enables TV viewers to partner with TV channels, co-producing TV content using smart phones for HD video capture & upload onto the TV programme and using networked
- TV facilities for team editing, publishing and rating of the co-produced TV content
- **Tourism application**
- Online tourism à la carte: Trip à la Carte is an online tourism platform enabling travellers to build "à la carte" from a map their own trip, selecting in each locality the activities, the lodging and the local transport of interest. It also provides them with LBS (Localisation Based Services) while on the move.
- Sustainable, environmental and safe tourism in protected areas (SENSA):

   a range of facilities for trip planning in natural parks, for "on the move" itinerary processing with offline routing and geo-localised awareness information, for travellers' safety with interactive/geo-localised satellite SOS messages and alert news from the park, and for optimal distribution of travellers in protected areas with real-time field observation reporting by visitors acting as preservation agents. The SENSA facilities make extensive use of advanced satellite communication, navigation and Earth observation capabilities.
- Real-time interactions with parks authorities focus on nature preservation and travellers support using advanced satellite communication, navigation and earth observation.



Databourg Systems SARL-S is a start-up company created as a spin-off from University of Luxembourg, SNT Centre in 2017. The company's core competencies is data analytics using signals/data form Satellite Communication Networks. Leveraging on its patent pending technology, it aims to be a leading provider of data analytic services to satellite operators. Moreover, it is developing environmental monitoring techniques using signalling data from SatCom networks.

# • PRODUCTS & SERVICES

Databourg Systems is focused on offering two different services:

- Data Analytics using Data from Communication Satellite Network: Databourg Systems' patent pending and proprietary technologies enable to provide satellite terminal localization and network performance forecasting services.
- Opportunistic Environmental Monitoring: Using Satellite signalling data, the company is developing environmental monitoring services, more specifically rainfall estimation and flash flood map services in collaboration with its partners.

# • TECHNICAL MEANS

Patent pending and proprietary technologies

# MAIN CUSTOMERS

- Satellite Operators
- Space Agencies
- Insurance Companies

# • MAJOR SPACE PROJECTS

- ESA kick-start CERASAT
- RAFAEL PoC (UniLu/FNR)



Localization map of a Satellite Terminal in a specific search region

#### CEO Ahmad Gharanjik CREATION DATE 2017 ORGANIZATION TYPE SME EMPLOYEES 3

#### ADDRESS

Databourg Systems S.A R.L-S 9, rue du Laboratoire L-1911 Luxembourg Luxembourg **CONTACT** Ahmad Gharanjik ahmad.gharanjik@databourg.com



Specialised in aerial photography, measures and aerial films via the use of drones, DRONELAB is designed to provide innovative solutions in the implementation of specific board equipment to meet the demands of the scientific, industrial, energy, environmental, surveillance and land management fields.

In order to achieve these goals, we not only use preconfigured drones that are suitable to perform missions with high added values, but also develop our own drones that are equipped with specific solutions to best meet the needs of the missions.

# PRODUCTS & SERVICES

The fields of application for which the use of drones have an added value

- are numerous. Here are some examples:
- Environmental missions IR camera
- Scientific research IR camera
- The industrial world IR thermal camera
- Humanitarian missions ortho photogrammetry
- · Security and police missions IR thermal camera

Among these fields of application, here are some examples:

- Aerial photography
- Cinematographic shooting
- Aerial thermography
- Precision farming
- Field mapping
- Photogrammetry
- Work inspection
- Historic site inspection
  - Surveillance of industrial sites
  - Flooded areas inspection
  - · Surveillance of road and rail infrastructure
  - Telecommunication antennas inspection
  - Surveillance of forest and detecting starting fires
  - Inventory of objects floating on water streams

# TECHNICAL MEANS

In the scientific world especially, there is a countless number of sensors that could be implemented through drones. It is therefore essential to develop ways to make them fully functional when installed on our drones. In order to achieve this, DRONELAB invests in the acquisition of a 3D printer and is surrounded by professionals in advanced areas such as electronics, infra-red custom development, material cutting with laser, sintering, 3D printing of special resins, carbon fiber, titanium, and also aeronautical aluminum.

# MAIN CUSTOMERS

- Luxembourg Institute of Science and Technology (LIST) Environmental missions
- University of Liège Scientific research
- Rigo & partners ingénieurs conseils Monitoring of construction site
- University of Luxembourg

# MAJOR SPACE PROJECTS

• Member of European InterReg program GRONE

ADDRESS

CEO

2013

SME

Total: 2

Space: 2

€ 250.000

**EMPLOYEES** 

Jean-Marc Simonis

ORGANIZATION TYPE

**R&D INTERNAL INVESTMENTS** 

**CREATION DATE** 

#### CONTACT

Jean-Marc Simonis Tel: +352 661 190 561 jean-marc.simonis@dronelab.lu



e-Xstream engineering, part of Hexagon's Manufacturing Intelligence division, has the most extensive and deep technology to leverage this approach for industrial multi-material use (plastics, composites, metal, rubber, foam, ...). With more than 17 years of experience in materials, our solutions are the standard in modelling plastics from injection molding and additive manufacturing, and the most referred solution for composites and data management.

Our products, Digimat and MaterialCenter support the **ICME**\* approach.

With our state-of-the-art technology, in-house material experts and ecosystem of technological partners, we strive to blend the boundaries between digital and real world in all industry segments.

\* ICME: Integrated Computational Materials Engineering offers engineers across industries the ability to use materials and manufacturing processes efficiently thanks to a multi-scale design approach connecting materials, manufacturing and final products.

# • PRODUCTS & SERVICES

Reducing development time and cost of composites materials is high on the agenda for all manufacturers to remain competitive and penetrate market. A powerful approach to achieve that is Integrated Computational Materials Engineering (ICME) – or in simpler words – an integrative design approach where materials, processing and final products are connected through various scales.

Digimat, state-of-the-art multi-scale material modeling software supports the ICME approach by offering engineers 100% confidence in design and simulation, and to virtually predict the behavior of composite coupons (unnotched, open hole, filled hole).

When organizations apply this method to composite materials, they quickly realize the amount of materials data that needs to be captured and validated, whether generated from virtual or physical testing. Our data management software, MaterialCenter enables organizations to trace, access and secure their data.

# TECHNICAL MEANS

Digimat allows:

• Material engineering: through the micromechanical modelling approach to predict the nonlinear, anisotropic, rate-dependent behavior of complex multi-phase composite materials

- Structural engineering: through the coupling of Digimat material models with commercial CAE codes to accurately predict the behavior of composite structures taking into account the influence of process simulation
- Process Simulation: Digimat provides process simulation solutions for the additive manufacturing of polymers. It helps process engineers to anticipate manufacturing issues and optimize part quality by predicting the relative influence of the various process parameters.

Digimat is used to study the thermo-mechanical behaviour of material lab samples and predict the influence of the material microstructure on the product end-performances. Through partnerships with the aerospace sector, e-Xstream has developed the appropriate tools and extensive know-how for modelling materials typically involved in lightweight aerospace composite structures.

#### Material Center allows:

- Dashboards for quick evaluation of materials data management projects and management oversight.
- Work request and approval workflow to keep projects on track.
- All materials-related processes, input and output documented through
   Audit Trail.
- · Process-oriented, automation approach to data management.
- Robust and intuitive interface for data search, retrieval and comparison for all data types tabular, curves, images, etc.
- Web-based interface to data management processes that enable distributed data authoring and maintenance.
- Built-in job queue interface that optimizes execution of materials simulation processes.
- Proven scalability to 100,000s of processes and petabytes of data to meet the needs of engineers for years to come.
- Integrates commercial Databanks for accessing critical materials data.

# MAJOR SPACE PROJECTS

- CompoSelector: Multi-scale Composite Material Selection Platform with a Seamless Integration of Materials Models and Multidisciplinary Design Framework
- PSIDESC: Predictive Simulation of Defects in Structural Composites
- EXTREME: Dynamic Loading Pushing the Boundaries of Aerospace Composite Material Structures
- Prediction of the thermo-elastic strength properties of tri-axial composite materials
- Multi-Scale Modelling of Advanced 3D Composite Materials for Ultra-Light Antenna Application
- APC, aiming at improving conception of aerospace structure through the use of composite materials
- VirtualComp, aiming at developing powerful and robust modeling tools for complex industrial composite structures using continuous fiber

CEO

2013

Dr Roger A. Assaker

ORGANIZATION TYPE

Intelligence Division)

**TURNOVER 2017 or 2018** Total: € 13.3M

e-Xstream engineering Z.A.E Robert Steichen

L-4940 Hautcharage Luxembourg

www.e-xstream.com

info@e-xstream.com

(part of Hexagon Manufacturing

**CREATION DATE** 

Large entreprise

**EMPLOYEES** 

Total: 69

Space: 15

Space: € 3M

**ADDRESS** 

CONTACT

Mira Toth Tel: +352 261766 07

5, rue Bommel



EarthLab Luxembourg was formed in 2015 to offer innovative services for professionals managing multiple hazards, integrating earth observation data with varied sources of information, such as aerial imagery, crowdsourced pictures, social media, trade and markets datasets, internal exposure databases or ground sensors. With extremely innovative techniques like Deep Learning or Computer Vision and data-streams processing capabilities, we are helping to identify, treat and proactively act on underlying factors generating cumulative effects. EarthLab Luxembourg creates tailored applications directly oriented on the end-user needs applying the adequate technologies and extraction of information. We believe that platforms combining latest technological developments, artificial intelligence, Big Data and interoperability will standardize and bring a new definition of data centric projects and a new community of users. With our modular approach we can propose and run advanced services related to risk exposure for insurance, strategic assessment and asset management concerns in the public and private sector. Thanks to our science skills and earth observation insights we offer a new vision on multiple risks that span beyond any geographical border and for which the interlinked consequences are underestimated. The concept of the Platform as A Service is based on our dedicated hybrid cluster allowing our customers to use our solutions to create new products, optimize their losses in case of extreme event and adapt their strategies using predictive analytics. We offer a clear valorisation of the data by creating multiple potential uses into one single central toolbox.

GENERAL MANAGER Thomas Friederich CREATION DATE 2015 ORGANIZATION TYPE SME

#### ADDRESS

**EMPLOYEES** 

1-10

EarthLab Luxembourg 49, rue du Baerendall L-8212 Mamer Luxembourg www.earthlab-galaxy.com/ luxembourg/en/ CONTACT

Benjamin Hourte Chief Technical Officer Tel: +352 621 490 643

# • PRODUCTS & SERVICES

We develop a highly flexible and data centric platform that allows to deal with the landscape of global risks. Our solutions are built on high-power computing to support decision makers in the event of risk manifestations, providing detailed, timely and relevant information. We provide to our customers a remote access to push their data and run their code on our data farm. A key advantage is that with our platform there is no ICT workload to setup, configure and maintain. We provide a dynamic vulnerability scoring in terms of operations, resilience of communities, supply chain and environment. We use in-house simulations models using analytics & cognitive science to anticipate the next landscape of major risks. We enrich risks models by creating information thanks to automatic recognition into massive datasets in order to give context to risk assessment. We also aggregate in real time thousands of datasets from socio and economic indicators allowing us to predict consequences of extreme situations (natural disaster, manmade accident, political event, pandemics, etc...).

Our different product lines provide end users with a central representation of the risks based on data feeds agglomeration and simulations based on different scenarios with a correlation with the local exploitation and the insured assets.

# TECHNICAL MEANS

EarthLab Luxembourg implements its proper products and services relying on its private infrastructure. The implemented technologies are following the "Big Data" paradigms and fully subscribe to an elastic model ensuring future large scale capacities.

- Data analysis: integration of data from multiple sources, whether structured or not, in real time or not, such as Earth observation, weather, social networks, financial and economic indicators, terrestrial sensors, connected objects and proprietary data.
- Data Modelling: one of our priorities is to correlate different raw data to extract relevant information, KPIs, or metrics. Our data processing resides in the development of automated treatments, learning mechanisms and a cognitive approach.
- Our Max-ICS platform: we create solutions that are directly oriented to the needs of end-users, integrating next-generation artificial intelligencetechniques. Our customers can easily access and manage their uses by interacting with an ICT infrastructure fully developed and operated by EarthLab Luxembourg.
- We work in **Lean Start-up mode** to limit the risks associated with the creation of new services. This concept is frequently used in the ICT sector for the development of Minimum Viable Product (MVP), using key success factors or KPI, and to limit its implementation cost.

# MAIN CUSTOMERS

The current EarthLab Luxembourg's client base is insurance companies, financial services and industrial companies as well as brokers with regard to environmental risks and large industrial complexes with regard to man-made hazards.

We are processing highly innovating projects in collaboration with our four shareholders, coming from geo-information, telecommunications and ICT: Telespazio France, e-GEOS, HITEC Luxembourg and POST Luxembourg Group. We are acting in the open source and open data communities to share data science knowledge for communities.



Located in the heart of Europe, Luxembourg is a unique gateway for European and international markets, limiting risks due to its secured regulatory frameworks in the financial sector and the management of sensitive information. Luxembourg's ideal international environment offers competitive advantages that meet clients' requirements for clear warranties in terms of risk management, service levels and quality. EBRC (European Business Reliance Centre) manages the whole supply chain and is thus able to offer a unique one-stop-shop to its clients, ranging from data centre services to integrated cloud computing and ICT managed services. A wide range of services is accessible in a full or selective operational model to support advanced ICT operations in a 24/7 mode.

Through its presence in the financial market, EBRC has over the years developed a unique know-how in the design, implementation and operation of critical systems. These quality and security requirements are considered as best practices within EBRC and are required for clients managing sensitive information (e-business, eHealth, International Institutions, Defense and Public sectors, Industry, Entertainment, Space, etc.).

# • PRODUCTS & SERVICES

#### **Trusted advisory services**

• Guidance and advisory in the management of operational risks, information security, business continuity, IT services and IT outsourcing.

#### **Trusted managed services**

- ICT agile services to boost your business
- End-to-end management of sensitive ICT infrastructures, from design and implementation to the daily operations.

#### **Trusted cloud Europe**

- Technology as a Service, enabling fast and secure business deployment
- Flexible infrastructure management through Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) and Hybrid Solutions.
- KaaS (Containers using Kubernetes as a Service) to support DevOps environment.

#### Trusted security Europe

- ICT security services from advisory till risk management and operations. Trusted resilience services
- Overcome increasing risks and uncertainty
- Design, implementation and management of business continuity solutions coupled with the management of ICT security based on resilient infrastructures.

#### Trusted data centre services

- Advanced ICT environment to support your business
- Full Data Centre Services based on redundant Tier IV certified infrastructures for maximum security and availability.

# TECHNICAL MEANS

#### Trusted data store

- · High performance store array for high density IOPS
- Large array for high data volume
- Long-term secured storage
- Highly secured data store mirrored arrays within multitenant Tier IV certified data centre
- Specific expertise for regulated architecture: PCI DSS Level 1 (payment industry), National regulation (CSSF), ISO 27001 reference

#### Trusted data processing

- Efficient top backup as a Service modality
- Dynamic processing resources for data manipulation
- Database services: MS SQL, Oracle, PostgreSQL, MySQL, Maria DB, NoSQL, Mango DB
- Strong partnership for big data development and high performance computing resources on study

#### Trusted data access

- High internet connectivity for ground broadcast Large and various Telco Pop- Teralink for European broadcast, Tier 1 Telcos for intercontinental broadcast
- High data availability thanks to Multi-site access & Multi-site store
- Trusted data privacy
- Advanced expertise of data privacy deployment Business impact assessment -Business continuity - Disaster recovery plan - Privacy impact assessment - Regulation compliance

# MAIN CUSTOMERS

The main client synergies within the space sector and its actors are established with POST Luxembourg, AdwäisEO, SES, Signal Horn (formerly Digitaria) and EarthLab Luxembourg to complete a space value chain integrating capture, transfer, treatment and dissemination. EBRC's Tier IV certified data centre are located next to the SES ground base in Betzdorf. They are open and advanced facilities bringing efficiency and flexibility to our continuous value chain with operational integrations that build strong and deeply integrated projects. This Data Centre has been accredited by ESA and is ready to host ESA projects.

# MAJOR SPACE PROJECTS

- EBRC for the final infrastructure, cloud providing compute, storage and data treatment
- The GSE project in Italy with Signal Horn for application layers and field deployment is dedicated to support and control production volume of renewable energy with a captured value coming from each wind, solar or hydraulic production point to create a complete follow-up and adapt the central production within a smart grid approach.



CEO

2000

SME

Yves Reding

**EMPLOYEES** 

Total: 210+

Total: € 77 M

Total: € 1.2 M

ADDRESS

Luxembourg

www.ebrc.com

5, rue Eugène Ruppert

L-2453 Luxembourg

Jean-François Hugon Tel: +352 26 06 1

marketing.support@ebrc.com

EBRC

**R&D INTERNAL** 

**INVESTMENTS 2018** 

**OUALIFICATIONS & APPROVALS** 

ISO 9001, ISO 20000, ISO 27001.

ISO 27018 (BP), ISO 22301, ISO

14001, ISO 50001, PCI DSS Level 1,

PFS of support (CSSF), Data Cen-

tres 3x Tier IV Design Documents,

2x Tier IV Facility Constructed

**TURNOVER 2019** 

**CREATION DATE** 

**ORGANIZATION TYPE** 



CEO Cédric Lorant **CREATION DATE** 2001 **ORGANIZATION TYPE** SME **EMPLOYEES** Total: 20 Space: 16 **TURNOVER 2019** Total: € 1.785.000 Space: € 1.585.000 **OUALIFICATIONS & APPROVALS** ECSS-ST-Q-70-08C and ECSS-ST-Q-70-38C **R&D INTERNAL INVESTMENTS 2019** € 350.000

#### LEGAL ADDRESS

EmTroniX 150, rue de Niederkorn L-4991 Sanem Luxembourg www.emtronix.lu OFFICE ADDRESS EmTroniX

5 rue Bommel Bâtiment SISA L-4940 Hautcharage Luxembourg CONTACT

Cédric Lorant Tel: +352 26 58 17 50 cedric.lorant@emtronix.lu EmTroniX is a dynamic Luxembourg company providing technological expertise, engineering design, prototyping and production services in advanced electronics and embedded software to customers involved in the most demanding technological fields such as Space, Aeronautics and Automotive. EmTroniX engineers gather an extensive and exclusive experience in the latest and most advanced technologies. Using state-ofthe-art development tools, they are able to offer the most objective and cost-effective solutions to all customer's technological needs. EmTroniX offers the significant advantage of having in-house all the skills and experience required to handle different technical aspects of engineering development projects. EmTroniX is expanding year after year. We are very proud of having been active participants in the development of the first Luxembourg S-AIS receiver embarked on both LEO satellites and the ISS, but also a major contributor to the first private commercial satellite (4M) orbiting around the moon. EmTroniX has also developed a high-performance FPGA-based combined ADS-B / AIS receiver for terrestrial and space applications and a Proximity-1 SDR autonomous receiver. EmTroniX is currently involved in the development of high capabilities SDR payloads for various customers.

# PRODUCTS & SERVICES

- Custom FPGA-based system developments: design, implementation, IP coding
- VHDL development and simulation
- In-house printed circuit board CAD design, production, assembly and validation
- Analogue / digital / high-power electronics design
- RF electronics, receivers and transmitters (up to Ka-Band) design & implementation
- Advanced Digital Signal Processing / Software Defined Radio / Real-time embedded software generation / system modelling using rapid prototyping / optimized auto coding

# TECHNICAL MEANS

- Vector Network Analyzers (Dual & Quad ports, up to 24GHz)
- Spectrum & Signal Analyzers (1.8GHz / 7GHz / 43 GHz)
- RF Arbitrary Signal Generators (3GHz / 20 GHz)
- High Speed RF DSO (4CH 20 G s/s 6 GHz)
- Low & Medium Speed DSO
- (4CH 100 MHz/300 MHz/500 MHz/1 GHz/1.5 GHz)
- Noise source
- Multi Channels Electronics Loads
- Battery Simulator (5A, 20V)
- Thermal Chamber (-30°/+130°C)

- High Precision LPKF RF Laser PCB prototyping Machine with Galvanic through hole plating
- Vapor Phase Oven

# MAIN CUSTOMERS

Automotive component manufacturers and research institutions, aeronautic development industry, space system developers / integrators (ESA, OHB LuxSpace, Thales Alenia Space Deutschland, SES-TechCom, QinetiQ, Airbus, Kleos, OQ Technology, SkyfloX, University of Grenoble).

# MAJOR SPACE PROJECTS

- ADSB Digital Receiver -SABIP (Thales Alenia Space Germany) -Multi-Channel FPGA Based ADS-B receiver.
- Proximity-1 Autonomous Transceiver (ESA) Software Defined Radio transceiver for Mars-Orbiter autonomous telecommunication HUB (automatic signal modulation, frequency and baud-rate detection).
- AIS payload PathFinder 2 (LuxSpace) Transceiver: AIS RF receiver and processing (HW/SW), BPSK downlink emitter (modulator and RF up converter & pre-amplifier) OBC Interface & Batteries Protection, Solar panel power tracker, antenna deployment, OBC & interface power supplies, A to D interfaces
- 4M Manfred Memorial Moon Mission or Lunar Pathfinder (OHB) First commercial demonstration satellite orbiting the Moon. Work: OBC interface, RF modulator, battery protection & charger, harnesses and full satellite integration
- COLAIS LuxAIS (LuxSpace) Design & Implementation of the Columbus AIS Receiver: AIS RF receiver and processing (HW/SW), FPGA (Synthesized processor, Custom IP, Digital Signal Processing) & mechanics
- VesselSat, 2 satellites (LuxSpace / Orbcomm) Dual chain AIS Receiver Payloads, Tele-Command Receiver GPS module integration Bus Interface Board: Magnetorquer control electronics, magnetometers, gyroscopes, A/D interfaces, payload remote enable, antenna deployment, power electronic. Sun Sensor: 3-Axis Solar position sensors
- Multi-beams Synchronous multi-channels GNSS receivers (LuxSpace)
- HERA's Juventas Radar CubeSat (GomSpace) First Low Frequency Radar probe of an asteroid. FPGA-based Digital Signal Processing board. Power-optimized design.
- MACSAT IOD (OQ Technologies), development of the Electronics Payload hardware transceiver as well as the Demonstration Terminals.
- Triton-X (LuxSpace OHB) is the next generation multi-mission microsatellite platform: High-Speed Downlink. FPGA-based downlink modulator and RF including SSPA for the Satellite Avionic.
- Generic SDR (ESA) Design, development, test & qualification of flexible multi-platform Software Defined Radio payload for wide-range telecommunication purposes like for CubeSat, Micro-Sat and Small Sat platforms.









CHAIRMAN & CEO Rolf Mathias Alter CREATION DATE 1984 ORGANIZATION TYPE Large Enterprise EMPLOYEES 1.052 TURNOVER 2018 € 176.5 M

#### QUALIFICATIONS & APPROVALS

AIRBUS Group, The BOEING Company, EASA Part 145, EASA Part 21 G, EASA Part 21 J, IRIS, DNV marine certification, DIN 6701 Class A1, EN 15085-2, ISO 14001, ISO 9001 & SAE AS 9100, NADCAP

#### ADDRESS

EC-Group 2, rue Benedikt Zender (Z.I.) B.P. 24 L-6468 Echternach Luxembourg www.euro-composites.com CONTACT

#### LUNTAC

Dipl.-Ing. Christoph Herrmann Chief Sales Offices (CSO) Defence & Space Technology Mobile: +49 160 3600 137

# 

The EC-Group is a global player in the field of advanced and demanding composites products. We offer technical solutions based on advanced composites adapted to the needs of our customers: we can develop solutions to your exact requirements, or we manufacture products precisely to your specifications. Just how it fits best for you and your production strategy.

# PRODUCTS & SERVICES

- Advanced composites parts production
- Machined and/or formed composite parts
- Design and manufacturing of tools and moulds
- Completion of drop-in parts (inserts, reinforcements, extruded profiles, priming, grinding, coating)
- Autoclave processing
- Resin infusion and resin transfer moulding processes for interior and structural parts
- Final assembly of complete units
- Kevlar®, Nomex®, Glassfibre and Aluminium Honeycomb (with or without perforation)
- Sandwich panels (flat and curved structures)

# TECHNICAL MEANS

- RI resin infusion
- Autoclave
- FSW friction stir welding
- Coating
- CAD/CAM software
- CNC milling centers
- Sandwich panel production
- Honeycomb production
- Quality control and measurement tools
- Laboratory for mechanical tests
- X-ray chamber
- Cleanrooms ISO 7 & ISO 8
- Ultrasonic inspection

# MAIN CUSTOMERS

ESA, QinetiQ Space, Airbus Defence and Space, Boeing, Thales Alenia Space, MDA Corporation, Deutsches Zentrum für Luft- und Raumfahrt (DLR), SENER

# MAJOR SPACE PROJECTS

#### **Ongoing Projects**

- PROBA-3: Aluminum structural panels, CFRP solar array substrates, Solar Array substrates
- PROBA-3: Optical bench
- ALTIUS Mission: Design & Engineering, Aluminium structural panels, CFRP solar array substrates, Bracketry, S/C environmental testing, S/C transport container
- SMILE MISSION: Payload Module Structure
- Skyflox: Radome design & manufacturing, final assembly
- 3D Honeycomb for Curved Structure Manufacturing
- ATHENA Mission: Low temperature radiator panel with embedded heat pipe

#### Heritage

#### ESA PROJECTS

- EUCLID: Aluminum External Panels manufacturing
- PROBA Next (P200): Aluminum structural panels, CFRP solar array substrates, Solar Array substrates
- Small Geo: CFRP and Aluminum Structural Panels, Transport boxes and Heat Pipe Test Panel for the Platform
- PROBA-V: Aluminum structural panels, CFRP solar array substrates, Solar Array substrates
- BepiColombo: High Temperature Aluminum Core (Flight Hardware)
- Perforated Hoenycomb core: Qualification of perforated honeycomb types for Space application
- Quartz-Glass honeycomb core and sandwich panels: RF transparent glass fibre sandwich panels

#### STUDIES

- Light-weight, torsion-free structural panel with excellent surface
   properties
- Development of CFRP radiator panels with integrated fluid tubes
- Manufacturing of Honeycomb panel with embedded heat pipes for telecommunication satellites
- Study for structural CFRP thermal conditions

#### PROJECTS

- Abrixas: Support panel for solar arrays
- BIRD: Solar Array support panels
- Herschel & Planck: Sub-Platform Test Dummy and Solar Panel Test Dummies
- Astrosat100: Structural Panel, Aluminum face sheets
- TET: Solar array panels, Payload panel
- DLR: DESIS CFRP box for ISS
- BOEING: parts for CST 100



Foersom Sàrl is specialist in engineering and flight service for multirotor UAS applications.

# PRODUCTS & SERVICES

Flight Service and UAS applications for:

- · Aerial photography and filming for advertisement and media producers
- Architectural photography from above
- Inspection of industrial installations
- Thermographic inspection
- Inspection of solar photovoltaic power stations
- Geographic surveys, geodata imagery and planning

# TECHNICAL MEANS

- Foersom Sàrl has the knowledge and expertise in R&D engineering and project experience to bring your UAS flight project from idea to flying solution.
- Flight license for Luxembourg and Germany. UAS multi-rotor flight with up to MTOW 15 kg.

# MAIN CUSTOMERS

- Photographers and video media producers
- Construction companies and architects offices
- Environmental survey offices
- Public administrations



Richard Foersom CREATION DATE 2010 ORGANIZATION TYPE SME QUALIFICATIONS & APPROVALS UAS flight license for Luxembourg and Germany

#### ADDRESS

Foersom 13b, avenue Guillaume L-1651 Luxembourg Luxembourg www.foersom.com/fase CONTACT Richard Foersom Tel: +352 661 458 165

info@foersom.com





Inverto is a leading supplier of broadcast reception equipment, remote monitoring and video streaming solutions serving major DTH operators across the world.

Leveraging on its strong R&D and software capabilities it has secured a leading position in a host of new breakthrough technologies including Ka/Ku Co-locate LNBs, dCSS, SAT>IP, cloud IoT, multiscreen video transcoding and mABR streaming.

Inverto has over 28 years of experience in the industry and is supplying millions of LNB, dishes, dCSS multiswitches and accessories every year to leading brands and tier-1 DTH operators. Inverto's broader expertise in digital video broadcast covering antenna, feed and microwave PCB design as well as mobile and real-time software in confined embedded environments allow for a truly holistic view on product design, sustaining innovation and guaranteeing world class quality.

# PRODUCTS & SERVICES

- LNBs: A supplier of choice for leading DTH operators across the world; the broadest product range in the industry covering Universal, band stacking or Unicable (dCSS) solutions for C band, Ku and Ka bands for single or multiple satellite reception (monoblock LNBs)
- Satellite Dish Antennas: A comprehensive range of satellite dish antenna and mounting accessories designed and engineered to meet the strictest performance and durability standards
- SatPal<sup>™</sup> and SatWatch Satellite installation and IoT remote monitoring solutions.
- SAT>IP Server/Client devices: The first SES-certified SAT>IP Server in the world
- Video transcoding and secure streaming solutions for IPTV / OTT services and mABR streaming gateways for 4G/LTE/5G-Satellite integration applications.
- Multiswitches: Most optimized and field proven designs of Unicable (dCSS) cascadable switches
- Accessories and Coax cables; RF splitters, combiners, power inserters and amplifiers for satellite TV distribution

# TECHNICAL MEANS

- RF measurement and test equipment signal generators, spectrum analyzers, oscilloscopes, noise figure meters, logic analyzers, DVB-S2 modulators
- Satellite signal measurements
- High speed PCB design and simulation tools
- Mechanical and product design tools
- Software development (embedded firmware, Linux, Windows, iOS, Android, cloud and web software applications)
- Systems engineering expertise

# MAIN CUSTOMERS

- DTH operators worldwide eg TataSky, Multichoice, OSN, Airtel, Polsat, and M7
- Distribution and OEM partners worldwide

# MAJOR SPACE PROJECTS

#### ESA projects:

- MLNB: Development of a Multi-Input Element Low Noise Block (LNB) or MLNB, mounted on a small parabolic reflector and reducing the impact of interferers from adjacent satellites. The MLNB allows signal reception with a small antenna, facilitates antenna pointing as well as reception of multiple satellites.
- SVC over satellite: Validation of multi-standard video decoding algorithms (AVC+HEVC) with DVB-S2 VCM over satellite by using Ku and Ka frequency bands.
- HTS DBS: A study of the context of a possible satellite-based content distribution network system and the development of a demonstrator of the key techniques required for such a product, including file transfer to caches and the cache management techniques.

Christophe Perini

**CREATION DATE** 

CEO

# ADDRESS

€1.5 M

#### Inverto 18, Duchscherstrooss

L-6868 Wecker Luxembourg www.inverto.tv CONTACT

**QUALIFICATIONS & APPROVALS** 

CE. RoHS. SAT>IP. SAT-5G

Christophe Perini info@inverto.tv



GomSpace Luxembourg is a subsidiary of the GomSpace Group established in 2017 with the aim to develop a centre for operations in Luxembourg as a service for nanosatellite (mega)-constellations on behalf of customers of the GomSpace Group.

The company will develop unique internal products, tackling the challenges of scaling operations efficiently for large constellations. Our developments will rely on a modern approach to software and include automation and AI techniques where relevant.

# PRODUCTS & SERVICES

Based on our internal software products, GomSpace Luxembourg will provide our customers with the following services:

- Satellite constellation operations incl. monitoring, maintenance, scheduling and continuously improving on-orbit performance.
- Payload operations and data delivery services to our customer's end-users.
- End-to-end network management from satellite sensor to space and terrestrial transport networks to final data and delivery to the end-users.

Our customers will be satellite operations/owners with a need for a strong organization to deploy, operate and maintain the complete technical infrastructure needs for the customer to efficiently deliver their space-based data and services to their customers, i.e. the end users.

# MAJOR SPACE PROJECTS

GomSpace Luxembourg is newly established, but its employees are people coming from the GomSpace group and the wider space community representing many years of experience with satellite development and space operations. Our initial focus is on the development of the Mega-Constellations Operations Platform product that will be the core of the service business.



#### ADDRESS

GomSpace Luxembourg 11, boulevard du Jazz L-4370 Esch-Belval Luxembourg www.gomspace.com CONTACT Lars Krogh Alminde

COUNTRY MANAGER

ORGANIZATION TYPE

Eduardo Cruz

2017

SME EMPLOYEES Total: 15 Space: 15

**CREATION DATE** 

alminde@gomspace.com Tel: +352 621 356 810



GovSat is a satellite operator and service provider. It is a public-private joint venture between the Luxembourg government and SES, the world-leading satellite operator. Its mission is to provide secure, reliable and accessible satellite communication services for governments – addressing the demand for connectivity resulting from defence and civilian security applications. Dedicated entirely to governmental and institutional users, the GovSat-1 satellite features high-powered fully-steerable spot beams and an X-band Global beam. It is equipped with anti-jamming features, encrypted telemetry and control, and uses assured frequencies. This enables an array of applications such as connectivity for theatres of operation, interconnection of institutional or defence sites, border control, ISR, as well as various types of communications for air, land and maritime missions.

# PRODUCTS & SERVICES

GovSat's portfolio of services covers key fields of expertise: capacity and coverage, anchor and teleport services, secure hosting solution and end-to-end solution offerings.

On the capacity side, GovSat-1 is a secure satellite capability featuring high-powered fully-steerable spot beams in X and Mil Ka-Band, and a Global X-Band beam. It is equipped with anti-jamming features, encrypted telemetry and control (TT&C), and is offered on a non-preemptible basis. Due to its orbital position at 21.5° East, GovSat-1's coverage reaches from 50°W to 90°E and 70°N to 70°S. GovSat offers capacity for short and long-term lease from MHz, transponders through to beams with full steering rights in X and Mil Ka-Band.

The architecture of GovSat-1 allows flexibility on how to anchor the traffic. Customers can use their own anchor facilities or the GovSat's high resilience anchoring service, as prime or back-up. It is also possible to offer access to other partners' teleports within the footprint.

# TECHNICAL MEANS

GovSat-1 is positioned at the 21.5 East Orbital position with coverage areas spreading over Europe, Middle East, Africa and South West Asia with maritime coverage for the Atlantic, Baltic, Mediterranean and Indian Oceans.

The satellite has a so-called "global X-band beam" and fully steerable X- and mil Ka-band spot beams that will provide communication capabilities within the mission area as well as back to the associated headquarters. This means that the satellite coverage area can be fully adapted to the requirements of the user.

GovSat-1 features high-powered fully-steerable spot beams, an X-band Global beam and a total of sixty-eight transponder equivalent units. It is equipped with anti-jamming features, encrypted telemetry and control, and uses assured frequencies.

# MAIN CUSTOMERS

GovSat is a new satellite communications capability dedicated to governmental and institutional users. It addresses the demands for connectivity resulting from defence and civilian security applications.

# • MAJOR SPACE PROJECTS

GovSat-1 was launched in January 2018 and is operational since March 2018.

Lifetime: >15 years







#### CEO Patrick Biewer CREATION DATE 2015 ORGANIZATION TYPE SME EMPLOYEES Total: 18 QUALIFICATIONS & APPROVALS ISO 9001, ISO 27001, NATO FSC, EU FSC, LUX FSC

ADDRESS

GovSat Château de Betzdorf L-6815 Betzdorf Luxembourg www.govsat.lu CONTACT

Melanie Delannoy Tel: +352 710 725 329 melanie.delannoy@govsat.lu



GRADEL develops special purpose machines for the space sector and has extensive expertise in the realization of complex equipment. We have a complete range of Mechanical Ground Support Equipment equipment to handle S/Cs or parts of them.

GRADEL also provides ultra-lightweight structures for flight hardware under the Trademark xFKin3D. The process Innovation xFKin3D is a highly flexible, versatile designed, cost-effective and sustainable endless roving winding fibre composite technology. A wide range of products or applications has already been realized for different industries and market segments. Flight hardware qualification (TRL8) for Space is planned for early 2021.

GRADEL realized in 2019 a Market & Technology study for materials used in lightweight. A large potential is predicted for constellations and launchers. Telecommunication and Scientific S/C have interest in high-end applications. The technology has a fully digitalized process for design finding, simulation and optimization. Winding is realized with a 9-axis robot equipped with an own developed end effector.

# PRODUCTS & SERVICES

#### MGSE:

GRADEL produces Self Levelling dollies with AGV systems, Hoisting Devices, Lifting Devices, Integration Stands and adapter rings with CoG measurement for the assembly integration and test of satellites and CATR facilities to test the antennas of S/C.

#### **ULTRA-LIGHTWEIGHT STRUCTURES:**

Fasteners or so-called "Brackets" are predestined for all possible shapes and 3D applications. The range extends from simple parts to relatively complex parts, which may also include additional functions and features. High stiffness in one direction, while spring effect in another direction on the same part.

Mass savings up to 70% for same stiffness and mechanical resistance compared to optimized aluminium components can be reached. Dimensions are not limited. Dispensers of Ø2 m can be realized. The minimum quantity required is 1, but the process is economically effective for a production of up to several thousand parts per year. Multi-axial static and / or dynamic load cases are covered by the standardised process.

Wherever you reach the limits with conventional methods and still want to reduce mass by keeping same mechanical characteristics, xFK in 3D is the solution.

# TECHNICAL MEANS

- Engineering office with highly qualified Phd & engineers (mechanical, electric, automation, regulation and simulation of dynamic systems, FEM-analysis)
- Software: SOLIDWORKS, FEMAP, NASTRAN, MATHLAB, SIMULINK
- Assembly and test workshop of 800 m<sup>2</sup> x 10 m high
- 9 axis winding robot for endless wound ultra-lightweight structures
- Strong collaboration with LIST for certification and qualification of the process technology

# MAIN CUSTOMERS

Airbus Defence & Space, OHB, Thales Alenia Space, Euro Heat Pipes, Luxspace, GOMSpace, One Web, Ariane Group, Rocket Factory and ESA

# MAJOR SPACE PROJECTS

Communication: Alphabus, E-3000, EDRS, Electra, Eurostar Neo, Neosat, SGEO, ELECTRA Science: Euclid, ExoMars, JUICE, Solar Orbiter, Proba III Earth Observation: MTG Others: Moon mission M4 Ongoing project: Winding structures with fibers made of lunar regolith (collaboration with RWTH Aachen & ESA)



#### CEO Claude

Claude Maack CREATION DATE 1965 ORGANIZATION TYPE SME EMPLOYEES Total: 65 Space: 25 TURNOVER 2017 Total:  $\in 11.7 \text{ M}$ Space:  $\in 4.7 \text{ M}$ Rab INTERNAL  $\in 0.6 \text{ M}$ INVESTMENTS 2017  $\in 0.45 \text{ M}$ 

**QUALIFICATIONS & APPROVALS** 

Certified ISO 9001:2015, 14001:2015 and 45001:2018. ISO

9100 planned for 2020

Nr. 6, ZAE Triangle Vert

Tel: +352 39 00 44 72

space@gradel.lu

ADDRESS

GRADEL

L-5691 Ellange

Luxembourg

Udo Winkler

www.gradel.lu

(ultra-lightweight structures)

# 58

HITEC

LUXEMBOURG

#### CEO Yves Elsen & Philippe Osch CREATION DATE 1986 ORGANIZATION TYPE SME EMPLOYEES Total: 55 Space: 16 QUALIFICATIONS & APPROVALS ISO 9001

AQAP 2110 TUV Saarland SGS USTC INDR ESR label for CSR SuperDrecksKëscht fir Betriber (in accordance with ISO 14024)

#### ADDRESS

HITEC Luxembourg 49, rue du Baerendall L-8212 Mamer Luxembourg www.hitec.lu **CONTACT** Philippe OSCH Tel: +352 49 84 78 1 Fax: +352 40 13 03 antennas@hitec.lu

# CORE BUSINESS

HITEC Luxembourg S.A., a 100%-owned Luxembourg company, has developed its business activities in the field of innovative and quality products and services. Quality management and assurance, corporate social responsibility and environmental friendly business are the basis for sustainable growth and long-term partnerships with our stakeholders.

The company offers, among others, satellite ground segment technology as well as innovative satellite based products and ICT services to support public safety services in case of crisis or disasters. Our range of Limited Motion (LM) and Full Motion (FM) high end antenna systems, operating in various frequency ranges and supporting institutional and commercial satellites, is complemented by our performing antenna components such as antenna control units (HACU®) and servo control units (HSCU<sup>TM</sup>). The company's services include project management, design, engineering, integration, installation, commissioning and maintenance of full antenna systems or antenna components.

# • PRODUCTS & SERVICES

#### Products:

 Limited and full motion ground station antennas, ranging from 3 to 14 meters in diameter and covering frequencies from L- to Q/V-band (HTS gateways, TT&C, IOT/LEOP, EO/data downlink) in particular 6m and 9m limited motion antennas in X- & Ka-Band and 4m to 13m full motion antennas from L- to Ka-band. Including options such as HVAC and de-icing

- Elevation over azimuth and equatorial mount positioners
- Nomadic Satellite Communication Systems: NoSaCo® Rapid and NoSaCo® Rack
- Mission Critical Information Management solutions for defence, emergency and humanitarian markets
- Antenna components: HACU® Antenna Control Units and HASK Antenna Servo Kits

#### Services:

- Project management and coordination
- Ground station system integration and turn-key supplies
- Ground station antenna refurbishment, retrofit and relocation
- · Ground station antenna maintenance and ILS-ISS
- Quality assurance and RAMS analysis

# MAIN CUSTOMERS

European Commission, ESA, DLR, Luxembourg Government, Caribbean Disaster Emergency Management Agency, Administration of the Republic of Slovenia for Civil Protection and Disaster Relief, Civil Protection of the Friuli Venezia Giulia Region, SES Group, Inmarsat, Lockheed Martin, POST Group, AIRBUS Defence & Space, Telespazio, CGDIS – Corps Grand-Ducal Incendie & Secours, Thales Alenia Space, GovSat, OHB, Luxembourg army.

# MAJOR SPACE PROJECTS

#### **Satellite Ground Station Antennas**

- Defence projects: Limited-Motion antennas (6.8m, 9.0m) in Ka-Band and in X-band
- DLR:
- Full-Motion antenna in Ka-band (13m) for IOT
- Wide-band Full-Motion antenna (5m) for GNSS monitoring
- ESA projects:
- Q/V-band large aperture HTS gateway development
- Antenna Control Units (program, step, monopulse track) development
- $\circ$  GSTP design study for a 3-axis Full-Motion antenna in S-/K-band (14m) for Earth observation
- SSA NEO: feasibility study and prototyping of telescope design for near Earth objects
- EDRS: 5 Limited-Motion antennas in Ka-band (6.8m) for TT&C, feeder uplink and data downlink
- Earth observation: 3-axis Full-Motion antennas in S/X-dual-band (6.8m)
- Galileo IOV: 2 Full-Motion antennas in S-band (13m) for TT&C

#### Satellite-based ICT solutions

- emergency.lu: Deployment of worldwide available Rapid response solution for humanitarian aid and disaster relief, integrating, among other solutions NoSaCo® and DISP®
- $\circ$  DG-TRAC tracking and tracing of dangerous goods in the medical sector
- DW-TRAC tracking and tracing of dangerous waste
- Service to provide a rapid mapping solution based on small observation

# HYDRÔSAT • CORE BUSINESS

Hydrosat is a data analytics company based in Luxembourg that applies proprietary algorithms to satellite thermal imagery, combines it with data fusion capabilities and delivers insights into plant health and related applications for commercial and government customers around the world.

# PRODUCTS & SERVICES

Our team in Luxembourg is focused on developing two commercial products, both with significant commercial potential and offering substantial environmental benefits. The first focuses on early and accurate yield forecasts of all crops across the globe. Agribusiness companies, financial traders, governments and other customers will have unparalleled insights into what they can expect out of local and global production of everything from grains to coffee to sugar cane, allowing businesses to operate more efficiently. Our second product provides tells farmers exactly when and how much to water their crops. Hydrosat's own field studies, backed up by NASA research, have demonstrated that this will increase farm production by 20% while also substantially decreasing water usage – a win for the farmer and a benefit for the planet.

# MAIN CUSTOMERS

- Food processors, packagers and distributors
- Commodity Traders
- Insurance Companies
- Government Agencies
- Corporate and Independent Farmers
- Humanitarian Organizations

# MAJOR SPACE PROJECTS

#### **Thermal Infrared Remote Sensing Constellation**

Although there are many space imagery constellations in orbit and planned for launch, thermal imagery is missing. Consequently, Hydrosat is developing a constellation of four spacecraft that will provide a complete heat map of Earth every few days. The data from these satellites will enhance our products and give us unparalleled access to high-resolution thermal imagery to meet the needs of a wide range of commercial and government customers.

#### PRESIDENT

Royce Dalby CREATION DATE 2018 ORGANIZATION TYPE SME EMPLOYEES Total: 6

#### **ADDRESS**

HYDROSAT SÀRL 9 Rue du Laboratoire L-1911 Luxembourg Luxembourg www.hydrosat.com CONTACT

Royce Dalby info@hydrosat.com



IBISA (Inclusive Blockchain Insurance Using Space Assets) enables the next generation of insurance for agriculture, a B2B platform for risk-sharing with low fees, no claims thanks to proactive and regular assessment- and fast pay-outs. The distribution model, Blockchain and Satellite EO technologies enable, for the first time, profitable crop protection products and affordable for farmers.

IBISA re-engineers the complete business process and business model to drastically reduce costs and enhance transparency.

For loss assessment IBISA combines the use of EO products with a "crowd-watching" approach enabled by blockchain to avoid the need of the very accurate EO assessments of traditional insurance.

# PRODUCTS & SERVICES

IBISA platform for mutual, insurers and MFIs. An end-to-end platform to provide crop protection in an automated and cost-efficient way. It includes parametric risk modelling and solvency calculation, customers administration and automated loss assessment.

Watchers Platform. IBISA also provides the automated loss assessment as a service to insurance companies.

# MAIN CUSTOMERS

Mutuals, Insurers and Micro Finance Institutions

# MAJOR SPACE PROJECTS

ESA Business Applications



CEO

Jean-Baptiste Pleynet CREATION DATE 2019 ORGANIZATION TYPE SME EMPLOYEES Total: 5 Space: 3

#### ADDRESS

Imagination Factory Lux 9, rue du Laboratoire L-1911 Luxembourg Luxembourg www.ibisa.network CONTACT Jean-Baptiste Pleynet Tel: +352 621 222 176

jeanbaptiste@ibisa.network



We are a Multimedia Service Company having, in the broadest sense, any interest whatsoever in electronic media and the development of communication technology. Our aim is to be predominantly active in the communications area and to invest, directly or indirectly, in other companies that are actively involved in the dynamic industry of communication and multimedia applications.

We conduct research & developmental activities into potential expansion and development opportunities in the field of communication technology applied to multimedia applications and in auxiliary services. We are headquartered in Luxembourg and operate worldwide through dedicated regional teams or qualified Business Partner.

# PRODUCTS & SERVICES

U Learning, a new generation software/hardware platform that enables an enhanced, participative learning experience combining together physical and digital presence.

U Learning enables active participation versus a passive presence taking remote learning to a new degree and enabling a rich learning experience for all those students that, for logistic reasons, have no direct access to the physical facilities.

The main components of the product are:

- touch interfaces, interactive walls, tables and tablets devices;
- blended context and adaptability;
- content creation and distribution.

Among these fields of application, here are some examples:

- school, primary and secondary
- university
- corporate training

# TECHNICAL MEANS

- Strong technical background in telecommunications: satellite communication X/C/Ku/Ka-bands, Wi-Fi and global 4G
- Operating through first class worldwide cloud infrastructures
- Specialized in the design and deployment of complex projects
- Specific competence in high level software design and implementation (Oracle, Java, XML, Web Services)

# MAIN CUSTOMERS

- European Space Agency (ESA)
- Glasgow School of Art (GSA)
- Luxembourg Institute of Science and Technology (LIST)

# MAJOR SPACE PROJECTS

**U learning** is an interactive learning framework which allows students to engage in ubiquitous, flexible, immersive, non linear learning. It enables the collaboration between remote students and classrooms using a dedicated satellite layer which takes care of seamless content synchronization and live experience management.

**3WayComm** project consists of the design, development and prototype manufacturing of a innovative triple-band VSAT maritime terminal for dual-use applications under the ESA ARTES Competitiveness & Growth Programme.

The most innovative feature of the proposed satellite antenna is the ability to operate on X-band, Ku-band and Ka-band with automatic switching and no manual intervention, thus allowing unlimited operation and coverage areas in every possible operational scenario.

#### CEO Federico Masier CREATION DATE 2016 ORGANIZATION TYPE SME

### ADDRESS

- Imagination Factory Lux 9, avenue des Hauts-Fourneaux L-4362 Esch-sur-Alzette
- Luxembourg

www.if-lux.com info@if-lux.com

#### CONTACT

Federico Masier Tel: +352 621 177 260 federico@if-lux.com



In-Space Services aims to introduce the space technology to support primary and most important agriculture activities. Earth Observations EO data will be used examine the quality and composition of the soil. This information will help farmers to reduce the amount of the fertilizer, bringing economic and environmental advantages.

The company focus mainly on hyperspectral data processing using AI technology. Working in close cooperation with clients, we will extract the most important information from the spaceborne sensors currently delivering EO data. Our mission is to bring space technology down to Earth and make it easily available and beneficial to agriculture industry.

# • PRODUCTS & SERVICES

#### Soil mapping:

- · Detecting basic soil composition elements using remote sensing;
- Developing soil maps;
- Developing fertilizer maps for farmers.

#### Earth Observation data enhancement:

- · Resolution enhancement in post processing;
- Data fusion from various sensors;
- Data reconstruction.

# TECHNICAL MEANS

Strong technical background in the following data processing aspects:

- Hyperspectral data processing;
- Machine learning in Earth Observation data;
- · Satellite imagery resolution enhancement;
- Various features extraction from the satellite imagery.

#### ADDRESS

CEO Inna Uwarowa

2019

SME EMPLOYEES

Space: 1 R&D INTERNAL INVESTMENTS 2019

€180 K

**CREATION DATE** 

ORGANIZATION TYPE

Total: 1+2 in-house consultants

In-Space Services Sarl 11, rue Pierre Werner L-6832 Betzdorf Luxembourg Tel: +352 26 176 212 www.in-space.com CONTACT Inna Uwarowa

Tel: +352 621 967 882 iuwarowa@in-space.com

# MAIN CUSTOMERS

In-Space Services targets global agriculture market. Our main customers are:

- Large farms >150ha;
- Fertilizer providers;
- Governmental institutions supporting agriculture and environmental protection.

# MAJOR SPACE PROJECTS

In-Space services is currently conducting the feasibility study for soil mapping services using hyperspectral spaceborne and airborne data.



InTech is a POST Luxembourg Group subsidiary specialized in IT Consulting and Digital Application Development. InTech designs and implements software solutions combining specific developments and integration of generic components and combines skills of project management, functional and technical architectural consulting, technical expertise and development.

InTech supports its customers and partners in their digital transformation by providing innovative and pragmatic services and effective solutions for their strategic project. Historically meeting the needs of Luxembourg's financial sectors, administrations and institutions, InTech's current objective is to diversify especially by targeting the space segment, mainly with its Innovation pole and its expertise in Blockchain and Artificial Intelligence.

# PRODUCTS & SERVICES

IT Consulting, Development of digital applications

# TECHNICAL MEANS

Open Source Development Tools, Blockchain, Artificial Intelligence, Machine Learning, IoT, Big Data

# • MAJOR SPACE PROJECTS

**IBISA:** IBISA is a risk-sharing service, an alternative to micro-insurance, targeting small farmers worldwide.

IBISA is based on a peer-to-peer architecture supported by blockchain and Earth Observation technology to reduce costs typically incurred by traditional insurer-centric paradigms.

CEO Fabrice Croiseaux **CREATION DATE** 1995 ORGANIZATION TYPE SME **EMPLOYEES** Total: 124 Space: 1.3 **TURNOVER 2018** Total: € 12 600 K Space: € 100 K **R&D INTERNAL INVESTMENTS 2019** Total: € 790 K Space: € 90 K

QUALIFICATIONS & APPROVALS The Information Security Management System (ISMS)

at itrust consulting is certified according to ISO/IEC 27001.

#### ADDRESS

InTech SA 208, Rue de Noertzange L-3670 Kayl Luxembourg www.intech.lu **CONTACT** Francis SUJKOWSKI Tel: +352 53-11-53-1 Mobil: +33 608164151 francis.sujkowski@intech.lu

# ispace

# • CORE BUSINESS

ispace is a private lunar exploration company and a leading competitor in the NewSpace Race. Headquartered in Japan with offices in Luxembourg and in the US, we develop micro-robotics that will allow us to learn more about the Moon's water and how to use it as propellant to broaden access to space. ispace is an enabler for science, progress and innovation. In this sense, we believe that by making the Moon accessible, we will provide companies with the opportunity to participate in the development of the lunar economy. Our vision is to create a new ecosystem in outer space and expand the human living sphere beyond Earth.

# PRODUCTS & SERVICES

- **Payload Delivery:** We deliver payloads to the Moon using our small and lightweight lunar landers and rovers.
- **Data Collection:** Using our lunar rovers, we will collect scientific information about the lunar environment, process and provide valuable data for space and non-space customers.
- Partnerships: We offer opportunities for companies to join the lunar adventure through partnerships based joint technology development, space business entry and corporate branding.
- **Resource Exploration Services:** We provide services and expertise in fields such as mission planning, space resources and reserves evaluation, autonomous navigation systems and space resources prospection and exploration.

# MAIN CUSTOMERS

- Space agencies, research institutes, private space companies
- Non-space commercial companies willing to expand their business in outer space or to use space-based technologies for terrestrial applications

# MAJOR SPACE PROJECTS

- ispace's first commercial lunar missions scheduled for 2021-2023
- Development of a cislunar transportation platform with frequent commercial flights to the Moon
- Development of methods to prospect, explore, extract and process
   lunar resources



#### CEO

Julien-Alexandre Lamamy CREATION DATE 2017 ORGANIZATION TYPE SME EMPLOYEES Total: 16

#### **ADDRESS**

#### ispace

5, rue de l'Industrie L-1811 Luxembourg Luxembourg www.ispace-inc.com **CONTACT** Aurelie Melchior, Executive Administrator Tel: +352 20 60 05 58 ispace-europe@ispace-inc.com



CEO

2007

SME EMPLOYEES

Total: 17

Space: 1

€ 4.000

**ADDRESS** 

itrust consulting

L-6831 Berbourg

Office building: 55, rue Gabriel Lippmann

L-6947 Niederanven

Tel: +352 26 176 212

Headquarters:

18 Steekaul

Luxembourg

Luxembourg

www.itrust.lu

Dr Carlo Harpes

sales@itrust.lu

CONTACT

Dr Carlo Harpes

**CREATION DATE** 

**TURNOVER 2018** 

Total: € 1 642.000

**R&D INTERNAL** 

critical infrastructure

**INVESTMENTS 2018** 

Space: € 255.000 including

**QUALIFICATIONS & APPROVALS** 

The Information Security

Management System (ISMS)

according to ISO/IEC 27001.

at itrust consulting is certified

**ORGANIZATION TYPE** 

# • CORE BUSINESS

itrust consulting s.à r.l., a 13-years-old, recognized actor in Luxembourg's and Europe's Information Security field, certified according to ISO/IEC 27001, consults its customers coming from public, financial, and private sector to protect their information against divulgation, manipulations and unavailability. The company acquires know-how in engineering and sciences, enabling it to find the economically appropriate solution for a specific security requirement. It applies and develops research projects, norms, security controls and information processing techniques, covering topics such as information security management systems, risk management, business continuity management, incident management, digital signature, cryptology, network security, internet security, critical infrastructure protection, space, computer forensic, etc.

# • PRODUCTS & SERVICES

#### Consulting services, sourcing and innovation studies

Management and guidance of security projects. Critical Infrastructure protection. Technology integration and assistance (PKI, VoIP, virtualisation, etc.). Risk analysis (TRICK Service™). Forensic and malware analysis. Personal data protection, Data Privacy Impact Assessment (DPIA) following GDPR. Assistance to CISO and Data Privacy officer. Managerial monitoring of security issues. Incident response team.

#### Hacking

Penetration testing and vulnerability assessment of hardware (network, server mobile devices, smart cards, firmware), software, web applications, and access security.

#### Organizational audit

ISO 2700x. ISO 20000. ISO 27799. IEC 62443. Business referentials (PSF, PSDC). Legal referential (EU directives, grand-ducal regulations, CSSF). Protection of personal data (CNPD).

#### Technical audit

Code review (OWASP, SANS, etc.). Equipment configuration review. Critical Infrastructure, SCADA. Wireless infrastructure. Data Protection. PCI-DSS. ISO 15408 (Common Criteria). CSSF Compliance. EuroPriSe. CNPD compliance.

#### Elaboration of security tools & services

LASP: provide assurance to location services that locations indicated are trustworthy. TRICK Service<sup>™</sup> (risk assessment). TRICK Cockpit (real-time risk monitoring).

#### **Training services**

Introduction and practical advice to comply with GDPR – Data Privacy; GDPR foundation certification – principles, legal framework and compliance; Data Protection Officer (DPO) – certified; Risk Manager certified for DPIA (guided by ISO/IEC 27005); ISO/IEC 270xx workshop; Lead Implementer ISO/IEC 27001 – certified; ISMS Lead Auditor ISO/IEC 27001 – certified; PSDC – eArchiving training session; Security awareness 4 your employees; etc.

# TECHNICAL MEANS

TRICK Tester (penetration testing platform). Galileo receiver. GPS repeater.

# MAIN CUSTOMERS

EU institutions, financial service providers, energy distributors, ESA, Lux. Ministries, etc.

# MAJOR SPACE PROJECTS

CRITISEC project: developing security products, services and standards for edge networks in critical infrastructures. itrust consulting develops an intrusion detection system and tailors it to an IoT environment. **QUARTZ project:** aims to develop a QKD system to distribute cryptographic keys to end users via satellite optical links. itrust consulting has a major role in the secure design of the ground station system components. H2020 - bIoTope: creating a SoS platform for connected smart objects (IoT). **ATENA:** Advanced Tools to assess and mitigate the criticality of ICT components and their dependencies over Critical Infrastructures. **CIPS SPARC project:** The Space Awareness for Critical Infrastructure project analysed space phenomena as threats for Critical Infrastructures. ESA LASP project: Localisation assurance service provider. Software/ service to verify/certify the user's location. This service was developed in partnership with ESA and the University of Luxembourg. LuxLAUNCH projects (opportunity studies - Galileo applications): Applications and Services on Broadband handheld devices. Standards, specifications & processes for space.

# ( KLEOS • CORE BUSINESS

Kleos Space S.A. is an Earth Observation technology and data as a service company. Kleos Space will deliver global maritime radio signal (RF) activity-based intelligence and geolocation as a service. The first Kleos Space satellite system, known as Kleos Scouting Mission (KSM) launching in spring 2020, will deliver commercially available data and perform as a technology demonstration. The Scouting Mission will deliver targeted daily geolocation services with a full constellation delivering near-realtime global observation.

# PRODUCTS & SERVICES

Kleos' initial RF geolocation data products are available in three levels – Guardian RF, Guardian LOCATE and Guardian UDT – and can be pre-ordered by registered users on a monthly or annual basis.

The data product will be delivered to customers in the Spring (European) of 2020 after data collection by the Kleos' Scouting Mission satellites and having been processed through the Kleos' algorithms on the ground.

# TECHNICAL MEANS

The multi-satellite Scouting Mission system is made up of 4x nano-satellites and will form the foundation of a constellation that delivers a global picture of hidden maritime activity, enhancing the intelligence capability of government and commercial entities when AIS (Automatic Identification System) is defeated, imagery unclear and targets out of patrol range. Future missions will include novel sensor deployment via in-space manufacturing technologies.

# MAJOR SPACE PROJECTS

Kleos Scouting Mission. In-Space Manufacturing technology development



# CEO

Andy Bowyer CREATION DATE June 2017 ORGANIZATION TYPE SME EMPLOYEES Total: 15 Space: 15

#### ADDRESS

Kleos Space 26, rue des Gaulois L-1618 Luxembourg Luxembourg Tel: +352 2088 2290 www.kleos.space CONTACT

Andy Bowyer office@kleos.space



Luxsense geodata is a young SME whose objective is to use innovative techniques from earth observation in research projects and to render services for the acquisition of reliable geodata. Further, the development of high level products for environmental studies, precision agriculture and engineering projects is one of the major goals of the company.

The use of UAVs (Unmanned Aerial Vehicles or drones) allows for a rapid intervention and the acquisition of extremely high resolution geodata. These characteristics of UAVs – combined with a multitude of different sensors – make these systems very powerful in the case of natural disasters or precision agriculture, where satellite data lacks the spatial or temporal resolution.

# • PRODUCTS & SERVICES

#### Geodata acquisition

- · UAV operation for data acquisition
- Data processing for RGB-, multi- and hyperspectral data

#### **Product development**

- Development of customized data products
- Precision agriculture: weed and disease detection, biomass and photosynthesis
- Construction site monitoring: volume estimation, 3D reconstruction, BIM and pipe detection

# • TECHNICAL MEANS

- Fixed-wing UAVs:
- These UAVs allow data acquisition of larger areas in short time intervals for 3D reconstruction purposes (up to 100ha / 30min).
  Heavy lift UAVs:
- Heavy till t
  - In many research projects, multiple camera systems need to be flown simultaneously and combined with sensors for side parameters.
  - Multi- and hyperspectral sensors and high-resolution RGB-cameras
  - The acquisition of the complete electromagnetic spectrum is required for the analysis of vegetation. The available sensor systems cover the spectral domain from 350 – 950nm.
  - A thermal camera captures long wave thermal infrared from 8-14µm and provides information about land surface temperature and emissivity.
  - Field spectrometer:
  - The field spectrometer captures light in the spectral range from 350nm to 950nm. This data is used for research in vegetation studies and for cal/val of UAV data.

# MAIN CUSTOMERS

#### Luxembourg municipalities

#### **Governmental administrations**

- Administration de la nature et des forêts
- · Administration des ponts et chaussées
- Administration de la gestion de l'eau

#### **Research institutions**

- LIST
- IBLA
- Universitiy of Trier

# MAJOR SPACE PROJECTS

MonESCA – Disease detection in grape vines LeguTEC – Vegetation monitoring and weed detection for precision agriculture mDrones4rivers – Biotope monitoring in riparian buffer zones

Dr. Gilles Rock CREATION DATE 2015 ORGANIZATION TYPE SME EMPLOYEES Total: 3 Space: 2

#### ADDRESS

CEO

Luxsense geodata 85-87, Parc d'activités Capellen L-8303 Capellen Luxembourg www.luxsense.lu

#### CONTACT

Dr. Gilles Rock Tel: +352 287 657 1 info@luxsense.lu



LuxSpace provides space solutions to the European and global institutional and industrial market in the fields of space/defence systems and applications with a focus on:

- Space systems and subsystems design, specification, procurement, manufacturing, integration and testing. This includes structure, electronics, Radio Frequency, power supply, AOCS, simulators, on- board software, GSEs and all major elements of satellites
- Satellite services and applications with a focus on Automatic Identification System (AIS) and Earth Observation (EO)

# PRODUCTS & SERVICES

- Microsatellites and subsystems in the 30 -150 kg class for applications in the field of Earth Observation (EO), telecommunications, science, and technology demonstration
- Telemetry Telecontrol & Command subsystems for geostationary and Low Earth Orbit satellites
- AIS satellites and payloads for global vessel identification and tracking
- Avionics and payload electronics
- Embedded software
- · Application software
- Simulator software
- Earth Observation products and service development
- Space systems related feasibility studies
- Technologies for solar sailing and de-orbiting

#### TECHNICAL MEANS

- Electronic Laboratory covering digital, analogue and Radio Frequency developments and testing
- Thermal test chamber
- Cleanroom for satellite integration
- Satellite simulation & design software

# MAIN CUSTOMERS

European Space Agency and other European Institutions (e.g. EMSA, DG MARE, DG ENTERPRISE, EUROSTAT, European Defense Agency), players inside European and global space sector like OHB, Orbcomm Inc., Thales Alenia Space, players inside maritime sector



# MAJOR SPACE PROJECTS

#### Telecommunication satellites:

- Core team member for OHB's developed Small GEOstationary (SGEO) Satellite Platform: LuxSpace being responsible for the TT&C subsystem and the satellite simulator
- Currently three SGEO Projects: Hispasat AG1 (launched in 2017), European Data Relay System (launch 2019), ELECTRA (in progress)

#### Microsatellites:

- Development, manufacturing and operations of 30 -150 kg class satellites
- Pathfinder 2 company funded first AIS satellite
- Vesselsat 1 & 2 the first satellites 'made in Luxembourg'
- 4M Manfred Memorial Moon Mission
- ESAIL: Prime contractor under ESA's ARTES SAT-AIS program
- Triton-X: Modular and scalable microsatellite platform

#### Satellite services & applications:

- AIS data services
- AIS added value service development for the maritime industry (e.g. fishery enforcement and safety and security)
- · GIS and EO services:
- LUCAS: Land Use/Cover Area statistical Survey LUCAS(Eurostat) Field survey data management and quality control
- Copernicus Global Land Service: quality control for high resolution hot spot monitoring activities

#### Space technology activities:

- Spaceborne sails as Drag sail for LEO satellite de-orbiting and/or as Deployable antenna
- Feasibility study for a small satellite based "Space Weather Monitoring" mission
- Space-based maritime reconnaissance & surveillance vessel detection using NAVRAD radar
- Augmented reality for satellite assembly, integration and testing



Large Enterprise (OHB Group Subsidiary) EMPLOYEES Total: 50 Space: 50

**ORGANIZATION TYPE** 

**Managing Directors** 

**CREATION DATE** 

2004

Jochen Harms, Oliver Salisch

TURNOVER

Total: € 12 M

### Space: € 12M

R&D INVESTMENTS € 2 M

QUALIFICATIONS & APPROVALS ISO 9001:2015

#### ADDRESS

LuxSpace 9, rue Pierre Werner L-6832 Betzdorf Luxembourg

www.luxspace.lu

#### CONTACT

Jochen Harms, Oliver Salisch Tel: +352 267 890 4000 info@luxspace.lu

#### 

LuxTrust is a Qualified Trust Service Provider and a Certification Authority. Established in 2005, the company implements and integrates innovative and multi-applicative solutions to secure on-line transactions, digital identity and electronic signatures for its customers, including governments, institutions, businesses and private individuals.

Its mission is to guarantee the digital identity and security of the electronic data of companies and citizens, and thereby increase trust in the digital economy to make life simpler and encourage business efficiency. LuxTrust manages the digital identities for all of Luxembourg and has expanded its business internationally recently.

# PRODUCTS & SERVICES

We provide strong electronic identities (eID) and solutions to help organizations digitize their processes whilst being compliant with latest EU regulations (from the on boarding of a user through the whole commercial/institutional process). Amongst other services, we provide:

#### • Electronic Identities

Identification made face-to-face through Registration Authority Network or Remotely enabling us to deliver strong eID that can be used for Qualified Signature.

#### Strong Authentication

#### • Qualified Trust Services

Qualified Electronic Seal, Electronic Signature, Timestamping, QWAC.

#### Electronic Signature solution

Our entirely API-based Signature platform (COSI), enables you to adress your specific needs whilst being easily integrated in your legacy IT infrastructure.

Our customers are from various sectors and evolve in international environments (banks, insurance, financial services, institutions, health) Amongst our references:

BIL, BGL, Banque de Luxembourg, ING, Spuerkees, POST, Raiffeisen, Spuerkees, Luxembourg Government, DG Santé of the European Commission, LNS, Société Générale

# MAJOR SPACE PROJECTS

- Quantum Key Distribution
- Authentication and data encryption for EM-SAT, a comprehensive Secure Operation Centre for emergency situations in chemical plants

CEO Pascal Rogiest CREATION DATE 2005 ORGANIZATION TYPE SME EMPLOYEES Total: 76 TURNOVER 2019 Total: € 15.743.089,92 QUALIFICATIONS & APPROVALS Qualified Trust Service Provider

on EU trusted list

#### ADDRESS

LuxTrust 13-15, parc d'Activités L-8308 Capellen Luxembourg www.luxtrust.com CONTACT Tel: +352 24 550 550 info@luxtrust.lu



Maana uses its proprietary In-Situ Resource Utilisation (ISRU) technologies developed for the space industry to revolutionise the way in which solar panels are produced, on Earth and in space.

# • PRODUCTS & SERVICES

- Solar cells (for Terrestrial & Space applications)
- Solar Panels (for Terrestrial & Space applications)
- Glass panes & components
- ISRU equipment

# • TECHNICAL MEANS

Maana Electric is specialised in In-Situ Resource Utilisation (ISRU) and Solar Photovoltaic technologies, for both terrestrial and space applications.

# MAJOR SPACE PROJECTS

Research & Development of ISRU demonstrators for ESA & LSA.



#### CEO

Joost van Oorschot ORGANIZATION TYPE SME EMPLOYEES Total: 30 Space: 25

#### ADDRESS

Maana Electric 2, Place de Paris L-2314 Luxembourg Luxembourg www.maanaelectric.com CONTACT Joost van Oorschot Tel: +352 691 330 516

info@maanaelectric.com



The core business of Made In Space Europe (MIS EU) is the development & sale of robotic arms for space applications. Additionally, MIS EU also participates in collaborative R&D projects related to robotic arm applications in space and extreme terrestrial environments. By lowering barriers to sophisticated in-space robotics, MIS EU is helping introduce the next generation of space industrialization.

# PRODUCTS & SERVICES

Space-rated robotic arms offered by Made In Space Europe are the company's main product.

The robotic arms are designed to carry out a range of functions which are widely applicable across space-based robotic missions. Satellite servicing, refuelling operations, station-keeping, manipulation of payloads, in-orbit assembly, planetary exploration, and in-situ resource utilisation (ISRU) can all be beneficially augmented with the use of MIS EU robotic arms.

In addition to providing robotic arms, MIS EU provides correlated services which include engineers to support integration of the arm to the spacecraft or rover, and a robotic arm software model for dynamic simulation. MIS EU also offers a prototype robotic arm for mock in-space operations which customers may use at the company's facilities in Luxembourg.

# • TECHNICAL MEANS

MIS EU's robotic arm has several key features.

- Standardized, open-source interfaces simple integration of arm-tosystem and open-source arm-to-end-effector connection interface
   Easily-programmable software - enables seamless programming of robotic arm
- Modularity and scalability arm specifications can be customized based on customer requirements due to a simple, modular system
- Tool changer and end-effectors robotic arm features several tooling options and a changer which can use different end-effectors while in-operation
- 5) Affordable robotic arm is mass-produced and commercially available

# MAIN CUSTOMERS

The main customers of MIS EU are companies and entities that need affordable robotic arms for industrial space applications and missions. These applications include orbital activities, such as satellite servicing and in-space assembly, as well those for surface activities, such as planetary exploration and ISRU. In addition to industrial space companies, MIS EU also works with R&D consortiums which are interested in refining robotic technologies for far-future missions (10+ years).

# MAJOR SPACE PROJECTS

At this time Made In Space Europe's efforts are dedicated to the development of the robotic arm product.



#### CEO

Jason Dunn (co-founder, acting Managing Director) CREATION DATE 2018 ORGANIZATION TYPE SME EMPLOYEES Total: 8 Space: 8

#### ADDRESS

Made In Space Europe 5, rue de l'industrie L-1811 Luxembourg Luxembourg Tel: +352 661 871 804 www.MadeInSpaceEurope.com CONTACT Jaroslaw Jaworski

JJ@MadeInSpaceEurope.com



We develop customized solutions using our

- MolecularGRIP™ technology for improved adhesion between difficult-to-bond materials with custom-designed primer layers
- Leaf™ technology for nano-structured, water-repellent and non-stick coatings

Our Molecular Plasma Technology enables single-step grafting of a wide range of one or more functional precursor molecules (organic, inorganic, nanoparticles, biomolecules,...) onto any surface using a scalable, dry, ambient, atmospheric process. The solutions we develop are easily scalable and we ensure a robust industrially implementation.

# • PRODUCTS & SERVICES

CEO Marc Jacobs, CEO CREATION DATE 2016 ORGANIZATION TYPE SME EMPLOYEES Total: 10 Space: N/A TURNOVER 2019 Total: € 1.5 M R&D INTERNAL INVESTMENTS 2019 € 500.000 Development and implementation of solutions for:

- Priming for improved bonding of inert materials (e.g. PTFE, Titanium, CFRP's, Polyolefins) in multi-material structures
- improvement of adhesion between any fibre and a polymer matrix
- non-stick, water-repellent and anti-corrosion solutions
- REACH-compliant, wet chemical primer replacement

R&D equipment for RTO's, Universities and companies Pilot lines Small scale production Custom-designed industrial systems After-sales service and remote diagnostics.

#### ADDRESS

Molecular Plasma Group Technoport Hall 4B Rue du Commerce L-3895 Foetz Luxembourg www.molecularplasmagroup.com CONTACT Marc Jacobs Tel: +352 545 580 461 marc.jacobs@ molecularplasmagroup.com

# TECHNICAL MEANS

- Lab facilities with PlasmaspotTM and PlasmalineTM equipment
- Small production runs
- Characterisation (cooperation with LIST)
- Engineering
- 3D printing for rapid prototyping

# MAIN CUSTOMERS

Airbus, Ariane, Valeo Research Institutes and Universities such as LIST, KU Leuven (B), University of La Rioja, VTT (Fi), PICC (CH), FILK (D)





ODYSSEUS Space aims at increasing the flow of goods and information in the Solar System. For this purpose, the company is developing cost-effective technologies such as laser communication and autonomous navigation.

The technologies developed by ODYSSEUS can already address the small satellite constellations and GEO satellite markets while paving the way for future applications in the Space Resources Utilisation value chain.

With its team of international experts located in both Luxembourg and Taiwan, ODYSSEUS Space has been providing its satellite related services in Europe and Asia for several years and is capable of acting as a bridge between both Space markets.

# PRODUCTS & SERVICES

#### Laser Communications:

The CYCLOPS transceiver offers compact, secured, high bandwidth communications to Space actors, expanding drastically their information exchange capabilities around the Earth and beyond. This versatile system enables both, inter-satellite and space-to-ground laser communication.

#### Autonomous Navigation:

ASTRAEUS provides autonomous guidance navigation & control capabilities to spacecraft anywhere in the Solar System. Its unique algorithm is especially adapted to missions in GEO and beyond: station keeping, interplanetary cruise, proximity operations & rendezvous to celestial bodies.

#### Services:

Market study, Mission Analysis & Design, System Engineering & Project Management consultancy, Launch Campaign support.

# MAIN CUSTOMERS

ODYSSEUS long term goal is to provide support to NewSpace companies who are aiming at exploring and exploiting resources beyond the Earth, facilitating their exchange of goods and information in the Solar System. In the context of a foreseen increase of traffic between the Earth and new Space outposts, ODYSSEUS technologies will contribute to a smooth, cost-efficient and automated traffic management of supplies and information.

Currently, ODYSSEUS is offering these technologies to actors where responsiveness is critical. This includes for instance the automated navigation of constellations of satellites around the Earth, and extremely fast and secured communications between those assets.

# MAJOR SPACE PROJECTS

The development of CYCLOPS novel laser communication terminal and ASTRAEUS autonomous navigation solution for spacecraft are the core ongoing projects of the company.

In parallel with its R&D activities, the company keeps providing small satellite related services to its customers to make their missions a success.

CEO Jordan Vannitsen CREATION DATE 2016 (Taiwan) 2019 (Luxembourg) ORGANIZATION TYPE SME EMPLOYEES Total: 6 (Luxembourg)

Space: 6 (Luxembourg)

#### **ADDRESS**

ODYSSEUS Space Technoport 9, avenue des Hauts-Fourneaux L-4362 Esch-sur-Alzette Luxembourg www.odysseus.space CONTACT Jordan Vannitsen Tel: +352 54 55 80 201

info@odysseus.space

# 

OffWorld has undertaken Research and Development in the field of extreme environment industrial robotics, initially applied to the mining and mineral processing sector. Applications are expanding into the construction and infrastructure markets. The objective is to establish an end-to-end collaborative robotic system comprising thousands of multi-species robots working together to achieve defined strategic objectives across mining, processing, fabrication, assembly, manufacturing and construction – essential elements for developing space infrastructure. Space operations require that these robotic systems undertake complex tasks autonomously or with minimal human intervention. OffWorld has developed a task agnostic machine learning framework to automate industrial processes. This approach enables operations in the space environment.

# PRODUCTS & SERVICES

OffWorld is currently at the prototype stage for its initial terrestrial mining robots. However, we are already developing our program to encompass modularity, massive scale production engineering, serviceability, forward and backwards compatibility and robustness. The first two prototypes were built in parallel within 5 months from final design to prototype 1.0 completion. The approach we are taking is that of mining as a service and rolling out first mine trials in 2020. The OffWorld platform is extending to space and lunar modules to begin development in our Luxembourg facilities.

# • TECHNICAL MEANS

OffWorld will refine its machine learning mining robots to make them lighter, increasingly modular, and lunar-surface-environment tolerant. This is necessary to reduce transportation cost to the Moon and be employed in mining ice bearing regolith located in permanently shadowed regions around the lunar poles. Each step in this ISRU process is envisioned as a stand-alone function within an autonomous robotic platform of multiple robotic units operating collaboratively together. Our autonomous robotic platforms are currently in development for Earth mining under internal funds with demonstration units already undergoing testing and development. Our ISRU Technology subsystem is a subset of OffWorld's overall concept for mining Moon and Mars regolith for volatiles and minerals.

# MAIN CUSTOMERS

Due to the dual use approach taken by OffWorld, customers will be both space and terrestrial.

- In-space transportation companies
- Space Agencies
- Terrestrial mining, construction and manufacturing companies

# MAJOR SPACE PROJECTS

Development, demonstration and deployment of lunar focused robust, scalable in-situ resource utilization robots.



CEO Jim Keravala CREATION DATE 2016 ORGANIZATION TYPE SME EMPLOYEES Total: 6 R&D INTERNAL INVESTMENTS € 350.000

#### ADDRESS

OffWorld 1, rue Jean-Pierre Brasseur L-1258 Luxembourg Luxembourg www.offworld.ai CONTACT

Jim Keravala jim.keravala@offworld.ai Tel: +1 310 890 2329



OQ TECHNOLOGY is a global 5G "Internet-of-Things" network operator providing the largest remote IoT data access and analytics platform and cutting costs of data transmission through satellites by a large factor by utilizing non-terrestrial networks (satellites, balloons, drones). We serve the oil and gas, maritime, Industry 4.0 and transport segments particularly for the management and tracking of assets in remote areas. Whether this is digital oilfield applications, offshore monitoring, SCADA applications, asset tracking, fleet management, smart metering or predictive maintenance, we provide you with an innovative low-cost connectivity solution. We also help mobile operators extend their cellular IoT coverage to remote and rural areas where their cellular tower coverage cannot reach.

Our wireless technology is compatible with cellular IoT, particularly Narrowband IoT. The modules are cellular compatible plug & play, easy to install, have long battery life and connect you directly to our or your data cloud.

Security is important for us, and all our modules and data interfaces are highly secure and encrypted. We have our own network and we can customise our service according to your needs to guarantee the reception of data in your own country only.

# PRODUCTS & SERVICES

**Connectivity Service:** We offer highly secure managed 5G IoT connectivity service with large data plans and low cost compared to traditional solutions.

**5G Sat M2M Modules:** Hybrid cellular terrestrial and satlelite NB-IoT modules that can roam and switch between the mobile and satellite network anywhere in the world.

**5G IoT Sat Terminals:** It is a universal NB-IoT data aggregator that is designed to provide a gateway for IoT and M2M data and connects to any satellite, regardless of the platform used. Typical applications include SCADA, maritime, and remote industrial connectivity. It implements edge-computing, high security standard, and low power communication. IT can connect to any VSAT or other satellite terminal.

**Data Analytics:** Our secure data analytics platform gives you access to a wide range of meta data that together with highly targeted analytics algorithms offer you the necessary information needed for your critical business decision-making processes and for optimising your operations.

**DSP House:** Strong experience and skills in cellular transceiver and software stack development for mobile and satellite operators, NB-IoT over satellite IP own development product and patented under OQ.

**Consultancy:** we support customers' hi-tech and telecommunication projects at all stages, from the definition of requirements, initial studies, engineering processes, procurement and management tasks as well as operations through to the end of the project with archiving and lessons learnt. During the project establishment phases, we have the experience to support the requirements capture, the analysis, the identification of key drivers, the operations concept definition, the cost estimation and the specification of statements of work, and the writing of commercial bids and proposals. OQ TECHNOLOGY can also provide monitoring of industrial contracts for clients.

# MAJOR SPACE PROJECTS

**MACSAT Feasibility Study:** OQ TECHNOLOGY successfully performed a detailed study and the system design of a global satellite system dedicated for Machine2Machine communication. The technology developed surpasses existing wireless technologies in meeting the extensive demands of IoT & M2M communication requirements. The study also included a detailed analysis of the M2M and IoT markets and target business models that allows such a technology to be rapidly implemented as a product and service.

Smart Automatic Model Based Architecture: The project aims to create a set of agile software tools implementing in their core Artificial Intelligence techniques and cognitive algorithms that support engineers in integral product design or complex processes by creating a modular framework. The software main objective is to be used to produce engineering test plans and routines in the automotive and aerospace industry, with minimal human intervention. It can be also used to manage the IoT networks. Using this tool customers can save up to 70% of the time and cost needed to develop conventional network optimization techniques. The AI training algorithm was successful in matching a human engineer work up to 93% in a specific scenario.

MACSAT In-Orbit Demonstration Mission: OQ TECHNOLOGY is the prime contractor of the MACSAT IOD mission, where it is designing, implementing, and building the first satellite to be launched to demonstrate the company's innovative IoT technology implemented in both the payload and user terminals.

**TIGER-1 Mission:** OQ Successfully tested NB-IoT over two LEO Cubesats, the mission was a technology proof of the feasibility of cellular IoT over LEO satellites and a successfully tested the developed transceiver algorithms developed by OQ.

CEO Omar Qaise

CREATION DATE 2016 ORGANIZATION TYPE SME EMPLOYEES Total: 5-10

#### ADDRESS

OQ TECHNOLOGY 40-42, Grand Rue L-6630 Wasserbillig Luxembourg www.oqtec.space **CONTACT** Omar Qaise Tel: +352 206 009 35 Mob: +49 170 223 8891 contact@oqtec.space



POST Luxembourg is Luxembourg's leading telecommunications and information services company, with one of the most well-known names in Luxembourg. It was founded in 1842, and has operated as a public enterprise since 1992. POST Luxembourg is the incumbent telecom operator of the Grand Duchy of Luxembourg and as such serves all segments of the community and all ranges of society, from residential to large corporate customers, offering both fixed and mobile services. Challenges that apply in the local and wider market. POST Luxembourg is also a founding partner in LU-CIX, the commercial Internet Ipv6 exchange.

The POST Luxembourg Group comprises 19 sub-companies offering a wide range of innovative and valuable solutions. Together this makes a staff headcount of more than 4,300 persons, making the POST Luxembourg Group the second largest employer in the Grand Duchy.

# PRODUCTS & SERVICES

#### **Telecommunication Services**

- Analogical and digital telephony (ISDN)
- Mobile network (POST Telecom SA)
- LuxDSL
- Alarmis
- Internet Provisioning including Luxembourg's first IPv6 commercial offerings
- Voice over IP; managed services
- An intelligent network
- ATM and Mirroring
- IPTV (Tele vun der Post), launched commercially in 2008 and including Video on Demand
- TERALINK, Luxembourg's International Broadband Network, launched in 2006
- A Fibre Optic Network In 2010, POST Luxembourg began laying an optical fibre network for all customers (LuxFibre) which will offer up to 100 Mbits/s

#### **Complementary Services**

Data Storage in 5 data centres across the country

# MAIN CUSTOMERS

POST Luxembourg serves all segments of the community and all ranges of society from residential to large corporate customers. Its major customers include the government of Luxembourg, as well as the largest financial institutions and the institutions of the European Union.

# MAJOR SPACE PROJECTS

- U-2010: FP6 project aiming at defining methods to establish communication for rescue workers in areas where there is none (remote locations with no network coverage, or where the existing network has been destroyed)
- HNPS Project: set up to develop a heterogeneous network concept for future European Public Safety communications. This will be based on the integration of different networks, including ad hoc deployable systems. The project considered the latest developments in the area of next generation network architectures and network management.
- **DG-Trac** in collaboration with the European Space Agency and other Luxembourg based partners, a feasibility study of Dangerous Goods Tracking in a specialised domain.
- DG-Trac2 the above feasibility study received a positive feedback from ESA, the supporting agency, and the project has been continued in a full deployment project that will last three years and will see the project proposal translated into a working business with real customers.

CEO Claude Strasser CREATION DATE 1842 ORGANIZATION TYPE Large Enterprise EMPLOYEES Total: 4.371 TURNOVER 2017 Total: € 770 M

#### ADDRESS

POST Luxembourg 8a, avenue Monterey L-2020 Luxembourg Luxembourg www.post.lu



**RespectUs** Export Control Compliance Daily.

RespectUs offers a SaaS (Software-as-a-Service) product to exporters of sensitive goods, their suppliers and banks.

All exporters of sensitive items (in Space vertical and other industries) face the challenge to determine the need to apply for and be granted a Governmental license when exporting, importing, transiting, brokering or transferring controlled goods, software and technology. It is their responsibility to obtain the license before proceeding, and an illegal (in the sense of, made without required license) put them at risk of heavy administrative and/or criminal sanctions, and civil liability. To answer the question if a license is required, they need to process different checks and screenings: customer, end-use, product and transaction. Currently done mostly manually (or with Excel sheets), RespectUs provide them with a cloud-based platform allowing them to process and duly document and keep records of the checks and screenings.

RespectUs platform will offer:

- Efficient product classification with regard to control lists, and exchange of classification sheets between suppliers and integrators
- Efficient customer and end-use due diligence
- Documentation of an internal compliance program
- Protection against legal fines and/or business suspension
- Productivity gains (time, resources, money)
- · Proper determination of license requirement
- · Demonstration of overall compliance with export control regulations

# PRODUCTS & SERVICES

The RespectUs platform will be composed of different modules, each of them being able to be subscribed to individually:

- Risk Assessment
- Customer Screening
- Product Classification
- End-Use checks
- License Determination
- Sanctions & Embargoes
- Knowledge Base

# TECHNICAL MEANS

RespectUs is a SaaS (software-as-a-service) product, that means a cloud-based computing software with a subscription basis and online access only.

# MAIN CUSTOMERS

SMEs and large enterprises from Space sector. Exporting companies and suppliers from other industries.

# MAJOR SPACE PROJECTS

Export Control compliance for Space companies, and their suppliers.

CEO Patrick GOERGEN CREATION DATE 2019 ORGANIZATION TYPE SME EMPLOYEES Total: 2 Space: 2 QUALIFICATIONS, APPROVALS

Graduate Fit4Start, 9th ed., Space

vertical (2020)

RespectUS 21 rue Glesener L-1631 Luxembourg Luxembourg www.respectus.space CONTACT

Patrick GOERGEN Tel: +352 27 86 4009 patrick.goergen@respectus.space



R&D in remote sensing applications in flooding and hydrodynamics

# PRODUCTS & SERVICES

- Remote sensing and computer simulations of flood hazard at local to global scales
- Flood disaster response assistance with Earth Observation (EO) products and services
- Flood event re-analysis using EO data and computer models
- Expert consulting services in remote sensing and modelling of flood hazard and risk

# TECHNICAL MEANS

- Expertise in AI and Machine Learning
- More than 15 years of expertise in academia and R&D in the field of remote sensing (in particular radar) and computer simulations of flood hazard:
- Expertise in flood hydrology;
- Experience in IoT, in particular using open geospatial web services.

# MAIN CUSTOMERS

#### Applied research funding sources:

- · Government departments;
- Space agencies;
- · Private sector companies;
- Public institutions (including universities):
- NGOs and international organisations;
- European Commission.

#### R&D services provision to:

- · Development aid organisations;
- Humanitarian response organisations;
- Private sector.

# MAJOR SPACE PROJECTS

- Active R&D projects focus mainly on flood disaster response assistance using EO products and services;
- Participation and mentoring in NASA/Europe Frontiers Development Lab (FDL);
- Acquisition of high-resolution drone data (Ville de Dudelange & Uni.lu).







#### CEO Dr. Guy Schumann

#### **CREATION DATE** 2017 **ORGANIZATION TYPE** SME

#### **EMPLOYEES**

#### Space: 1

#### **QUALIFICATIONS & APPROVALS**

Government-accredited private research institute

#### ADDRESS

#### RSS-Hydro Innovation Hub Dudelange 100, route de Volmerange L-3593 Dudelang Luxembourg www.rss-hydro.lu

#### CONTACT

Guy Schumann Tel: +352 206 005 63 01 rss-hydro@outlook.com



CEO

2001

SME

**EMPLOYEES** 

Total: € 3.9 M Space: € 210 K

**R&D INTERNAL** 

FR13/018059

FR12/01276

ADDRESS

L-5326 Contern

Luxembourg Tel: +352 26 17 941

CONTACT

Walter Grzymlas

w.grzymlas@

**INVESTMENTS 2019** 

**OUALIFICATIONS & APPROVALS** 

Certificat ISO 9001 : 2015

Certificat ISO 9100 : 2016

Valid until 04/08/2021

Valid until 04/08/2021

SATURNE TECHNOLOGY 2 Rue de l'Etang

www.saturne-technology.com

saturne-technology.com

Total: 13

Space: 2 TURNOVER 2019

€ 2.4 M

Walter Grzymlas

**CREATION DATE** 

**ORGANIZATION TYPE** 

# CORE BUSINESS

SATURNE TECHNOLOGY serves its clients and partners through experience and skills. The main objective is to meet the expectations and needs of customers, while respecting the three most essential points for effective partnership: quality, price, deadline.

The permanent challenge for all our customers is to quickly introduce new products on a changing market. Project managers, developers and designers use our services to validate a concept or the functionality of their parts or a prototype, detect possible design problems, present team marketing and convince their clients. They need to test different solutions, compare and confront them, validate industrial processes and optimise their knowledge to reduce manufacturing costs and, finally, confirm the launch of production in small, medium and large series.

# PRODUCTS & SERVICES

#### Additive manufacturing

Our selective laser process is the ideal solution for realising your functional parts. There is no loss of time between conception and getting your metal parts as parts are not obtained by removing but by adding material and additive manufacturing. We can make complex shapes and produce what was until recently inaccessible for the state of the art: • geometric forms without limit

- conduits and internal canals, in any forms and geometries
- more efficient cooling systems
- optimised lightening
- moving mechanical parts (e.g. ball joints, etc.)

#### Laser welding

SATURNE TECHNOLOGY's laser welding machines allow the realisation of welding, point by point, as well as cords with high quality and perfect precision:

- with or without contribution of material
- speed and precision
- absence of mechanical constraints
- complex forms

#### Laser drilling

We can make small circulars holes diameters, without moving the beam. Materials which can be drilled include steel, plastic, copper, ceramics, etc.

#### Laser cladding

With our reloading laser technology, we can deposit different types of alloys or materials on mechanical parts to increase their durability, hardness and profitability. Our deposits are realised with a "coaxial" head, allowing fine and/or important deposits, having a connection with the basic material, completed and without constraint.

#### Laser cutting

Our cut laser applies to different types of materials with complex contours which require a specific treatment, fast and without resistance. This method presents a number of advantages, the main one being the manufacturing without deformation in parts up to 3 mm in thickness. Our laser machines allow obtaining a precision lower than 1/100 mm on very diverse materials.

#### Precision engineering

To enable us to finalize the manufacture of parts in additive manufacturing or other parts made internally we have invested in a set of precision mechanics such as milling, EDM cutting, EDM drilling and grinding.

# TECHNICAL MEANS

AM Machines: 1 XSLM 500 HL, 2 X PROX 300

Machining: Machining 3 & 5 Axis, Manual Milling, CNC Lathe Turning, Manual Lathe Turning

Non Destructive Testing: CT Scanning, Radiographic Scanning, Blue Light Scanning, Laser Scanning, CMM

**Post Build Processes**: Wire EDM, Blasting (wet/dry), Support Removal, Chemical etch (FOD removal), ULTRASONIC / Other, Powder removal, Behringer Band Saw / Giant Tumbeler

#### Vacuum Heat Treat

Mechanical Testing: Ambient Temperature Fatigue Testing, High Temperature Fatigue Testing, LCF, HCF, Crack Propagation Growth, Fracture Toughness, Ambient and High Temperature Tensile Testing, Impact Testing, Tensile Testing

Hardness Testing: Rockwell Testing, Superficial Testing, Micro hardness Testing, Vickers Testing

**Chemistry Lab Services**: ICP-OES, Interstitial Element N, O, H, C, S, Sub-ppm Elemental Analysis, Flow Test, Tap Density Test, True Density Test, Morphology Evaluation, Failure Analysis, Metallographic Evaluation, Preparation, Grain Size, Microstructure, Macro Etch/Micro Etch, Porosity/ Density Evaluation, Particle Size Distribution, SEM w/EDS

# MAIN CUSTOMERS

Civil and military aeronautics, space, industry, armament, medical, automotive, nuclear, food-processing industry, art and jewellery, research and development

# MAJOR SPACE PROJECTS

Development and additive metal fabrication as well as laser welding of waveguides and satellite support. Development and additive metal manufacturing of engine components for rocket propulsion.









As the leader in global content connectivity solutions, SES operates the world's only multi-orbit constellation of satellites with the unique combination of global coverage and high performance, including the commercially-proven, low-latency Medium Earth Orbit (MEO) O3b system. By leveraging a vast and intelligent, cloud-enabled network, SES is able to deliver high-quality connectivity solutions anywhere on land, at sea or in the air, and is a trusted partner to the world's leading telecommunications companies, mobile network operators, governments, connectivity and cloud service providers, broadcasters, video platform operators and content owners. SES's video network carries over 8,300 channels and has an unparalleled reach of over 365 million households, delivering managed media services for both linear and non-linear content. The company is listed on Paris and Luxembourg stock exchanges (Ticker: SESG).

# • PRODUCTS & SERVICES

SES leverages a vast and intelligent network that spans satellite and ground infrastructure to create, deliver and manage video and data solutions. The company has two business units, focusing on very distinct businesses.

Across the Video business unit, SES offers a suite of capabilities to deliver high-quality video anywhere, anytime, and on any screen, via a comprehensive suite of distribution solutions using satellite, terrestrial, and IP networks.

Out of several thousand channels served via SES's satellites, the company carries 3,000 HD TV and commercial UHD TV channels. SES offers services such as content management, channel playout, content distribution; service and business management; media platforms. More information under www.ses.com/video.

The Networks business unit of SES provides market-tailored, fully managed solutions for customers in the telco, cloud, maritime, aero, energy and government segments. It is working with standards organisations and a growing partner ecosystem to help drive automation, orchestration and standards-based networking capabilities.

SES Networks' offering includes a suite of Signature solutions the industry's most comprehensive range of services and expertise; networks and platforms, and more: <u>www.ses.com/networks</u>.

# TECHNICAL MEANS

Satellite operation and services leveraging a multi-orbit fleet of GEO and MEO satellites, as well as extensive ground infrastructure.

# MAIN CUSTOMERS

SES is trusted by public and private broadcasters, content owners, telcos, MNOs, enterprises, governments and institutions across the world.

# MAJOR SPACE PROJECTS

Today, SES's O3b MEO system is the only technically-, operationallyand commercially-proven non-geostationary (NGSO) system for delivering low-latency data communications. Positioned at only 8,000 kilometres away from Earth, the system powers low-latency high-throughput solutions that can be seamlessly integrated into terrestrial networks. The current O3b constellation has been operational since 2013 and is delivering fibre-equivalent connectivity services to customers in nearly 50 countries.

Based on the proven concept of the current O3b MEO system, SES's next-generation satellite communications system O3b mPOWER will bring exponentially more capabilities and opportunities. O3b mPOWER is the world's only fully-funded NGSO broadband system in development today. The highly flexible O3b mPOWER constellation comprises an initial constellation of seven ultra-high-capacity, low-latency, high-power MEO satellites, each with thousands of fully-shapeable and steerable beams that can be shifted and scaled in real-time to meet customers' demands. O3b mPOWER will provide multiple terabits of throughput globally to drive digital transformation and cloud adoption virtually anywhere on the planet.

Among other upcoming top of the range space assets, is SES's high-throughput geostationary satellite SES-17, dedicated to providing services for the aeronautical, maritime, fixed and mobile broadband markets.



#### CEO Steve Collar CREATION DATE 1985 ORGANIZATION TYPE Large Enterprise EMPLOYEES Total: 2.000+ TURNOVER 2019 Total: € 1,983.9 M QUALIFICATIONS & APPROVALS SES Techcom SA ISO 90001-2008

**ADDRESS** 

Chateau de Betzdorf

L-6815 Betzdorf

Luxembourg Tel: +352 710 725 1 www.ses.com

SES



SkyfloX develops the ESA patented concept ORCA (Optical and Rf Constellations on Airplanes) and plans to use commercial airliners as a platform carrying small remote-sensing equipment, which would image the ground as the planes travel on their regular routes. A constellation of such payloads, hitching a ride on the thousands of aircraft flights crossing the continents every day, would provide coverage and revisit frequencies impossible with satellite-based systems and at a fraction of the cost.

# PRODUCTS & SERVICES

The pilot project, co-funded by ESA's Business Applications Program, is the first step towards ORCA's commercial deployment, which will enable a whole new range of applications such as early forest fire detection, disaster relief, affordable infrastructure monitoring, resource management or detailed monitoring of the environment and the atmosphere.

# • TECHNICAL MEANS

SkyfloX has in-house (thermal) remote sensing expertise, air law expertise, aircraft certification expertise, develops proprietary software for coverage simulations and statistics, and owns the IP of the Supplemental Type Certificate (STC) currently in development with SAFRAN necessary to install ORCA payloads on aircraft.

# MAIN CUSTOMERS

Currently confidential, though SkyfloX is actively working with the largest EO analytics companies in the world for its upcoming pilot project.

# MAJOR SPACE PROJECTS

SkyfloX has signed a multi-million Euro contract with the European Space Agency (ESA) Business Application Programme to co-fund the development of services using its revolutionary aircraft-based Earth observation system ORCA. ESA will co-invest in the pilot project together with SkyfloX and its partners, which include major airlines Luxair and Transavia, as well as strategic aerospace players such as Germany-based Safran Engineering Services and Kampf Telescope Optics, Luxembourg's Euro-Composites and EmTroniX, and Swedish Spacemetric.



#### CEO Tim Heijmann CREATION DATE 2018 ORGANIZATION TYPE SME EMPLOYEES 6 R&D INTERNAL INVESTMENTS not disclosed

#### ADDRESS

- SkyfloX 9, avenue des Hauts-Fourneaux L-4362 Esch-sur-Alzette Luxembourg www.skyflox.eu CONTACT Tim Heijmann
- Tel: +352 661 318 780 t.heijmann@skyflox.eu



Space Cargo Unlimited is dedicated to seizing the potential of Space microgravity for commercial applications on Earth. Space Cargo Unlimited operates a variety of pressurized third parties' vehicles for round-trip missions to Low Earth Orbit, carrying payloads for research & manufacturing purposes.

# PRODUCTS & SERVICES

Space Cargo Unlimited offers turn-key pressurized round-trip missions from launch platforms around the world. With a portfolio ranging from suborbital missions on new space vehicles, as well as established platforms such as ISS, Space Cargo Unlimited offers a comprehensive range of modern science applications as well as manufacturing opportunities in space.

# TECHNICAL MEANS

Building on strategic partnerships with vehicles operators and leveraging the high-level expertise of the European industry, Space Cargo Unlimited develops comprehensive expertise in complex microgravity project management and funding. Space Cargo Unlimited has partner teams in France, Germany, Italy, and the USA, with a network covering nearly all major actors in space infrastructures worldwide.

# MAJOR SPACE PROJECTS

In November 2019, with mission ComµBioS SCU transported bottles of red wine to the International Space Station to age in Space for a year-long mission. The goal is to better understand the evolution of food taste and microorganic composition in the extreme conditions of Space. Wine being taken here as a proxy for complex liquid food systems.

In December 2019, with mission ALPHA SCU exposed vine calluses to weightlessness aboard a Blue Origin New Shepard spacecraft before returning to Earth. In this experiment, SCU commissioned a new scientific protocol called "Self-Guided Evolution" triggering a high evolutional rate of organisms in a Space environment.

In March 2020, with mission CANES SCU transported 320 vine plants to the International Space Station to be stored for a duration of 6 months. The goal is to trigger the plants to mobilize and resort to their inner defenses when threatened by the harsh environment of Space. CANES purpose is to discover the mechanisms at play in the plants inner defense systems to help plants adapt to harsher environments in the context of global climate change.

These missions are part of the larger Mission WISE (Vitus Vinum in Spatium Experientia). Space Cargo Unlimited's Mission WISE aims at developing new models and technology to tackle the future of agriculture and food by leveraging the effect of microgravity on complex biological systems. Mission WISE is the first comprehensive, privately led applied research program in Space, aimed at preparing the future of agriculture.

# CEO Nicolas Gaume

CREATION DATE 2014 ORGANIZATION TYPE SME EMPLOYEES 5

#### ADDRESS

Space Cargo Unlimited 12, rue Guillaume Schneider L-2522 Luxembourg Luxembourg www.space-cu.com **CONTACT** Nicolas Gaume Tel: +33 6 08 75 48 75 or +1 425 559 0800 ngaume@space-cu.com



space4environment is an independently owned SME focusing on adding the environmental dimension to Earth Observation in the land domain, respectively "using space data to provide space for the environment", as expressed in the company's motto.

At space4environment we are building our GIS and Earth Observation activities on three pillars of expertise:

- · Sound knowledge of the data (at national and European level),
- Expertise in data handling, processing and scientific analysis,
- Policy related thematic assessments

space4environment is applying this expertise on the one hand for the provision of quality control and quality assurance of Copernicus products, as well as in support of environmental reporting obligations and dataflows, and on the other hand to assess issues like environmental sustainability, the condition of ecosystems and their services or the state of environment in general.

# PRODUCTS & SERVICES

#### GIS and EO data processing

Satellite data processing & analysis - Land use / land cover mapping, change mapping - Database design, management & interactive query tools (dashboards) - Spatial modelling and software development - Digital Cartography - Web mapping tools

#### **Environmental assessments**

Mapping and assessment of ecosystems and their services - Green Infrastructure - Land systems and resource efficiency - Urban sustainability -Disaster risk mapping - LULUCF reporting and data analysis

#### Geodata provision and distribution

Official distributor of Eurogeographics data

#### Management and consultancy

Requirements analysis - Geographic information consultancy -Project definition and supervision

# MAIN CUSTOMERS

International organisations

- European Commission (DG Environment, Eurostat, JRC, ESPON)
- European Environment Agency (EEA)
- European Space Agency (ESA ESRIN)
- Airbus DS Geo
- Convention on Biological Diversity (CBD)

#### Luxembourg organisations

- Ministère de l'Energie et de l'Aménagement du territoire
   Département de l'aménagement du territoire
- Ministère du l'Environnement, du Climat et du Développement durable
   Département de l'Environnement
- LuxSpace
- LISER
- LIST Environnement et Agrobiotechnologies

# MAJOR SPACE PROJECTS

#### Copernicus:

- Quality control of Copernicus High Resolution Layers and Hotspot Monitoring products
- Quality assurance of Copernicus Global Hot Spot Mapping products for Africa
- Quality assurance of the VHR 2018 satellite image coverage of Europe (6 Mio sqkm)
- Development of a new European land monitoring concept (i.e. 2nd generation CLC or CLC+)

#### Land cover mapping:

- Land Information System Luxembourg 2015
- Land cover 2018 a very high-resolution land cover map of Luxembourg
- Land use 2018 a very high-resolution land use map of Luxembourg
- Development of an interactive, EO-based information and monitoring system for Natura2000 sites
- Mapping of CLC Luxembourg: 2006, 2012 and 2018
- Coordination, capacity building and quality assurance of CLC 2018 in 10 countries (6 West Balkan Countries, Cyprus, Denmark and Switzerland)







CEO

SME

Total: 9

Space: 9

**ADDRESS** 

Luxembourg

CONTACT Stefan Kleeschulte Tel: +352 26 71 41 35 info@space4environment.com

**EMPLOYEES** 

**TURNOVER 2018** 

Total: € 1.644.000

Space: € 900.000

space4environment

L-6947 Niederanven

48, rue Gabriel Lippmann

www.space4environment.com

Stefan Kleeschulte

ORGANIZATION TYPE

CREATION DATE



SPARC Industries addresses some of the most sophisticated questions in the field of plasma-based technologies with its team and its selfdeveloped, highly specialized software tools.

Apart from having the general capability of simulating new and highly innovative space propulsion technologies, these software tools will allow both incrementally optimizing existing propulsion technologies, as well as studying disruptive concepts.

The current satellite thruster development is a logical consequence of SPARC Industries' previously developed and tested satellite propulsion technology. A novel thruster concept has been identified and implemented in the prototype. In this new concept, two major features are preserved: novelty and simplicity.

The simplicity of the thruster allows using both, noble gases as well as molecular gases. The former has benefits in terms of energy efficiency and reactivity, the latter is beneficial in the context of space resource utilization and air-breathing. The prototype is designed to operate with Krypton although other noble gases would also work.

# PRODUCTS & SERVICES

Within our R&D service we offer our core expertise for engineering & scientific consultancy. This includes performing simulations with tools which match the requirements – including our unique plasma simulation tool for high Knudsen number gas and plasma flows. Our self-developed gas & plasma simulation tool is being used to simulate very energetic gas flows at very low densities (where standard flow simulation tools (CFD/MHD) fail in reproducing physics accurately due to invalid assumptions. SPARC Industries SARL also offers an international maintenance service for neutron generators to end customers and manufacturers.

# MAIN CUSTOMERS

Clients with questions and problems from aerospace, nuclear, and low-pressure plasma industry find in SPARC Industries a reliable, competent, and loyal partner.





#### CEO Dejan Petkow CREATION DATE 24.11.2017 ORGANIZATION TYPE SME EMPLOYEES Total: 8 Space: 8 R&D INTERNAL INVESTMENTS € 150.000 QUALIFICATIONS & APPROVALS RDI Certificate

#### ADDRESS

SPARC Industries TECHNOPORT SA – BELVAL 9, avenue des Hauts-Fourneaux L-4362 Esch-sur-Alzette Luxembourg www.sparc-industries.com CONTACT Dejan Petkow

Tel: +352 5455 80560 info@sparc-industries.com



Spire is a next-generation data and predictive analytics company that collects data from space to solve problems on Earth. Spire identifies, tracks and predicts the movement of the world's resources and weather systems. Using its constantly improving global constellation of radio frequency (RF) listening satellites and predictive analytics capabilities, Spire helps businesses and governments decide, with increasing certainty, what to do next in a rapidly changing world.

The team in Luxembourg is focused on Spire Weather, offering industry-leading model technologies and predictive product suites. These robust forecasting tools have the power to help companies across industries.

The Luxembourg office is also home to Spire's Maritime business unit, which delivers AIS data APIs with built-in maritime intelligence to industry stakeholders.

# PRODUCTS & SERVICES

Spire focuses on developing products that leverage big data and predictive analytics to provide next-generation intelligence, designed for a world in which accurate weather forecasting is more vital than it has ever been before.

#### Spire Sense Cloud

A one-stop-shop for maritime data analytics, best-in-class maritime domain awareness and state-of-the-art vessel tracking.

#### Spire Stratos Cloud

Uses signals from global navigation satellites to gather weather data about our atmosphere, ground, oceans, and magnetic field. Spire's Global Earth Model is one of the world's most accurate and frequently updated weather forecasts, it can support business and humanitarian efforts the world over.

#### Spire AirSafe Cloud

Optimises management of the skies for safety, profitability and environmental conservation by identifying, tracking and predicting the global movement of aircraft.

#### Spire's Space as a Service

Offers organisations and governments the unique opportunity to rapidly deploy custom payloads and RF listening sensors, with a global footprint, i mere months

# TECHNICAL MEANS

Spire has almost 100 nanosatellites in orbit. It has the world's largest constellation of RF listening satellites, collecting thousands of radio occultation measurements for high-precision weather data and Earth Information measurements that no other company is capturing. With ship tracking (AIS), aircraft tracking (ADS-B), advanced weather model and custom RF listening products, Spire enables decision-makers to continuously optimise strategic and tactical decisions for the future.

Spire's satellite network is equally matched by the world's largest LEO ground station network. By harnessing the exponential impact of technology, Spire can reliably and consistently grow the might of its global data collection and analytics capability faster than anyone else. This enables it to rapidly deploy custom products that have never been in space before, at low cost, just months after they are conceived.

# MAIN CUSTOMERS

Customers range from small logistics analytics companies to large enterprises and governments. Our panel of experts and strategic partnerships across verticals are well positioned to tackle some of the most pressing problems of the 21st century.

# MAJOR SPACE PROJECTS

We are rapidly scaling our team in Luxembourg in order to carry out a wide portfolio of scientific and engineering projects, including:

- Provision of a Data Lake containing all data generated by Spire to public research institutions in Luxembourg and local start-ups.
- Real-time, all-weather monitoring of flooded areas, current CYGNSS satellite constellation can compensate for imaging satellites' shortcomings under heavy cloud cover.
- Real-time monitoring of the ionospheric disturbances caused by tsunami waves in order to determine the location of the tsunami wave after an earthquake and thereby improve warning systems.
- Determination of the feasibility of soil moisture data from nanosatellites. Using surface reflections, our satellites can determine the local moisture of the soil, improving irrigation needs in the most raindeprived areas of the world.

# CEO

# Peter Platzer CREATION DATE

#### 2012 (San Francisco, California, USA) 2018 (Luxembourg) ORGANIZATION TYPE SME

EMPLOYEES Total: 30

**ADDRESS** 

Luxembourg

CONTACT

www.spire.com

Merima Muhovic Tel: +352 285 5031 Merima.muhovic@spire.com

33, rue Sainte Zithe

L-2763 Luxembourg

Spire

Telindus Luxembourg is a Proximus company and, through Telindus Telecom, the Group's enterprise operator in Luxembourg. It provides solutions to a variety of private and public sector companies. Its areas of expertise include enterprise networks and connectivity (national and international), datacentres, systems, storage, security, collaboration, applications and mobility.

Relying on Telindus Luxembourg's expertise, Telindus Telecom develops innovative "IT-as-a-Service" solutions and is positioned as the best global telecom operator for enterprises in Luxembourg. Entrepreneurs, decision makers, IT managers, discover the first global Telecom and ICT solution created by Cloud experts. With a customer centric approach, Telindus Luxembourg positions itself as the privileged partner for businesses and administrations in Luxembourg. In order to accompany its customers, at their own pace, with the highest respect for their evolution, Telindus adapted its wide range of solutions and services to meet the very specific needs to any customer profile.

With more than 400 accomplished specialists, Telindus Luxembourg's strategy is to focus on customer needs managed through a single point of contact to meet overall ICT requirements.

In the Space domain, Telindus positions itself in activities related to Security, Virtualisation, Routing and Switching.

# • PRODUCTS & SERVICES

Our solutions portfolio is designed around 6 strategic pillars and meets the needs of today's economy, the any3Economy (anywhere, anytime, anyhow):

- Enterprise Network and Connectivity: Deliver a state of the art converged and secured platform within companies offering national and international connectivity
- Enterprise Datacentres: Answering the growing demand for Everythingas-a-Service and pay as you use customer needs
- Enterprise Security: Relying on technology to face security risks and ensure business continuity
- Collaboration: Deploying the toolbox for smarter enterprise wide unified communication
- Applications: Providing application availability to the any 3 customer
- Mobility: Putting the power in the hands of the user who wants to work in a ubiquitous world

Telindus Telecom can provide your business with tailormade connectivity solutions adapted to your specific needs, including fixed and mobile telephony, Internet, networking and Cloud computing. Beyond technical consultancy, integration and project management

competencies, Telindus is also a renowned player in the professional training industry.

# MAIN CUSTOMERS

Major companies from all sectors: Finance and Insurance, Commerce, Industry & Transport, Publics services, Services and E-Business.

# MAJOR SPACE PROJECTS

- TC Authentication and Data System Security: qualify the security of applications residing on ESA / ESOC Relay LAN DMZ and applications communicating with ESA ESTRACK Ground Stations and recommend improvement in the architecture
- Mission Control System Security Study: assess the current security level
   of the SCOS-2000 Mission Control System
- Data System Security Risk Analysis: improve the information security of ESOC's Operations Data System by identifying a set of security controls that optimally (in terms of Return on Security Investment) governs the security assurance all through the implementation and operation phase
- Study on Cryptographic Design: evaluation of selected cryptographic configurations (localisation of security mechanisms, combinations of algorithms, key-sizes, etc.) in the context of packet TM/ TC protocols
- Standards, specifications and processes for space software and hardware development: analysis of the use of standards, processes and specifications for software and hardware developments in the context of projects for ESA and in the space sector in general
- GMES Security Concept Study: Analysis of GMES security requirements fulfilment within the reference architecture and specification of a suitable security concept
- Generic Secure Ground Architecture: Design and prototypic implementation of a security architecture to generically authenticate and encrypt communications between ground stations and spacecraft
- Generic Application Security Framework: Extension of space software development standards to introduce application security aspects into software development lifecycles. Implementation of software to identify security requirements and track their implementation within the software development process.

#### CEO Gerar

Gerard Hoffmann Chairman & Managing Director Telindus Luxembourg CREATION DATE 1978 ORGANIZATION TYPE Large Enterprise EMPLOYEES Total: 500 Space: 29 QUALIFICATIONS & APPROVALS

telindus

GFC8 – Ground System Software related activities

#### ADDRESS

Telindus Luxembourg 81-83, route d'Arlon L-8009 Strassen Luxembourg www.telindus.lu **CONTACT** Tel: +352 450 915-1

contact@telindus.lu







Environmental Research and Innovation (ERIN) department The ERIN department is active in the use of Earth Observation (EO) data for environmental management, precision agriculture, maritime surveillance and risk management applications. The focus of the research in remote sensing is geared towards a better use of EO data in operational water resources and ecosystem management tools and to integrate remote sensing data (satellite, airborne and ground) together with global navigation satellite systems for near real-time eco-hydrological, hydraulic, and crop growth modelling. These activities are supported by computer scientists active in data analytics, statistics, interactive 2D/3D visualization and data management. ERIN is also active in studying how satellite networks will be integrated in future 5G-IoT (Internet of Things) systems, enabling efficient crisis management, and environmental monitoring.

# PRODUCTS & SERVICES

- Development of retrieval algorithms for biochemical and structural parameters from vegetation and soils, as well as for extracting hydrology-related variables such as evapotranspiration, soil moisture and flooded areas from EO data
- Integration of satellite, airborne and in-situ remote sensing data together with global navigation satellite systems and telecommunication for developing space-based environmental, agricultural and risk management applications
- Service activities for surveys, environmental monitoring, civil security using the thermal hyperspectral airborne platform and drones
- Maritime traffic monitoring based on the integration of Synthetic Aperture Radar and AIS data.
- High-dimension data analytics and visualisation
- Geospatial software technologies and platforms for web based data integration
- Training

# TECHNICAL MEANS

- Thermal hyperspectral airborne platform, including a lightweight and compact imaging radiometric spectrometer (Hyper-Cam-LW built by Telops), a stabilisation platform, an Image Motion Compensator mirror, a GPS/INS unit, and a visible boresighted camera
- Airborne imaging spectrometer for simultaneous acquisition of VNIR and SWIR data (400-2500 nm), an ASD FieldSpec3 non-imaging spectrometer, a LI-COR LAI-2000 Plant Canopy Analyzer and a Minolta SPAD 502 DL Portable Chlorophyll Meter for Leaf Area Index (LAI) and chlorophyll reference measurements in the canopy
- UAV platform: DJI multicopter platform equipped with hyperspectral, LIDAR and thermal sensors
- HPC infrastructure for advanced computation and visualization wall
- IoT-satellite integrated testbed

# MAIN CUSTOMERS

ESA, CNES, Ministry of Environment, Water Agency, Civil security, Ministry of Agriculture, Luxspace, HITEC Luxembourg, Terrasphere, Aerovision BV, Aurea Imaging, Capgemini, VITO, TELOPS-Canada, University of Leuven, TU Vienna, University of Bristol, space4environment, adwaïsEO, SES, EarthLab, Cybercultus, Kleos, Blue Horizon, Hydrosat, World Bank, ISARDSAT, CIMA Research Foundation, Earth Observation Data Centre, Wageningen University, ISRIC World Soil Information Center, University of Münster, JPL, NASA AMES Research Centre, European Space Operations Centre, Agroptimize

# MAJOR SPACE PROJECTS

LANDCOVER CCI – Global land cover map development for climate modelling applications

SOC3D – 3D soil organic carbon monitoring using VNIR reflectance spectroscopic techniques

PLANTSENS – Detection of plant stress using advanced thermal and spectral remote sensing techniques for improved crop management. TOPBOX – Time series analysis of PROBA-V vegetation data toolbox M2MSAT – Light-weight application and transport protocol for future M2M application

YPANEMA – Mapping of crop nitrogen status from Sentinel-2 images through inversion of a canopy reflectance model

SKUA – Vessel monitoring and kinematic modelling based on satellite Earth Observation and ground measurements

SENSECO – Optical synergies for spatiotemporal sensing of Scalable ecophysiological traits

CASCADE – Combining earth observation with a large scale model cascade for assessing flood hazard at high spatial resolution

Prof. Dr Lucien Hoffmann CREATION DATE 2015 ORGANIZATION TYPE Public Research Centre EMPLOYEES Total: 190 Space: 20

HEAD OF DEPARTMENT

#### ADDRESS

Luxembourg Institute of Science and Technology (LIST) Environmental Research and Innovation (ERIN) department 41, rue du Brill L-4422 Belvaux Luxembourg www.list.lu/en/research/erin **CONTACT** Prof. Dr Lucien Hoffmann Tel: +352 275 888 1



IT for Innovative Services (ITIS) department

HEAD OF DEPARTMENT

Prof. Dr Eric Dubois

**ORGANIZATION TYPE** 

Public Research Centre

**QUALIFICATIONS & APPROVALS** 

for Space Standardisation -

Software Engineering

Luxembourg Institute of

Science and Technology

IT for Innovative Services

L-4362 Esch-sur-Alzette

www.list.lu/research/itis

Prof. Dr Eric Dubois

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Fax: +352 275 885

eric.dubois@list.lu

5, avenue des Hauts-Fourneaux

(ITIS) department

Luxembourg

CONTACT

cations Projects)

**ADDRESS** 

(LIST)

ECSS-E-40 (European Cooperation

Guidelines for the Telecom Appli-

**CREATION DATE** 

**EMPLOYEES** 

Total: 144

Space: 9

2015

The IT for Innovative Services (ITIS) department of the Luxembourg Institute of Science and Technology (LIST) has as objective to support the digital transformation of organisations, with a focus on the role of digital 'big data' for improving the performance of: Processes, Infrastructures and People

Its experts arrange numerous multi-disciplinary skills for optimal R&D realisations on IT-enabled business services, service system architectures quality, information intensive service, data and business analytics, collaborative learning and decision support.

# PRODUCTS & SERVICES

#### Distributed Systems Architectures

- IT Services oriented architectures
- Distributed architectures and multi-agents' systems
- Interfaces and communication between IT applications
- Mobiles and ambient infrastructures
- Wireless and mobile data communication, incl. satellite communications

#### **Critical Information Management in Data Intensive Systems**

- IT/IS systems and data/information security and privacy
- Protection strategies for critical information
- Techniques and tools to search, analyse and manage formal and informal information
- Knowledge modelling and ontologies
- Business analytics and artificial intelligence

#### Data Sciences

- Data analytics and (explainable) Artificial Intelligence
- Machine Learning
- Knowledge modelling and ontologies
- Visual Analytics
- Scalability issues in data sciences
- Advanced Statistics
- Combining data-driven and physics-based modelling in complex problem solving.

#### **Cognitive systems**

- Human-Computer Interaction
- (Large-scale) Visualisation
- Personalisation of services
- User Interfaces Design
- Augmented and Virtual Reality
- Situational Awareness
- Engineering and management of collaborative learning
- Assessment environments

# MAIN CUSTOMERS

ESA, SES, HITEC Luxembourg, LuxSpace, Cybercultus

# MAJOR SPACE PROJECTS

- TRANSCOMAS (ERDF Interreg) Creating a cross-border Network of AeroSpace Measure and Control facilities, to allow interested Space actors to benchmark their products and services and thus to improve fulfilment of highly requesting requirements of the Aerospace sector.
- CARLINK (Celtic) developing an intelligent wireless traffic service platform between cars supported by wireless transceivers beside the road. The primary applications are real-time local weather data, urban transport traffic management, and urban information broadcasting. Cars (using SAT based location services) have integrated wireless transceivers to communicate with base stations located beside the road. In addition, cars may also communicate between each other as members of an ad-hoc network. Base stations provide real-time information (e.g. local weather) to the cars driving past. At the same time, cars gather real-time data (weather, traffic density) and deliver this information back to base stations.
- DG-Trac (ESA) Dangerous Goods Tracking & Tracing Feasibility study on a tracking and tracing system for dangerous goods transport in the medical sector.
- SENSA (ESA) (participating) Sustainable, Environmental and Safe Tourism in Protected Areas Safety services and real-time touristic information for travellers in protected parks in South Africa. SENSA uses satellite trackers with other networks and dedicated mobile applications to help the tourists connect in all situations with the parks authorities.
- DMSS (ESA) (participating) Advanced data analytics and visualisation of spacecraft telemetry data (joint project with KU Leuven).
- Publimape (FNR) (participating) Publimape analyzes the semantic and the quality of data contributed on the social networks, focusing on multimodal content in social platforms, notably tweets featuring both text and picture. It develop a tool chain for building operational knowledge and using it for the monitoring of major environmental event and crisis. The project includes the test of the novel approach on a real-scale pilot use-case consisting in a major flood event. (joint project with Remote Sensing Group of LIST).



#### Materials Research & Technology (MRT) department

The Materials Research and Technology department (MRT) is a department of the Luxembourg Institute of Science and Technology (LIST). MRT pools its skills and technologies to improve materials technologies for the industry, including the space sector.

Our research and technology activities rely on the following fields of expertise:

- · Nanomaterials and nanotechnology
- Composite materials
- Manufacturing technologies
- Scientific instrumentation

# PRODUCTS & SERVICES

Specific to the space sector, MRT activities target five priority technologies:

- Advanced manufacturing for space applications, aiming at manufacturing new (multi-)functional, lightweight or durable composite materials, by a combined approach of instrumented and robotized processes, adequate numerical modelling and testing.
- Thin Film technologies. Based on a large panel of industry-scalable deposition technologies, MRT develops thin film technologies for a wide range of surface functionalities.
- Technologies for energy, targeting more powerful, lightweight and safer energy storage, generators and innovative energy harvestors.
- Autonomous Sensors. MRT develops miniaturized temperature, mechanical & chemical sensors based on innovative sensing technologies and printing technologies.
- Scientific Instrumentation for space, focusing on miniaturized instruments and sensors platforms, for space exploration, autonomous in-space manufacturing and in-habitat monitoring.

# • TECHNICAL MEANS

#### Up-scalable processing technologies

- (bio-based) Raw materials refining and modification
- Synthesis of nano-structures, nano-particles and organic chemistry
- Powder engineering
- Thin-film processing, engineering and devices
- Polymer Processing
- Composite manufacturing

#### Advanced characterisation & Functional measurements

- Molecular analysis
- · Elemental and isotopic analyses
- Structure, morphology and topography
- Non-destructive Inspection
- Mechanical testing
- Accelerated ageing
- Thermal analysis
- Characterization of optical & electrical properties

#### Numerical simulation

- Commercial codes (finite element, molecular dynamics, crystal plasticity)
- In-house codes (finite element, composite, boundary element method, e-Xtended finite element, XEFG)

# MAIN CUSTOMERS

Airbus DS, Axon' Cable, CNES, CSL, ESA, Euro-Composites, Gradel, I-space, KLEOS, Luxspace, Molecular Plasma Group SA, NASA, SouthWest Research Institute, Thales Alenia Space

# MAJOR SPACE PROJECTS

- · Super-black coating technology for complex opto-mechanical systems
- · Miniaturized mass spectrometers for space exploration
- Miniaturised chemical sensors for the monitoring of molecular contamination on payload surfaces
- Anti-static ETFE based nanocomposite
- Improved thermal conductivity of epoxy resin
- Carbon-based solutions for super-capacitors, Li-ion batteries and fuel cells
- Software tool enabling numerical analyses of composite space structures
- Fully integrated stress-temperature sensors for structural health monitoring
- Antibacterials-antifungal coatings for in-orbit habitat
- In-space pultrusion manufacturing

**HEAD OF DEPARTMENT** 

#### **ORGANIZATION TYPE**

Public Research Organisation EMPLOYEES Total: 200 Space: 15

#### ADDRESS

Luxembourg Institute of Science and Technology (LIST) Material Research & Technology (MRT) department 41, rue du Brill L-4422 Belvaux Luxembourg www.list.lu/en/mrt CONTACT

Dr Damien Lenoble Tel: +352 275 888 580 damien.lenoble@list.lu



University of Luxembourg Geodesy and Geospatial Engineering (GGE)

**HEAD OF DEPARTMENT** 

**ORGANIZATION TYPE** 

University of Luxembourg

and Communication (FSTC) Geodesy and Geospatial Engineering (GGE)

Prof. Felix Norman Teferle

Tel: +352 46 66 44 5790

norman.teferle@uni.lu

Fax: +352 46 66 44 35790

L-1359 Luxembourg www.uni.lu

Faculty of Science, Technology

6, rue Richard Codenhove-Kalergi

**CREATION DATE** 

2017

University

Total: 7

Space: 4

ADDRESS

CONTACT

**EMPLOYEES** 

Prof. Felix Norman Teferle

# CORE BUSINESS

The Team Geodesy and Geospatial Engineering specializes in geodetic high-precision measurements and Earth Observations (EO) within various multi-scale geophysical, environmental and engineering applications, as well as improvements in the involved measurement techniques (e.g. GNSS, SAR remote sensing, photogrammetry, LiDAR).

- GNSS-derived crustal deformations for studies of sea-level rise, glacial isostatic adjustment and plate tectonics
- GNSS-derived atmospheric parameters for applications in meteorology and climatology using real-time, near-real-time and post-mission processing
- Multi-platform digital photogrammetry for the computation of high resolution digital terrain/elevation models for flood hazard modelling and flood prediction
- High-precision multi-sensor geodetic monitoring for infrastructure applications
- Multi-sensor 3D reality capture for Building Information Models and Digital Twins

# PRODUCTS & SERVICES

We are GNSS specialists and can provide a variety of related products (station coordinates, atmospheric parameters and satellite orbit and clock products as well as Earth Rotation Parameters). In the past we have provided coordinate solutions for reference GNSS networks on national to global scales. Our background in remote sensing and geospatial engineering allows also for classic topographic survey products, the generation of digital terrain and elevation models, building information models (BIM) as well as deformation maps of geophysical features/infrastructure and subsidence/uplift maps of cities and regions. We are an International GNSS Service (IGS) Tide Gauge Benchmark Monitoring (TIGA) working group analysis and combination center. We provide near real-time hourly GNSS tropospheric products to EUMETNET eGVAP for assimilation into numerical weather prediction models.

# TECHNICAL MEANS

We operate state-of-the-art permanent GNSS stations at Findel Airport and Campus Kirchberg (G.D. Luxembourg), Walvis Bay and Lüderitz (Republic of Namibia) and the South Atlantic Ocean islands of South Georgia (South Georgia and the South Sandwich Islands), St. Helena and Tristan da Cunha (Ascension, St Helena and Tristan Da Cunha). We maintain a variety of scientific GNSS software (Gamit/Globk, Bernese GNSS Software, PRIDE, Napeos, RTKLib), as well as various geospatial software suits (e.g. Leica GeoOffice, Trimble Business Center, Hexagon Geospatial Suite, PCI Geomatica, ESRI ArcGIS), which we run on our in-house workstations or on the UL High Performance Computing Facility (ULHPC). For projects also available are our GNSS RTK kits, reference GNSS kits, terrestrial laser scanners, a drone and state-of-the-art surveying equipment.

# MAIN CUSTOMERS

Administration du cadastre et de la topographie (ACT), Administration de la navigation aérienne (ANA) – MétéoLux, RSS-Hydro S.a.r.L, National Oceanography Centre (NOC), British Antarctic Survey (BAS), GeoForschungsZentrum Potsdam (GFZ), International Oceanographic Commission (IOC), Hartebeesthoek Radio Astronomy Observatory (HartRAO), Astronomical Institute University of Bern (AIUB), University College London (UCL), Luxembourg Institute of Science and Technology (LIST), Maxar/DigitalGlobe, PCI Geomatics, Hexagon Geospatial

# MAJOR SPACE PROJECTS

Participation in NASA Frontiers Development Lab (FDL) in 2017, 2018 and 2019:

- Lunar Resources (Water & Volatiles) https://frontierdevelopmentlab.org/ fdl-2017
- Space Weather Challenge 02, Improve ionospheric models using GNSS/ GPS data https://frontierdevelopmentlab.org/space-weather
- Disaster Prevention, Progress and Response, final topic: Flood detection in orbit (onboard a cubesat) https://fdleurope.org/fdl-europe-2019





**Geophysics Laboratory** 

#### HEAD OF DEPARTMENT Prof. Olivier Francis CREATION DATE 2005 ORGANIZATION TYPE University EMPLOYEES Total: 15 Space: 10

### ADDRESS

University of Luxembourg Faculty of Science, Technology and Communication Geophysics Laboratory Maison du Nombre 6, avenue de la Fonte L-4364 Esch-sur-Alzette Luxembourg www.uni.lu **CONTACT** Prof. Olivier Francis Tel: +352 46 66 44 6264 Fax: +352 46 66 44 5643 olivier.francis@uni.lu

# • CORE BUSINESS

The Geophysics Laboratory focuses on climate, sea level variability and geodynamics. The primary goals include obtaining reliable geodetic measurements of environmental change and assessing the influence of human and natural factors in those changes. To do so, the group has developed a patented differential free-fall gradiometer as part of our activities in scientific metrology, advanced high-accuracy Global Navigation Satellite Systems (GNSS) techniques, provided interpretation of time variable gravity from space and improved the modelling of environmental effects on geodetic observations.

# PRODUCTS & SERVICES

The gravity instrumentation can be used for metrology. We have the ability tomeasure the acceleration of gravity to 1-2 microgal (1 microgal = 10-8 m/ sec<sup>2</sup>). GNSS, for example GPS, can be used to monitor positions of stationary and moving objects with high accuracy on a global scale. We have the ability to apply different GPS processing strategies for absolute and relative positioning, and modelling depending on client requirements to achieve millimetre to centimetre level precision and accuracy.

# TECHNICAL MEANS

- Absolute Gravimeter: The portable instrument has the ability to measure the acceleration of gravity to 1-2 microgal (1 microgal = 10-8 m/sec<sup>2</sup>)
- Relative Gravimeters: The portable Scintrex Relative gravimeter has a precision of about 3 microgal (it is sensitive to height changes of 20 mm)
- Superconducting Gravimeter: Non-portable relative instrument that primarily records changes in gravity due to solid Earth and ocean tides and atmospheric pressure; it is valuable in monitoring short- period changes in gravity
- GNSS Equipment: The GL have a range of state-of-the-art geodetic grade GNSS receivers which have the ability to observe all current GNSS signals

# MAIN CUSTOMERS

NASA, ESA

# MAJOR SPACE PROJECTS

We use satellite imagery data but also satellite gravity, GNSS observations, and altimetry for our research. The Geophysics Laboratory developed GNSS reflectometry to detect changes in soil moisture, snow depth, and sea-level for scientific applications. Recently, GL have developed algorithms for spaceborne GNSS-R for soil moisture and sea-ice studies.



# Research Unit in Engineering Science (RUES)

HEAD OF DEPARTMENT Prof. Stephan Leyer CREATION DATE 2003 ORGANIZATION TYPE University EMPLOYEES Total: 120 Space: 10

#### ADDRESS

University of Luxembourg Faculty of Science, Technology and Communication Research Unit in Engineering Science (RUES) 6, rue Richard Coudenhove-Kalergi L-1359 Luxembourg Luxembourg www.uni.lu CONTACT Prof. Stephan Leyer

Tel: +352 46 66 44 5842 Fax: +352 46 66 44 35842 stephan.leyer@uni.lu

# • CORE BUSINESS

Within the University of Luxembourg, a leading institution of advanced research and higher education, the Research Unit in Engineering Science (RUES) – covering civil, mechanical and electrical engineering, as well as geophysics – recognises the socio-economic needs and challenges of both society and industry. To address these, the research unit has committed itself to becoming the Greater Region's education and research leader as well as a global player in its core research areas. A special focus will be placed on energy, environment and sustainable growth, contributing to, among other things, the European Strategic Technology Plan and the European Union's emphasis on creating an Innovation Union in Europe. The aim is to provide an innovation-driven research environment and to seamlessly integrate research and education to form future leaders and critical thinkers.

Our research activities can be organised in three main areas:

- Construction and Design: research into civil and mechanical engineering structures, fatigue behaviour, dynamic testing methods and development processes
- Energy and Environment: research into energy efficiency of buildings, energy consumption and renewable energies
- Automation and Mechatronics: research into mechatronic systems, dynamics of electromechanical systems
- The majority of projects have an applied as well as a fundamental character and are executed in close collaboration with industry. The focus can be on the technology, or on the process of its development, simulation and validation.

All research activities are integrated into a network of national, regional and international public and private research institutions.

# PRODUCTS & SERVICES

- Satellite control
- Space robotics
- Improvement of development processes
- Dynamics of mechanical structures
- Energy consumption
- Communication

# MAIN CUSTOMERS

EURO-COMPOSITES, HITEC Luxembourg, DKE Aerospace, Goodyear, ISS, Husky, IEE, Delphi

# MAJOR SPACE PROJECTS

**Galileo**: DMGA (Dynamic Modeling of Ground Antennas) The goal of the DMGA project is to obtain a very accurate and optimised static and dynamic model of large satellite ground antennas including the closed loop full motion control by integrating modern computation tools like CAD, FEM analysis, Multi-body systems and regulation simulation software. The simulation models are validated by measurements on the real antenna on site.

**Satellite Control**: research is carried out in the area of modelling and advanced control of satellites, especially attitude and orbit control systems, with a special focus on micro satellites.

**Space Robotics**: modelling, simulation and control of robotic manipulators for spacecraft and satellites. Applications are in the area of space debris removal and on orbit servicing.

Further research is carried out in the area of systems engineering and the improvement of development processes for micro satellites.



**HEAD OF DEPARTMENT** 

Prof. Björn Ottersten

ORGANIZATION TYPE

Public Research Organisation

**CREATION DATE** 

2009

University

**EMPLOYEES** 

TURNOVER 2019 Total:  $\in$  22 M Space:  $\in$  6 M

**R&D INTERNAL INVESTMENTS 2019** € 7.500.000

Total: 330

Space: 60

# CORE BUSINESS

The Interdisciplinary Centre for Security, Reliability and Trust (SnT) conducts internationally competitive research and PhD education in information and communication technology (ICT) with an emphasis on creating socio-economic impact. Working with public and industry partners, SnT carries a mission to establish Luxembourg as a European centre of excellence for secure, reliable, and trustworthy ICT systems and services. Space-related research features prominently among its strategic priorities, with current projects including work in satellite communications, space resources and space vehicles. SnT scientists conduct both long-term research and engage in demand-driven projects; an interdisciplinary approach allows them to tackle problems not only from a technical perspective, but also to address organisational, human and legal issues. Through SnT's Partnership Programme, researchers currently work in collaboration with over 48 private and public organisations, addressing the key challenges facing industry and the public sector in ICT. Along with the Partnership Programme, the Technology Transfer Office (TTO) ensures that SnT is at the heart of efforts to build a vibrant innovation ecosystem in Luxembourg. The Center has undergone a rapid development since its launch in 2009; recruiting top scientists, launching over 80 EU and ESA projects, protecting and licensing IP, launching four spin-offs, and creating a dynamic interdisciplinary research environment with some 330 people.

• PRODUCTS & SERVICES

SnT's priority areas aligned to the objectives of the government's Digital Lëtzebuerg strategy. Specifically, SnT's actions address the diversification of the economy, bring research actors closer to areas of important economic activity, strengthen Public–Private Partnerships (PPP) and increase Luxembourg's international focus, especially through a greater participation in European programmes.

# MAIN CUSTOMERS

Around 70% of SnT's income stems from competitive research funding and over 150 M EUR external funding has been secured since the creation of the Centre. Through the SnT Partnership Programme, large numbers of partners have proved willing to invest in joint research activities, ultimately improving their competitiveness through new and improved services and systems.

The programme currently counts 48 partners.

# MAJOR SPACE PROJECTS

SES Partnership - Research Program in Satellite Systems VHTS: User Terminal Wideband Modem for Very High Throughput Satellites, ESA.

LiveSatPreDem: Live Satellite Precoding Demonstration, ESA. FlexPreDem: Demostrator of Precoding Techniques for Flexible Broadband Systems, ESA.

SIERRA: Spectral efficient Receivers and Resource Allocation for Cognitive Satellite Communications, FNR-ANR.

PROSAT: on-board PROcessing techniques for high throughput SATellites, FNR.

MOSIS: Model-Based Simulation of Integrated Software Systems

#### ADDRESS

Interdisciplinary Centre for Security, Reliability and Trust (SnT) University of Luxembourg JFK Building 29, avenue John F. Kennedy L-1855 Luxembourg Luxembourg www.securityandtrust.lu **CONTACT** Prof. Björn Ottersten Tel: +352 46 66 44 35563 Fax: +352 46 66 44 35563 snt@uni.lu



# ABOUT THE LUXEMBOURG SPACE AGENCY

The objective of the Luxembourg Space Agency is to develop the space sector in Luxembourg by fostering new and existing companies, developing human resources, facilitating access to funding and supporting academic research.

The agency implements the national space economic development strategy, manages national space research and development programs, and leads the SpaceResources.lu initiative. Furthermore, the LSA represents Luxembourg within the European Space Agency and space-related programs of the European Union and the United Nations.

#### LUXEMBOURG SPACE AGENCY – ECONOMIC DEVELOPMENT TEAM

#### **Charles Koener**

charles.koener@space-agency.lu

Frédéric Rouesnel frederic.rouesnel@space-agency.lu

Luxembourg Space Agency 19-21, boulevard Royal L-2449 Luxembourg Tel: +352 288 482 10

Space Segment Components and Materials Subsystems Systems Equipments Engineering Services GS Sys RF/µwave Comm. Antenna Systens Data / Signal Handling / Processing Electri-cal Power Thermal Control AOCS / GNC Structures Propulsion **Company Name** adwäisEO Aistech Spac Amphinicy Luxembour Arspectra ArViCom Blue Horizon Bradford Deep Space Indus CGI Contec CREACTION Cybercultus Databourg System DRONELAB HOLDING EarthLab Luxembourg EBRC EmTroniX EURO-COMPOSITES e-Xstream engineerin Foersor FTA Communication Tech GomSpace Li GovSat Gradel HITEC Luxembourg Hydrostat IBISA Imagination Factory Lux Intech In-space Services ispace Europe 

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# TABLE OF LUXEMBOURG SPACE CAPABILITIES 2020

	Ground Segment Equipments / Software / Services Data																					Se	ervi	ice	Se	egr	ne	nt																	
	Equipments / Software / Services Data																										Serv	ices																	
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Ground Stations	Antenna Systems	RF Equipment (transmitters, receivers)	Baseband Equipment and Software	In-orbit Calibration &Testing Equipment	Other Ground Station Equipment (frequency & time, GSC monitoring & control)	Control Center Software	Flight Dynamics Software	Mission Control - Spacecraft/Payload/Ground Segment Simulators (simsat, eurosim)	Mission Analysis Software	Ground Segment Network (interface equipment NDIU, software)	User Operations (payload operation SW applications)	Assembly Integration and Test (ground support equipments)	Operational Support - Spacecraft operations	Mission Control Engineering Support (GS S/W dev. and MRO)	System Monitoring & Control (S/w and Services)	Other	Weather Data	RF Data	Optical Data	Orbit Transfer Services	In-Orbit Testing Services	Hosting Services	Teleport Services	Satellite Broadband Services	Communications Services (including resilient and secured)	IoT/M2M Communication	Crisis Management	e-Health & Telemedecine	Flood Management	Land & Forest Monitoring	Change Detection	Atmosphere Parameters Monitoring	Biomass Monitoring	Crops Monitoring	Renewable energy monitoring	Security Applications & Services	Maritime Surveillance	Transport of Dangerous Goods	Tourisms & Leisure Applications & Services	Medias Applications & Services	Applications & Services for the steel & banking sectors	Location-based Applications & Services	Smart grids & Services	Sensors networks & Services	Export Control Compliance

\* Technology

\* Technology

		tems Subsystems Mechanisms Electri- Structures Mechanisms Electri- cal Structures Mechanisms Electri- cal Thermal AOCS (CNC Brownies Simple Handling (Comm.																						Ground Segment							Service Segment																	
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Company Name	Communication/Navigation Satellites EO/meteorology Satellites Science Satellites	place Exploritation accurses Plateforms (30-100 kg) TT&C Subsystems (GEO) Telecom Pavloads	Optical Instruments (Hyperspectral) Robotic payloads Other Payloads or Instruments	Navigation Payloads Life Support	Primary Structures Secondary Structures Deployable Structures	Others Structures Storage/Deployment Mechanisms	Hold Down and Release Mechanisms Other Mechanisms	Solar Arrays Batteries	Hermat Protection Heat Transport and Rejection Systems (heat pipes, capillary driven loops)	Uptical Sensors (star trackers, sun sensors, earth sensors, FUG) Mechanical sensors (MEMS, accelerometers) GPC / GNSS receivers	de organizations (wheels, Control Moment Gyros) Actuators (wheels, Control Moment Gyros) Chemical Thrusters	Electrical thrusters Water Thrusters	Solar Sail RF / microwave Analog Signal Electronic Devices	On-board Computers (bus/payloads) Other Digital/mixed Signal Electronic Device (remote terminal units)	On-board Software (Processing, Data compression) Antenna Reflectors	Phased Arrays Other antenna systems (Omnidirectional, Helix, Horn)	Valves, Tubes, Fittings Electromechanical Parts for Mechanisms	Mechanical Components for Mechanisms Cables, Connectors, Relay, PCBs	Electrical and Electronic Components Metal Forms	Coatings Composite Materials	Other Components or Materials	Engineering Software Provision and Support (CAE) Test and Space Qualification	System/Mission analysis support Duality Accurates Support	granty restriction support. Independant Verification and Validation Mechanical Machining / Processing	Central procurement Other Services	In space manufacturing (Orbits and celestial bodies)	Procedure Control Contents Mission/Payload Operation Centers Genund Chatiene	dround stations Antenna Systems RF Enuinment (transmitters receivers -)	nr Equipment (transmitters, receivers) Baseband Equipment and Software In-orbit Calibration &Testing Equipment	Other Ground Station Equipment (frequency & time, GSC monitoring & control)	control clenter software Flight Dynamics Software Mission Control - Spacecraft/Payload/Ground Segment Simulators (simsat, eurosim)	Mission Analysis Software Ground Segment Network (interface equipment NDIU, software)	User Operations (payload operation SW applications) Assembly Integration and Test (ground support equipments)	Uperational Support - Spacecraft operations Mission Control Engineering Support (GS S/W dev. and MRO) System Monitoring & Control (S/w and Services)	Other Weather Data	RF Data Optical Data	Orbit Transfer Services In-Orbit Testing Services	Hosting Services Teleport Services	Satellite Broadband Services Communications Services (including resilient and secured)	101/ MzM Communication Crisis Management 이 바이바 도 Telenordeeine	e-reatin & letemedecine Flood Management	Land & Forest Monitoring Change Detection	Atmosphere Parameters Monitoring Biomass Monitoring	Crops Monitoring Renewable energy monitoring	Security Applications & Services Maritime Surveillance	rransport of Dangerous goods Tourisms & Leisure Applications & Services Medias Applications & Services	Applications & Services for the steel & banking sectors Location-based Applications & Services	Smart grids & Services Sensors networks & Services Export Conptiance
Kleos Space		/ _ / /				0 0,		· · · · ·					0, 1														,								<u> </u>			- '			-				o, _ ,			
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POST Luxembourg																																																
RespectUs																																																
RSS-Hydro																																																
SATURNE TECHNOLOGY																																																
SES																																																
SkyfloX																																																
Space Cargo Unlimited																																																
space4environment																																																
SPARC Industries																																																
Spire Global																																																
LIST MRT department																																																
Uni.lu Geophysics laboratory																																																
Uni lu RUFS																																																
Unilu SnT																																																
Uni.lu Geodesy and Geospatial Engineering																																																



# TABLE OF LUXEMBOURG SPACE CAPABILITIES 2020

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LET'S MAKE IT HAPPEN