Designing the future of aviation
EREA, the association of European Research Establishments in Aeronautics, is a non-profit organisation whose members are Europe's most outstanding research centres in the field of aeronautics and air transport. These organisations joined EREA in order to:

- PROMOTE AND REPRESENT JOINT INTERESTS
- INTENSIFY COOPERATION IN THE FIELD OF CIVIL, MILITARY AND SPACE-RELATED AERONAUTICS RESEARCH
- IMPROVE AND INTENSIFY COOPERATION WITH THIRD PARTIES IN THE FIELD OF AVIATION
- FACILITATE INTEGRATED MANAGEMENT OF JOINT RESEARCH ACTIVITIES, THUS CONTRIBUTING TO EUROPE'S ROLE AS A GLOBAL PLAYER IN AERONAUTICS

The European aviation industry has gone through an extensive process of integration. At the same time, the air transport sector has undergone integration into multinational mega-carriers, while regulation is now a European responsibility. Closer European cooperation is also being established in the area of security and defence. All of these developments have created a new environment for the EREA research organisations, which were originally founded to meet national requirements. The change of focus from national to European clients has driven further cooperation among European research establishments.

EREA was founded in 1994 to tackle the European challenges that national research establishments began to face.

The EREA Joint Position Paper (September 1993), initiating EREA's creation in 1994, established multiple future lines of activities for the research establishments, in particular:

- To pursue a policy on the coordinated use of and investments in wind tunnels and other facilities, and on joint operation of experimental assets, with the aim of correlating these hitherto nationally-dedicated resources, and rationalising the use of existing and future facilities for the joint benefit of Europe
- To develop joint research programmes and technology acquisition projects relating to the research establishments' own domains, and relating to research activities initiated by third parties such as the EC

EREA believes that European aviation ambitions are achievable only through a joint effort in research and innovation. That is why EREA supports industrial projects scientifically and technically. The organisation also collaborates with European public authorities and industry so as to define and implement a long-term research policy encompassing commercial and technological dimensions. Last but not least, EREA provides objective, neutral and impartial expertise to the EU, national authorities, industry and other bodies.
MEMBERS
The origins of the EREA partners date back to the earliest years of aviation and represent a rich history of contributing to innovations in aerospace.

The national research centres that joined forces in EREA are:

- CEIIA (Portugal)
- CIRA (Italy)
- DLR (Germany)
- FOI (Sweden)
- ILOT (Poland)
- INCAS (Romania)
- INTA (Spain)
- NLR (Netherlands)
- ONERA (France)
- VKI (Belgium)
- VZLU (Czech Republic)

In addition to these full members, there are two associate members:

- AIT (Austria)
- CSEM (Switzerland)

AFIT, Poland’s research centre for military aeronautics, joined EREA as an affiliate member of ILOT.

Although the present members and associates are the most important non-industry research establishments in Europe, EREA continuously strives to build and improve relationships with other establishments in the new European Union member states, and with universities, industrial laboratories and research organisations outside Europe. Our strategic partnership with TsAGI of Russia is an example of how EREA is seeking to step up collaboration in Europe.

ORGANISATION
EREA has been an association under Dutch law since 1999. Its internal organisation is made up of the EREA Board, the General Assembly, the Executive Secretariat (ES), the Aviation Research Group (ARG), and the Security Research Group (SRG). Through its Board and dedicated working groups, EREA over the past 20 years has established its member organisations as key players in the European aviation community.

The Executive Secretariat coordinates all EREA activities and aims to enhance the strategic relationships between the EREA members and between the association and the European Commission, European industry and universities.

The Aeronautics Research Group (ARG) was created back in 1989.

EREA has widened the scope of its joint research to embrace research into security through the Security Research Group (SRG), a dedicated working group established in 2004.
More than 5,000 researchers working on aeronautics

About € 0.5 Bln Annual spent on research in aeronautics per year

About 175 thesis per year

More than 6000 Publications per year
**EREA AVIATION RESEARCH GROUP (ARG)**

The EREA-ARG acts as the EREA interface towards the European Commission for research and technology initiatives related to European civil, military and space related to Aviation. Originally the perimeter of ARG was mainly dealing with aeronautics; in due consideration of Flightpath 2050 and SRIA the EREA-ARG area of interest has been modified to embrace Aeronautics and Air Transport System.

EREA-ARG works in close co-operation with other groups within EREA (e.g. EREA-Security Research Group, EREA-Executive Secretariat).

**MAJOR TASKS OF ARG**

EREA-ARG, within the Aviation perimeter, will contribute to liaison with:

- the European Commission;
- the European industry (ASD/IMG4, IMGs,...), SMEs and University;
- other research organisations and agencies (EASA, Eurocontrol, other REs);
- existing networks and working group devoted to EU FP;
- EC funded large programmes (e.g. CS JU, SESAR JU, CS2 JU, SESAR2 JU);
- Existing networks devoted to coordinate trans-national and trans-regional research activities (e.g. AirTN, EACP, CARE,...).
**erea-security research group (SRG)**

The SRG acts as interface towards the European Commission and the European Defence Agency and assists in implementing joint actions for research and technology initiatives related to European civil and military security programmes.

According to the scope of EREA (civil, military and space related aeronautics), the group mainly handles security issues related to the Air Transport System.

**Major tasks of SRG:**

- Inform the EREA-members about relevant (policy) developments within the European Union and of other European initiatives related to Security
- Act as a point of contact at working level towards the services of the European Commission, the European Defence Agency and European industrial, regulatory, and other groups
- Promote the common interests and market opportunities of EREA and disseminate relevant information among Members
- Assist and co-ordinate initiatives of the Association members towards the European Union and other bodies
- Work in close co-operation with other groups within EREA (EREA-Aeronautics Research Group, EREA-Executive Secretariat)

**erea executive secretariat (ES)**

The EREA Executive Secretariat consists of the permanent points of contact with the EREA members. The ES is responsible for the overall coordination of EREA activities and sets out the internal and external strategy of the association. The Executive Secretariat addresses all political issues relating to the long term vision of EREA and its members. Last but not least, ES promotes the internal and external visibility of EREA by publishing EREA Newsletters, facts and figures, maintaining the EREA website and organising the EREA Annual and Young Researchers Event. ES-members prepare and accompany the Board members in EREA Board meetings.
**RESEARCH ACTIVITIES IN EUROPE**

All the member research establishments of EREA play a pivotal role in national research and innovation policy. They contribute to a competitive national aviation industry by offering industry, SMEs and universities technical assistance and high-tech research facilities. Many EREA members also provide technical assistance to their national governments, mostly in the field of air transport and defence.

At European level, EREA members fulfil a significant role in European framework programmes for research and innovation, and contribute substantially to programmes such as Clean Sky and SESAR.

**EUROPEAN AERONAUTICS RESEARCH INFRASTRUCTURES**

The Advisory Council for Aeronautical Research in Europe (ACARE) has stated that a set of world-class and efficient research capabilities is a strategic factor for promoting the development of aeronautics in Europe.

Fundamental and applied research in various scientific disciplines (such as fluid mechanics, materials, structures and systems) and the development of sub-components and components (like engines) and aeronautical end-products (including fixed-wing aircraft and rotorcraft) has always been associated with extensive design, computation, testing, optimisation and validation activities. This complex process calls for the systematic use of various research facilities, such as aerodynamic wind tunnels, combustion and structural test beds, material elaboration apparatus, clusters of small computers (or conversely high-end super-computers), air traffic management and air traffic control simulators, flight simulators, and research aircraft.

These facilities, used for different disciplines and specialities, differ greatly in their size and range of application but are often linked to one another through a complex immaterial network that transforms basic scientific knowledge into competitive products while integrating environmental, safety and security requirements. As such, they are an essential asset for Europe, even if the vast majority of these facilities was originally developed to meet national objectives.

**CAPABILITIES FOR EXPERIMENTAL AND NUMERICAL SIMULATIONS ARE KEY ENABLERS FOR THE DEVELOPMENT OF AERONAUTICS**

It is generally acknowledged that research infrastructures are extremely important to the aviation industry and the scientific community working on aeronautics. All past and present aeronautical components or products have been tested in aerodynamic wind tunnels, and the same is likely to occur with future products. This is not at odds with the trend towards greater dependency on numerical simulations. After all, the fast, detailed and accurate design procedures necessary to meet increasing constraints (especially those related to environmental and safety issues) require increasingly powerful testing and evaluation capabilities with multi-disciplinary and multi-physics features. Experimental and numerical simulations will always be complementary to each other. So in parallel with the effort directed towards testing capabilities, it is necessary to provide the aeronautical research community with effective and affordable access to European high-end computing resources.

**AERONAUTICS INFRASTRUCTURES ADDRESS SCIENTIFIC AND INDUSTRIAL RESEARCH IN A COMPLEMENTARY WAY**

Industrial customers (i.e. aircraft manufacturers) make commercial use of facilities for developing and enhancing their products during limited test periods. This contributes towards making the facilities available for scientific research to other users who need them for limited periods of time. This situation benefits the numerous research projects conducted under national or EU programmes on both fixed and rotary-wing aircraft, and is conducive to improving basic knowledge (of such matters as flow stability, transition, wakes, vortices and the combustion process) through tests directly funded by research establishments to improve fuel efficiency and reduce noise.
The automotive, railway, civil engineering and wind power industries also stand to benefit from these publicly maintained infrastructures and the associated know-how, while the industrial community benefits from the results of fundamental research that improves technologies in several fields.

There is a demand for increasingly accurate experimental databases. This necessitates the development of highly sophisticated non-intrusive measuring instruments, which will notably stimulate fundamental research in specific domains of physics (like coherent optics).

Aeronautics research facilities further contribute to European integration through exchanges with industrial customers (mostly transnational companies) and researchers from different countries who are involved in operating them. Formal pan-European networks have been established to improve overall efficiency by exchanging best practices and progressively specialising in fields of application. Examples are AT-One for Air Traffic Management, DNW, and ESWIRP for wind tunnels.

Although ‘traditional’ ground-based facilities (like aerodynamic wind tunnels and propulsion test beds) are the most emblematic and well-known examples of aeronautics research infrastructures, the sector also needs and must leverage a large variety of other capabilities. Examples include vibration and fatigue test beds, crash facilities, electromagnetic compatibility facilities, control tower simulators, and flying test beds.

Similarly, at the system level it will be necessary to validate an entirely new operational Air Traffic Management concept, using a sophisticated infrastructure that includes automatic/fast-time simulation tools, a human-in-the-loop simulation platform, and field experiment platforms.

AERONAUTICS FACILITIES ARE AN ASSET THAT MUST BE PRESERVED

Most of the major aeronautics facilities were funded by national governments in the 1950s and 1960s to meet their national needs. So it is striking when you consider that an aircraft like the A380, which is likely to be in service for the next 40 years, was extensively tested in 50-year old aerodynamic wind tunnels.

A majority of large and medium-sized facilities are run on an operating costs recovery basis by national aeronautics research establishments, and are open to any customer. University aeronautics departments operate laboratory facilities more suited to conducting basic research, while industrial companies own limited research equipment for their exclusive use. Aeronautics facilities are essential for improving basic knowledge and for supporting the competitiveness of the European industry. They represent a tremendous asset with a value estimated at more than €4 billion. Maintaining, renewing/upgrading or replacing these facilities represents enormous challenges and a financial burden that operators using national funding schemes are finding it more and more difficult to support on their own. The upshot is that less than 1% of the total asset is re-invested each year, a situation that is unsustainable in the long term.
Europe (through the EU and intergovernmental tools) will need to be increasingly involved in the process of investing and re-investing, while facility operators will have to make further progress in the rationalization process that began several years ago and has already produced tangible results. In this field, as in others, Europe should be in a position to compete on an equal footing with the US, where large aeronautics facilities are regarded as national assets and are supported as such at the federal level. Operators, in particular of medium-size key capabilities, must examine, in association with national and European public authorities, the fairways and procedures necessary to optimise the use made of existing facilities, while reducing existing unnecessary duplications and preventing any risk of new duplications involving public funds.

**AERONAUTICS FACILITIES BENEFIT OTHER SECTORS**

‘Low-speed’ and ‘high-speed’ aeronautics research infrastructures (in particular wind tunnels) allow several sectors unrelated to aeronautics to pursue their own objectives. Surface transport sectors (road and rail) are intensive users of some facilities, and benefit from the testing and measuring techniques and associated expertise available thanks to aeronautics applications. In the space sector, too, launch and re-entry configurations have been extensively modelled and tested using tools developed for the aeronautics sector. Civil engineering is another sector that benefits from aeronautics research infrastructures.

Environment and aviation safety also benefit from aeronautics infrastructures by such means as regular improvements at component level (e.g. combustor performance) or through the study of specific phenomena (like wake vortices). Security stands to gain more from the investments already made by the aeronautics community (e.g. in UAVs) Because it addresses both scientific and industrial research and covers a wide range of scientific disciplines and associated expertise, this complex network of research infrastructures is a key enabler of Europe’s ongoing development. This network, built on a small group of strategic facilities, represents a tremendous asset and the needs of the research community that runs it will need to be carefully considered at regional, national and European levels in the years ahead.

**TYPOLOGY OF EUROPEAN AERONAUTICAL FACILITIES**

Strategic facilities individually represent investments higher than €100 million, and have an annual operating budget of more than €5 million. They are open to any customer and serve the industrial market as well as national and EU programmes on a commercial basis. These facilities are competitive in a global market. Europe has ten complementary strategic facilities in this category for civil aeronautics.

Key aeronautics facilities individually represent investments in the region of €10 million. Their tariffs are based on full costs recovery (excluding capital investments) and they are used by players other than the operator through their own funding. This category also includes facilities of a unique nature. There are about 100 such key facilities throughout Europe. Common facilities are the large number of other medium-sized or small capabilities covering a wide range of applications across various disciplines. They are considered basic tools and their owners bear the costs in most cases.
**WHAT IS FUTURE SKY?**

*EREAA, the association of European Research Establishments in Aeronautics launches Future Sky: a Joint Research Initiative in which development and integration of aviation technologies is taken to the European level.*

Future Sky is based on the alignment of national institutional research for aviation by setting up joint research programmes. EREA believes institutional co-operation of European research establishments is the best guarantee to ensure technological development to the benefit of European society and industry, beyond the current SESAR and Clean Sky timescales.

Future Sky’s overall goal is “Twenty-four-Seven”. This concept describes the full airside mobility, 24 hours a day, 7 days a week, resilient against any impacts e.g. from disruptive events like extreme weather, in line with the goals laid down by FlightPath 2050.

Although Future Sky finds its origins in the alignment of the research programmes of the national research establishments, industry and universities are explicitly invited to join Future Sky. The European Commission will be involved not only through the funding mechanisms for Future Sky under Horizon 2020, but also in giving guidance for the set-up and management of the joint research initiative.

**COLLABORATION OF NATIONAL RESEARCH ESTABLISHMENTS**

The national research establishments that have gathered in EREA are all committed to contribute to Future Sky. For each joint research programme, the national research establishments will draft of roadmap for the next five to seven years. The research establishments will map out which areas of a certain research theme are covered by their institutional research programmes and where they see opportunities for sharing results and joint planning. The roadmap will also identify certain research gaps that are not yet or insufficiently covered by the national institutional research programmes. These gaps will be tackled in a new European research project in which the research establishments will actively seek to collaborate with universities and industry. The aim of Future Sky is to enhance collaboration between national establishments and to involve the aviation research community as whole to prepare for a competitive European aviation industry in 2050.

**HOW FUTURE SKY CONtributes TO FLIGHTPATH 2050**

In order to fulfil Flightpath 2050 goals European aviation research needs to target the complete Air Transport System and to apply a full life cycle engineering approach, covering the full research and innovation chain. The ACARE SRIA envisages putting in place attractive and efficient research instruments, which ensure continuity between research on promising breakthrough concepts, their validation by focussed RTD actions and finally their demonstration in an integrated environment.

Furthermore Flightpath 2050 and the ACARE SRIA are proposing to establish multidisciplinary clusters of excellence for research and innovation, to achieve common technology goals (outcome of a common strategy to address societal issues). They ensure that the appropriate organisations are tackling activities at the appropriate level in the innovation chain. For demonstration activities on system level the well-known JTI concept lead by industry has been proven to be successful.
Future Sky will combine the power and the capacities of the research establishments in EREA into multidisciplinary clusters of excellence proposed by Flightpath 2050 in order to ensure appropriate mid and long term research on lower level TRLs complementing the industrial lead demonstration activities on higher TRLs. As mentioned above Future Sky will address the 24/7 Air Transport System as outlined in Flightpath 2050.

**THE JOINT RESEARCH PROGRAMMES UNDER FUTURE SKY**

Twentyfour-Seven Enablers – the four major pillars of JRI, will be started one by one every two years. The joint research programmes, or so-calles TSE, under Future Sky will be:

**TSE 1: SAFETY** – EREA takes the responsibility to provide the research and validation needed to guarantee in the short term safety rules, regulations, measures and standards, and in the long term to fulfil the Flightpath 2050 goals concerning safety.

**TSE 2: VEHICLE** – quiet operating air transport vehicle, serviceable from small airfields, make use of ultra-quiet or hybrid-electrical engines, use flow control for maximum lift on short runways, allow for fast boarding, fuelling, catering, etc.

**TSE 3: SYSTEM** – the air transport system ATS aspects shall be addressed by this joint research programme. A special focus will be on the insertion of UAVs in the civil ATS; this JRI shall define the base to fulfil the corresponding goal of FlightPath 2050.

**TSE 4: ENERGY** – as a consequence to TSE 2 and TSE 3 asking for new energy concepts, the last TSE will address the energy system on-board and on-ground. Only with these four elements, the whole 24/7 goal can be gained, and the complete impact of aviation to the environment can be analysed.

It is foreseen that Future Sky will be part of the European Commission’s programme for research and innovation Horizon 2020. For each joint research programme or TSE in which the research establishments will coordinate their institutional programmes and at the same time set up open European research projects to fill the gaps of a research roadmap, a European contribution of about 25 million is foreseen.

**HOW TO JOIN FUTURE SKY**

Although Future Sky is an initiative of EREA, the joint research initiative is aiming to go well over the boundaries of EREA members: a contribution from all the aviation research stakeholders is needed to achieve the ambitious goals of the programme. Apart from the coordination of national institutional research programmes, each Joint Research Programme will define research projects open to all. On [www.futuresky.eu](http://www.futuresky.eu) you will find the latest information on Future Sky, its Joint Research Programmes and contact information.
The Polish Air Force Institute of Technology, AFIT (Instytut Techniczny Wojsk Lotniczych), is a scientific research and development organisation (R&D) which is supervised by the Minister of National Defence.

The history of the AFIT reaches back to 1918, when the Scientific & Technological Division was established by the Ministry of Military Affairs. In 1921 the Division was changed into the Military Center of Aeronautical Research, which in 1926 was changed again into the Institute of Technological Research into Aeronautics. This institute existed until 1936, when it was transformed into the Aviation Institute of Technology. In 1953 the Air Force Research Institute was established by the Ministry of National Defence. In 1958 the name was changed into Air Force Institute of Technology, which exists since then.

MISSION / OBJECTIVES
Its mission is scientific support and research into problems of operating the military products of aeronautical engineering. Owing to the studies in the field of reliability and broadly understood flight safety, the institute has significantly contributed to the development of Polish aviation. Significant achievements, home and abroad, include numerous scientific and research together with experimental and design studies that have been used in the Polish Air Force.

LOCATION
The AFIT headquarters is located in Warsaw.

PROGRAMMES / ACTIVITIES
The institute provides aeronautical engineering research and development and services as follows:

- GROUND AND FLIGHT TESTS
  AFIT provides ground and flight tests, including aircraft and helicopters certificate tests, tests of individual pilot’s equipment and airborne high-altitude and rescue systems, airborne and ground systems, and designs and develops relevant measuring and recording systems.
  AFIT provides certification tests of aeronautical products for the air force, including air armament, and simulation tests. Additionally it develops and tests aerial rocket targets used for training.

- AIRCRAFT WEAPON SYSTEMS
  AFIT upgrades weapon systems, and develops air weapons and aerial targets, and ground-based and flying testing systems for air forces.
  AFIT also tests air weapons after warranty periods to extend service-life, and upgrade the on-board attack avionics systems for aircraft and helicopters.

- AIRCRAFT SIMULATION, TRAINING AND MODELLING
  The capabilities of AFIT include formulation of mathematical models of flight dynamics, air weapons, performance of radar and missile-guiding stations, certification tests of flight simulators, and the development of multimedia training systems (e-learning).
AFIT also provides training systems and flight simulators for control officers, interception navigators, pilots, and air-traffic controllers.

- **AIRCRAFT SAFETY AND RELIABILITY TESTING**
  AFIT provides accident investigation development, computer-aided systems to assist aircraft operational-phase management, and testing of materials used in aeronautical structures.
  AFIT also supplies systems to record parameters of aero-engines, non-destructive testing of structures, service-life tests of structural components, and data decoding systems. In addition, AFIT examines operational damage and failures to aeronautical structures, and helps to extend aircraft service-life and the time between overhauls.

- **UNMANNED AERIAL VEHICLES (UAVS)**
  AFIT provides new UAVs and applications, software, air-reconnaissance-delivered imagery analysis and distribution systems, and UAV operator training.

- **AIRCRAFT SURVEILLANCE SYSTEMS**
  AFIT supplies terrain aircraft surveillance systems, and systems to protect widespread areas.

- **AVIONICS SYSTEMS**
  Ground and airborne equipment; integration of avionics systems into aircraft and helicopters; development of operational-phase assisting diagnostic instruments; integration and maintenance of avionics systems; integrated self-protection systems, helicopter modernization; communication systems integration; avionics systems digitalization; helmet mounted display for flight parameters.

- **AERONAUTICAL AND AIRFIELD DIAGNOSTICS**
  AFIT conducts engine certification tests, and geological and engineering surveys of soils. It also develops diagnostic software, designs diagnostic stations to test structural components and predicts the service lives of structure materials.

- **AIRCRAFT FUEL AND UTILITY FLUID TESTING**
  AFIT supplies quality assessment of engine fuels, lubricating oils, lubricating greases, preservatives, engine coolants, break fluids, industrial (processing) fluids, bio-fuels and bio-components for fuels and oils. It also develops technologies for operating fluids of synthetics, minerals and bio-components.

**C4ISR SYSTEMS**
Integrity of the network centric systems; depository of the link systems standards; systems for future soldier, F-16 simulator for procedures.

The institute’s development strategy intends to increase research potential through participation in projects within the Framework Programmes of the EU, the European Defence Agency as well as other European research programmes.
The AIT Austrian Institute of Technology (AIT), Austria’s largest non-university research institute, is among the European research institutes a specialist in the key infrastructure issues of the future.

As an Ingenious Partner to industry and public institutions, AIT is already researching and developing the technologies, methods and tools of tomorrow, paving the way for the innovations of the day after tomorrow. The Republic of Austria (through the Federal Ministry for Transport, Innovation and Technology) has a share of 50.46%, while the Federation of Austrian Industries owns 49.54% of the AIT Austrian Institute of Technology.

LOCATION
In Austria, there are over 1,100 employees - largely based at the main facilities Vienna Tech Gate, Vienna TECHbase, Seibersdorf, Wr. Neustadt, Ranshofen, Graz and Leoben – working on the development of those tools, technologies and solutions for Austrian industry considered to be of future relevance and which comply with the institute’s motto “Tomorrow Today”.

MISSION / OBJECTIVES
The AIT Austrian Institute of Technology takes a leading position in the Austrian innovation system and a key role in Europe as the RTO focusing on the key infrastructure topics of the future. AIT provides research and technological development to realize basic innovations for the next generation of infrastructure related technologies in the fields of Health & Environment, Energy, Mobility and Safety & Security. These technological research areas are supplemented by the competence in the area of Innovation Systems.

As a national and international network node at the interface of science and industry AIT enables innovation through its scientific-technological expertise, market experience, tight customer relationships and high quality research infrastructure.

PROGRAMMES / ACTIVITIES
The relevant activities concerning the aerospace research include:

DESIGN OF LIGHT WEIGHT STRUCTURES
Environmentally-friendly vehicles are poised to play a major role on the traffic of tomorrow. In order to achieve maximum efficiency, their weight must be kept to a minimum. The AIT is developing new techniques for designing lightweight and safe vehicles comprising aluminium and magnesium components.

MULTI-MATERIAL DESIGN
Sustainable mobility is dependent on innovative solutions for the environmentally-friendly, safe and efficient production of vehicles. The AIT develops special design techniques which takes account of the characteristics of light metal alloys. The methods developed allow safety-critical components and structures for innovative vehicle concepts to be realised as multi-material structures both virtually and as concept demonstrators.
CUSTOMISED MATERIALS DEVELOPMENT
A comprehensive understanding of micro-metallurgical aspects and their relationship with the macroscopic environment is fundamental to the development of new materials and their processing. Material development at AIT is based on alloy development, taking into account the processes involved in manufacturing components as well as the desired component characteristics. This process is complemented by experimental material and component characterization.

ELECTRIC DRIVE TECHNOLOGIES
In recent years, AIT’s Electric Drive Technologies Business Unit has positioned itself as a recognised development centre for automotive electric drive concepts, helping both manufacturers and suppliers adapt to the electric era. Regarding the shift towards more electric aircraft, AIT can provide knowhow in energy storage device (esp. battery systems), power electronics as well as electric motors/generators with high electric efficiency.

ELECTRIC ENERGY SYSTEMS
The business unit Electric Energy Systems helps the industry to develop emerging technologies for electricity networks and photovoltaics. The facilities include a high voltage and high power laboratory e.g. for lightning strike tests.

SAFE AND AUTONOMOUS SYSTEMS
AIT’s Department Safety & Security develops real-time capable 3D vision sensors to enable cost-effective and reliable image recordings of surroundings in 3D. The integration of secure “on-board autonomous systems” and cooperative communication systems for networking infrastructures and increasing traffic safety are further main research activity themes, including Visual Airborne Self Localization or Aerial and Runway Obstacle Detection and Tracking.

DYNAMIC TRANSPORTATION SYSTEMS
AIT’s performs research in traffic systems optimization to enable pedestrians, cyclists, public transport and motorised individual traffic getting from A to B more quickly, more safely and in a more environmentally friendly way. Main research topics in aviation are simulation and prediction of passenger flows, modelling service times at airport processing stations and active counter management, airport ground access mode choice modeling as well as the collection and analysis of passenger motion data.
Since its foundation, CEIIA seeks to contribute to the construction of a new industrial model based in the evolution of Portugal from a logic based on technology importation to a development, integrating and exportation logic involving and building global supply chains.

The basis of this logic is smart specialisation around tradable products and integration of national technologies, whereas engineering capabilities and product development philosophy play a central role as a pull factor for attracting new projects to Portugal with leading international players and emerging markets.

This approach requires an intense engagement with clusters of multi-sectorial nature and multi-technological dimension associated with complex tradable products (e.g. systems, structural modules and even vehicles and aircraft) as the basis of an industrialisation strategy.

With a special focus on internationalisation of Portuguese engineering – associated with product development in large international projects of key players –, CEIIA seeks to induce the increase of national know-how and technology development, and to attract manufacturing to Portugal, as recently achieved with the electric vehicle Buddy of Norway, with the national program of intelligent mobility and with the military transport aircraft KC-390 by EMBRAER.

CEIIA’s activities are oriented towards the promotion of competitiveness of Portuguese industry through coordination, management, implementation and dissemination of actions with the following objectives:

- Strengthen coordination of players and initiatives;
- Anticipate changes in the strategies of customers, products and technologies;
- Empower the Portuguese industry at a human-level capital and entrust its productive development;
- Develop value chains in Portugal and in neighbor markets;
- Develop strategies for the industry supply of components to traditional and new customers in global markets;
- Specialise the Portuguese industries in the design, development, manufacture and validation of new generations of vehicles, components and engines;
- Attracting Foreign Direct Investment oriented to existing development and manufacturing capabilities;

To achieve these goals, CEIIA develops its activity around three strategic intervention areas:

- Consolidation and specialisation of the activity around manufacturers and suppliers of mobility industries;
- Diversification of CEIIA’s activity with the integration in the supply chain of the industry to different markets;
- Development of the national supply chains by increasing the “local content” around the major projects of mobility industries.

LOCATION

Our headquarters is in Matosinhos, near Porto and we also have offices in Maia, Lisbon and São José dos Campos, Brazil.
PROGRAMMES / ACTIVITIES

• Planning and implementation of Aeronautical Programmes - Rotary and Fixed Wing – focused on the development of aerostructures, covering mainly: design and stress analysis, aerodynamics, aero-acoustics, aeroelasticity, man-machine interface, structural testing and certification;
• Development of Engineering, Design and Advanced Manufacturing Programmes with OEM’s and Academia;
• Development of Aeronautical supply chain programmes within the Portuguese Mobility Technological Cluster;
• Development of International Aeronautical RDI Programmes in cooperation with Portuguese Universities and International Research Entities.
The Centro Italiano Ricerche Aerospaziali CIRA (Italian Aerospace Research Center) is a not-for-profit private company under the control of the Ministry of Education, University and Research. The shareholders include ASI (Italian Space Agency), the major Italian aerospace industries, the Regione Campania and the National Research Council CNR.

CIRA was founded in 1984, when the Ministry of Research initiated the National Aerospace Programme (PRORA) in order to support the Italian aerospace industries, authorities and universities with proper facilities, skills, competences and capabilities. The company became operational in 1986. At that time the primary objectives were the design of “world class” test facilities and the education and training of the team of researchers. Later on CIRA’s commitment was widened to include the new task to build up system integration competences and expertise.

**MISSION / OBJECTIVES**

As defined by PRORA, CIRA’s mission is to build, operate, maintain and upgrade large scale facilities and laboratories, to develop theoretical and experimental R&TD activities, to produce and exchange information, to educate and train personnel, and to participate in European and international programmes. In particular CIRA’s activities in aeronautics are mostly targeted to:

- development, validation and application of theoretical and numerical tools,
- design, management and execution of test campaigns (including test article design, assembly and integration),
- technology development & integration (including technology demonstration, through prototype design, realization and testing),
- systems design, analysis and integration (looking at both, near term as well as futuristic configurations - e.g.: supersonic and hypersonic planes),
- certification.

These activities are performed applying competences in the main aeronautical scientific and technical disciplines with the objectives to support the Italian industries, authorities and universities, to contribute to the definition of programmes and projects, and to promote the aggregation and networking of competences at regional and national level.

**LOCATION**

CIRA is located in Capua nearby Naples.

**PROGRAMMES / ACTIVITIES**

CIRA's programmes comply with the PRORA programme, with the technology development guidelines approved by the ministry, and with specific industrial requests (cooperation agreements and contracts). All of the research activities are streamlined through six strategic programmes:
**UNMANNED AERIAL SYSTEMS:** The programme focus is on the development of key technologies for unmanned autonomous flight. Technologies such as GNC, single obstacle detection, and augmented vision are developed and tested on a manned platform. Other technologies such as ice protection, structural health monitoring, out-of-autoclave manufacturing, prognostic and diagnostic systems, and alternative energy sources for primary and secondary power are developed through specific technological demonstrators. Some of them will also be tested in flight, through a common flying test bed with the Unmanned Vehicles for Space Access program.

**UNMANNED VEHICLES FOR SPACE ACCESS:** The programme aims to develop a flying test bed for orbital re-entry in order to validate key enabling technologies (GNC, aerothermodynamics, thermal protection systems based on ceramic UHTC and ablative materials, and cold composite structures). The development of these technologies will benefit from the strong synergy between numerical simulation capabilities, experimental data from the two flight experiments of the UAV flying test bed and from CIRA’s word class Plasma Wind Tunnel. The flying test bed will also meet the requirements of the Unmanned Aerial System program and seek international partnerships in order to contribute to Europe’s independent access to space.

**AEROSPACE PROPULSION:** The programme aimed at the development of key technologies and systems in the field of Propulsion; most of the activities belong to the following projects: HYPROB: funded by the Italian Ministry of Research, is targeted at the development of a Liquid Oxygen and Methane rocket engine demonstrator. An hybrid rocket engine will be developed, too. HETS: Electric Propulsion activities are keen to space qualifying an effective Hall Effect Thruster. LAPCAT-II project is committed by EC and is devoted to advanced Scramjet propulsion system suitable for a future hypersonic commercial aircraft. Flight Tests has to be performed by Exafly-Int goings-on, in four-five years. CMD GF-56 (Diesel Engine for GA) has been a cutting-edge activity, “Technological Demonstration of a Compression Ignition Engine for Aviation”, funded by Ministry of Research.

**ON-BOARD SYSTEMS AND ATM:** Within such research program, new technologies and the related modeling and design tools are developed to increase the level of autonomous management of unmanned and manned aircraft missions. The goal is to obtain better performance for next generation aeronautical platforms as well as to increase reliability, flight safety and operational flexibility reducing development costs and times. In this frame CIRA participates to the largest national (PRORA UAV, MISE-808, etc.) and international programmes (SESAR, MIDCAS, etc,) devoted to this topic.

**REGIONAL TRANSPORT AIRCRAFT:** The program aims to develop technologies for improved aircraft performance, for reduced environmental impact, and increased safety. Major activities are through the Clean Sky ITD Green Regional Aircraft where CIRA contributes to the development of new technologies for low weight and low noise configurations, new aircraft configurations, and mission and trajectory management. Significant efforts are also dedicated to flight safety in icing conditions where CIRA offers its word class Icing Wind Tunnel and numerical simulation capabilities (HAIC, STORM). To enhance aircraft performance and reduce environmental impact CIRA performs aerodynamic, aeroacoustic and structural design and optimisation, including the integration of innovative technologies such as flow control and structural morphing (AFLONEXT, SARISTU).

**GREEN ROTORCRAFT:** The program aims to develop “Green” technologies to promote an ever increasing role of rotorcraft, both conventional and next generation tiltrotor, in the air transport system of the future. The major efforts are through the Clean Sky ITD Green Rotorcraft where CIRA contributes to innovative rotor blades, reduced airframe drag, and environment-friendly flight paths. Major developments on the next generation tiltrotor are expected in Clean Sky 2.
CSEM is a private, not-for-profit Swiss research and technology organisation. It develops innovative technology platforms through four strategic programmes corresponding to the domains in which the centre has acquired, over the years, a national and international reputation: microsystems, ultra-low-power integrated systems, surface engineering and systems.

**LEGAL STATUS / HISTORY**
It was created in 1984 when three Neuchâtel institutions active in the field of microtechnology — the Centre Electronique Horloger (CEH), the Fondation Suisse pour la Recherche en Microtechnique (FSRM), and the Laboratoire Suisse de Recherches Horlogères (LSRH) — merged, with the support of the Swiss Federal Council, to become CSEM. Besides the confederation and the Canton of Neuchâtel, many well-known Swiss companies supported the new R&D center from the outset, most becoming shareholders and maintaining links with CSEM as it developed further.

**MISSION / OBJECTIVES**
CSEM delivers advanced technologies and unique R&D services to the industrial sector, thereby reinforcing the sector’s competitive advantage. Supported by federal and cantonal authorities CSEM bridges the gap between academic findings and industrial requirements.

Specifically, CSEM develops, integrates, and matures innovative technologies and transfers them to established industrial partners. Its support to industry ranges from feasibility studies through custom product-development based on advanced technologies, to small-series production. CSEM also facilitates new entrepreneurs’ access to its technology platforms, encouraging them in the creation of start-ups.

CSEM customers operate in established markets including medtech, industrial control (including the machine tools industry), watchmaking, aeronautics, and space, as well as in emerging markets such as cleantech (including energy production and management) and environmental monitoring. CSEM does not undertake research in one specific direction alone. Rather, its technology platforms can be applied to almost any market.

**LOCATION**
CSEM is headquartered in Neuchâtel and has four regional centers in Zurich, Muttenz, Alpnach, and Landquart. Internationally, CSEM has innovation centers in the United Arab Emirates and in Brazil.
PROGRAMMES / ACTIVITIES

CSEM develops innovative technology platforms through four strategic programmes corresponding to the domains in which the centre has acquired, over the years, a national and international reputation:

• **MICROSYSTEMS** – The development of microsystems-based devices requires the kind of multidisciplinary approach in which CSEM excels, involving the MEMS design and fabrication process, ASIC, system integration, packaging, testing, training, and small-scale production of MEMS components and packaged microsystems.

• **SYSTEMS** – CSEM’s multidisciplinary systems activities promote innovation in the application domains of scientific instrumentation, medical-device technology, automation, and cleantech with a special emphasis on the integration aspects of micro- and nanosubsystems as well as on application demands such as miniaturization, precision, reliability, and comfort in harsh environments.

• These systems activities aim to master the techniques required to analyse, design, and build instrumentation systems by investigating the convergence of microtechnology and flexure structures.

• **ULTRA-LOW-POWER INTEGRATED SYSTEMS** – This program is primarily focused on the design and industrialization of wireless and vision systems that take advantage of low-power and/or low-voltage Systems-on-Chip (SoC).

• It aims at the applied research and development of complete low-power and miniaturized embedded systems mostly based on CMOS integrated circuits and systems or SoCs. Such systems are typically made up of one or several SoCs including analogue, RF, and digital blocks and combined with antennas, imagers, sensors, MEMS, and energy sources into a heterogeneous system.

• **SURFACE ENGINEERING** – Focusing on functionalized surface systems structured on the submicron scale, CSEM develops technologies adapted to mass manufacturing with great accuracy and affordability. Surface functionalities such as wetting, optical reflectivity, (bio-) molecular absorption, or electronic properties are built in, extending the capabilities of known large-area manufacturing technologies such as embossing, injection moulding, polymer self-assembly, and UV-lithography to precisions in the submicron to nanometre range.

• CSEM provides solutions in fields ranging from integrated bio-sensors to novel photovoltaic cells and innovative lighting devices.

CSEM multi-disciplinary programmes are applied to aeronautics and aviation in many different ways:

• Integrated, autonomous wireless sensor networks powered with energy-harvesting devices to perform health monitoring on aircraft structures.

• Development of high-performance MEMS and miniaturized sensors to measure different aircraft parameters (e.g. 6 DoF nano accelerometers, MEMS gyroscopes, linear encoders, and absolute encoders).

• Measurement of pressure distribution and airflow on aircraft wings with pressure sensor strip and pressure sensing paint technologies.

• Non-destructive inspection and testing of primary aeronautics structures using phase contrast X-ray imaging.

• Energy harvesting devices based on photovoltaic cells and high-performance solar panels for solar aircraft.

• Characterization of the slat’s boundary layer during flight.

• Calculation of wing deformation during flight.

• Ash cloud and ice cloud detection.

• Prevention of corrosion on fuel tanks.
**DLR** is a non-profit organisation and Germany’s national research center for aeronautics and space and acts as the German space agency. Its research and development work include aeronautics, space, transportation, energy and security.

The oldest predecessor organisation of DLR was founded 1907 in Göttingen which was the Aerodynamische Versuchs Anstalt (AVA). In 1969 several German research establishments were integrated into one organisation. Through the fusion of the German space agency in 1997, the organisation was finally called Deutsches Zentrum für Luft- und Raumfahrt (DLR).

**MISSION / OBJECTIVES**

The primary objective of DLR’s aerospace research activity is to fulfil governmental and societal needs and to enhance the competitiveness of aerospace industries in Germany and Europe. DLR performs fundamental and applied aerospace research and development by:

- Further development of civilian transport systems from the perspectives of efficiency/economy, safety and environmental compatibility
- Technological contributions towards assuring the capability profile of the German armed forces

The DLR aeronautics programme is in line with the following major challenges:

- Orientation with the European strategic research and innovation agenda for civil aviation
- Research into the complete air transport system and all its major components
- Carrying out specific defence-related research work, making greatest possible use of synergies with civilian themes
- Strategic co-operation with the most important German and European partners from research and industry

**LOCATION**

DLR has 32 institutes and facilities at 16 locations in Germany: Augsburg, Berlin, Bonn, Braunschweig, Bremen, Cologne (headquarters), Göttingen, Hamburg, Juelich, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stade, Stuttgart, Trauen and Weilheim as well as offices in Brussels, Paris, Washington, D.C. and Tokyo

**PROGRAMMES / ACTIVITIES**

Besides Aeronautics, DLR performs research programmes in Energy, Transportation, Space research and Security. The Aeronautics program is described below as being the most relevant with respect to EREA activities.

The DLR Aeronautics research is covering the following domains:

- Optimisation of the performance and environmental compatibility of the entire aircraft system
- Expanding the range of helicopters to all weather conditions
- Efficient and environmentally-friendly aircraft engines
- Safe, environmentally-friendly and efficient air traffic (flight control, flight operations)
The activities are organised in four research topics:

**FIXED-WING AIRCRAFT**
The research topic Fixed-Wing Aircraft is orientated to address three general, medium-term objectives:
- Concepts for new aircraft configurations
- Design of new aircraft or aircraft families
- Continuous improvement of existing aircraft
It consists of the sub-topics
- Flight Physics
- Structures and Materials
- Systems and Cabin
- Concepts and Integration
- Flight Physics Simulation and Validation
- Military Technologies
- Laser Research and Technology

Under the DLR/Onera partnership agreement so-called Common Research Projects have been established to harmonize the research programmes of both establishments.

**ROTORCRAFT**
Following the needs and requirements of official and industrial customers in Germany and France, the activities are currently concentrated in six Research Fields, including all DLR, Onera and joint DLR/Onera rotorcraft related tasks and projects as agreed upon in the DLR/Onera partnership agreement:
- The Virtual Rotorcraft
- The Quiet and Comfortable Rotorcraft
- The Smart Rotorcraft
- The Robust Rotorcraft
- The Innovative Rotorcraft
- Materials and Manufacturing

**ENGINE RESEARCH**
This research topic covers all DLR activities with respect to environmentally friendly and efficient engines with high specific performance for civil and military aircraft. In particular:

- New Engine Concepts
- Fan and Compressor Technology
- Combustion Chamber Technology
- Turbine Technology
- Numerical Simulation / Experimental Validation

**ATM AND OPERATIONS**
The future development of air traffic will be highly affected by the optimization of the overall traffic flow in particular close to airports and in terminal areas. Related DLR activities are concentrated in the following sub-topics:

- Efficient Flight Guidance
- Human Factors and Safety in Aviation
- Climate, Weather and Environment
- Communication, Navigation and Surveillance
- Air Transport Concepts and Operations
The Swedish Defence Research Agency FOI is an independent agency, funded primarily through contracts, reporting to the Swedish Department of Defence.

FOI was founded in 2001 by merging two already existing agencies, the Aeronautical Research Institute, FFA, and the Defence Research Establishment, FOA. Currently, FOI employs around 950 people of whom more than 700 are scientists.

Apart from a Board and a Director General, FOI has an Administrative and Technical Support Division and five Research Divisions. These latter are: “Defence Analysis”, “Defence & Security, Systems and Technology”, “Information- and Aeronautical Systems”, “Sensor- and EW Systems”, and “CBRN Defence and Security”.

MISSION / OBJECTIVES
FOI specializes in defence related research and technological development with the goals of obtaining, preserving and increasing the level of technology to be applied in the sectors of defence and security. FOI contributes to defining objectives, programmes and projects relative to defence and security, providing technical support and services to other governmental organizations and industrial and technological enterprises as well. FOI performs its tasks for the Swedish government and its other customers both independently, and in cooperation with partners both within and outside Sweden.

Mission statement of FOI
• The Swedish Defence Research Agency (FOI) is required to:
• Perform research, develop methodologies, technologies, and evaluations for the Armed Forces and supporting disarmament and international security.
• Work to transfer results from defence related research to other sectors.
• Perform defence related analyses based on available international information and other sources.
• Take measures to enhance cooperation between defence and civil research, as well as between national and international research.
• Provide technical support and services to public bodies and industry within its remit.
• Actively support, within legal statutes, export of Swedish defence materiel.

LOCATION
FOI’s head quarter is located in Kista, Stockholm. Other locations are Grindsjön, Linköping and Umeå.

PROGRAMMES / ACTIVITIES
The programmes most closely related to aeronautical development are:

Swedish National Aeronautics Programme: Cooperation with Saab on CFD code development and Hybrid Structures.

Swedish Military Programme: Cooperation with Saab and GKN on CFD, Structures and Materials, National Code development on low signature (radar and IR-modelling), communication systems, sensor technology, weapons integration, and conceptual design.
Participation in some 20 projects within the European Framework programme including Clean Sky

**FOI ACTIVITIES IN AERONAUTICS INCLUDE:**

- Conceptual design of both fighter and civil aircraft including new aircraft concepts
- New propulsion concepts
- UAV concepts
- Mission planning
- Stability and control issues of tailless concepts
- Innovative control effectors
- Directional stability
- TVC concepts
- Mission planning
- Autonomous flight control
- Development and application of numerical tools
- Design and shape optimization
- Flow control
- Applications to missiles, store release, spacecraft
- Fluid-structure integration and aeroelasticity

**COMPUTATIONAL MECHANICS**

- Design and analysis of different aeronautical structures
- Large scale (Gdofs, TFlops) 3D p-adaptive FEM
- Fatigue and Fracture
- Buckling and post-buckling
- Composite materials and structures
- Smart structures and structural health monitoring
- Damage tolerance analysis

**COMPUTATIONAL FLUID DYNAMICS**

- Stability and control
- Non linear control techniques
- Architecture for development and integration of real time simulation models
- Integration of simulation models for Swedish Air Force combat simulation centre
- Operating the military flight simulation centre for pilot training in battle scenarios

**FAILURE ANALYSIS**

- Integrated experience on failures in orbital rockets and various aircraft failure investigations
- Also experience in failure analysis of nuclear reactor details, pressurised gas tanks, welded structures etc

**SIGNATURE MODELLING AND MEASUREMENTS**

- Development of national codes for RCS and IRS
- IR signatures for whole body, cavities and surroundings including specular and diffuse reflections
- EMCAV/EM3D – hp-adaptive solution of 3D electromagnetic scattering from cavities
- RCS measurements 0.3 – 110 Ghz
- IR measurement systems
- Target and background modelling
- Development of RAM/RAS

**FLIGHT MECHANICS, SIMULATION AND MODELLING**

- Damage tolerance testing
- Validation of computer modelling
- IRCAV/EM3D – hp-adaptive solution of 3D electromagnetic scattering from cavities
- RCS measurements 0.3 – 110 Ghz
- IR measurement systems
- Target and background modelling
- Development of RAM/RAS

**SENSOR AND EW SYSTEMS**

- Develop new sensor systems with emphasis on radar, IR- and other optical systems
- Develop systems for electronic warfare including counter measures
The Institute of Aviation, ILOT, is the Polish research and development establishment subordinate of the Ministry of Economy through the Supervised and Subordinated Units Department. The institute is an independent legal body; it owns its assets and has full legal capacity and power to act.

The history of the Institute of Aviation dates back to the renewing of Poland’s independence after the First World War. The institute was founded in 1926. Up to 1939 the institute under its previous name, Institute of Aviation Technical Research, performed the authorisation and certification testing of all military aircraft produced and operated in Poland. Later it was named General Institute of Aviation and was active as a research and design centre for flying objects such as rockets, flying targets, helicopters, airplanes, and aircraft equipment. From 1998 the ILOT has developed into a major centre of new technologies. It offers services to clients and strategic partners of the biggest aviation consortiums.

The mission of the Institute of Aviation is to provide research services of highest quality in aviation, aeronautics and related domains to companies worldwide. The strategy is based on the active participation in diverse European and world priority themes. ILOT is determined to achieve the strategic objectives of:
• becoming one of the leading aeronautical research centres in the world, and
• increasing its competitiveness in the global research market.

The Institute of Aviation continues and expands research into all aspects of the aviation sector. It promotes and implements research results and conducts education activities through co-operation with organisations and institutions worldwide. ILOT invests in the development of scientific research workforce and research infrastructure and aims at enhancing human and organisational potential.

LOCATION
ILOT is located in Warsaw.

PROGRAMMES / ACTIVITIES
ILOT as an independent entity is able to flexible adjust to the requirements of the international research market. More than 75% of the research executed by ILOT is performed for partners from USA, Canada, Spain, UK, Germany, Italy and France.

In addition ILOT receives funds from the Ministry of Science and Higher Education, the National Centre for Research and Development and the National Science Centre as research grants assigned in competition. These funds are concerned with statutory research, scientific promotion of the employees, investments and supporting realization of industry commissions. From this funds ILOT also develops technology demonstrators like ILX-27 – large unmanned helicopter.
ILOT is also very active in European research programmes. Among others, ILOT participated or participates in the following projects:

- **AERONET III** – “Coordination Action of European Commision on Aircraft Emission and Reduction technologies”
- „**CESAR**“ - Cost Effective Small Aircraft
- “**IMPERJA**” – Improving the Fatigue Performance of Riveted Joints in Airframes
- “**SUPERSKYSENSE**” – Smart Maintenance of Aviation Hydraulic Fluid Using an On-board Monitoring and Reconditioning System
- **X3-NOISE** - Aircraft External Noise Research Network and Coordination (FP6).
- **X4-NOISE EV** Aviation Noise Research Network and Coordination (FP7).
- **GRASP** – GReen Advanced Space Propulsion
- **ESPOSA** – Efficient System end Propulsion for Small Aircraft
- **AEROFAST** - Aerocapture for future space transportation
- **RASTAS SPEAR** - RAdition-Shapes Thermal protection investigAtionS for high-SPeed EArth Re-entry
- **SAT-Rdmp** - Small Air Transport Road Map
- **CEARES-NET** - Central European Aeronautical Research Network Events
- **CoopAIR-LA**” – Cooperation European Union –Latin America in Aeronautics and Air Transport
- **OREAT II** - Open Rotor Engines Advanced Technologies II
- **STARLET** - Basic wind tunnel investigation to explore the use of Active Flow Control technology for aerodynamic load control
- **ESTERA** - Multi-level Embedded Closed-Loop Control System for Fluidic Active Flow Control Applied in High-Lift and High-Speed Aircraft Operations
- **TFAST** - Transition location effect on shock wave boundary layer interaction
- **Endless Runway**
- **ASCOS** - Aviation Safety and Certification of new Operations and Systems
- **LIFE+** Evaluation of the health state of forests and an effect of phosphate treatments with the use of photovoltaic SLE UAV
- **PULCHER** - Pulsed Chemical Rocket with Green High Performance Propellants

In order to perform these projects the activities of ILOT concerning aerospace in its New Technologies Centre and the Materials and Structures Research Centre include theoretical work, design & analysis and laboratory research in the fields of:

- aerodynamics (CFD and experimental analysis)
- avionics and systems integration
- design and strength analysis of metallic and composite structures (airplanes, helicopters, non-standard constructions and others)
- rocket propulsion
- landing gears and energy absorption systems
- aircraft propulsion including piston, turbo-shaft, & jet engines
- composite technologies
- vibration and flutter analysis
- environmental research
- testing of mechanical properties of materials, structures and structural components
INCAS – National Institute for Aerospace Research “Elie Carafoli” is the leading research establishment in aerospace sciences in Romania, with more than 60 years tradition in aerospace engineering, flow physics and applied aerodynamics, using state-of-the-art technologies and unique infrastructure of national strategic importance.

Since 1950, when the Applied Mechanics Institute of the Romanian Academy was established, aerospace research was carried out under different names and structures. Finally, after reorganisation in aerospace research and aeronautical industry, a new organisation was created, INCAS, as the only research institute in Romania specialized in aerospace activities.

The National Institute for Aerospace Research “ELIE CARAFOLI” - INCAS of Romania is active under this name since 1991, according to the certificate of registration at the Chamber of Commerce and Industry of Bucharest.

MISSION / OBJECTIVES
INCAS is a comprehensive research establishment, fulfilling a national and international role in providing world class capabilities across the whole spectrum of basic and applied research in aerospace sciences, industrial support and specialized expertise. INCAS performs this mission in an integrated environment with industry and academia, and supported by higher education training in areas reflective of the Institute’s mission. It aims to achieve this in an innovative, responsive, caring and flexible working environment with state-of-the-art facilities and the most advanced technology available.

It is committed to providing access to state-of-the-art technologies for the worldwide aerospace industrial community, universities and academia, and to achieving quality and excellence in all aspects of its work.

This commitment extends to the provision of basic and applied research, development and consultancy services for industry and society, with due regard to the technological, commercial, social and cultural needs of the community it serves.

INCAS has been involved in all major national aeronautical projects for civil and military areas, and currently is acting as a major player in EU policy for R&D development under Flight Path 2050 vision and future Horizon 2020 program.

LOCATION
The National Institute for Aerospace Research - INCAS - is located in Bucharest, Romania.

PROGRAMMES / ACTIVITIES
INCAS’ expertise in aeronautics includes:

• Main design authority and system integrator
• Aerodynamic design
• Experimental wind tunnel validation
• Global performance analysis
• Structural design and analysis
• New materials and technologies in aeronautics.
The institute elaborates computing programmes and computing methodologies for the completed testing benches and installations.

An important field of the research and development activity of the institute refers to aeronautical and space plants restructuring, retrofit and up-grading.

For an easier industrial implementation of the institute’s research, in order to obtain the expected parameters in a shorter time and more efficiently, the institute is carrying out associated activities to be offered to the end-users. Such activities are:

- technical assistance;
- consulting;
- scientific and technical support;
- testing performed on special facilities;
- issuing of quality certificates.

In addition, the institute carries out studies referring to strategies, prognosis, reliability, evaluation, aircraft assessment and airborne instruments.

INCAS performs aircraft personnel training consisting in:

- organisation and survey of diploma and doctorate activities;
- organisation of national and international conferences in the aerospace field;
- organisation of airspace educational courses.

INCAS performs efficient research and development activities with industrial applicability in different aircraft, helicopter and rocket development programmes. In upgrade programmes INCAS provides the testing equipment and conducts the performance testing.

INCAS is participating in Clean Sky, SFWA – Smart Fixed Wing Aircraft as an associate member in a consortium formed out of two research centres in Romania, INCAS and STRAERO and two industrial partners, Romaero and Avioane Craiova and in GRA – Green Regional Aircraft as partner in the CIRA PLUS consortium. The participation in the JTI is highly supported by Romanian authorities and is considered as a major step towards integrating R&D and industrial capabilities at EU level in aeronautics.

Participation of INCAS in European projects started in FP5 with relative limited involvement. From FP6, INCAS has increased his international visibility being involved in one IP and several STREPs: IP CESAR - Cost Effective Small Aircraft, STREP UFAST - Unsteady Effects in Shock Wave Induced Separation, STREP AVERT – Aerodynamic Validation of Emission Reducing Technologies; in FP7 INCAS’ most important projects are: ESPOSA - Efficient Systems and Propulsion for Small Aircraft, HAIC – High Altitude Ice Crystals, AFLoNext - Active Flow- Loads & Noise control on next generation wing, ATLLAS-2 - Aerodynamic and Thermal Load Interactions with Lightweight Advanced Materials for High Speed Flight.

In addition INCAS is contributing to several important support actions in FP7: AeroPortal (AeroSME & SCRATCH projects) CEARES, REStARTS, SAT-Rdmp, CAPPADOCIA, BEWARE.
The Instituto Nacional de Técnica Aeroespacial or National Institute of Aerospace Technology in Spain, INTA, is a public research establishment specialized in research and aerospace technological development. It is an organisation attached to the Spanish Ministry of Defence through the State Secretariat for Defence. INTA is an independent legal body with own assets and financing, managing independence and full legal capacity and power to act.

INTA was founded in 1942. At that time, the primary functions of the institute were for technical support to aeronautical services and authorities, and technical assistance to the aeronautical Industry. Such tasks are still being performed, in addition to many others mainly related to our projection into other countries, especially within Europe.

**MISSION / OBJECTIVES**

INTA’s most relevant goal is to obtain, preserve and increase the level of technology to be applied in the aerospace sector.

INTA contributes to defining objectives, programmes and projects related to aeronautics and space science, providing technical support, assessment and services to official bodies and agencies, and to industrial or technological enterprises as well.

INTA performs co-operation and research tasks for the Spanish Ministry of Defence, and research and development for the aeronautical industry within and outside Spain.

**LOCATION**

The INTA main campus is located close to Torrejon de Ardoz, about 20 km from Madrid. Other facilities are spread throughout the rest of the country, namely, Robledo de Chavela, Villafranca del Castillo, El Arenosillo (Huelva), Granada, and a tracking station in Maspalomas (Canary Islands).

**PROGRAMMES / ACTIVITIES**

The current programmes most closely related to aeronautical research and development are:

- **UAVs:** For many years INTA has carried out an extensive research programme in order to develop the technologies required for the design and construction of a range of unmanned aircraft:
  - **SIVA:** Medium tactical UAV for surveillance and reconnaissance missions.

Missions and current status:

As UAV Type II training tool, SIVA has been used for the Spanish army since 2006 and the Spanish air force since 2012.

As part of the PERIGEO project (CDTI), SIVA will be used for testing onboard future space technologies and payloads 2013-2014.

As part of the DRONE project (DGAM), SIVA is being used for testing improvements in datalink technologies.

As part of The DEMO RPAS (SESAR), SIVA will be the platform in charge of making autonomous flights in a non segregated airspace 2014.
• ALO: Small tactical UAV for surveillance and reconnaissance missions.

Missions and current status:
As part of the SAIDENT project, ALO is demonstrating its capabilities in collaborative flights (2 or more UAVs operating as same time)

• MILANO: Medium Altitude Long Endurance UAV.

Missions and current status:
INTA personnel are carrying out the first prototype integration. Maiden flight is expected in 2014.

• DIANA: High speed target drone.

Missions and current status:
INTA personnel are carrying out flight tests at CEDEA (INTA facility in Southern Spain)

In order to perform INTA aeronautical projects, activities include:
• Fluid dynamics: Development and application of numerical tools; aerodynamic analysis and design.
• Turbojet engine testing: Upgrading and optimization of turbojet engine testing facility.
• Experimental aerodynamics: Low and high speed wind tunnels.
• Structural testing: Structural and fatigue tests on various parts of many different aircraft models.
• Structures and mechanisms area: Design and analysis of different aeronautical structures.
• Aircraft certification: EF2000 and A400M programmes: Monitoring of tests made by the Spanish prototype (IPA4). INTA is the technical body for aircraft certification of the Ministry of Defence, acting on behalf of the Airworthiness Military Authority. INTA issues certification for military aircraft which are built in Spain. In programmes such as EF2000, A400M, NH90 helicopter, Tiger helicopter; INTA participates in certification and qualification of air tankers FRTT for the RAAF, UK and Arabia

Since the beginning of FP7, year 2007, 45 aeronautical projects were financed with the participation of INTA, acting either as leader or as partner.
The National Aerospace Laboratory of the Netherlands (NLR), founded in 1919, is an independent aerospace knowledge enterprise. Our mission is to make air transport and space exploration safer, more sustainable and more efficient.

We meet the needs of stakeholders throughout the aerospace sector, from air transport, airspace and airports to military aviation, from government to industry and from manufacturers to airlines. NLR’s multidisciplinary approach focuses on developing new and cost effective technologies for aviation and space, embracing everything from design support to production technology and MRO (Maintenance, Repair and Overhaul). With its unique expertise and state of the art facilities, NLR bridges the gap between research and application.

NLR covers the entire spectrum of RDT&E (Research, Development, Testing & Evaluation), including all the essential phases in research, from validation, verification and qualification to evaluation. NLR’s work contributes to the innovative and competitive strength of government and industry, in the Netherlands and Europe.

LOCATION
NLR has approximately 650 employees who work at offices in Amsterdam and Marknesse in Flevoland province. The company posts annual turnover of approximately 75 million euro.

NLR AND EUROPE
As one of Europe’s leading research establishments, NLR is a major player in European research programmes. We are intensively involved in European collaborative research projects and in programmes like SESAR and Clean Sky. The applied knowledge that NLR contributes to these programmes reinforces innovative strength and the attainment of the sustainability targets of European governments and industry.
**PROGRAMMES / ACTIVITIES**

NLR’s aerospace competences are clustered in the market segments of Civil Aviation, Civil Industry, Defence and Security Industry, Space, and Defence and Peacekeeping.

**CIVIL AVIATION** addresses the capacity of European airports and the development of new concepts for air traffic management. NLR helps to improve the safety of aircraft operations and to reduce operational costs and environmental loads. We help industry to address challenges that involve third party risks, emissions, alternative fuels and noise issues. In the SESAR programme, NLR is a pivotal player in fulfilling the European ATM master plan, aimed at creating a new European ATM system.

**CIVIL INDUSTRY** assists industry in the fields of aerodynamics, aeroacoustics, aeroelasticity, structural design, avionics design and man machine interfaces. This segment also specialises in the development of aerospace vehicle structures using new composite materials and metals. Other fields of work include validation (wind tunnel tests, flight tests, structural tests, electronics tests) and support in training pilots, maintenance personnel and production personnel. Together with other European participants, NLR developed and tested the Contra-Rotating Open Rotor (CROR), which will reduce the fuel consumption and thus CO₂ emissions of European aircraft.

**DEFENCE AND SECURITY INDUSTRY** supports European industry in requirements generation or analysis, technology development, testing and verification, and qualification or certification of their products and services. It also provides assistance in logistics, health management, training and simulations. NLR is involved in the development of the Lockheed F 35, and the knowledge and experience gained in this programme can be applied to the defence programmes of the European defence industry.

**THE SPACE** segment concentrates on the development of the European space infrastructure and its usage. It supports satellite, launcher or payload system engineering, thermal control, and testing and verification. Space also works on the technical infrastructure for applications for earth observation, navigation and manned spaceflight. A good example is the complex cooling system that NLR developed for equipment on the International Space Station (ISS) for a mission to search for antimatter and dark matter.

**DEFENCE AND PEACEKEEPING** specialises in technical and operational support for the safe and effective deployment of air defence platforms, and in technical support for the acquisition of new weapon and threat systems. It also supports the lifecycle management of aerospace related weapon systems, and the definition and implementation of military aviation standards. NLR developed a new analytical tool that simplifies government decisions on the procurement of aircraft protection management systems, thus contributing to the safety of European military aircraft.
Onera is a public establishment (EPIC) reporting to the French Ministry of Defence. Onera has an independent legal personality, its own assets, financing and managing independence, and full legal capacity and power to act.

The “Centre Aéronautique de Meudon” was born in 1794 and the first aerostats were designed, manufactured and flown from there (1877). In 1935, the Grande Soufflerie de Meudon (S1Ch) was built as the largest wind tunnel in the world. The Office National d’Etudes et de Recherches Aéronautiques (Onera) was founded in 1946 and later renamed in “Office National d’Etudes et de Recherches Aérospatiales”. Onera is a true pioneer in aeronautics and space studies and their applications.

MISSION / OBJECTIVES

Onera is acting as the bridge between basic research and technology applications, creating innovative solutions that enhance industry’s competitiveness and meet the major challenges facing the society: environmental protection, security, sovereignty.

The key missions are:

• Direct and conduct aerospace research, as described in particular in the Defence and Security White Book and the Civil Aeronautics Research Council (Corac) requirements,
• Build and operate test facilities and the associated processing systems,
• Transfer results to companies in France and Europe,
• Provide top quality services and expert analysis for industry and government agencies,
• Train new researchers and engineers, and
• Develop pan-European aerospace research.

The core activity is “application-oriented” research for the French government and the aerospace industry and the scope of business encompasses:

• Civil and military aircraft,
• Helicopters and tilt rotors,
• Propulsion,
• Orbital systems,

• Space transport,
• Missiles, defence & security systems,
• Aerospace systems.

Onera services span Technology Readiness Levels (TRL) 2 to 6, where the transition from research to industry is most demanding.

LOCATION

Onera is having its principal place of business at Chemin de la Hunière - BP 80100 - 91123 Palaiseau Cedex – France. Other localtions are in France (Chatillon, Meudon, Toulouse, Modane, Lille, Salon de Provence), and an office in Brussels (CLORA).

PROGRAMMES / ACTIVITIES

Onera’s fields of activity are focussed on

• Industry competitiveness
• Environment and society
• Defense and security
• Enhancing knowledge
Experts were involved in many major aerospace programmes like Airbus jetliners, Dassault aircraft, European launch vehicles, Graves space surveillance system (operated by the French Air Force) and Nostradamus over-the-horizon radar, Scramjets, Innovative very-high temperature alloys for turbine blades and disks, Very Large Telescope (VLT) in Chile, High-resolution infrared measurement instruments.

Onera has been for many years a major participant in the European Framework Programmes. Onera is one of the major associated member of the Clean Sky Joint Technology Initiative (JTI) through its participation in three Integrated Technology Demonstrators (ITD): SFWA (Smart Fixed Wing Aircraft), GRA (Green Regional Aircraft), GRC (Green RotorCraft) and in the Technology Evaluator.

Among particularly innovative programmes are:

**HELICOPTERS**: Over 30 years of intense research on rotors, European rotorcraft now sets the best standard for noise and vibrations. Onera scientists provided industry with powerful design tools to drive the competitive advantage.

**DASSAULT AVIATION’S FALCON 7X**: During the design phase, Onera helped to enhance the aerodynamics and to reduce drag for lower fuel consumption.

**UNMANNED COMBAT AIR SYSTEMS (UCAS)**: Onera is fully committed to the UA “system of systems” concept, driving basic research to develop enabling technologies.

**SETHI**: the new-generation airborne imaging system with radar and optronic sensors for aerial views of earth, preparation of satellite missions and security applications.

**IESTA**: Infrastructure for evaluating future concepts for air transport systems, combining all the aeronautical skills of Onera (platform, noise, emissions, engines, etc.) and its know-how in terms of system evaluation and simulation architecture.

**PPLANE**: Onera has been leading a consortium of 13 industrial and research partners. A comprehensive view on the possibility to develop a Personnel Air Transport System (PATS) has been conducted including: its viability (affordability, social acceptance), its structure (technology availability) and its organisation (regulation issues) as a part of the global air transport system, integrated into the air traffic management system.
The Central AeroHydrodynamic Institute named after Professor N.E.Zhukovsky (TsAGI) was founded on December 1, 1918. TsAGI is Russia’s National State Research Center in aeronautics.

Today, TsAGI has more than 4,400 employees. Its wide range of test facilities includes more than 60 wind tunnels to simulate flight conditions at speeds ranging from 10 m/s up to Mach 20.

**MISSION / OBJECTIVES**

TsAGI’s mission is to secure Russia’s leadership in aeronautics, to guarantee national security and the competitiveness of the Russian aviation industry. To accomplish this mission TsAGI is involved in strategic planning and the development of Russian R&D programmes in aeronautics.

**LOCATION**

TsAGI is located in the city of Zhukovsky 40 km southeast from Moscow.

**PROGRAMMES / ACTIVITIES**

TsAGI's activities are focused on but not limited to aeronautics and include:

**AERODYNAMICS**

All aircraft developed in Russia undergo tests in TsAGI wind tunnels. In addition to conventional aircraft configurations the Institute also conducts research into new aircraft concepts. TsAGI's new innovative projects include cryogenic fuel aircraft, laminar flow control, forward swept wing, deep integration of power plant and airframe, «blended» and «flying» wing concepts, etc.

**FLIGHT DYNAMICS & CONTROL SYSTEMS**

Flight dynamics and control systems have always been a priority for TsAGI. The Institute has introduced advanced flight simulators and control system simulators for solving tasks involving dynamics of maneuverable and passenger aircraft. Simulators developed by TsAGI played a major role in creating control systems for Russian military and civil aircraft with a strong focus on flight safety.

**STRUCTURES**

TsAGI provides the scientific acumen in developing and improving regulatory documents regulating the safe operation of aircraft with respect to static, dynamic and thermal strength, life and reliability, loads, aeroelasticity and shimmy. The Institute conducts fundamental and applied research in these areas.

**HYDRODYNAMICS**

Hydrodynamics is a scientific field which has been studied at TsAGI since its foundation. TsAGI’s primary hydrodynamics research task is to make recommendations for safe aircraft water landing. Also, an object's underwater high velocity motion with strong cavitation is an important part of TsAGI's research. The hydro test facilities include a water channel, high speed water test bench, a water shock hydro acoustic tank, etc.
AEROACOUSTICS
TsAGI researchers work to ensure the compliance of Russian aircraft with ICAO noise standards and to enhance the efficiency of cabin and cockpit sound proofing and sound absorption. Aeroacoustics covers theoretical and experimental investigations on aircraft noise generation and propagation, and the development of noise reducing methods.

AEROSPACE RESEARCH
TsAGI specialists comprehensively resolve problems of thermodynamics, dynamics and control, strength and acoustics, and rocket-spacecraft power plants. The research covers all phases of flight: ascent, reentry of detachable sections, orbital maneuvers and interplanetary flights, reentry, automatic landing, etc.

INDUSTRIAL AERODYNAMICS
TsAGI has modern methods and software to design wind power plants and to test full scale models in wind tunnels, and has experience in conducting aerodynamic and strength tests of propeller and vertical-axis turbines. TsAGI also studies wind loads on high buildings and bridges. In its wind tunnels the Institute performs tests to find optimal shapes for trains. The Institute is a recognized expert in the design of industrial fans and compressors, as well as ventilation systems.

MEASUREMENTS AND METROLOGY
The Institute has developed its own unique tools and measurement systems. TsAGI has built various types of multi-component strain gauge balances. These balances make it possible to measure with high accuracy aerodynamic loads in a wide range of flow speeds (up to Mach 20), under high temperatures and for short test durations. TsAGI is also a pioneer in non-contact optical measurement methods.

MODELS AND EQUIPMENT MANUFACTURING
An important activity at TsAGI is the design and manufacturing of aerodynamic models (including those made of composite materials), strain gauge balances and non-standard equipment. The dimensions of models produced by TsAGI range from a few centimeters up to 12 meters. TsAGI has a full range of equipment needed for the manufacturing of models. In addition, research is carried out on improving model design techniques and production technologies.

MULTIDISCIPLINARY STUDIES
TsAGI has considerable experience in the concept design of both civil and military aircraft and in the development of software for automated multidisciplinary design and its application to define configurations and basic parameters. TsAGI also conducts system studies for future development of civil and military aviation.

INTERNATIONAL COOPERATION
TsAGI is cooperating with more than 50 leading aerospace companies, research institutions and universities from Europe, Americas and Asia, as well as with dozens of organizations from CIS-countries. An important part of TsAGI’s international cooperation is the participation in the EU Framework Programmes.
The von Karman Institute for Fluid Dynamics, VKI, is an International Not for Profit Association (INPA) incorporated under Belgian Law as an independent legal person.

The VKI was founded under the name of TCEA (Training Center for Experimental Aerodynamics) in 1956, under the auspices of the Advisory Group for Aeronautical Research and Development (AGARD) of NATO by the action of Professor Theodore von Karman, in his position as chairman of AGARD. He proposed the establishment of an institution devoted to training and research in aerodynamics which would be open to young engineers and scientists of the NATO nations. It was strongly felt that this form of international undertaking would fulfil the important objective of fostering fruitful exchanges and understanding between the participating nations in a well-defined technical field, and the Belgian Government agreed to host the projected new center in its Aeronautical Laboratory in Rhode-Saint-Genèse, bearing in mind the existing facilities. Negotiations between the governments of the USA and of Belgium resulted in a formal agreement between the two governments, reached in Belgium in September 1956 and signed officially in Paris on December 15, 1956. Later the support of the Institute was shared, with different contributions, between a larger number of NATO countries Theodore von Karman acted as the Institute’s Chairman until his death in 1963. It was then that the name of the organisation was changed in memory of its founder.

MISSION / OBJECTIVES

VKIs mission, as defined by its statutes, is:

• to promote the training of scientists and engineers from the NATO countries in the field of fluid dynamics; The Research Master in Fluid Dynamics (master after master level) received the NVAO accreditation. NVAO ensures the quality of educational programmes following the Bologna agreement for higher education in Europe.
• to contribute to the dissemination of knowledge in the field of fluid dynamics;
• to undertake, to instigate and promote studies and research in the field of theoretical, numerical and experimental fluid dynamics.

Scientists and engineers coming from other non-NATO countries, in accordance with the policy of NATO, can be authorized by the Board of Directors to participate in the activities of the Institute.

The missions of the institute are fulfilled by:

• Running training programmes for scientists and engineers at undergraduate, post-graduate, after-master, doctoral and post-doctoral levels.
• Organising and hosting continuing education programmes like Lecture Series, organising and participating to international conferences
• Performing research in various fluid-dynamic fields in the context of training programmes, following the principle of “training in research by active research” (the main programme being the doctoral one), as well as performing research for industrial partners, research agencies or other organizations, often involving industrial consortia, and conducted under specific research contracts or grants.
LOCATION
The VKI is a non-profit international research and educational establishment, located in Rhode-Saint-Genèse, at about 15 km South of Central Brussels, Belgium

PROGRAMMES / ACTIVITIES
Recent programmes and activities in aeronautics cover the following fields:

FLIGHT AND SPACE PROPULSION: Fluid hammering in satellite propellant lines, Flash evaporation in liquid propulsion, Pressure oscillations in solid boosters, Deformation of thermal protections, Cryogenic science

FLIGHT AND GROUND TESTING FOR AEROSPACE: CATE in-flight experiments, strategic ground testing approach for high-speed re-entry, Optical spectroscopy, original tomography methods, characterisation of noise level, Static and dynamic stability study of the ARV re-entry vehicle

SMALL SATELLITES: Cubesats to perform atmospheric research as well as in-orbit technology demonstrations.

AEROACOUSTICS: Simulation methodologies for airframe noise modelling, theoretical and experimental investigations of ventilation noise in ducted systems, modelling and control of the noise emitted by the aircraft Environmental Control Systems, application of porous materials to reduce the interaction noise in Contra-Rotating Open Rotor (CROR) propulsion systems

INSTRUMENTATION DEVELOPMENT: Airborne Research using PIV, Icing detection by non intrusive optical technique, design and manufacturing of cooled probes for measurements at engine temperature, qualification of the flow in a new steady state model-turbine rig, Development of tip timing methods

PHYSICAL AND NUMERICAL MODELLING: COOLFluiD-2 (CF2) platform, wall boundary condition model with variable catalytic efficiency and radiative equilibrium, MHD solver for Space Weather applications, new Finite Volume solver for the full Maxwell equations, innovative Monte Carlo-based algorithm for radiation transport, RANS and LES models into the Residual Distribution solver, rarefied gas dynamics, satellite application, Hyperwall prototype

DESIGN AND OPTIMIZATION: Optimization on axial fans, radial and axial compressors, axial and radial turbines and automotive fans, development of a Total Integrated Design and Optimization Software for Turbomachinery

LOW PRESSURE COMPRESSORS AND TURBINES: roughness, transition, separation and boundary layer control, influence of Reynolds number, free stream turbulence, blade loading, periodic inlet wakes, technological effects, aerodynamics and stability of low pressure compressors (boosters)

INTERNAL FLOWS IN TURBOMACHINES: optimization of the return bend in an internal cooling channel, rotating facility for the investigation of centrifugal, buoyancy and Coriolis effects on internal cooling flows, internal and external cooling of high pressure turbine components.

INDUSTRIAL PROCESS FOR NANOPARTICLES: dedicated laboratory for the research on surface passivation of metallic nanoparticles, non-intrusive diagnostic tools.
VZLU – Aerospace Research and Test Establishment is a national centre for research, development and testing in the field of aeronautics and space.

The history of VZLU (Aerospace Research and Test Establishment) dates back to 1922, a year when the Institute for Air Navigation Studies under the auspices of Ministry of Defence was founded. More than 80 Czechoslovak aircraft types have passed through the VZLU’s gates since then. VZLU ensures a wide range of research, development and testing work necessary for designing new aircraft including certification tests.

**MISSION / OBJECTIVES**

The main mission of VZLU is to generate new knowledge, transfer it into industrial use and provide its partners with maximum support in the development of new products. As a multi-discipline research organisation, VZLU exploits synergic effects and also contributes to the devolvement of automotive, rail, defence, security and power industry and civil engineering.

The major multi-disciplinary fields that VZLU specialises in are: aerodynamics, structure strength and durability, material and corrosion engineering, composite materials and technologies and accredited testing. VZLU cooperates closely with similar organisations throughout Europe to ensure feedback essential to its continuous development.

VZLU creates, organizes and concentrates new knowledge in disciplines that are necessary for the development of aviation equipment and disseminates it in various ways within research and university communities. Special emphasis is placed mainly on applying this knowledge on new or innovative products and services. Thus, VZLU’s primary mission is to be a reliable provider of R&D services for different industrial branches.

**LOCATION**

VZLU is a scientific technical base located in Prague – Letňany.

**PROGRAMMES / ACTIVITIES**

RESEARCH - DEVELOPMENT – INNOVATION - TESTING

VZLU is performing internal research and provides RTD and testing services for national and foreign industrial partners in the following domains:

**AERODYNAMICS**

- Research and development in the field of applied external and internal aerodynamics
- Development of specialized CFD software for external and internal aerodynamics
- Development of simulation tools pertinent to the area of aero-elasticity
- CFD calculations and flow simulation, optimization, flight mechanics
- Measurements in wind tunnels
- Simulation and measurement of wind resistance of building structures
- Simulation and measurement of harmful gas propagation in the atmosphere
PRODUCT ORIENTED RTD ACTIVITIES
- Research and development in the area of turbine engines (operation, combustion chambers, compressors, turbines, gearboxes etc.)
- Research and development of propellers and industrial fans
- Research and development of advanced composite structures
- Calculations and testing of the products for use in space (instruments, equipment, small satellites)
- Mechanical and climatic resistance testing
- Electrical systems testing
- Reliability analysis

STRUCTURAL STRENGTH AND DURABILITY
- Research and development in the field of structural durability
- Development of new procedures and software applications for strength analysis
- Development of new methodologies for strength and modal analysis
- Analysis, calculations and experimental verification of strength characteristics of structures
- Static, dynamic and fatigue tests of structures
- Modal analysis, aero-elasticity and ground vibration testing (GVT)
- Experimental stress analysis
- Non-destructive testing (NDT)

MATERIALS AND TECHNOLOGIES
- Research and development in the field of materials
- Research and development in the field of corrosion resistance and surface protection
- Research and development of technologies for production of composite structures
- Material analysis and material characteristics testing
COLOPHON

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NLR
Paul Eijssen
Frank Vos

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Ronald Nonnekens

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