

AVIATION STRUCTURES AND DESIGN DEPARTMENT

The Aviation Structures and Design Department specializes in designing composite and metal aircraft structures and the technological equipment to produce them. In addition, the department carries out performance analysis, load analysis and modernization projects of currently used aircraft. An experienced design team allows the implementation of project work to go beyond the aviation industry and to suggest optimal solutions, taking into consideration specific client requirements.

The work carried out on the basis of the approval no AP 270 Design Organization approval (ADOA) issued by the European EASA and quality management systems ISO 9001: 2009, AQAP 2110: 2009, AQAP 9001: 2008.

DESIGNING:

- metal structures,
- composite structures:
 - aviation structures of glass and carbon composites,
- technological equipment/tools:
 - moulds for the performance of composite structures,
 - assembly tooling/equipment,
 - additional equipment currently used in airplanes and helicopters.

TRANSPORT SYSTEMS DEPARTMENT

The Transport Systems Department focus is on transport system research associated with aircraft design.

Moreover, in the framework of our activity, we undertake structure stress and aircraft performance analyses, cooperate in creating programs and manage aircraft certification processes.

SERVICES PROVIDED:

Participation in National and European Union funded projects:

- applying for national and EU funding of projects,
- project coordination and management,
- participation in work, preparation of reports,
- project approval process.

Research and Development work in the field of Air Transport:

- preparation of air transport related forecasts and development strategies,
- qualitative and quantitative research of the passenger and air cargo markets,
- software design and implementation, including artificial intelligence methods in optimization, management and modelling of transport systems,
- passenger and air cargo systems modelling and design,
- air transport safety and security,
- technological and economic aspects of design, planning and exploitation of aircraft.

Aircraft design:

- organisation and management of aircraft design process and its optimisation,
- aircraft performance calculations,
- strength calculations,
- undertaking of flight tests,
- aircraft certification.



CENTER OF NEW TECHNOLOGIES

MISSION

The Center of New Technologies was established in June 2005. The Center carries out R&D projects in the area of aeronautics including theoretical works, design and analysis and laboratory research. Most of the projects are carried out and financed within the framework of domestic competitions of the Ministry of Science and Higher Education, the Innovative Economy Operational Program and Framework Programs of the European Union (6FP, 7FP).

Mission of the Center is to provide R&D services to Polish and foreign companies to help them raise their competitiveness.

Laboratory research is conducted in the facilities of laboratories certified by the Polish Center for Accreditation (PCA) and are furnished with testing and measuring equipment that is unique in Poland. Since October 22nd, 1997 the Aerodynamic Laboratory (Certificate No. AB 129) and Landing Gear Laboratory (Certificate No. AB 131) have offered accredited tests.

AREAS OF EXPERTISE OF THE CENTER:

- aerodynamics (CFD and experimental analysis),
- design and strength analysis of metallic and composite structures (airplanes, helicopters, non-standard constructions and others),
- landing gear and energy absorption systems,
- transport systems.

The Center of New Technologies combines:

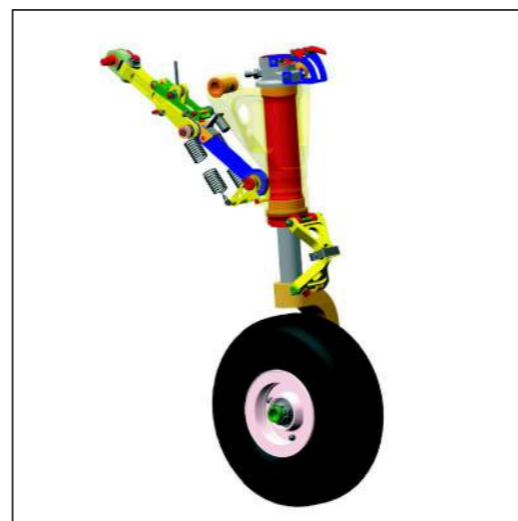
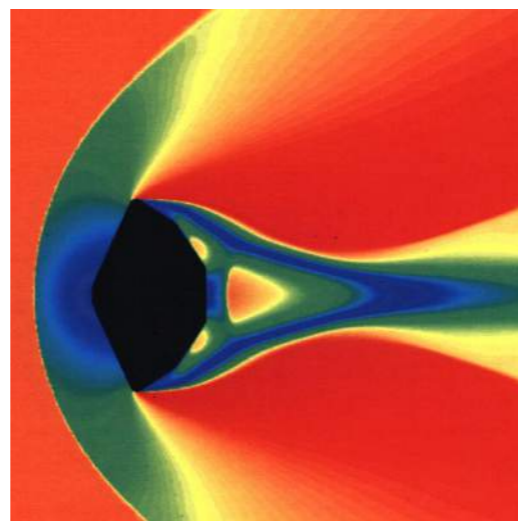
- Aerodynamic Department,
- Aviation Components and Equipment Test Department,
- Aviation Structures and Design Department,
- Transport System Department.



AB 129



AB 131



AERODYNAMIC DEPARTMENT

AERODYNAMICS RESEARCH LABORATORY

The laboratory operates five wind tunnels, which includes the largest and the fastest wind tunnels in the Central-Eastern Europe. The center has one of the world's most advanced research infrastructure in terms of applied aerodynamics.

Areas of activity of the Laboratory:

- environment:
 - environmental studies of wind resistance,
 - energy and its resources:
 - aerodynamic studies of wind turbines, which are the latest solutions in energy-generation technologies,
 - aerodynamic studies of power units and cooling towers,
- transport infrastructure:
 - aerodynamic studies of various means of land and air transport.

The scope of the conducted work includes:

- aerodynamic research for Polish and international aviation industry,
- research and development work related to applied aerodynamics, which are also conducted within confines of European Framework Programmes,
- wind tunnel studies of non-aeronautical aerodynamics conducted for automotive, construction, energy, space technology, sports, shipbuilding and military sectors,
- commercial research studies for domestic and international customers,
- close cooperation with aviation industry leaders, technical universities and entities from the R&D sector.

The Aerodynamics Research Laboratory has implemented:

- a Quality Management System compatible with the standard requirements,
- Laboratory Management System compatible with the requirements of the Internal Control System Criteria standard.

Technical results of research obtained in the laboratory are recognized both by the International Standard Organization ISO as well as by ILAC.

Since 22nd October 1997, the Aerodynamics Research Laboratory has the Accreditation Certificate No. AB 129 issued by Polish Centre for Accreditation.

Aerodynamic tunnels:

- Low Speed Wind Tunnel - a closed-loop tunnel with an open measuring space, diameter - 5 m, long - 6.5 m, engine power - 5.6 MW, wind speed - 90 m/s.
- Trisonic Wind Tunnel - blow-down type tunnel with partial recirculation of the flow, can be operated in three regimes: subsonic, transonic and supersonic, supplied from two spherical compressed air tanks (combined volume - 2880 m³, max. pressure - 6.5 atm).
- Low Speed wind Tunnel - a closed-circuit, continuous-flow tunnel, 1.5 m - diameter of open test section, powered by a 55 kW electric engine, constant-speed fan, max. velocity of the medium - 40 m/s.
- Low Turbulence Wind Tunnel - atmospheric, open-circuit tunnel with two linked, closed, rectangular test sections, powered by two direct-current engines, rated 5.1 kW and 64 kW.
- Supersonic Wind Tunnel - a blow-down type tunnel with a closed test chamber (0.15 x 0.15 m), velocity range - M = 1.22 - 3.5.

COMPUTATIONAL FLUID DYNAMIC AND FLIGHT MECHANICS GROUP

Design and optimization:

- design of parametrical models of objects for research and optimization (airfoil, wing, inlet ducts for jet and turboprop engines, engine nozzles etc.),
- airfoil design,
- multicriterial and multidisciplinary design of aircraft and its elements,
- aerodynamic design of ducts,
- aerodynamic design of helicopter rotors,
- design of propellers, rotors, wind turbines etc.,
- design of parametric models for non-aviation applications and CAD design.

Analysis:

- simulation of flow around an aircraft and parts of the airframe,
- simulation of flow around a helicopter and parts of the airframe, and interference with surrounding objects,
- unsteady flows in shape shifting domain and around such geometries,
- fully three-dimensional simulation of flow around the main rotor of a helicopter (in forward flight and in hover) based on the URANS (Unsteady Reynolds Averaged Navier Stokes) solution,
- fluid structure interaction for modeling nonrigid blades of helicopter rotors including blade flapping,
- flow simulation in ducts (e.g. air intake ducts in aircraft engines),
- spaceship re-entry atmosphere flow simulation,
- aeroacoustic analyses.

AVIATION COMPONENTS AND EQUIPMENT TEST DEPARTMENT

DESIGN:

- airplane and helicopter wheel and skid landing gear,
- "shimmy" and anti resonance dampers.
- landing gear shock absorbers (single and double acting),
- test stands,
- ABS for aircraft brake systems,
- actuators and locks,
- wheels and high energy brakes,
- UAV landing gear.

Design processes are aided by the CAD 3D SOLID EDGE system, fully compatible with the Unigraphics and Catia systems. Strength analysis and stiffness evaluation are performed using the MSC NASTRAN/PATRAN and FEMAP/NASTRAN systems.

COMPUTATIONAL SIMULATION METHODS FOR:

- cases of applying a load to aircraft landing gear components and to other energy absorbing structures and materials,
- dynamic load conditions,
- stability simulation with experimental validation,
- shimmy phenomena,
- behavior in extreme conditions,
- computer simulation for aircraft touch-down dynamics for different landing gear concepts,
- braking transients (dynamic, heat transfer and vibration).

ANALYSIS:

- stiffness, strength and flexibility evaluation of subassemblies and complete landing gears,
- optimization and integration of landing gear elements, braking systems, dampers, and control systems,
- evaluation of design process, conformance with quality standards and research methodologies,
- reliability and durability evaluation of landing gear elements using analytical and experimental methods,
- a review of the state of knowledge in the area of helicopter and landing gear technologies.

CONSTRUCTION OF TECHNOLOGY DEMONSTRATORS AND PROTOTYPES

Implementing projects and filling orders in the area of construction of all types of technology demonstrators, demonstration installations, prototypes, as well as testing and technological instrumentation related to widely understood aviation engineering:

- creating prototypes of components, parts, fuselages, devices and structures:
 - mechanical, static, electrical, automatic, with the use of both aviation and workshop technologies,
- construction of all types of technology demonstrators, iron birds, glass birds, power supply system demonstrators, mechanization system demonstrators, etc.
- implementation of projects in the area of combustion engine adaptation and modification for the purpose of using such engines in newly designed propulsion systems,
- construction and maintenance of testing devices and stations for static and dynamic tests, testing of propulsion systems,

framework mechanization systems, and of other systems and subassemblies in the area of widely understood aviation technology,

- complete construction of hovercraft,
- complete maintenance of combustion engines for aircraft, car engines, inboard and outboard boat engines,
- construction of structures welded with the use of an argon and carbon dioxide blend.

TESTS

The Aviation Components and Equipment Test Department together with the Landing Gear Laboratory are capable of conducting comprehensive tests in accordance with FAR, EASA, MIL and AP standards for helicopters and aircraft with take-off weight of up to 20.000 kg (44.000 lb).

Facilities:

- 10 ton drop test machine,
- 3 ton drop test machine with a drum,
- 40/20 ton press (vertical and/or side load),
- 5 ton automatic drop test machine for functional/fatigue tests of complete landing gear,
- rotary drum for wheel fatigue tests,
- DP test stand for functional and fatigue tests,
- IL 68 - model tests of friction pair materials,
- rotunda field stand for testing rotors and complete helicopters,
- two ILX-27 unmanned helicopter prototypes for flight tests,
- optical strain gauge measurement stand, 64 channels,
- system for thermographic measurements, up to 650°C.