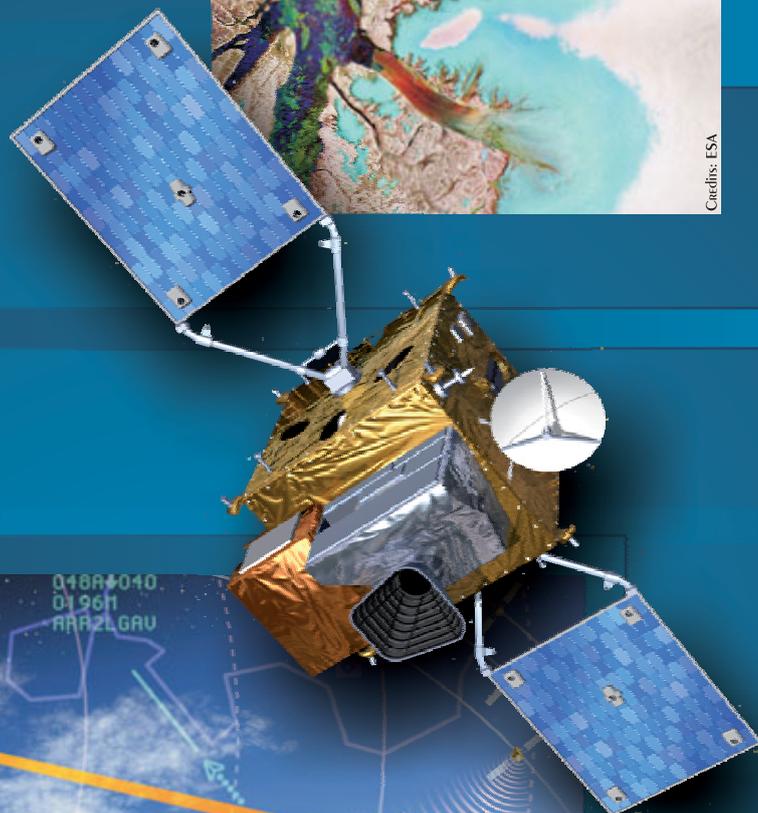


# CZECH SPACE ALLIANCE



Credits: ESA



2x Credits: ESA - P. Carnall



# Introductory Word of the Vice-Minister of Transport

We are confronted with an era of revolutionary technological development which interferes in all fields of human activity. Perhaps the most demanding and extreme environment where new technological developments are to be applied is the outer space. It is because of the demanding conditions and difficult accessibility of the space why the supplied instruments must be reliable and capable of long-term operations without being maintained by human crew. Consequently, the development and subsequent manufacture of hardware as well as software components of satellite or space transport systems is extremely demanding not only as regards know-how, the quality of instruments and environment of the production but also in terms of financing. Exceptionally high costs associated with space flights are one of the reasons for involving international cooperation of many countries into space projects.

The role of a guarantor of space research and space technological development is fulfilled by the European Space Agency, established in 1975. In 2008, the Czech Republic has become the 18th ESA Member State, together with all the obligations and rights. By participating in ESA's programs the Czech industry is now capable of applying its know-how and capacities in newly opened technological opportunities.

Highly competitive environment in a prestigious field of space technologies is creating various obstacles for companies, acting independently, in their effort to succeed in demanding tendering procedures. Therefore, some of them have decided to put their activities under an umbrella of the Czech Space Alliance and be jointly presented abroad with the help of this association.

## The role of the Ministry of Transport in space flights

Space technologies are having an impact on the functioning of the present world in a substantive way. They are becoming a natural component of many sectors of human activities, namely as from 60s of 20th century already. One of the most important sector in which space technologies are finding their application is the transport sector.

The Ministry of Transport is interested in the transport development and accordingly also in the space technology development closely associated with the transportation or, as the case may be, in the transfer of space technologies, initially developed for other activities, into the transport field.

Among the technologies predominantly used in the transport and associated with space systems we have to include the global navigation satellite systems, there is no doubt about it. Currently it is a case of American GPS which, however, has been designed as a military system from its beginning and which fails to comply with certain civil sector requirements (the guarantee of services to be provided, for example). Consequently, the European navigation system Galileo, which is one of the most ambitious EU projects, will be put into operation in the next future, according to current expectations. For this reason, the Ministry of Transport has launched in 2001 a project called "Involvement of the Czech Republic in the Galileo Project". The

project aimed at contributing to advanced development of application superstructure in the transport field so that this superstructure might be capable of using positioning data acquired under extraordinary conditions. As a follow-up, for the purpose of developing satellite navigation applications, a Global Navigation Satellite Systems Coordination Board of the Minister of Transport has been established. At present, the satellite navigation in the transport sector is already used for block systems in railway transport management on lines showing low traffic intensity, for positioning of special consignments in the course of their transportation, for the navigation of integrated rescue system vehicles in a terrain not providing an easy survey, and in many other fields. At the occasion of ESA's Council of Ministers, held in the Hague on 25th to 26th November 2008, the Czech Republic as a new European Space Agency member accepted a commitment to contribute, among others, to telecommunications program ARTES by the amount of M€ 6,13. The ARTES program and its Elements represent main ESA's activities in the telecommunications field and associated applications. For instance, through the Ministry of Transport, the Czech Republic will contribute to ARTES Element 10 Phase II.1 by the amount of M€4,14. The ARTES Element 10 referred to is also known under the acronym Iris, and it is focused on making the air traffic control more advanced and efficient with the aid of satellite systems. The project objective is to facilitate the use of ground and, in the future, also satellite data exchange systems as well as systems for the communication between pilots and air traffic controllers. The project Iris is closely connected with EU initiative "Single European Sky" the technological part of which is a new industrial project SESAR. The SESAR aims at developing European new generation system for the air traffic management in Europe. The responsibility for the satellite part of the system falls within the competence of ESA. Project Iris is a typical example of how the transport sector as an integrator provides for comprehensive project implementation. The integrator, on the one hand, takes account of end users' requirements in terms of operating technology and, on the other, also takes into account the relations to other industrial sectors.

The development and construction of space technologies is a prestigious sector laying highest demands on suppliers. Space activities as such represent a discipline with highest innovative potential, and they represent for the Czech industry an opportunity for finding its place in this sphere and for further development.





The Czech flag hoisted at ESA ESTEC grounds

# The Czechs space technologies today and in the past



## The Czech Republic became the 18th ESA member state

The Czech Republic acceded to the ESA convention on 14<sup>th</sup> November 2008. The accelerated passage through the transition programme PECS (2005-2008) to full membership is the consequence of its extensive background in space science and technology, going as far back as its substantial participation in the Inter-cosmos programme, the strong interest of the recent Czech governments and the very good results of the Czech industry participation in PECS. This event came considerably earlier than envisaged when the country started the first industrial ESA projects in January 2005. For some years to come, it will make the Czech Republic the only new EU states to achieve such recognition of its technological and scientific know-how.

At the ESA council on 26<sup>th</sup> November 2008, the Czechs surprised by contributing not only the 5.4 M € the mandatory budget, but also subscribing some 20 M € to fourteen optional programmes. The Czech industry is now ready to partner with other ESA industry to make good use of these budgets.

The optional programs to which the Czech Republic subscribed are:

- EOEP periods 3 - EO envelope programme
- GMES Space Component Segment 2
- MTG - Meteosat 3rd Generation
- ARTES 1, 3-4, 10, 20
- EGEP – European GNSS Envelope Programme
- ELIPS-3 Programme Period
- PRODEX
- FLPP - the Future Launchers Preparatory Programme
- ETHE – European Transport & Human Exploration
- GSTP phase 5 – General Support Technology Program

Well before the full membership, Czech industry successfully participated in standard ESA competitive tenders, as well as in GJU, e.g. entering the INDRA consortium which won the Galileo Search & Rescue bid. The full membership and the correspondingly increased

budget is now attracting not only the companies with space experience and with existing international partner network, but also additional technology companies. To enable their smooth familiarisation with ESA procedures and industrial partner network building, the Czech Republic is now benefiting from the industry incentive scheme, a transitional measure defined in the Treaty for the Accession of the Czech Republic to the ESA Convention, and proven with recent ESA new members. Its advisory body is the joint ESA-Czech Task Force. The Czech Industry Incentive Scheme, an ESA programme following ESA's rules and procedures, allocates for this 45 % of the Czech mandatory contribution to ESA over the first 6 years.

The first ESA open call under the scheme (AO6052), restricted to the CR with a budget of 2.3 M €, was concluded towards the end of 2009 with very good result for industry which, in contrast to the PECS programme, where pure research played the leading role, took the bulk of the budget. Moreover, the lion's share of the projects and the budget went to the members of the Czech Space Alliance, which presents to you this brochure.

Moreover, the more experienced CSA companies are already participating in ESA bids with ESA partner companies, with the first successes already being scored.

## The Czech Space Alliance (CSA) – association of 15 companies

The **Czech Space Alliance** is an industrial association of, and for, the Czech space SME's, with proven skills and track record in aerospace business and with broad international client base. Some have more than 15 years' track record in space business, including ESA, others are respected suppliers of aerospace industry such as Airbus. The alliance was established in 2006 under the auspices of CzechTrade, the export promotion agency of the **Ministry of Industry and Trade**. Recently it also started working with non-SME's, as associate members. The alliance comprises 15 companies, 3 of which are associate, from a spectrum of technology disciplines and with over 300 man years of experience in space projects.

Among the main alliance goals are:

**Internally**—represent and promote the interests of the space industry to the national decision makers and stakeholders, the national and international media and other relevant associations or entities; co-operate with the ministries and all other official entities supporting space activities in the formulation of space policy and creation of suitable conditions for the growth of the space industry.

**Externally**—present the skills of its members at international events and establish dialogue with similar associations and space agencies, be they in Europe or beyond; help its members to develop business relationship with potential partners in other European Space Agency member states and their international partners.

Before the Czech national space agency (foreseen in the recently drafted Czech space plan) becomes established, the Czech relationship with ESA continues under the responsibility of the department for international scientific co-operation of the **Ministry of Education, Youth and Sports (MEYS)**. This ministry, supported by the **Czech Board for Space Activities** (including representatives of three CSA members) and the private non-profit company **Czech Space Office (CSO)**, had been managing the space activities through the **Programme for European Co-operating States (PECS)**. Following the Czech accession, the Ministry of Transport (MT), the Ministry of Industry and Trade (MIT), and the Ministry of Foreign Affairs (MFA) became increasingly involved and are voicing their positions. All the ministries, the Task Force, the CSO as an administrative office, and the CSA representing the experienced companies, will be helping our industry for 6 years to develop skills and opportunities to enable us to become more familiar with the ESA business culture and procedures, and more competitive with ESA member states' industry.

CSA aims to provide to all the government and support bodies its practical know-how and experience with space projects on one hand, and alert them of the industrial needs, preferences or possible impediments in their endeavour to become more involved in and more competitive in ESA programmes. It is an important complement and source of practical information, to the activities which the official entities carry out or plan to do. As such, CSA very actively participates as expert advisor for industry along with the CSO for the science and academy issues, in the government group led by the MT, together with MEYS, MIT, MFA, National Security Institute and others, that is drafting a proposal of a national space strategy for the 6 year duration of the ESA industry incentive scheme.

CSA is one of the founding members of the pan-European association of national space alliances, **SME4space**, which was established at the Paris air-show in 2007. At the show, SME4space signed a co-operation agreement with the ESA DG. Since then, it also ran a study of the needs of SMEs in ESA, for the ESA SME Unit. The Czech alliance covered the PECS countries in this study.

Czech industry can build on the very strong experience in space science and technologies. However, during its substantial participation in the Soviet Interkosmos missions, as well as through building and operating a number of national satellites through till 1996, not to speak of the first Czech cosmonaut, the experience did not include commercial considerations. This started changing over the last decade or so, and recent experience is based on real business co-operation mainly with Spanish, Italian, Austrian, British and German companies. These already include successful results in commercially driven tenders.

By co-operation with the national decision makers, building networks with international partners and developing space business activities in ESA and elsewhere, CSA shall decisively contribute to the Czech Republic becoming a strong and valued partner of ESA and ESA member state industries.

Among recent activities were various seminars and mutual visits with Astrium, TAS, and smaller national industries in and from ESA member states, such as France, Germany, Spain, Portugal etc. CSA members have won 9 out of 11 industrial projects under the Task Force open tender covering electronics, precision tooling of vital spacecraft component, EGNOS software, ground segment support, EO data processing, electronic components, etc. Two members are also participating in the IRIS/Artes 10/ANATARES project, to which the Czech Republic made a substantial contribution. Similarly, we expect to be participating strongly in the MTG project, for which we have already been contacted by both of the prime bidders. Participation in standard ITTs is also in progress with experienced partners.

Nevertheless, for some time to come, the Czech Republic will be suffering under-return of the ESA contribution, which should be an additional attraction for consortia led by over-returning countries' companies, to consider giving us the opportunity to demonstrate our existing skills and high adaptability to the ESA environment.

## Some historical references to Czech space science & technology

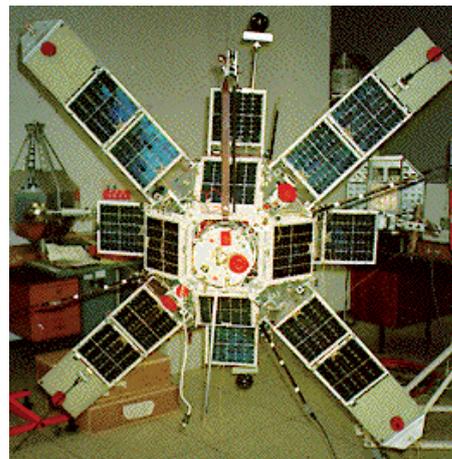
The newest ESA member, the Czech Republic, is by no means a newcomer to space sciences and technologies. Its history goes back half a millennium. Astronomy and astrology thrived on its territory from the middle ages and the space technology and science peaked during the Soviet era, when the Czech and Slovak engineers and scientists were at the forefront of space exploration, even if largely unknown abroad under the cloak of the Soviet Interkosmos programme, and in absence of any business or sustainability approach.

In the 16<sup>th</sup> century, Kepler and Tycho Brahe were among scientific personalities who found in Prague the ideal environment and benefactors for their groundbreaking work. Two of the Kepler's laws were conceived here. Start of the 18th century saw the inauguration of the Klementinum observatory. Its unbroken record of meteorological measurements is one of the oldest in the world. In the 19th century Doppler taught at the Prague Technical University. In 1842 he presented to the Royal Czech Learned Society his investigation of the "Doppler effect". 70 years later, Einstein was putting the final touches on his theory of relativity in Prague. Czech scientists and inventors contributed in a wide range of science and technology fields

### 20<sup>th</sup> century Czech science, national space programmes and substantial participation in Interkosmos

In the 1950's, work under the leadership of Dr. Ceplecha in interplanetary mass movements resulted in the first calculation of the interplanetary orbit of a meteor, leading to the discovery of the Luhy/Pribram meteorite. Important for stellar astronomy was the construction of the 2m telescope in Ondřejov in the 1960's (incidentally, its control system was automated in the 90's by one of the CSA members).

Since the 20's, the Czechs showed passion for launcher technology. In 1929 Pešek registered a patent for a rocket engine, to accelerate aerial bombs. Another inventor constructed solid fuel rockets and tested them in 1931. His two stage rocket reached 1500m. He envisaged rocket launches from aircraft – the principle used half a century later, by the Pegasus launcher. In the 50's the Military Academy in Brno developed sounding rockets. The work peaked in 1968, when they tested solid fuel prototypes. The goal was to build a cost effective 2-stage launcher. The project was stopped following the invasion of Czechoslovakia by the Warsaw Pact in 1968. Rocket engines were used for simulations of side-wind burst effect on cars, bridges or television masts - early examples of transfer of space technology.... In the 40's the Czech born Frank J. Malina co-founded JPL, together with Theodor von Karman, and participated in development of the first US rockets Private and Corporal. In 1989 the communist regime fell and with it both the bulk of opportunities and interest in the Soviet or Russian space programme.



**Magion 4, Launched 1995, to study Earth magnetosphere and ionosphere**

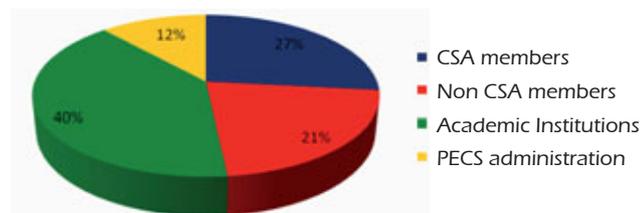
The Czech Republic was founded after the velvet divorce from Slovakia in 1992. In 1999 it joined NATO, in 2004 the European Union. The national satellite program Magion continued with launches of spin stabilised Magion 4 and 5 in 1995 and 1996 respectively. The latest national satellite Mimosza with a micro-accelerometer mission, was launched in 2003. New generation of its main payload, the micro-accelerometer has been chosen by ESA and Astrium to fly in the SWARM mission. A CSA member BBT's crystallizer was operational on the MIR station from 1995 until the termination of MIR in 2001 - along with the original equipment CSK-1, which was on-board for full 17 years and thus one of the longest working equipment on-board MIR.

For a more extensive coverage of the Czech space history up to the year 2000, download a paper presented at the IAF 2000 conference [http://www.iguassu.cz/downloads/czechs\\_manuscr2b\\_rio.pdf](http://www.iguassu.cz/downloads/czechs_manuscr2b_rio.pdf).

## 21<sup>st</sup> century the "Program for ESA Co-operating States" (PECS) and then the ESA membership

At the break of the century, ESA decided to bring eligible new democracies into ESA. The PECS co-operation programme was born. PECS was foreseen to enable the Czech Republic, Poland, Hungary and Romania, to get familiar with ESA way of working before becoming full members. Before accepting the Czech Republic into PECS, in 2002 ESA commissioned a survey of our technological skills. The survey, carried by the French NODAL Consultancy, was very positive (the full presentation at [http://www.iguassu.eu/downloads/iss\\_nodal\\_mod.pps](http://www.iguassu.eu/downloads/iss_nodal_mod.pps)) finding generally high level of technical skills, education and language abilities as well as identifying companies providing world class standard products and services. Some companies already had experience in space and even ESA projects. Two successful international space projects were highlighted as demonstration of the capabilities. It is no surprise that the two referenced companies, the Czech Space Research Centre and Iguassu Software Systems, together with already referenced space veteran, BBT, became the founders of the Czech Space Alliance.

Czech Republic started PECS in January 2005 when ESA awarded industry (all of them CSA members) projects in satellite positioning, EO technologies and satellite control. Initially the largest share of the PECS budget went to science institutions, but the balanced tipped heavily to industry following the full ESA membership. Whilst most projects were based on direct negotiations, even in this transition period, one CSA member participated in a consortium which won work in a standard ESA competitive tender.



**Budget distribution of the PECS programme (2005-2008)**

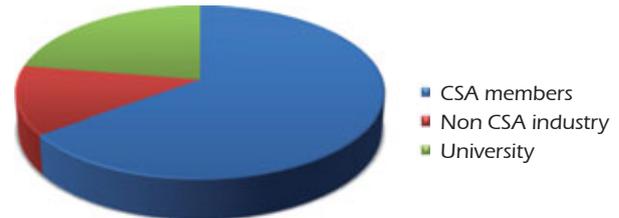
Source : Czech Space Office

Following the Czech application for full ESA membership, ESA carried out another industrial audit in October 2007. The aim was to assess the capabilities of the Czech industry and researchers to participate in ESA projects. Five ESA experts reviewed previously prepared questionnaires distributed to Czech entities selected by the relevant ministries, the Czech Space Office and several professional organisations. The audit consisted of face to face meetings with 26 pre-selected companies and two research institutes, including visits to four aerospace factories. Most of the members of the Czech Space Alliance at the time, were among those selected for personal interviews.

Owing to the successful participation of the Czech industry, the good results of the ESA industrial audit in October 2007 and the strong support of the ESA membership by the Czech government, the Czech Republic's application to become ESA member was accepted much earlier than PECS foresaw. Less than 4 years after starting PECS, the Czech Republic acceded as the 18th country to the ESA convention and immediately subscribed to a number of optional ESA programmes. Both industry and academia responded very well to the first open call for proposals, AO6052, initiated by the ESA Czech Task Force under the industry incentive scheme, with 54 proposals being submitted – far in excess of the available budget.

The projects, valued approximately 1.8 M €, which were awarded by ESA under this scheme to the CSA members are

ANF Data	Study of SCOS-2000 deployment over WAN for a concept of CMCP
AVX Czech Republic	Hermetically Sealed Low ESR Tantalum Capacitor
BBT-Materials processing	New acousto-optic device based on Calomel for hyper-spectral imaging NAOMI
CSRC	Preparatory Activities for MTG Participation
Evolving Systems Consulting	Reusable Payload On Board SW Framework
Frentech Aerospace	Fuel pressure regulator 3 – RRT 3
Iguassu Software Systems	Parallel Data Mining Components
Iguassu Software Systems	Real-time GNSS Performance Monitoring Tool
L.K. Engineering	Real-time Extrapolation Methods for Thermal Testing



**Budget distribution of ESA recommended proposals for AO6052 in 2009 (estimate). Compare budget distribution industry/university as well as CSA/non CSA with the PECS.**

The results of the above restricted open tender are in addition to participation in competitive tenders with established partners from ESA member states, which are also bringing first good results, and an ongoing project from the PECS period in X-ray mirror technologies (Rigaku).

The Dual Segment Langmuir Probe and the Thermal Plasma Measurement Unit, designed and manufactured by our member CSRC were launched onboard the PROBA2 Satellite on 2.11.2009 and are in full operation since 18.11.2009. This is the first successful launch of Czech technology into space in our ESA membership and a fitting way to launch more extensive participation of the Czech industry in further ESA programmes. We are ready to demonstrate that the last is not the least.

## And next?

Our companies are well advanced in a number of technologies and will be increasing their experience through the industrial incentive scheme. We are looking for partnership with space companies in and outside the ESA countries, to offer our technical knowhow and the enthusiasm of a recent newcomer to ESA. In return we hope to learn from your experience of the ESA environment.

If you want to take advantage of our enthusiasm, flexibility and "can-do" approach, benefit from our cost-effective contribution combined with the fact that our country is under-returning, and give us a chance to participate in your bids to ESA, contact the alliance or its individual members. You can approach us individually, or we can arrange a broader industry networking seminar in your country or in Prague. Ready to czech us out? Some companies, and some member countries, are already intensively doing so, and are very happy with the results, so do not end up being left out.

**Petr Bares**, President of the Czech Space Alliance  
Former ESA ESOC staff member for 12 years

April 2010

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# 5M

## 5M s.r.o.



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**5M s.r.o.** is manufacturing company with own R&D department who specializes in composite production and bonded sandwich structures.

**5M** develops and produces epoxy adhesives for extra high strength bonds, epoxy resins for lamination, pultruded composite profiles and sandwich panels.

**5M** is strong focused at innovative process and new products.

**Certified ISO 9001:2001**, 120 employees and 3000 m<sup>2</sup> production area included new hall for pultrusion technology.

## 5M s.r.o.

### Who are we?

5M s.r.o. is an SME manufacturing company who specializes in composite production. 5M was founded in 1992 as a completely private and purely Czech company. Its founders have been involved in adhesive bonding, composites and sandwich constructions for a number of years before, therefore the tradition of development and production of these materials has continued for over than 25 years.

5M s.r.o. is strongly focused on development and innovations, the results of this strategy are minimum 5 new products or significant innovations a year. Most products stem from internal development; in some cases the company co-operates with research and test institutes and analogical departments of universities. In these days has 5M s.r.o. 120 employees and 3000 m<sup>2</sup> production area include new hall for pultrusion technology with 5 pultrusion production lines.

5M s.r.o. is certificated ISO 9001:2001

### How can we help you?

- technical consultancy for bonding of all materials and constructions
- technical consultancy for glassfibre laminate production
- research and development regarding customer request
- experience in hi-tech technologies (aerospace industry)
- innovative solutions due to own laboratory

### What can we offer you?

5M's product range is very wide and covers basic raw materials and products for composite industry production. In our production portfolio you can find following groups of products:

**Epoxy adhesives LETOXIT** – structural epoxy foil or pasty adhesives for extra high strength bonds (mainly metals, composites, wood). Our epoxy adhesives were used in construction of microaccelerometer Mimosa, in construction of passenger aircraft L-410 or in fighter plane Albatros L39.

**Epoxy resins LETOXIT** – systems for production of laminate (glassfiber) elements, particularly on the basis of epoxy resins. The optimal combination of epoxy resin and hardener can be chosen for each application and different production conditions, such as mixture, pot life, curing method, technology and properties of final laminate.

Our product range of epoxy resins covers certificated systems for aviation.

5M s.r.o. is producer of unique epoxy foil resin LF Technology (Letoxit Foil Technology), which is epoxy resin in the form of flexible foil, which softens at increased temperature and it is able to impregnate originally dry reinforcement and cure in one step. During manipulation, production and curing doesn't release any hazard vapours and foil is very friendly to use.

**Semipreg (prepreg)** – In the world of composites preimpregnated fabrics well known as prepregs are used for a long time.

Regarding increasing demand for this way of dry production of laminate parts we have developed our own alternative, which keeps all advantages of prepregs and adds new ones. We started to call our product semipreg, because we are talking about fabric impregnated from one side by resin foil LETOXIT LFX.

In our production range are glass of carbon semipregs based on epoxy or phenolic foil resins.



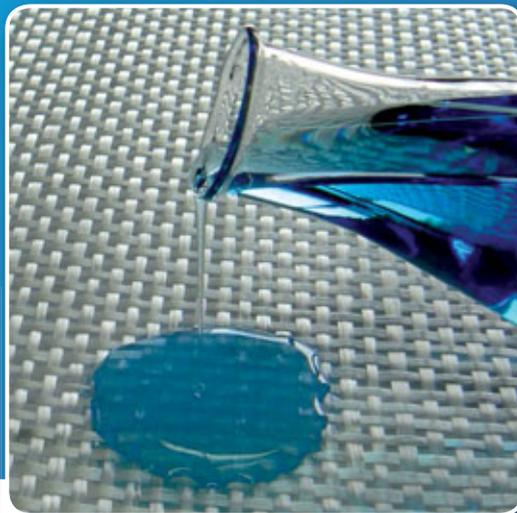
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**Pultruded composites profiles** – Well known as GRP, FRP, CRP, glassfiber or carbonfiber profiles. We produce it by a pultrusion technique from resin and reinforcing elements. Polyester resin is applied as a matrix most frequently; epoxy, vinyl ester, acrylate and other resins are used for special applications. In most cases, glass fibres are used as reinforcement, but carbon or aramid fibres are applied too. Depending on the properties required, straight fibres (rovings), various types of mats or fabrics or their combination are chosen.

The composite profiles are the most used in aviation, transportation or building and construction industry.

**Sandwich constructions** – The sandwich constructions (panels) are characterized by high strength, stiffness and very low weight at the same time. 5M produces honeycomb sandwiches in the form of flat or spatially shaped panels with various types of ending, with pasted elements for further assembling and many other types including complicated tailor-made constructions. We are able to offer you panels with sizes, cell sizes or plate quality as you require. We have long-term experiences with production of panels with complicated shapes, with inserts inside (for threads for example), with edges,...

We have well-equipped workplaces and trained employees, and we guarantee top-quality and stable results. Bonded constructions proved high dimension and reproductive precision, and shape and dimension stability, which makes spare parts easily replaceable.

Due to our experiences and long term innovative strategy we obtained award "Innovation of the year 2008" from Association of Innovative. The award concerns our accurate sandwich panels for building of radiotelescopes.

5M s.r.o. produces sandwich construction from aluminium, steel or composites materials (glassfiber, Nomex, foams,...).

## Who are our customers?

5M supplies its products to large industrial manufacturers as well as to aircraft manufacturers, manufacturers of transport means, electrical engineering and equipment producers and sport equipment producers, etc. A significant part of our production is exported, furthermore we have established in 2002 daughter company 5M Slovakia s.r.o. and nowadays we have sales representative in Italy, Bulgaria, Slovenia and Germany. A part of the production has replaced products previously imported to the home market, and Czech customers use part of our production as raw material.

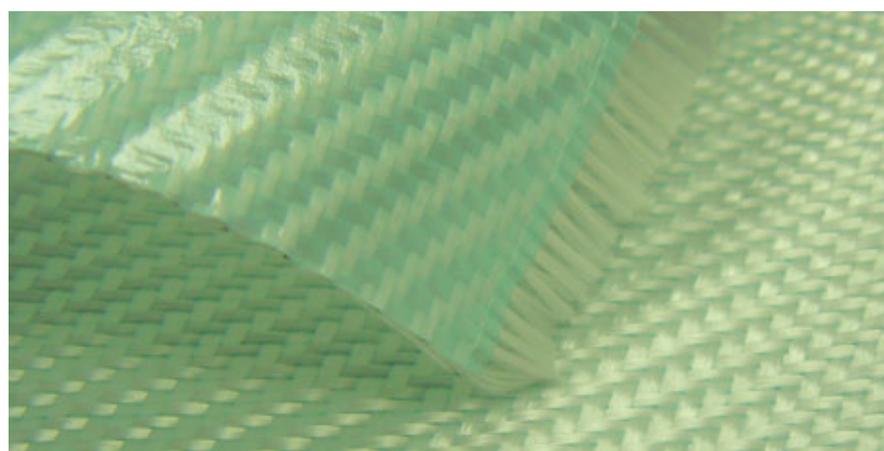


Fig. 1

- PULTRUDED COMPOSITE PROFILES**
- excellent mechanical properties
  - corrosion resistance, long service life
  - low heat conductivity

Fig. 2

The carbon wing beam is produced from pultruded profiles

Fig. 3

- STRUCTURAL EPOXY ADHESIVES**
- excellent shear and peel strength, high toughness
  - gluing of etal, composites, wood, plastics
  - foil and pastelike



Fig. 4

- SANDWICH PANELS**
- made from aluminium, composites, nickel
  - extra low weight (light structure)
  - customer made panels

Fig. 5

High precision sandwich panels are controlled at 3D measuring machine and than use in telescope construction

Fig. 6

- EPOXY RESINS**
- certification for aviation
  - nonylphenol free, room temperature curing, great impregnation ability
  - customer made epoxy systems



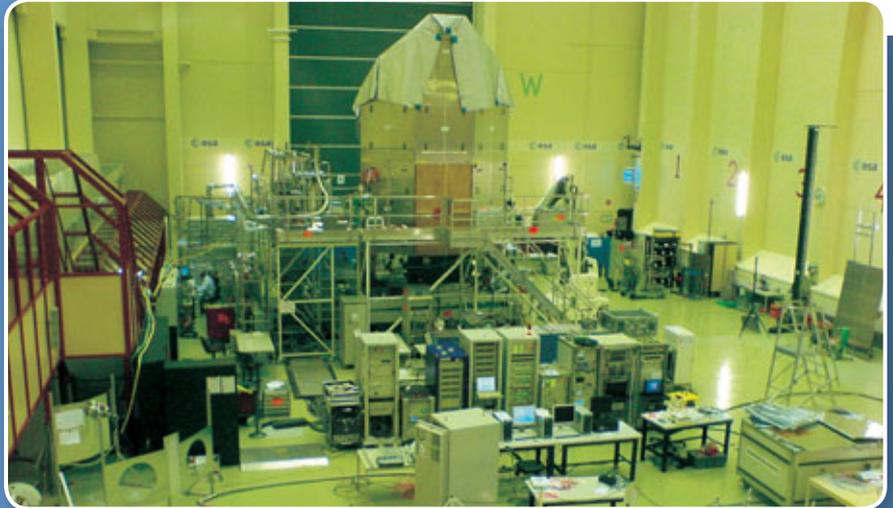
## SEMIPREG / PREPREG

- fabric impregnated from one side by foil resin
- great variability in composition
- customer made

# ANF DATA

a Siemens Company

## ANF DATA a Siemens Company



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## ANF DATA

a Siemens Company

### Company profile

ANF DATA spol. s r.o. is a subsidiary of SIEMENS AG Austria. ANF DATA spol. s r.o. was established in 1992 as a software house. The company's business comprises software development projects in many areas such as banking, insurance, telecom, embedded systems and also aerospace.

The Aerospace Industry Solutions (formerly Space Business) department was established in 1998 and is focused on the development of software and hardware solutions for the European Space Agency (ESA) and leading satellite operators. Aerospace Industry Solutions staff has extensive experience in large international projects for leading technological companies.

### There are three Aerospace Industry Solutions groups:

- Satellite Checkout / Test Equipment
- Satellite Communication Solutions
- Ground Segment Solutions

**SATELLITE CHECKOUT / TEST EQUIPMENT group** is oriented towards development and production of special hardware solutions such as:

- The development and production of Special Check Out Equipment (SCOPE)
- Custom power supply systems with high reliability
- Custom test setups
- RF test systems
- RF-SCOPE
- Power-SCOPE
- Payload Test Systems
- Electrical Ground Support Equipment (EGSE)

### Supported technologies:

- Own laboratory and prototype production site for electronic design and tests of circuits and devices
- Special designs for extreme or unusual conditions
- Radiation tolerant electronic design
- Custom made electronic design (EDA)
- Custom made electronic devices

### Projects participation:

- HERSCHEL\_PLANCK
- SWARM
- GAIA
- GALILEO



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**SATELLITE COMMUNICATION SOLUTIONS group** is dedicated to the development of new and modern satellite traffic monitoring software - the Siemens Multi-Site and Multi-Satellite Control and Monitoring System (SIECAMS).

**SIECAMS Applications:**

- Digital Carriers (open/closed SMS, DVB, VSAT...)
- Analogue FM-TV Carriers
- TDMA, CW, CW-EDF

SIECAMS is installed on 20 ground stations distributed all over the world and monitors the downlink traffic of 28 satellites.

**Supported technologies:**

- Satellite technology SW/HW
- Signal processing
- RF technology
- C++, Java, TCL/TK, XML/HTML, WEB
- Database technologies

**Customers / Projects:**

- Eutelsat (Siecams)
- Telekom Austria (Siecams)
- Horizon (Siecams)
- NSN Brazil (ELU)
- Turksat (ELU)

**GROUND SEGMENT SOLUTIONS group** is focused on the software development and technology analysis in the following areas:

- SCOS-2000 based Mission Control & Checkout Systems
- Ground Station Monitoring and Control System
- Earth Observation Infrastructure
- Performance Evaluation and Analysis

**Supported technologies:**

- C/C++, Java, TCL/TK, Python, Database technologies
- TCP/IP, CORBA, GPIB, Basic M&C, XML/HTML/GML, OGC-WMS/WCS/WFS, SOAP
- SSE, GSSC/GMMI, IlogViews
- Automated testing IDATG, ART

**Successful participation on the following ESA projects:**

- Advanced SCOS-2000 Monitoring: CORBA based Data Distribution Prototype
- Advanced SCOS-2000 Monitoring Extension:
  - SCOS-2000 Command Supervisor
  - EGOS Data Transfer & Data Management Libraries (DTL/DML)
- DTL/DML based Mission Control System Demonstrator
- Special Observation Services & Infrastructure (SOSI-CZ)
- Study of SCOS-2000 Deployment over WAN for a concept of CMCP (SWAN)

**Fig. 1**

Maintenance mission of SCOE of satellite, ESTEC

**Fig. 2**

ESA Ground Station, Cebreros, Spain

**Fig. 3**

SIECAMS Installation

**Fig. 4**

Power SCOE rack rear side



A KYOCERA GROUP COMPANY

# AVX

## A Kyocera Group Company



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## AVX

A Kyocera Group Company

AVX is a multinational company based in the U.S.A. and a part of the Japanese industrial group KYOCERA, a leading global manufacturer of passive electronic components. The company offers a wide range of products for various electronic applications from mobile phones, laptops and MP3 players, through the automotive industry to high-reliability aerospace and medical devices.

AVX is the world's number one tantalum and niobium capacitor manufacturer with a market share of over 20%.

### History

AVX has operated in the Czech Republic since 1992. Growing global market opportunities combined with AVX's high volume manufacturing experience and its established technology leadership led to the successful opening of a new plant in Lanškroun in 1994 for the assembly of tantalum SMD chip capacitors. Production grew significantly and a second plant for anode manufacturing was opened in 1998, realising a total start-to-finish solid electrolytic capacitor production facility.

Currently employing 1700 staff, the Lanškroun plant now provides technical, customer and logistic support services to AVX customers worldwide. The first co-operation on development projects at Lanškroun was begun in 1998 covering high-temperature (150degC) tantalum capacitors for automotive electronics, and further development activities at the plant have grown significantly since that time. In 2002, AVX introduced a new, revolutionary, solid electrolytic capacitor based on a niobium oxide anode, initiating a new era in the history of the capacitor.

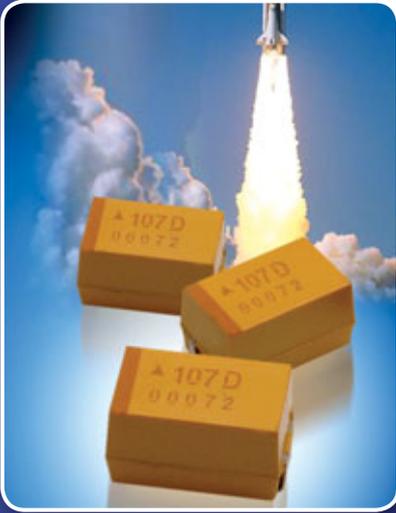
AVX is an established supplier of tantalum capacitors for the European Space Agency (ESCC - 3012), and further aerospace capacitor development projects have been introduced in 2009.

### Business activities

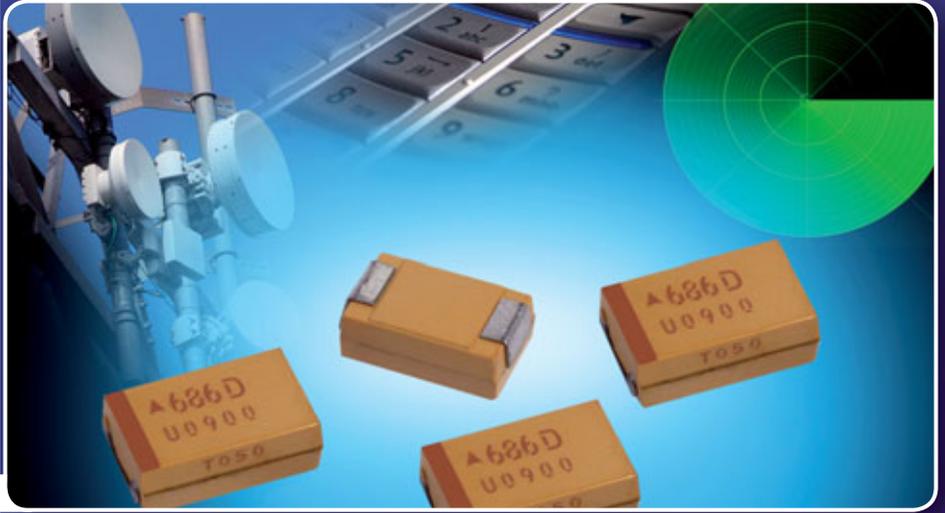
AVX, a recognized leader in the global passive electronic component and interconnect products industry, is at the forefront of technology, design, manufacturing and supply.

AVX enjoys significant competitive advantages including the benefit of global manufacturing and distribution provided by 20 manufacturing facilities in 11 countries. This assures customers of the most efficient balance of demand and production capability in response to their just-in-time inventory requirements. With research and development centres in five locations around the world - United States, Northern Ireland, England, France and Israel - AVX has fostered customer relationships involving the design of new and advanced products to fulfil their specific product requirements.

AVX continues to invest heavily in R&D. The company is set apart from the competition by its broad array of specialty product offerings including ceramic and tantalum capacitors, connectors, thick and thin film capacitors, resistors and integrated passive components. AVX also benefits from its partnership with Kyocera Corporation and the wide breadth of products and technologies that its Japanese parent company offers. AVX enjoys a balance between high volume commodity products and its increasingly-innovative Advanced and Hi-Rel Products offerings.



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### Acquired Certifications:

**CECC-ECQAC** – granting the right to use the mark or certificate of conformity

**IECQ-CECC** – incorporating the requirements of ISO 9001:2000

**ISO 9001:2000** – Quality Management System

**ISO / TS 16949** – Quality Management System (meeting the requirements of the automotive industry)

**ISO 14001:2004** – Environmental Management System environment

**SONY GREEN PARTNER AWARD** – granted to companies meeting the requirements of SONY environmental protection.

**ISO 9001** – Quality Management System

**AS 9100** – Quality Management System

**ESCC 3012/001**

**Fig. 1**

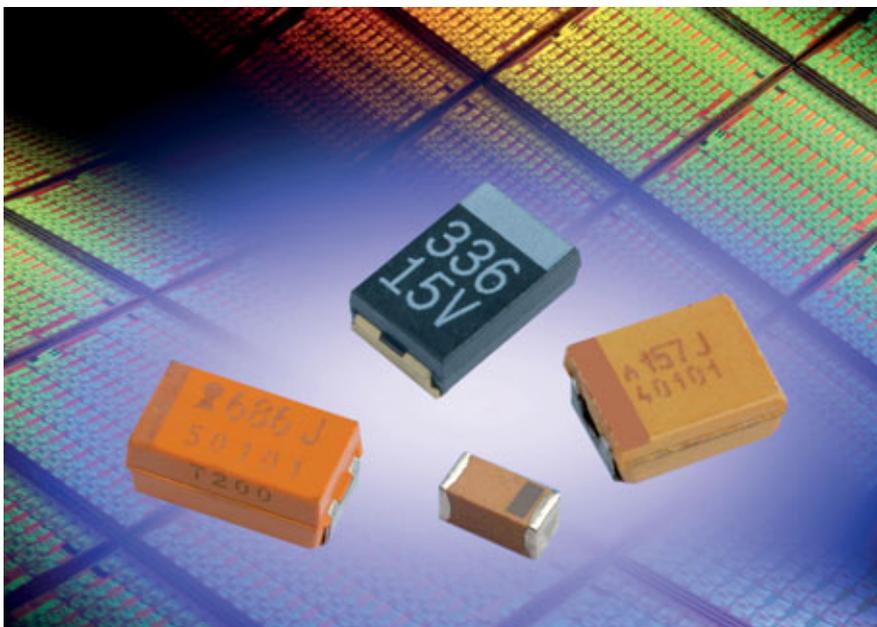
**AVX High Reliability MIL PRF 55365 Qualified Tantalum Capacitors**

**Fig. 2**

**AVX Tantalum Aerospace Capacitors ESCC 3012 Qualified**

**Fig. 3**

**Low ESR, High Power AVX Tantalum Multianode Capacitors**



AVX offers the widest range of tantalum and NbO capacitors



# BBT Materials Processing, sro.

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## BBT Materials Processing, sro., Prague (BBT)

Established in 1991

### Main Fields of Activities

- Crystal chemistry, study of crystal growth and solidification processes, growth of crystals for technical applications (optics, acousto-optics, laser applications, etc.).
- Material sciences and technology in Space (Salyut 6-Sojuz, MIR, ISS) and on Earth.
- Development and manufacturing of apparatuses, devices and software according to customer's requirements for Space and on-ground applications, incl. mechanics and electronics.
- Digital Image Analysis (sample microstructures, etc.).

The BBT team is proud to be associated with many scientific and technological programmes and projects. Our products (scientific facilities and devices) were operational on board Salyut 6 - Sojuz and MIR orbital laboratories for 17 years ! - non-stop from 1984 up to 2001 (to 1990 within the Czech. Acad. Sci., from 1991 within BBT).

### Some of our selected products and achievements:

**CSK-1A, -1B and 1C:** The programmable space furnaces and crystallizers for MIR-type and FOTON-type orbital laboratories for material research in microgravity.

**TITUS/CSK-4:** The 2<sup>nd</sup> generation programmable space furnace for the Euromir '95 (ESA) and MIR '99 - PERSEUS (CNES) missions (BBT in co-operation with ESA, DLR-MUSC, DARA, Humboldt Univ., Kayser-Threde, RKK Energija).

**Fast optical processors** for Space applications (ESA) - BBT in co-operation with STIL, Ireland.

**Mercurous halides, sapphire and ruby crystals** and their applications (acousto-optics, polarizers, IR-optics, microwaves, laser technologies, electronics etc.).

**Non-equilibrium multi-component alloys:** Realisation and scientific evaluation of the ground-based, space and post-flight experiments. R&D and manufacturing of the related apparatuses, devices, software, etc.

**Assistance in the training of astronauts** to operate the research apparatuses made in BBT.

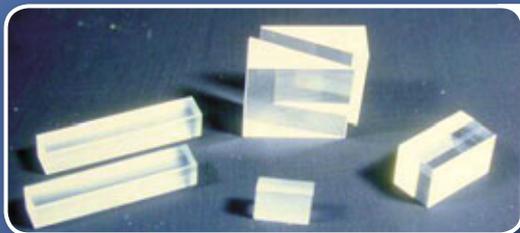
**Equipment** for material experiments both in long-term micro-gravity and in a short weightlessness using a drop-tower and in higher gravity fields using centrifuges.

**Advanced TITUS:** The 3<sup>rd</sup> generation facility designed for the material experiments in microgravity. (In cooperation with DLR-MUSC, Humboldt Univ., RKK Energia/MIR).

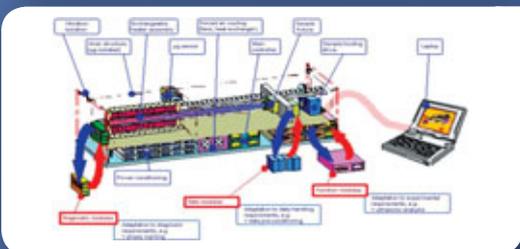
**TITUS MPP** (Multi-Purpose Platform with the Advanced Tubular Furnace with Integrated Thermal Analysis Under Space Conditions) – 4<sup>th</sup> generation facility designed as a tool for the materials sciences experiments on board the International Space Station (ISS). (In co-operation with DLR, Humboldt Univ., RKK Energia and with a financial supports of the Ministry of Education of the Czech Republic and ESA-PRODEX).

**Passive Damping Platform:** Damping of vibrations and other disturbing accelerations for a material research in microgravity.

**Thermographic probe** with 10 thermocouples was used for determination of the temperature profiles in space furnaces.



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**DTA (differential thermal analysis) probe** with six chambers was used for both the study of phase transitions in materials and an accurate calibration of absolute temperature scale. The theoretical models of kinetic phase diagrams have been developed.

### Participation in selected programmes and projects:

**INTERKOSMOS - MORAVA I** (1976-80, Salyut 6-Sojuz), **Morava II** (1986-88, MIR), **Morava III** (1990-97, MIR), **CSK-3** (1989-90) and **CSK-1** (1984-2001): Preparation, realisation and analysis of the international projects in material sciences.

**International Users Support Centre for Interkosmos** projects in material science which also served for German experiment TES in 1993-4 (laboratory for the ground-based preparation, realisation and scientific evaluation of space experiments) (within CSAV).

**RIM-MIR:** Experiments of a recalcence of Ag-Ge alloys on board MIR using the CSK-1 furnace (three-lateral cooperation of Germany (DLR), Czechoslovakia and Russia).

**TES** and **TEST-TES:** Participation in the German (DLR) **TES** and **TEST-TES** experiments of a recalcence of alloys (realised on board MIR orbital laboratory using CSK-1 furnace).

**Drop-tower Bremen:** Non-equilibrium solidification experiments performed under conditions of a short-term free fall (in cooperation with ZARM-University in Bremen, Germany).

**MIR'92** (1992-3): Set of material experiments on board MIR using the CSK-1 furnace (ESA, DARA, DLR-MUSC, BBT, RKK Energija).

**EuroMIR'94** (1994-5): Set of material experiments on board MIR using the CSK-1C furnace (ESA, DARA, DLR-MUSC, BBT, RKK Energija).

**EuroMIR'95** (1995-6): Set of material experiments on board MIR using the TITUS/CSK-4 furnace (ESA, DARA, DLR-MUSC, BBT, RSC Energija, Humboldt Univ., Kayser-Threde).

**GermanMIR'97** (1997): German programme (DLR) - set of material experiments on board MIR using the BBT furnace CSK-4 (TITUS).

**MIR'99 - PERSEUS** (1999): Set of material experiments on board MIR using the BBT furnace CSK-4 (TITUS) - RSC ENERGIJA (Russia) and CNES (France).

**KONTAKT: Several projects** - Sets of material space experiments.

**PRODEX:** Study of non-equilibrium solidification of multi-component alloys, DTA measurements.

**EUROSTARS:** Innovative acoustooptic systems in the Mid infrared.

**ESA-Task Force:** Acoustooptic device for hyperspectral imaging in space applications.

etc.

**Fig. 1**

CSK1-C space furnace with the astronauts Pedro Duque (Spain) and Ulf Merbold (Germany) – ESA Programme EuroMIR '94. (Photo DLR, Germany)

**Fig. 2**

TITUS and CSK-1C space facilities on board the MIR space station. (Project MIR '99 – PERSEUS). (Photo CNES, France)

**Fig. 3**

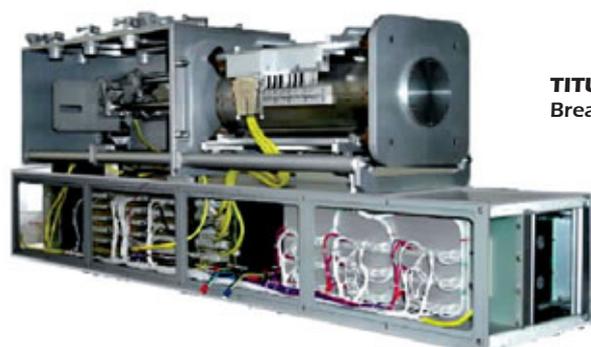
Crystal elements for optics, acousto-optics and laser applications

**Fig. 4**

TITUS MPP Multi-Purpose Platform - artist's view

**Fig. 5**

TITUS space facility on board the MIR space station with the French astronaut Jean-Pierre Haigeneré (Project MIR '99 – PERSEUS) (Photo CNES, France)



**TITUS MPP**  
Bread-board model BM-1.



# Compotech PLUS spol. s r. o.



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## Compotech PLUS spol. s r. o.

### CompoTech provide competitive advantage in structural composite tubes to the world's leading companies.

We help our customers to develop market opportunities and work with them to enhance their products and maximise their cost benefits. This is achieved by optimizing the composite tube, its production technology, and the use of materials.

### What's in a Tube?

A simple and versatile shape, a composite tube can be deceptive. Look a little closer and you will start to unravel the secrets inside this tube's structure.

Found just about everywhere ....Industrial machinery, vehicles, aeronautics, marine. – A composite tube enhances the performance of many structures or mechanical operations, and CompoTech has dedicated its efforts since 1995 to developing technology that makes this tube more effective. Whether that's providing stiffness, strength, reducing weight, improving efficiency, or reducing cost.

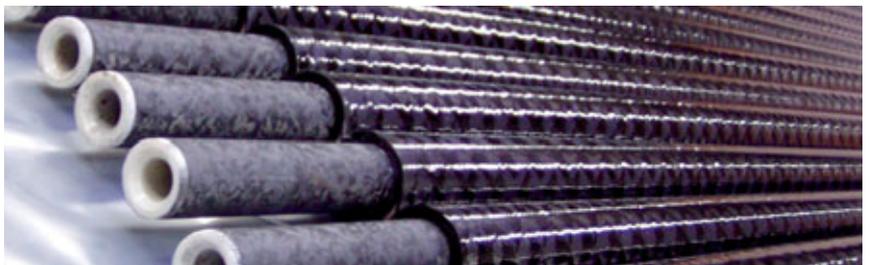
Made from carbon, aramid and/or glass fibres, CompoTech's tubes are highly engineered and are produced using the company's unique zero degree axial fibre laying process. Although often compared to filament winding, CompoTech's process differs by offering increased performance through higher mechanical properties, in particular higher bending stiffness and strength. This is achieved as a result of a thorough understanding of composite processes, and ongoing research, analysis and design.

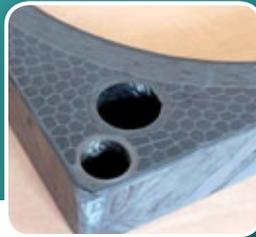
These resources and skills enable CompoTech to be a solution provider, not just a tube manufacturer, so customers can rely on the supply of a part to match their needs, deadlines and costs.

### CompoTech provides solutions for a very wide range of industries and applications

Not as simple as they look, CompoTech's carbon and glass composite tubes are highly engineered and manufactured using a unique zero degree axial fibre laying process, which has been developed over the past ten years through extensive research, analysis and practical application.

The recent developments of 3D cell structures and connection systems have widened the applicable range of products significantly, making CompoTech engineering even more valuable. These latest refinements of the process enables CompoTech to offer highly customised tubes, which can vary in length, diameter, wall thickness, shape, natural frequency, energy absorption, temperature stability, thermal conductivity and mechanical properties. CompoTech's team of experts is able to help you to find the right solution, depending on performance requirements and integration with other components.





All CompoTech products are capable of directly and/or indirectly achieving some or all of the following:

- Reducing weight
- Reducing labour time
- Reducing the number of components
- Reducing cost
- Increasing longevity
- Increasing performance
- Enabling productivity

## Technology

CompoTech places equal importance on every aspect of its technical capability, from the initial design and engineering through to materials selection and production process. Much research has been carried out into all of these areas to ensure customers receive a structural composite tube that will perform to the highest standards, whatever the application.

## Zero degree axial fibre laying process

### 3D Fibre Cell Structure

CompoTech has developed its own fibre laying process for structural composite tubes, which is particularly suitable for components which require high bending stiffness, stability & significantly improved Dynamic properties

**This process offers:**

- Maximum bending stiffness and strength
- Excellent dynamic properties
- Predictable and controllable high fibre content
- Consistent and repeatable thin or thick walled tubes and sections

This is due to the optimisation of the axial fibre placement, fibre fraction and low porosity, all of which contribute to the impressive stiffness, strength and dynamic performance.

The laying of fibres in filament winding is carried out at a small 'helical' angle of 5° or 7°, which is often called 'near zero'. Although many people believe the strength and stiffness characteristics to be the same as zero degree (unidirectional) axial filament laying, CompoTech's research has shown that there is a clear improvement of about 15 % in stiffness and about 40% in strength of zero degree axial fibre laying over 'near zero' degree.



**Fig. 1**

Robot holding frame

**Fig. 2**

Hydraulic cylinder and piston rod with unique joint system

**Fig. 3**

Corner of 3D beam showing cell structure, corner tube for slideway attachment and service tube

**Fig. 4**

Cross-section of headstock 3D beam

**Fig. 5**

40m span carbon fibre agriculture spray boom with integral mechanical attachment points

**Fig. 6**

Robot T-arm for automotive lines



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## Czech Space Research Centre

### Profile, History and Mission

CSRC is a privately owned Ltd. company situated in Brno and founded in 1994 to transfer the space technology and standards to the Czech space industry.

CSRC main domain is a **complex realization of space electronics project** based on electronics design and cleanroom manufacturing.

CSRC main power consists in the long-lasting practice and high technical level of the designers of electronic systems for space purposes proved by a series of successfully operating instruments in many satellites.

CSRC significant scientific and research base is the Faculty of Electrical Engineering and Communication, Brno University of Technology, with its broad material and personal technical background proved by a long-term collaboration in many international research projects.

CSRC has implemented the ESA ECSS standards related to the electronics design and cleanroom manufacturing activities including the certified system of quality assurance corresponding to ISO 9001:2000 standard.

CSRC has its expert delegated to the Czech Ministry Board for cooperation with ESA to implement and coordinate the ESA space projects into the Czech space industry.

### Complex Realization of Space Electronics Projects

#### Hardware Design

Standard digital circuits and single-chip microcontrollers, digital circuits with signal processors, FPGA and CPLD design using VHDL, behavioral simulation of the design, test at multi-layer PCB design, electronic circuits for PCI bus including control software development, analog circuit design, behavioral simulation.

#### Software Development

Software development is focused on the control and data processing for aerospace, communications or process control including efficient man-machine interface, signal processor and single-chip microcontrollers programming in C language and assembler, development of user specific applications for PC.

#### Mechanical Design and Manufacturing

Design of the mechanical parts and/or entire systems based on the CAD/CAM systems with electronic data formats exchange. Mechanical manufacturing is outsourced in qualified facilities having certification in the field of aeronautics and space production, applied technologies including CNC machining, alodine, anodisation, electron beam welding, glass feed-through manufacturing, thin layer sputtering, alodine in aerospace quality, laser-beam cutting.

#### Design Verification

Design output in all space projects is submitted to a complex verification using mechanical and thermal analysis based on finite elements method. Parameters are verified to allow safe operation in the space conditions taking into an account especially the space temperature range in the satellite and the vibrations during the launch phase. Testing procedures for thermal vacuum and mechanical vibrations tests are considered as a standard part of the design verification process.

#### Project Management

Main design process phases, steps and processes are namely the user requirements analysis, preliminary design, prototyping and design verification, final design, analyses and simulations, components and material procurement, control software with graphical user



interface, user and service documentation, test equipment design and manufacture, delivery and integration support, quality assurance.

### Cleanroom Manufacturing

Space hi-rel manufacturing activities are realized by ESA certified operators in the 100.000-class cleanroom, producing Flight Model & EM PCBs respecting the ESA ECSS manufacturing procedures. Manufacturing flow covers, for example, incoming inspection, components preparation, thermal pre-soldering processes like de-golding and pre-tinning component lead, soldering of through-hole components, soldering of SMD components, fine pitch soldering, fine mechanical operations like frame & fasteners installation, riveting, treatment, cleaning, nitrogen drying, polymerization, mechanical pre-soldering processes like pre-forming, bending, cutting of component leads, packaging and expedition procedures and other cleanroom activities.

### Prominent Space Projects

#### Satellite INTEGRAL, PSAC Project (launched)

Plastic Scintillator Anti-Coincidence Flight unit for photomultiplier high-voltage control, an experiment for the INTEGRAL (International Gamma Ray Astrophysics Laboratory) satellite for processing of the light emission caused by X ray particles covers development, design, analyses, manufacturing, testing, delivery and support in integration. The PSAC components are the High voltage power supply, the Low voltage power supply and the Electronic control box with the radiation hardened Actel 1280 FPGA.

#### Satellite SMART-1, EPDP Project (launched)

First European mission to the Moon covers the design and development of the flight hardware and software for SMART1 satellite, implementation of CAN bus including analyses, manufacturing, testing, delivery and support in integration.

#### Satellite DEMETER, I/V Converter Project (launched)

Interface system for the Langmuir probe is an intelligent interface between the Langmuir probe and the ground system for scientific data acquisition when converting low-current of pA to  $\mu$ A range to voltage. Interface board operation is controlled by the software application with graphical user interface. The activities cover the development, design, analyses, manufacture, testing, delivery and support in integration.

#### Satellite PROBA 2, DSLP&TPMU Project (launched)

PROBA 2 represents a complete delivery of the electrical and mechanical design including FPGA design, power supply design and all ESA requested tests, simulations and documentations. Two SLP probes (Segmented Langmuir Probe) are dedicated for surround satellite plasma measuring by means of the three TPMU (Thermal Plasma Measurement Unit) process sensors.

#### Satellites SWARM/TEASER, Microaccelerometer

Manufacturing one engineering model and three flight models for three satellites, the SWARM project being supported by ESA.

### ESA Project AO6052

#### Preparatory Activities for METEOSAT Third Generation (MTG) Participation

The main technical objective is to set up a detailed preparatory study to investigate the ways and means to integrate CSRC Company, as a space industrial element of the new ESA member state Czech Republic, in the most suitable way into the METEOSAT Third Generation Programme as well as other future ESA programmes.

### Other Projects Participation

XMM Satellite - EPIC Experiment, TARANIS Satellite, AGILE, MALST, SMART FUEL, METOP, SATEL-COM, NODE 3, GOME 2, CLUSTER II, PCDF-CCD HEAD, MONSTER and others...

**Fig. 1**

**PROBA2 - DSLP&TPMU Project, Data processing & communication unit, 2x I/V converters for segmented Langmuir probes, HW converting low-current of pA to  $\mu$ A range to voltage**

**Fig. 2**

Clean Room class 100.000

**Obr.3**

**SMART1 - EPDP Project, First European mission to the Moon, EPDP Measuring Unit, CAN bus (left) INTEGRAL - PSAC Project, Plastic Scintillator Anti-Coincidence, Flight unit for photomultiplier high-voltage control (right)**

**Fig. 4**

**PROBA2 - DSLP&TPMU Project, Data processing & communication unit, 2x I/V converters for segmented Langmuir probes, HW converting low-current of pA to  $\mu$ A range to voltage**

**Obr.5**

**DEMETER - I/V Converter Project, I/V converter for Langmuir probes, HW converting low-current of pA to  $\mu$ A range to voltage**



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ESA bidders code:  
ESABD 58020

## evolving systems consulting s.r.o.

an ESC Holding company

### General information

- ESC is a European company with offices in Munich, Vienna and Prague. ESC aerospace laboratories (including HAES CCUAS LABS - The Hacker Model Prod. and Evolving Systems' Competence Center for Unmanned Aerial Systems) are headquartered in Prague.
- ESC is a software and hardware producer and specializes in electronics, especially embedded microcontrollers, data transmission and microwave high frequency applications.
- ESC is active in the areas of Information, Communications, Control and Automation and provides innovative technologies and comprehensive know-how to benefit customers in several countries.

### Products and activities

#### Flight software programming for various satellite on-board instruments:

Flight Software (Startup SW & Application SW) for ESA's SWARM Microaccelerometer MAC04. We are working on the Flight software (Startup SW & Application SW) and GSE software (Test Equipment SW) for an Microaccelerometer Instrument MAC04 for the Earth's Magnetic field and environment Explorer SWARM. We deliver the complete software packet in all phases (requirements and architecture design phase, detailed design and implementation phase, delivery and acceptance phase). Prime: Astrium GmbH, Integrator on the Czech side: VZLÚ a.s.

The ESA mission will provide the best ever survey of the geomagnetic field and its temporal evolution, in order to gain new insights into the Earth System by improving our understanding of the Earth's interior and physical climate and the launch is mentioned for mid 2011.

Participation in GSTP program with AO6052, project "Reusable Payload On Board SW Framework" (tbc).

#### GSE (Ground Support Equipment) software programming:

Ground Support Equipment (GSE Test Equipment Software) Software for the MAC04.

#### Data Processing software:

Data processing ground segment software for SphinX - a fast Soft X-ray Spectrophotometer for the Russian Satellite CORONAS.

We are working on software for the Russian side of Space community - we are developing data processing ground segment software for SphinX - a fast Soft X-ray Spectrophotometer for the Russian CORONAS Solar Mission in cooperation with Astronomical Institute, Academy of Sciences of the CR, v. v. i. The end customer is Space Research Center of the Polish Academy of Sciences.

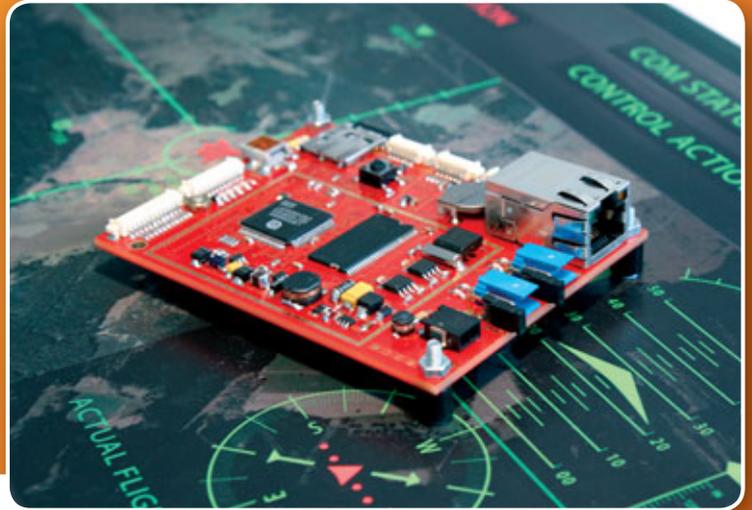
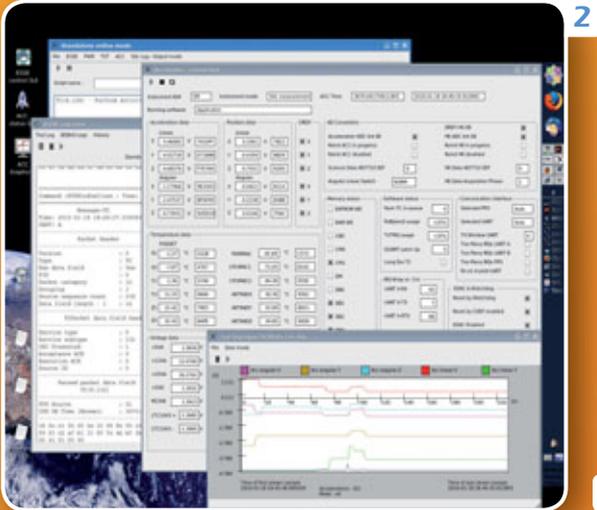
The purpose of software is to analyze and process incoming data dumps, downloaded from the Spacecraft operational center. The inputs for the processing are SphinX spectrometer science (X-ray) data and auxiliary data - housekeeping/technological data and S/C position/orientation data. Processed data will be accessible locally using the interactive visualization tool and remotely using web server (data catalogue and visualization). Launched on January 30, 2009.

#### AO6050 IRIS System Design Phase B:

IRIS, element 10 of the ARTES programme, aims to develop a new Air-Ground Communication system for Air Traffic Management. It is the satellite-based solution for the Single European Sky ATM Research (SESAR) programme. By 2020 it will contribute to the modernisation of air traffic management by providing digital datalinks to cockpit crews in continental and oceanic airspace.

#### Non Space:

- ESC is developing 4 UAV production lines (HAES 90, 400, 700 and HAES Scanner) in 2010. ESC's R&D development in Unmanned Control Systems (ESCUCS) includes S&A Collision Avoidance System; UAS Ground Segment modules compliant with STANAG 4586 w/ C2 integration; long-term aims also include UGV and even UUV.



- Integration and Process Automation of large IT Systems: Integration of the Security Management System (SMS) - Concept and execution of the merger between the savings banks in the KSV System. Test & Configuration Management of large scaled IT Systems.
- Architecture of Web-Applications, connected with Databases, running on a Mainframe: Internet Banking Architecture - a multi-channel platform for connecting of various distribution channels (HBCI, Web), connecting of cooperation partners (TxB, LBS) and provision of their services over the Internet, S-Internet banking architecture (savings banks' Internet banking).
- RWE Rhein-Ruhr: implementation of the system Optimization of Energy Flows for the RWE collection centre in Ruhr Area. RWE Graphic modeling of the network of gauging points of the energy flows and their statistic evaluation; integration of customers and trade partners through the Internet.

### Technical know-how

We have in our team qualified software and hardware engineers, who have made several flight software kits as well as ground segment software and hardware for various satellites/flying vehicles. They are fit in real-time and embedded systems programming.

Besides of that we have Software Architects, Database Engineers and good Test & Configuration Engineers.

Our "Space" Engineers are familiar with ECSS-E-40B (Space Engineering – Software, Part 1B & Part 2B), our management also with ECSS-Q-20B (Quality Assurance), ECSS-Q-80B (SW Product Assurance) and ECSS-M-40B (Space Engineering – Configuration management), and other ECSS standards.

### Field of specialization

- Embedded Software & Real-time Software & Control Systems & Navigation.
- Software Architecture & Design & Development & Programming.
- Embedded microcontrollers, data transmission and microwave high frequency applications.

### Software quality

We apply the ECSS standards:

- ECSS-E-40B Space Engineering – Software, Part 1B & Part 2B
- ECSS-E-70A Ground systems and operations – Part 1A & Part 2A
- ECSS-E-70-41A Space Engineering – Ground systems and operations – Telemetry and telecommand packet utilization
- ECSS-M-00-03A Risk management
- ECSS-M-40B Space Engineering – Configuration management
- ECSS-Q-20B Quality Assurance
- ECSS-Q-80B SW Product Assurance et al.

### "Space" objectives for next years

Our company would like to be one of the best players on a field of embedded systems development for

- scientific • commercial • military
- satellite on-board systems in Europe.

We are of course very interested in ESA projects in

- Downstream services • Telecommunications
- Ground segment data • Earth observation and processing software
- Satellite navigation

We want to succeed in crossfire of ESA ITTs.

**Fig. 1**

The SWARM satellite development phase is in progress with EM2 testing with OBC breadboard in Astrium clean room. ESC delivers flight software for one of the SWARM instruments, the Microaccelerometer MAC-04. From the left: ACC EM2 in the SWARM OBC testbed, SWARM electrical system engineer (EADS), SWARM SW system engineer (EADS), ACC electrical engineer (VZLU), ACC SW engineer (ESC), © EADS + © ESC

**Fig. 2**

Ground Support Equipment (GSE) for SWARM instrument ACC. The figure shows the ACC status window and a science data graph

**Fig. 3**

ESCUS Control Unit on a design of UAV GSE, © ESC, 2010



HAES 400, UAV Aerial Target, produced in HAES CCUAS LABS - The Hacker Model Prod. and Evolving Systems' Competence Center for Unmanned Aerial Systems



# Frentech Aerospace s.r.o.

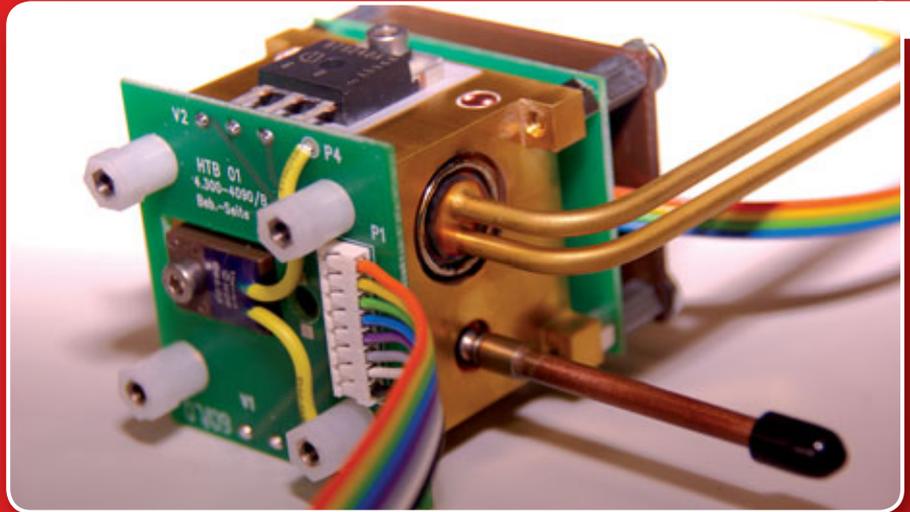
## Contact:

Frentech Aerospace s.r.o.

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## Frentech Aerospace s.r.o.

Supplier For Aerospace

The company has also in its strategy plans not only deliveries of precision mechanical parts, but also deliveries of complete modules on which the company is going to take part in their design and development.

The company also aims to cooperate with institutions such as Czech Space Office and ESA.

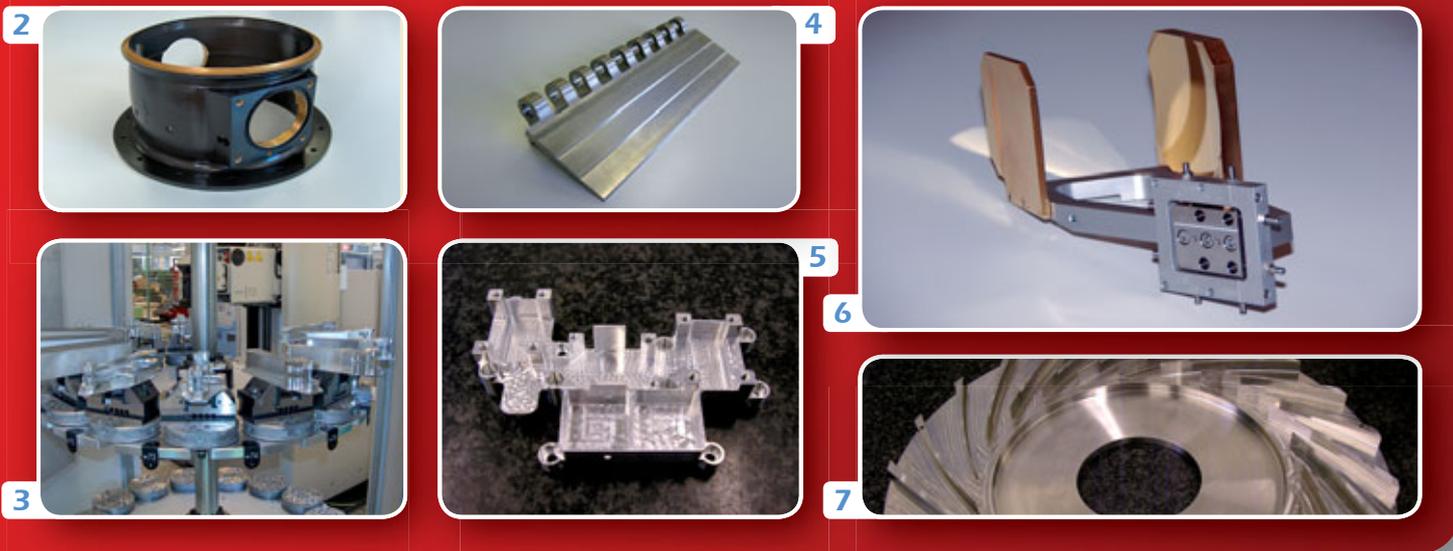
Frentech Aerospace s.r.o., as a 100% exporter, who is able to deliver products with very high added value (up to 80%), is going to reach its demanding targets with using of own know-how for production of precision parts for aerospace industry (i.e. Airbus A380 a telecommunication satellites).

## History and description of the company

### Frentech Aerospace s.r.o.

Frentech Aerospace s.r.o. was established in 1994, originally under the name Frencken Brno s.r.o. Frentech Aerospace s.r.o. is from its beginning focused on production of precision mechanical parts mainly for foreign customers. The company has continuously developed into the position of supplier of precision mechanical parts and components (parts, modules) for aircraft, space, medical, electrotechnical, optical, etc. devices for significant European and worldwide producers. Frentech Aerospace s.r.o. has delivered and still delivers components for production of Airbus planes -for all types- including A380 and A400M and for these planes also assures big amount of spare parts. Another part of production is focused on production of precision components for telecommunication satellites (for example ECS EUTELSAT), production of special machines and high tech devices (machines for dosing and packing medicaments, packing machines, gas analyzators, etc.), Frentech Aerospace s.r.o. is a direct offset





partner in program which is connected to hiring of fighting aircrafts JAS 39 Gripen by Czech Republic. The whole production of the company is aimed for export. The target countries are Germany, Great Britain, Switzerland, Netherlands, USA and France.

Nowadays, the company has 80 employees, up-to-date machinery located on approx. 3200 m<sup>2</sup> (2400 m<sup>2</sup> manufacturing area facility, 400 m<sup>2</sup> assembly area facility, 500 m<sup>2</sup> office area facility) with corresponding setting, quality and logistic departments. Production flow is managed with using of CPC software. The company has developed quality management system certified according to ČSN EN ISO 9001:2009 and is also certified by Airbus according to standard QSF-A as a supplier for German aircraft and space industry and by Honeywell according to ČSN EN 9100:2003.

The current level of Frentech Aerospace s.r.o. was reached in complicated competitive market formed mostly with foreign companies and also with pressure from customers on high quality products, with flexibility, quickness and fulfilling of delivery schedules. This market is very demanding regarding to qualification of the employees, technical equipment and technological background of the company on all departments and all its levels. Management of the company is focused on maintaining of the competitive strength, which has resulted in finding solutions in optimization of the production with using of automatization techniques and also in using of up-to-date technologies in its development and production realization.

Frentech Aerospace s.r.o. is now part of the holding Czech Aerospace Systems s.r.o.

**Fig. 1**  
Gas analysis sensor

**Fig. 2**  
Valve casing for B787 (Dreamliner)

**Fig. 3**  
Automated tooling on 5-axis Fehlmann machines in Frentech

**Fig. 4**  
Titanium hinge for A380 (Airbus) cargo doors

**Fig. 5**  
Precision tooled element for a telecomms satellite

**Fig. 6**  
Mirror assembly for ESO (Project ALMA)

**Fig. 7**  
Diffuser for a Honeywell aircraft engines



Frentech Aerospace company offices



# G.L. Electronic s.r.o.



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+420573356293

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IT +393403617837

## G.L.Electronic s.r.o.

G.L. Electronic provides technical support especially in the field of space, air and military technologies.

### General Information

G.L. Electronic was established in 2003. We draw on many years' professional experience gained in foreign companies engaged mainly in production and application for space, air and military technologies. G.L.Electronic operates especially in the EU countries and above all in Italy.

### Products and Activities:

#### CLEAN ROOM ACTIVITIES

G.L. Electronic has become a qualified company since 2003. G.L. Electronic offers technical support especially in the field of space, air and military technologies. We focus on the following main assignments:

- Production: HI-REL PCB mounting, both internal and external cabling, complete implementation of bonding and final integration and assembly of the unit.
- Measurement: testing of HW and SW of PCB's according to the customer's requirements, including final unit tests.

The realization of the above-mentioned activities is performed in clean rooms (clean room class 100 000).

#### GROUND SEGMENT EQUIPMENT

Since 2007 we have participated in ESA and CNES projects in Centre Spatial Guyanais in French Guiana as well. G.L.Electronic provides the company Carlo Gavazzi Space and Telematic Solutions with technical support by installation of measuring, control and telecommunication distribution systems on the launching pad VEGA, Soyuz and Mangousta.

### Certifications:

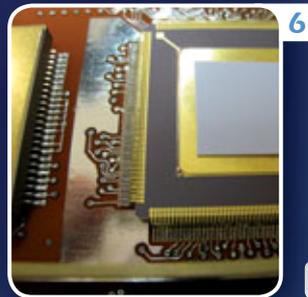
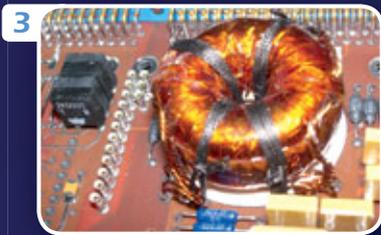
Today the team of the company G.L. Electronic consists of professionally qualified ESA trained and certified technicians. The certification is according to the ESA-ECSS-Q-70 Standards issued by the Instituto Italiano della Saldatura in Genoa that is authorised to award the ESA certification.

#### ESA Certified: CAT 2 & CAT 3

- ECSS-Q-70-08
- ECSS-Q-ST-70-26
- ECSS-Q-ST-70-28
- ECSS-Q-ST-70-38

### Quality System:

The company introduced the quality control system according to the process identification document (PID) & updating (PUD).



### Industrial Electronics:

G.L.Electronic also uses the previous professional experience in the field of industrial electronics focused on the production and non-standard production applications. The company performs the complete output quality control of these production processes as well

#### Cooperation on the following projects

##### New space Projects:

GLOBALSTAR2, SWARM, GAIA, AMS-PDS02, LISA, AMOS4, BEPICOLOMBO, SENTINEL1

We provide technical support especially in complete manufacturing, quality control and measurement. Technical support for the final integration (external, internal harness).

##### Implemented space Projects:

SAR LUPE, AGILE, HERSCHEL, ISS DHPU, EUTEF, FSLECCU, BIOLAB, KAZASAT

We participated mainly in technical assistance in production, quality control and measurement. Technical support for the final integration (external, internal harness) and installation of solar panels.

#### Cooperation on the following projects in French Guiana

Launch Vehicles: VEGA, SOYUZ

Security camera system: MANGOUSTA

We are concentrated primarily on technical support for the complete electrical installation: telephone, audio and video signal and safety (gas leak), and special applications and individual measurements.

**Fig. 1**

Space segment team

**Fig. 2**

Ground segment team

**Fig. 3**

Power board – hand soldering

**Fig. 4**

External harness

**Fig. 5**

Internal harness

**Fig. 6**

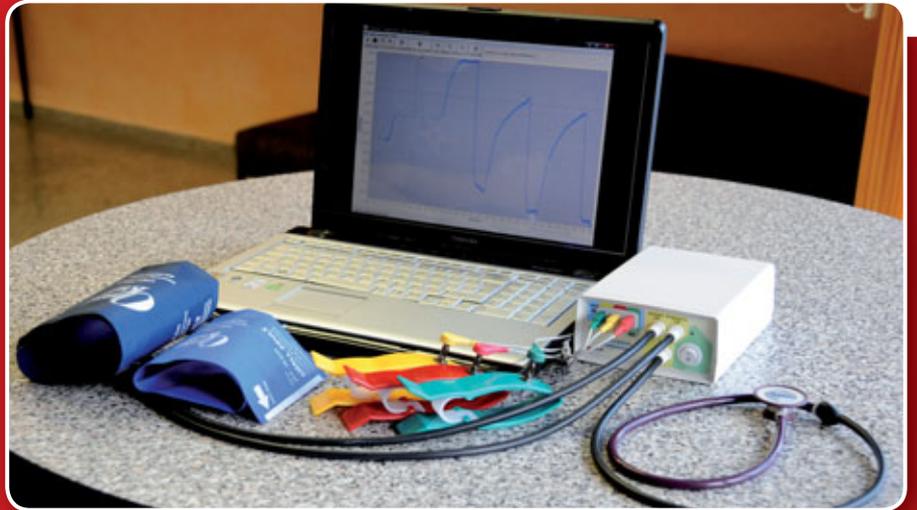
Digital board – hand soldering

**Fig. 7**

Launch Vehicle VEGA,  
Credits: ESA – J Huart

Launch Vehicle Soyuz  
Credits: ESA/CNES/ARIANESPACE - D. Ducros





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## Chipinvest

### Who Are We

Chipinvest is a joint stock company founded in 2005 with the aim to develop and market portable diagnostic devices and systems for medical applications. The core competence of the team is covers the following main areas:

- Embedded systems
- Image processing, data mining and Expert systems
- Integrated circuit design

### Embedded systems

The product was developed with the aim to enable screening and early stage diagnostics of selected diseases in the place of need (point-of-care). In this way the platform is convenient not only for the current application in cardiovascular diseases, like atherosclerosis, but also infectious diseases that are of importance to developing world.

#### The systems combines the following main functionalities:

- measuring of selected parameters, e.g. vein stiffness non-invasively
- portable ultrasound
- screening lab for detection of selected markers

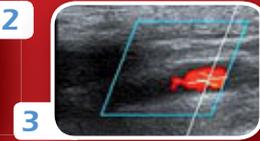
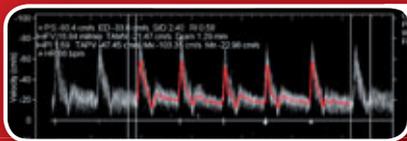
### Expert systems

We were invited to provide a diagnostic solution for new selected new forming technologies. The project resulted in patented expert systems.

### Integrated circuits

Our focus is on low power mixed signal, examples of IP blocks provided for customers are given below:

- **Linear timer:** Digital circuit which controls the stimulus pulse timing and blanks all other sensitive blocks as Z-sensor, Accelerometer and input amplifiers. It provides control signals for charging pumps and DSP.
- **Output Stage:** This analog circuit creates from the timing coming from Linear timer actual stimulus pulse. The stimulus amplitude and duration is fully programmable. Part of the Output stage are charging and discharging pumps for holding capacitors.
- **Clock generator:** Mixed analog/digital circuit which creates from basic X-tall oscillator all internal free running and gated clocks. It also provides master clock for the external CPU and controls the handshaking mechanisms.
- **Service request controller:** Digital block collecting all internal interrupts and service requests from the L289, prioritising them and generating interrupts for the external microprocessor.
- **IEGM:** Digital sensing technology allowed to collect and save measured data. Due to limited memory size it was necessary to compress them. IEGM compression block was designed to compress 2 channels internal cardiogram data and send the data stream thru DMA channel to the memory.



**Fig. 1**

System view

**Fig. 2**

Pulse wave evaluation

**Fig. 3**

Sonographic evaluation

**Fig. 4**

Arterial and venous diagnostics

**Fig. 5**

The box

- **DSP:** Programmable multi channel digital filter used to determine QRS and T-wave in the internal EGM signal. Our engineers were responsible for the functional and production test.
- **Watchdog:** An obligatory block on every IC. Running on independent oscillator clock serves as security policy for cases when the system froze, for the cases when the supply voltage drops down and does the start-up reset sequence (different for analog and digital part of the L289).
- **Digital trims:** This block provides the hardware necessary to control the rate limit oscillator, the bias current generator, the band gap and selection of various reference signals to the analog test buses.
- **Supplies & References:** LDO 2V regulator supplying separately digital and analog circuits and external CPU. The Reference circuits includes a digitally trimmed ibias current generator, digitally trimmed band gap voltage reference and power on reset trigger function.
- **Telemetry B:** The Transceiver-receiver block performs the physical transmission and reception of telemetry which is defined in the Telemetry B Physical Layer Specification. The hardware supports two sensitivity modes: a high sensitivity mode and a low sensitivity mode.
- **Test points:** This block provide test access to different digital and analog signals around the pacemaker chip and brings them to the test pads. This is necessary for production testing.
- **DMA controller:** Design of 24 bits DMA controller used on D488 microprocessor.
- **Clock doubler:** A mixed mode design, where analogue circuit is made in digital technology. This block is used to double the internal master clock frequency of the D488 CPU core whenever firmware needs

Thanks to close links to prime experts mainly in Cardiology and Microbiology we can offer complete solutions for the diagnostics of given disease.

## Our focus - Integrated application programme

Thanks to our existing relations to physicians, private clinics and representatives of rural regions we focus our attention to integrated application programme with the aim to extend the current projects to new areas. Partners active in Satellite communication, Telecom or other diagnostic devices are welcome.

## Contact:

Iguassu Software  
Systems a.s.

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160 00 Praha 6  
Czech Republic

Tel: +420 235 351 000  
(English)

Tel.: +420 603 85 44 77  
(English, Spanish, German)

Fax with e-mail forward:  
+44 7092 034415

petr@iguassu.eu  
www.iguassu.eu

ESA bidder's code:  
ESABD 58008



## Iguassu Software Systems a.s.

The first Czech company to participate in a winning ESA competitive tender

### Principal business area and clients:

Software design & development and consultancy  
for space clients including

- ESA ESOC, ESA ESRIN, ESA GNSS Toulouse, Eumetsat, GJU/Indra, Thales Alenia Space, ACS (Italy), Astrium (Germany)

and for non-space technologies

- HP (Germany & US), Agilent (Germany), KNAPP (Austria), Ingersoll Rand (US), SciSys plc, CAM GmbH, Iridium (subcontract), HTS UK, ABB (Germany), Ingersoll Rand US, Ministry of Transport & the Inter-American Development Bank (Argentina)...

including real-time systems, satellite navigation, GRID technologies in EO processing, embedded systems.

Iguassu has extensive and in-depth experience in multi-national teams and consortia, and long term assignments in Europe and the Americas.

All staff speak fluent English, some also German, Spanish, limited Brazilian Portuguese. Japanese skills are being developed in-house (see our Japanese website). Projects were successfully carried out in the UK, Germany, Spain, France, Italy, Austria, Argentina, Brazil, and USA.

### European Space Agency (ESA) track record

Iguassu Software Systems (ISS) participates in ESA work since 1994, when it was founded as a Czech subsidiary of SciSys. The MD used to be ESOC staff member for 12 years and works in space business since 1975. This helped ISS to keep its position with ESA suppliers even after it became an independent Czech SME, following the Management Buy Out in 1999. ESA survey of Czech industry in 2002 gave ISS top marks, highlighting its EUMETSAT FFP project, design & development of test tools for MSG CF system validation, as an outstanding example of successful Czech co-operation in international space projects. In 2007 ESA experts carried out another audit of Czech industry and ISS was again one of the successful companies.

Direct contracts with ESA started after 2004, when the Czech Republic became a co-operating ESA state (PECS). ISS was the only Czech company to win several bids when PECS started and, as confirmed by the Czech Space Office, it was the most successful Czech company during the PECS period 2005-2008. During that time it was also the first (and so far the only) Czech company to participate in winning competitive ESA bid, with ACS as prime.

When the Czech Republic joined ESA in 2008, ISS was again the only company to win more than one project in the first Czech open call. In one of them, an experienced ESA supplier is its subcontractor. We also embark now on another project won in a competitive tender, with Astrium D as our prime. Further competitive bid with an Austrian prime has been submitted to ESA.

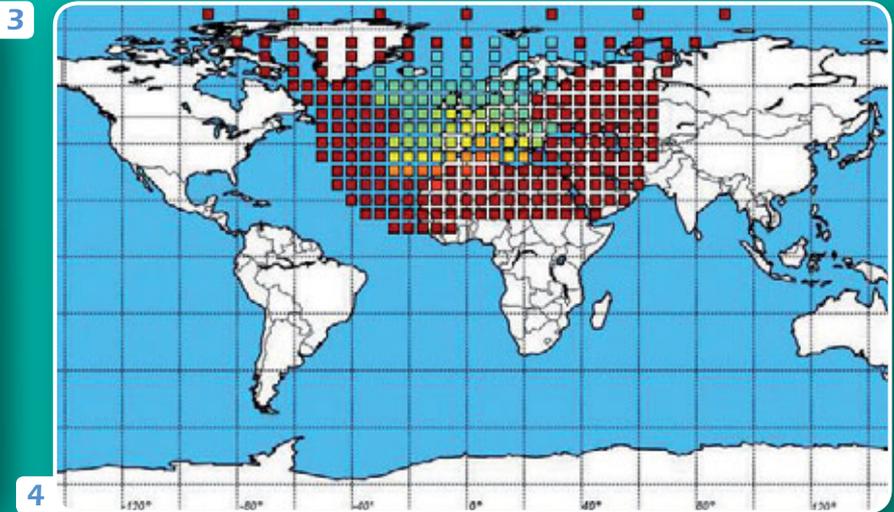
### Currently on-going or soon to start ESA Projects

- Real-time Performance Monitoring Tool for EGNOS (AO6052)
- Parallel Data Mining Components (AO6052)
- IRIS/Artes 10, satellite communication for civilian air-traffic (subcontract to Indra)
- Design & dev't. of interference monitoring for GNSS reference stations (AO6149, prime Astrium D)
- Continued operation of an EGNOS monitoring station, linked into the PERFECT int'l. network

### ESA and Galileo projects completed since 2005

Image Information Mining in Time Series - Iguassu was a member of the ACS consortium which had won the AO5119 bid, contributing its GRID experience to the development of EO information mining in time-series. The work was carried out on ESRIN and ACS premises

- EGNOS SISNeT II including complete design & development of a new generation SISNeT server
- Design & development of EGNOS education tools, based on experience gained in SISNeT
- Galileo Search & Rescue subsystem co-development - subcontract to the Indra consortium, including Thales, Alcatel Space, CNES...
- Galileo ALGINT co-development - subcontract to SciSys



- Study of SME needs in ESA – subcontracted to the Italian SME association AIPAS to cover CEE/PECS countries
- EGNOS SISNeT development, conceived in co-operation with GMV, including mobile applications
- porting of SAR algorithms to GRID technologies and co-development of “Grid of Demand”, conceived in co-operation with Indra Madrid, and carried out on-site in ESRIN
- setting up of the 1st Central European EGNOS receiving station, monitoring the integrity of EGNOS satellite navigation data (IMAGE/PERFECT Project), linked in real-time into ESA central database

#### Space projects participation (over 45 man years) before 2005 include

- Meteosat TP Main Control Centre CF
- Satellite Control System SCOS 2000 for ESOC
- Envisat payload processing (ESRIN),
- IRIDIUM terminal test software (Racal, UK)
- MSG, MCF (UK, Eumetsat, and Prague) and Primary Ground Station (Gilching, D)
- telescope auto-tracking system (turnkey system Czech R.)
- ground segment systems maintenance and user support for ESOC computer network

#### Marketing and consultancy track record of Iguassu staff

- WEU Satellite Centre (now EU SC) in Spain, for Anite Systems
- CONAE Argentina, 2.4 M US\$ satellite station, for Anite Systems
- United Nations (UNEP), Mercure satellite communications project, for Anite Systems
- Latin American satellite station report for ESA external services
- INPE Brazil 9.4 M US\$ bid for CBERS system, for Anite Systems
- Market intelligence and bid support in Brazilian aerospace for Vega and SciSys
- Latin-American aerospace market report for Shreeveport
- Czech defence market consultancy for Inmarsat (subcontract to TriPolus)
- aerospace consultancy for ESA External Services, Integral Systems (F), Ministry of Interior

#### Examples of non-space projects

- 5 years’ consultancy and development work for HP in Germany and California
- Embedded software design & development for ThermoKing / Ingersoll Rand

#### Non revenue-earning activities on behalf of the Czech Republic

- ISS managing director is a member of the team lead by the Ministry of Transport to draft the Czech national space plan document
- leading the Czech Space Alliance since its foundation in 2006 and co-operation with space associations in ESA countries, co-founding the pan-European trade association SME4space;
- since 2001, ISS has been on the „Czech Board for Space Activities“ advising the Ministry of Education
- promoting the Czech space industry skills on international markets, from IAC 2000 Rio, through Prague (e.g. keynote speech in “ICT technologies in space”, DASIA), ISRO Bangalore (delegate of the Czech President’s diplomatic mission), Tokyo (Czech Japan Technology Days), Argentina, Portugal, Spain, Mexico ...as well as participation in top level ESA meetings, e.g. between the Czech prime minister and the ESA DG
- developing working relationship with overseas agencies such as the Canadian Space Agency, the Japanese JAXA, the Brazilian AEB/INPE and the Argentine CONAE; preparation of co-operating agreements with the Brazilian space agency and the Japanese space industry association MANTEN

#### Iguassu Software Systems is your ideal software partner for future ESA bids and other international space endeavours -

- over 100 man-years of space experience, and staff working with ESA since 1975
- successful business partnership with renowned ESA suppliers in A, D, E, I, UK..
- won significantly more ESA projects than any other Czech company in all the stages of the Czech Republic’s involvement in ESA

Try us and see for yourself!

Status April 2010

**Fig. 1**

**Galileo Satellite System**  
Credits: ESA - J. Huart

**Fig. 2**

**Comparison of RGB bands composition and artificially colored clustered scene**  
Credits: Landsat TM – free sample image

**Fig. 3**

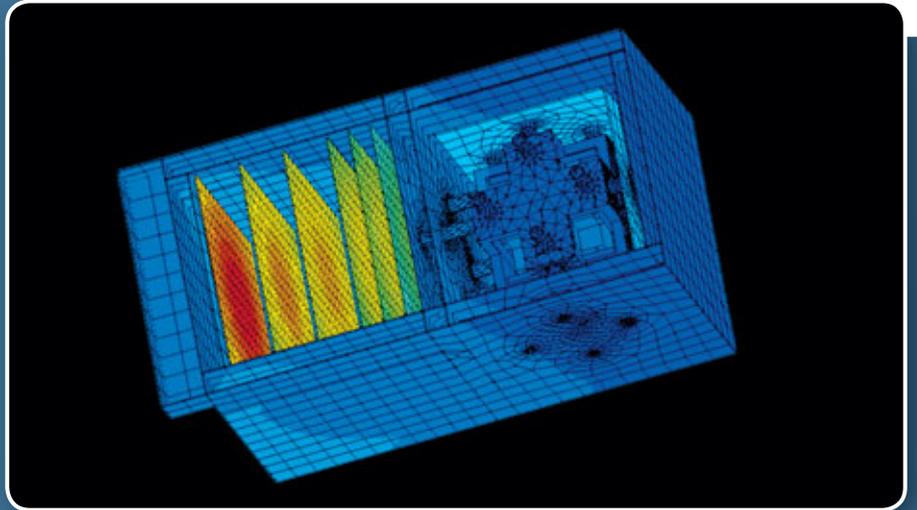
**Ellesmere Island and northwestern Greenland - Envisat ASAR radar image**  
Credits:ESA

**Fig. 4**

**Ionospheric delay over Europe, SBAS MeNTOR – ISS product**  
for more info see  
<http://www.egnos-pro.esa.int/sbasmentor/index.html>  
and <http://www.iguassu.cz/sbas-sim/>



**L. K. Engineering, s.r.o.**



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**L. K. Engineering, s.r.o.**

LK Engineering (LKE) provides engineering services in mechanical area. The core activities are focused on design and analysis using advanced engineering computations. LKE can offer a solution to companies with product R&D activities in each part of design process such as an innovative design proposal, conceptual study and detailed design evaluation.

We use the most advanced computational technologies and knowledge available to satisfy challenging requirements of today's products. These techniques and our experience help to reduce a cost and time during a development period and contribute to product competitiveness.

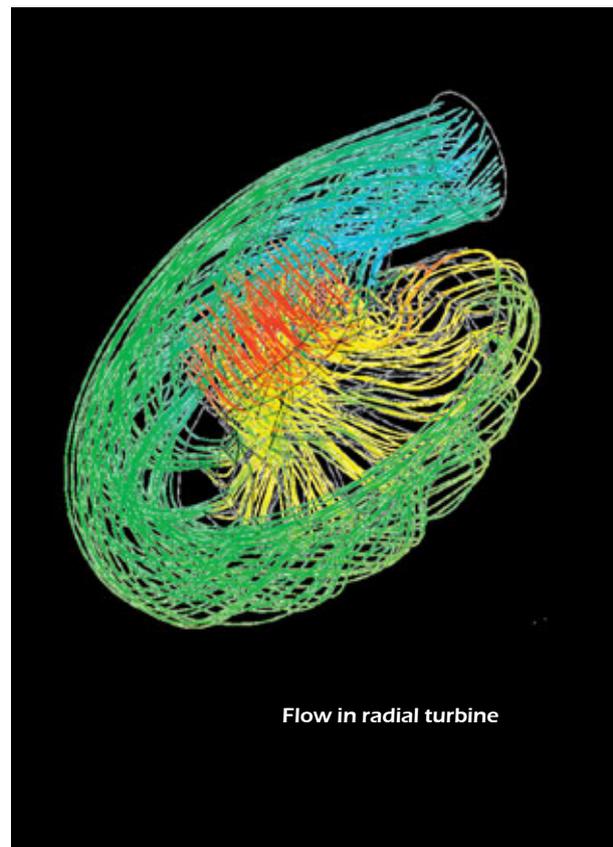
LKE provides service to diverse group of clients and team of LKE experts has successfully accomplished projects for various areas of industry such as power generation, aerospace, transportation, architecture, etc.

**History**

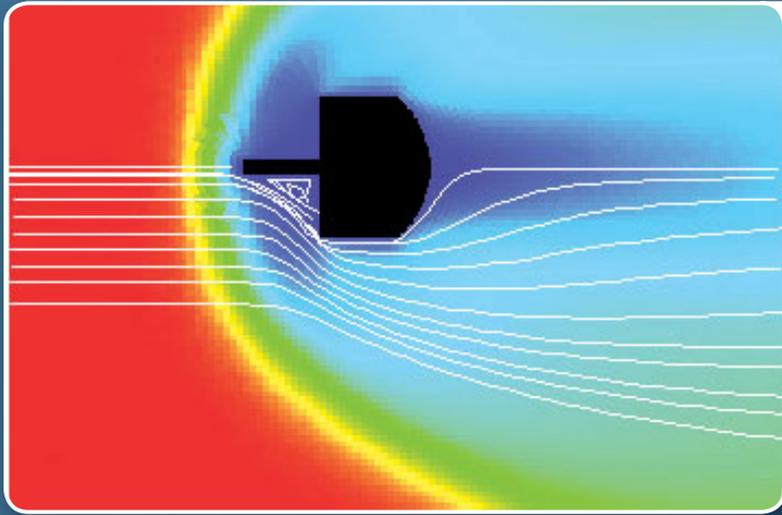
L.K. Engineering was established in 2001 after previous successful experience of its founders in area of technical calculation for power generation industry. At first the company was oriented to international OEM in US market and later company activities expanded also to European region and regional customers.

**Capabilities:**

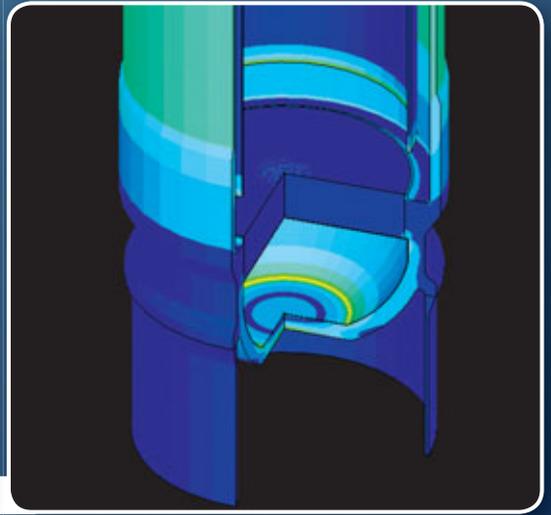
- Stress, thermal and fluid dynamic calculations
- Fatigue life and fracture mechanics evaluation
- Design of highly loaded components and optimization
- Numerical computation involving complex physical effects
- Product qualification acc. to specified code
- Expertise, reviews and consultation
- Development of unique computational software
- Technical documentation
- Project management



Flow in radial turbine



2



3

### Space core activities:

- Thermal design and analysis of the spacecraft systems
- Structural evaluation of spacecraft components

### Quality of service

is guaranteed by our professional and highly trained team who has long experience with projects in international environment. LKE staff continuously acquires the latest technologies in the area of CAE and implement them into provided services.

### LKE mission is:

Commitment to client demands, contribution to successful and cost effective design of final product.

**Fig. 1**

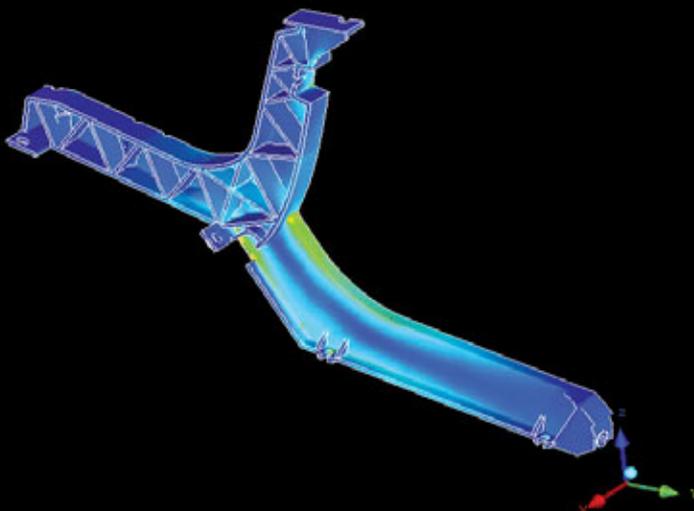
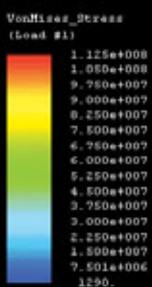
Thermal and deformation analysis of micro-accelerometer

**Fig. 2**

DSMC simulation of hypersonic rarefied flow

**Fig. 3**

Structural design of pressure vessels



Structural optimization of aerospace parts

# Rigaku Innovative Technologies Europe, s.r.o.

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## Rigaku Innovative Technologies Europe, s.r.o.

### Company profile

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

### Expertise and Experience

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

### X-ray Optics

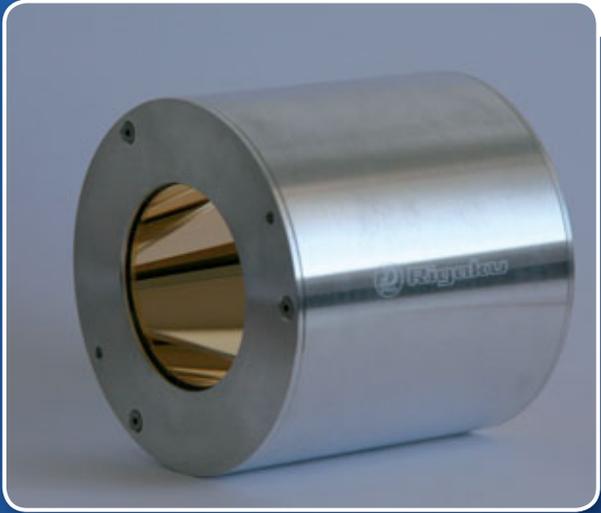
RITE has outstanding capabilities in the ray-tracing, designing, manufacturing and testing of super smooth X-ray optics for EUV, XUV and X-ray radiation. Optical group is based on historical background and includes leading researchers in the field of advanced X-ray optics in the Czech Republic. This group has developed various technologies for manufacturing of optics and many more innovations in this field. The company currently uses electroplating technologies, electroless deposition of metals, ion milling and shaped technologies for manufacturing of optics. Particularly, replication technologies of metal (Au, Ni, Pt...) and/or multilayer coated surfaces and Multi-Foil Optic (MFO) technologies are applied. Combination of extremely smooth optical surfaces and other processes/technologies is one of the key Rigaku technologies.

### X-ray Cameras

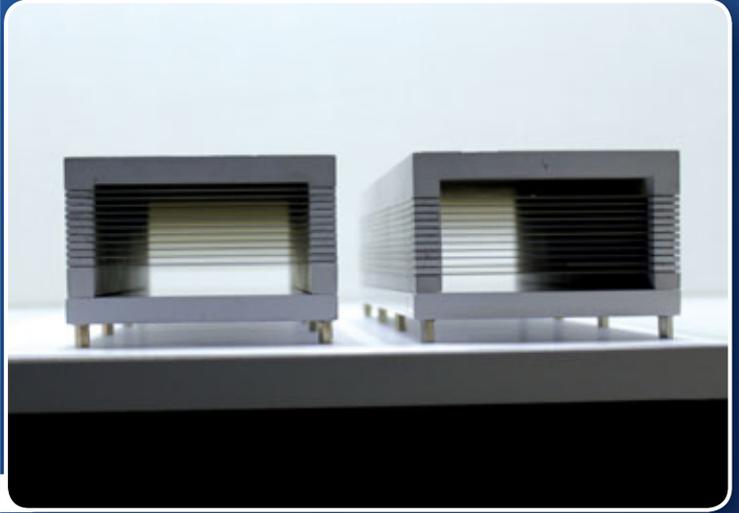
The other important field of RITE R&D activities is X-ray detectors and cameras. Especially, scientific imaging with BI CCD detectors primarily developed for EUV/SXR applications is on superior level. Currently RITE manufactures (produces) four types of cameras - soft X-ray digital CCD camera, two types of fast readout X-ray cameras (40 Mpixels/s) and X-ray camera with spatial resolution around (below) one micrometer.

### Design of Complex Opto-Mechanical Systems

X-ray optics or detectors are key components of any X-ray instruments. Moreover RITE has capability to design and provide manufacturing of complex Opto-Mechanical system using these components. The design of parts and mechanical systems is realized using CAD system NX/Unigraphics. Mechanical manufacturing is partly outsourced through specialized facilities.



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## Applications

RITE super smooth X-ray mirrors and X-ray detectors are used in laboratories and companies. Grazing incidence X-ray mirrors and X-ray cameras from RITE have applications in semiconductor industry, astrophysics, EUV lithography, material research, biology and hot plasma research.

## Cooperation and References

RITE cooperates with Czech academic institutes (Charles University, the Academy of Sciences of the Czech Republic, Czech Technical University, Institute of Chemistry in Prague, etc.) as well as with international institutes (ESTEC ESA, University of Colorado, Institute of Optoelectronics, Military University of Technology). The scientific standard of RITE is demonstrated by several successful international projects:

### Elliptical optics for EUV

- Academy of Sciences of the Czech Republic – 2008
- Institute of Optoelectronics, Military University of Technology – 2009

### CCD cameras

- Bhabha Atomic Research Center, Mumbai, India – 2009
- X-ray camera with micron resolution, RC Japan – 2009

### International projects

- Novel X-ray Optics Technologies for ESA X-ray Astrophysics Missions – ESA PECS project
- Applications of Kirkpatrick Baez Imaging Systems in Space – co-operation with Colorado (Prof. Webster Cash) and Iowa University (Prof. Randall L. McEntaffer) - Ministry of Education, Youth and Sports

**Fig. 1**

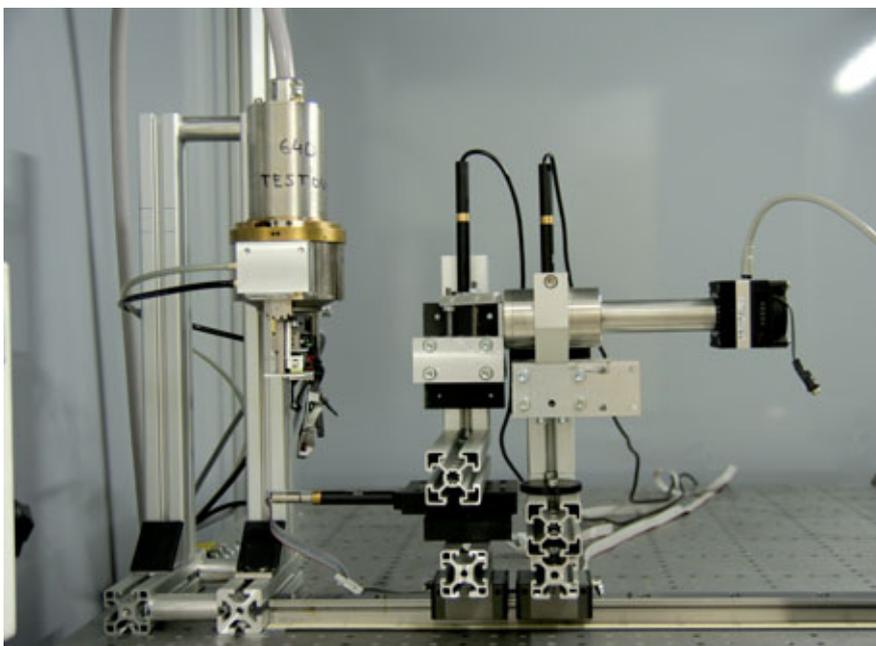
X Sight high resolution X-ray camera

**Fig. 3**

EUV elliptical optics for plasma research experiment

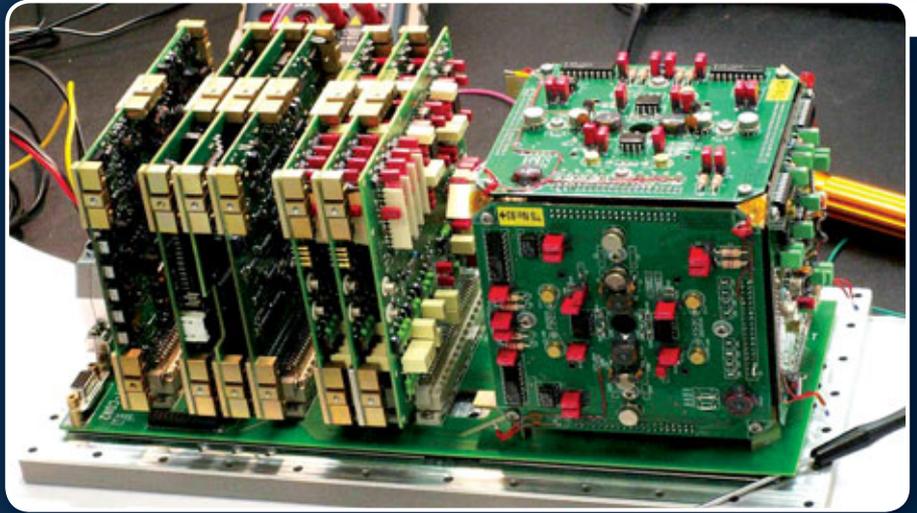
**Fig. 3**

Multi-Foil elliptical X-ray optics



X-ray experimental facility including X-ray source (8 keV)

# Space Research Instruments



## Space Research Instruments

Space Research instruments (SRI) develops measuring and special custom-design electronic devices, not just for space purposes.

SRI was founded by Petra and Robert Pacanda in 2005 and has been profitable ever since. By focusing on innovative solutions, using the best available technologies, and, above all, maintaining the highest quality standards adopted by the aerospace industry, SRI is becoming the regional leader in specialized electronics design for space-related projects. SRI competencies include:

- complex PCB design (in accordance with ECSS Q70 standards) – currently up to 8 layers
- component applicability assessment (Space components, ESA Preferred Part List, Rad-Hard components)
- electronic systems integration (bus design, interoperability protocol specification)
- prototyping and small series manufacturing
- electronic measurements and testing, including basic testing in a thermal or vacuum chamber

In addition to its core competencies, SRI leverages its established relationships with academic and industrial entities to deliver a wide range of specialized solutions, reliably fulfilling orders ranging from pure research to turnkey solutions delivery, including highest-quality manufacturing of critical spacecraft components. Our partners include:

- Czech Technical University in Prague, namely faculty of electronics
- Aeronautical Research and Test Institute in Prague
- Czech Space Research Centre in Kromeriz

Our past achievements include:

- MAC04\* electronics development
- MAC04 ground segment test equipment development
- MAC04 coils and transformers manufacturing for PFM and FM
- development of various measurement jigs
- smart card data conversion module development



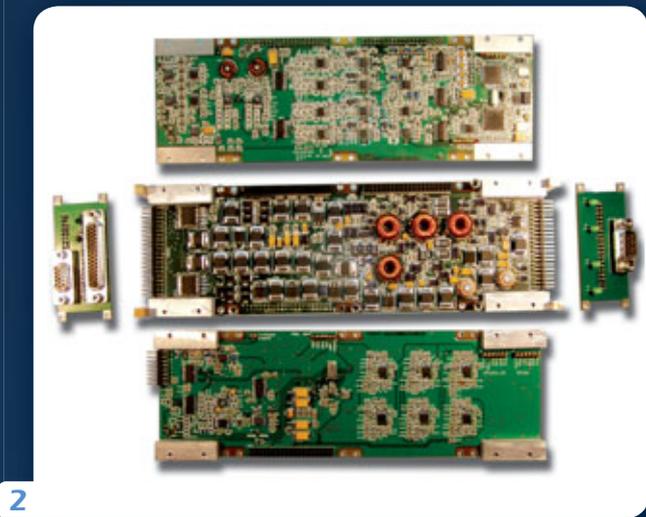
CPU board for MAC04  
breadboard model

### Contact:

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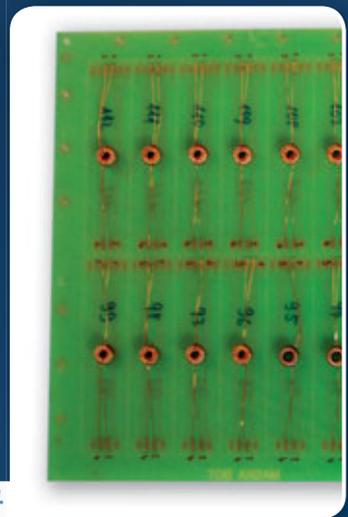
E-mail: [sri@sri.cz](mailto:sri@sri.cz)  
Web: <http://www.sri.cz>



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## MAC04

MAC04, a part of the ESA SWARM\* project, is a unique microaccelerometer relying on the following components designed by SRI:

- POSDET – position detection boards; measuring rotation and translation components of a reference cube (a mechanical component) in all 3 dimensions, and controlling the cube position in response to its measured displacement
- ACTRAD – 3 independent boards; control circuits (PD controller for reference mass driving) and 24bit A/D converter for measuring POSDET output signals
- GNRHSK – generation of analog and digital signals (clock signal for ACTRAD boards, synchronization signal for PWR board and harmonic and rectangle 230400Hz signals for POSDET boards) and measuring of housekeeping information (temperature measurements (from  $-50^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$  range), 20 points of 16bit voltage measurements).
- PWR – power supply board; primary side voltage from 20V to 35V, secondary side voltages:
  - » +5V for digital circuits (galvanically isolated section 1)
  - »  $\pm 5\text{V}$ ,  $\pm 12\text{V}$ ,  $\pm 25\text{V}$  for analog circuits (galvanically isolated section 2)
 switching frequency synchronized by internal clock 115200Hz, soft start, over current protection on secondary side, under voltage and over voltage protection applied
- CPU – controlling and data collection unit; SRI designed and built the first CPU unit for a breadboard, based on Microchip PIC18F8722 MCU, with these characteristics:
  - » Two galvanically isolated serial links (RS422)
  - » External synchronization: 2xPPS (Pulse per Second) input
  - » On-board over voltage protection

\* SRI has been working on MAC04 as a subcontractor to the Aeronautical Research and Test Institute in Prague (VZLU). SRI is a sole developer of the electronic components for MAC04 with the exception of the flight version of CPU board.

**Fig. 1**

MAC04 breadboard model

**Fig. 2**

Electronic boards for MAC04 TSTEGSE

**Fig. 3**

ACTRAD board for MAC04 engineering model

**Fig. 4**

Coils and transformers for MAC04 PFM and FM



Assembling process



# UNITES Systems a.s.

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## UNITES Systems a.s.

Company UNITES Systems a.s. develops and produces top class electronics since 1991.

UNITES Systems a.s. has 18 years of experience in development and production of ATE solutions. Our company was established in 1991. At the beginning we were a sales & support representative of SZ Testsysteme – M3000 series. Since 1992 we operate as an independent company with its own development and production departments.

The main focus of UNITES Systems a.s. is development and production of test systems of electronic components, functional blocks, development of test applications for our testers as well as for test systems of other vendors. We can provide testing of components provided by the customer, we offer test systems loan and we also provide consulting thanks to our deep know-how of test and measurement. Another field UNITES Systems a.s. is involved in is customer specific development of electronics which includes analysis of the problem and realization of proposed solution – software, firmware, CAD, hardware, production and test. We provide worldwide service as well. Last but not least is assembly of boards for our customers ranging from prototype assembly, low volume assembly up to small serial production.

## Products

**UNIMET** is universal test system, configurable with exchangeable test adapters for testing wide range of passive and active components (resistors, coils, diodes, bipolar transistors, MOSFETs, relays, analog & digital ICs as well as hybrid modules, etc.). This system is especially used in aerospace industry for component qualification to ensure 100% quality.

**UNISPOT** is specifically designed and dedicated test system for mass production of discrete components ranging from low power chips (UNISPOT S40 / S80 ACCEL) to high power up to 2500V and 1000A (UNISPOT DHP). Test system UNISPOT S40/S80 ACCEL is currently considered as the fastest on the market in its class. Tester throughput is up to 1.440.000 devices/day. Measurement range is +/- 30V/3A and 600V/10mA

**UNICHECK** is functional test system with possibility of basic ICT testing, with great capacity of input and output lines (analog and digital) and with infinite possibilities of various extensions. Basic unit consists of 256 analog input pins (16-bit resolution), 8 analog output lines (14-bit resolution), 32 fast digital I/O, 16x Open Collectors, communication interfaces (RS232, RS485, USB, Ethernet) and we can use up to 256 such units in one system.

**Customer Specific Testers** can be supplied if requested. As an example of such customer specific tester can serve AL-METER – a system for measuring AL constant of ferrite core.

**Other activities** resp. areas of expertise include wireless transceivers, low power, battery powered applications, sophisticated solutions based on FPGA/CPLD, controlling systems, development of test system parts, VI sources, etc..



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## Certifications

- ISO 9001:2000
- ISO 14001:2004
- OHSAS 18001:2008



## References

Following companies (aerospace) are using UNITES Systems a.s. services as well its products to support their high levels of quality standards:

Realized projects lies in performing electrical test of components and modules dedicated for high reliability applications. The parts are measured using our test systems, afterwards they are exposed to various types of climate, radiation and temperatures and than they are tested again. The measured data is then evaluated and degradation of electrical parameters is determined.

- ESA Estec
- RUAG Space Sweden AB
- AIRBUS
- Thales Alenia Space ETCA s.a.
- CNES
- ISRO

**Fig. 1**

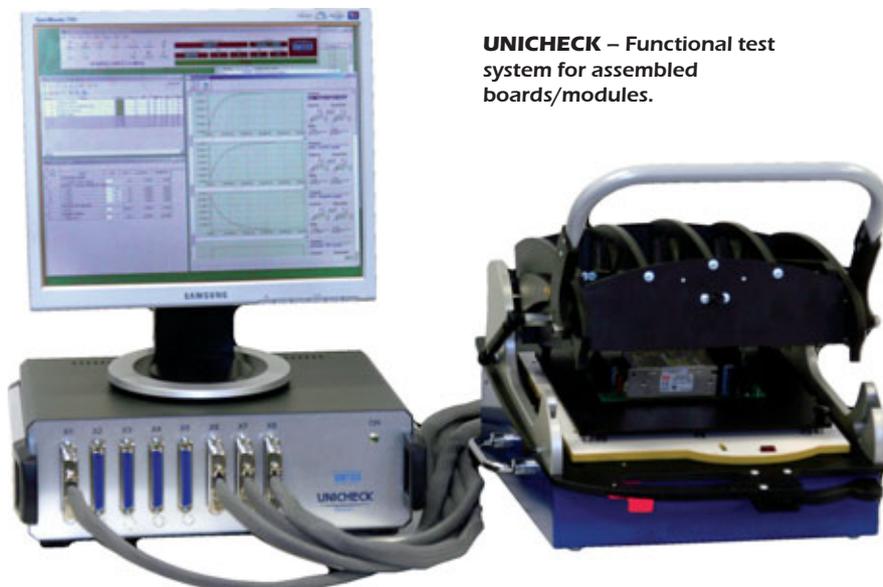
**UNIMET 4000** – Universal semiconductor test system for laboratories, incoming inspections and low volume production

**Fig. 2**

**VAS252** – High power VI source 52V/200A extension allowing testing of Power MOSFET/IGBT

**Fig. 3**

**UNISPOT S40 ACCEL** – Test system for mass production of small signal discrete components, capable of testing up 60.000 units per hour. Measurement range +/- 30V / 3A a 600V / 10mA



**UNICHECK** – Functional test system for assembled boards/modules.

# 5M

## 5M s.r.o.

5M s.r.o. is manufacturing company with own R&D department who specializes in composite production and bonded sandwich structures. 5M develops and produces epoxy adhesives for extra high strength bonds, epoxy resins for lamination, pultruded composite profiles and sandwich panels. 5M is strong focused at innovative process and new products. Certified ISO 9001:2001, 120 employees and 3000 m2 production area included new hall for pultrusion technology.

e-mail: 5m@5m.cz, website: www.5m.cz

# BBT<sup>®</sup>

## Cestmir Barta, BBT Materials Processing, Crystal Science & Technology Institute

BBT Materials Processing is a research, development and production company with extensive international experience in material sciences and technology in space (Salyut 6-Sojuz, MIR, ISS), including in ESA and Energija. It focuses on high-tech applications in space, including development and manufacturing of apparatuses, devices, control systems and software.

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## CSRC s.r.o.

The CSRC main domain is complex realization of the space electronics systems covering both the Flight hardware & software design and manufacturing in the own cleanroom (100.000 Class). The whole CSRC design process is in conformity with the ESA procedures applied by the internal ESA certified staff. The complex activities include also testing, simulations, analyses and mechanical design. Since 1994 CSRC has delivered own Flight DPU Hardware to the Integral, Smart-1, Demeter and Proba-2 satellites, now all successfully operating on the Orbit. CSRC is an audited SME with the ESA approved cost structure and hour-rates.

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## ChipInvest a.s.

ChipInvest provides solutions and access to funding to early stage technology companies seeking to improve their market position. The major interest is focused on IC design, EDA and embedded systems or other technology development opportunities closely linked to the semiconductor industry. ChipInvest actively seeks companies interested in growing their business in the Czech Republic taking advantage of the intellectual potential of central and eastern Europe.

e-mail: bohrc@chipinvest.com, website: www.chipinvest.com



## CompoTech Plus spol. s r. o.

CompoTech Plus offers expertise, design consultancy, R&D, and manufacturing in structural composite tubes. We help our customers to develop market opportunities and work with them to enhance their products and maximise their cost benefits. This is achieved by optimizing the composite tube, its production technology, and the use of high-tech materials.

e-mail: enquire@compotech.com, website: www.compotech.com



## Iguassu Software Systems a.s.

Software design & development, and technology consultancy. Extensive international experience. Over 100 man years in projects for ESA, Eumetsat and Galileo. In CZ, it is the most successful space company and the only one to win in competitive ESA bids. Focus on satellite positioning, GRID technologies in EO processing and other high tech applications.

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## SRI s.r.o.

Space Research Instruments (SRI) develops measuring and special custom-design electronic devices, not just for space purposes. Our activities: complex PCB design in accordance with ECSS Q70 standards, component applicability assessment, electronic systems integration, prototyping and small series manufacturing, electronic measurements and testing, including basic testing in a thermal or vacuum chamber.

e-mail: sri@sri.cz, website: www.sri.cz



## UNITES Systems a.s.

UNITES develops test systems and provides various services in the field of measuring and testing. The test systems are successfully used among others in aerospace. UNITES has developed the fastest tester in the world for testing semiconductor devices. The offered services are: comprehensive services in testing; customer specific development (HW, SW, FW) and production of electronics; and development and production of programmable VI sources.

e-mail: jmach@unites.cz, website: www.unites-systems.com



## G.L.Electronic s.r.o.

G.L.Electronic offers technical support especially in the field of space and military technologies. Clean room activities: Production HI-REL PCB mounting and cabling with final integration of the unit. Measurement & testing of HW / SW. Ground equipment: installation of measuring, audio signal, safety (gas leak) and telecommunication distribution systems on the launch pad.

e-mail: gl.electronic@tiscali.cz, website: www.glelectronic.cz



## L.K. Engineering s.r.o.

L.K. Engineering (LKE) focuses on design and detailed analysis services in area of industrial engineering. LKE provides services to diverse groups of clients including developers, owners, and design companies. By means of advanced computational technologies, deep knowledge, and own experience, LKE helps to increase competitiveness and reliability of customer's products while reducing development costs.

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## Frentech Aerospace s.r.o.

Frentech Aerospace s.r.o. is a supplier of precision mechanical components and modules for aircraft and space industry. Company is equipped with up-to-date technology and software for performed business.

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## Evolving Systems Consulting s.r.o.

Evolvsys.cz is a software producer & hardware assembler, which provides flight software development for various satellite on-board instruments as well as data processing ground segment software. Delivers innovative technologies and comprehensive know-how to benefit customers in several countries. Company is active in the areas of Information, Communications, Control and Automation.

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## Associated companies



## Rigaku Innovative Technologies Europe s.r.o.

Rigaku (former Reflex) offers expertise, R&D, and manufacturing of precise X-ray optic, and precise X-ray cameras for industry and scientific research. It also provides other services, including metrology, numerical simulations, data processing and visualisation, mechanical design and manufacturing.

e-mail: prague@rigaku.com, website: www.rigaku.cz, www.rigaku.com



a Siemens Company

## ANF data

ANF DATA offers software and hardware development and consultancy in the area of Ground Support for Space Applications, prototyping of electronic devices and systems, expertise in power supply systems, HW & SW test systems, satellite communication and mission control systems. Our skilled and experienced staff is ready to help you.

e-mail: anfdata@anfdata.cz, website: www.anfdata.cz



A KYOCERA GROUP COMPANY

## AVX Corporation

5M s.r.o. is manufacturing company with own R&D department who specializes in composite production and bonded sandwich structures. 5M develops and produces epoxy adhesives for extra high strength bonds, epoxy resins for lamination, pultruded composite profiles and sandwich panels. 5M is strong focused at innovative process and new products. Certified ISO 9001:2001, 120 employees and 3000 m2 production area included new hall for pultrusion technology.

e-mail: company@avx.cz, website: www.avx.com



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