



Łukasiewicz
Institute
of Aviation

SPACE TECHNOLOGIES



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GENERAL COMPANY INFORMATION

Łukasiewicz Research Network - Institute of Aviation is one of the most modern research institutions in Europe, with traditions dating back to 1926. The Institute closely cooperates with the world's tycoons of the aviation industry and institutions from the space industry. The strategic research areas of the Institute are aviation, space and unmanned technologies. Tests and services for domestic and foreign industry in the field of metallic and composite materials, additive, remote sensing, energy and mining technologies are also carried out here. Łukasiewicz Research Network - Institute of Aviation is made up of eight research centers:

AVIATION TECHNOLOGIES CENTER

develops technologies dedicated to aircraft design, aerodynamic research and aircraft certification.

SPACE TECHNOLOGIES CENTER

conducts research and development in the field of space propulsion, space transportation, satellite testing and remote sensing.

UNMANNED AERIAL VEHICLE TECHNOLOGIES CENTER

conducts research and development in the field of drones and anti-drone systems.

MATERIALS AND STRUCTURES RESEARCH CENTER

offers materials and structural components testing in a wide range of loads and temperatures. Thanks to a large number of certified test stands it is a regional leader in fatigue and strength testing.

COMPOSITE TECHNOLOGIES CENTER

delivers composite technology solutions and composite material tests for the aerospace industry.

ENGINEERING DESIGN CENTER

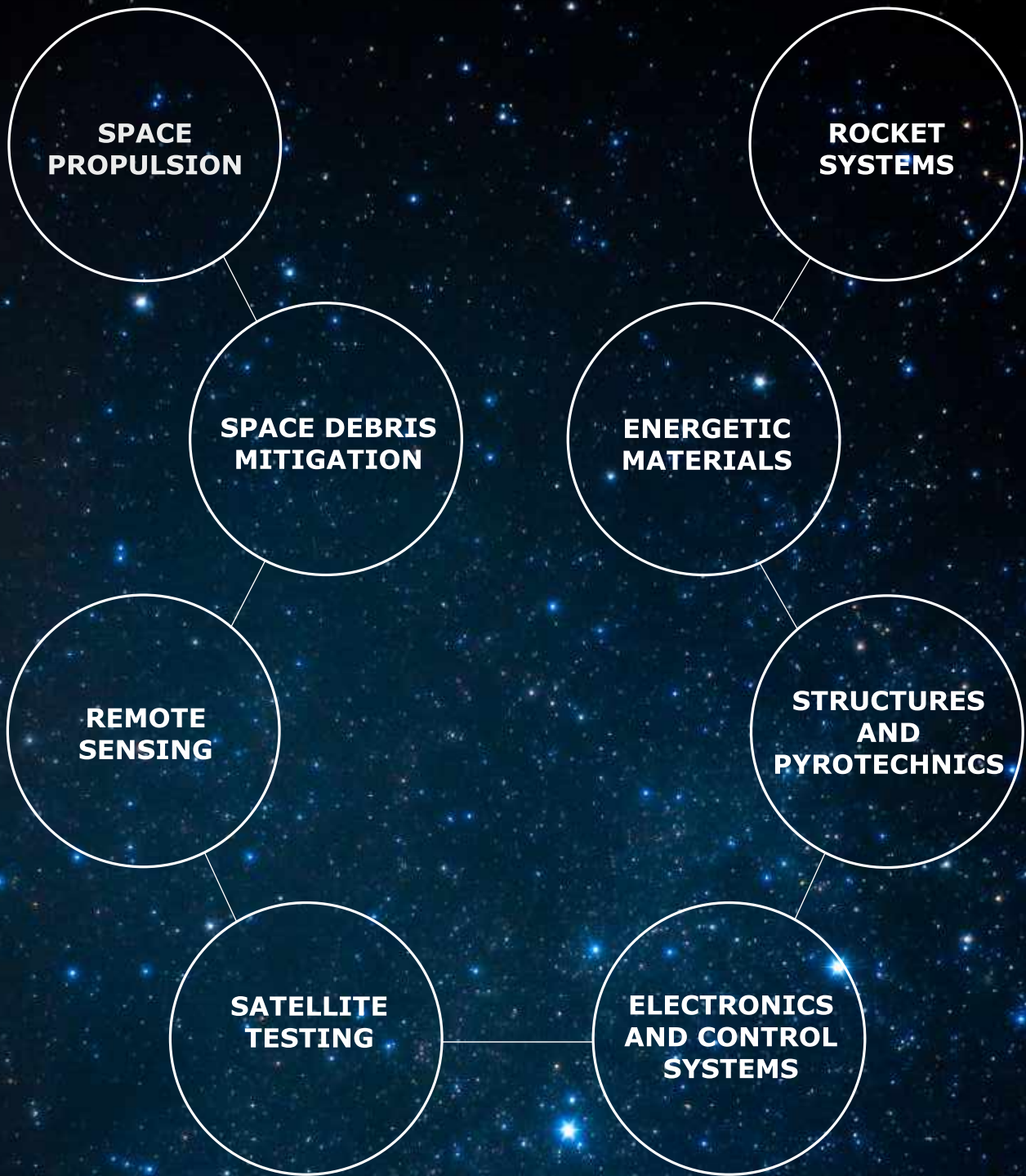
is an engineering alliance between General Electric Company Polska Sp. z o.o. and Łukasiewicz Research Network - Institute of Aviation. The Center offers design, research and development services in the fields of aviation, gas power and renewable energy.

ENGINEERING SERVICES CENTER

provides mechanical and thermal engineering support to strategic research and development projects.

ENERGY TECHNOLOGIES CENTER

focuses on engineering areas: designing, manufacturing, analyzing and servicing parts for high-power gas turbines and wind turbines. One of the main tasks of this center is to implement a new energy era that will build a cleaner future.



OFFER

The main area of interest of Łukasiewicz Research Network – Institute of Aviaton within Space Technology is providing research and development services and supporting industry with product development. World-class facilities, experienced staff and young talent ensure quality and allow delivering game-changing solutions to the global market. Certified laboratories and knowledge concerning European Cooperation for Space Standardization (ECSS) make Łukasiewicz Research Network – Institute of Aviaton a strong partner in the domain of Space Technology.



CHEMICAL SPACECRAFT PROPULSION

Łukasiewicz Research Network – Institute of Aviation is capable of designing, manufacturing and testing rocket propulsion components and systems. Dedicated Propellants, Catalysts and Space Propulsion laboratories are part of the existing infrastructure. The Institute has wide experience in development of monopropellant thrusters, liquid rocket engines, as well as hybrid and solid rocket motors.

MONOPROPELLANT THRUSTERS AND FULL PROPULSION SYSTEMS

- Thrusters and engines for spacecraft with thrust in the range of 1 - 500 N.
- Hydrogen Peroxide Reaction Control Systems for rockets.
- Propulsion for satellite de-orbit.
- Advanced catalyst beds.
- Cutting Edge High Performance Green Propellants.
- Full green propulsion systems for small spacecraft.

Key products under development:

- 1 N low-cost Hydrogen Peroxide Thruster (ESA funding).
- POLON – green propulsion system for microsatellite platforms (NCBiR funding).

LIQUID BIPROPELLANT ENGINES

- Development of bipropellant thrusters for spacecraft and engines for launch vehicle upper-stage propulsion.
- Green storable propulsion for exploration missions, including descent and ascent throttleable propulsion.
- Achievement of significant cost improvements due to use of Additive Layer Manufacturing.
- Development of feeding systems with electric pumps/HTP-powered turbines.
- Capability to design and test engines of thrusts up to 100 kN within national partnerships.
- Liquid rocket engine igniters based on hydrogen peroxide catalytic decomposition and pyrogen igniters based on environmentally-friendly composite propellants.

Key products under development:

- 10 – 20 N bipropellant thruster for Green Space Propulsion (ESA funding).
- 450 N Green Liquid Apogee Engine providing unprecedented performance and capabilities (ESA funding).
- Green upper-stage propulsion for small launch vehicles (reignitable, thrust 5-8 kN)*
- Deep-throttling green propellant engines for landers and reusable rocket stages (ESA funding).

* Project financed by the National Centre for Research and Development aiding national security and defense activities.

HYBRID ROCKET MOTORS

- Robust technology for space transportation.
- High performance due to use of 98+% Hydrogen Peroxide.
- Experience with Additive Manufacturing of complex geometry fuel grain.
- Patented hybrid fuel technology.

Key products under development:

- Green propellant hybrid rocket motor with Polyethylene fuel 4 kN thrust version successfully flown during suborbital missions, highly scalable technology.

SOLID ROCKET MOTORS

- Low-cost composite-structure solid rocket motors, tested in-flight.
- High performance composite, as well as double base, propellants.
- Solid rocket motors for microlauncher applications with propellant mass fractions in line with top systems of their size produced worldwide.
- Development of small motors: for stage separation, spin control, ullage solid rocket motors etc.
- Solid propellant gas generators – use of low temperature fuel-rich solid propellant with no solid combustion products, serving as a robust medium for turbine operation.

Key products under development:

- SRM for de-orbit using aluminum-free high-performance propellant (ESA funding in 4 consecutive projects), the only European SRM for de-orbit meeting ESA Clean Space requirements and spacecraft acceleration limits.
- 50 kN solid rocket booster*.
- 6 kN solid rocket motor for rocket-assisted take-off for UAVs.

* Project financed by the National Centre for Research and Development aiding national security and defense activities.

PROPULSION SYSTEMS

- Components for use with state-of-the-art and green propellants:
 - Propellant tanks,
 - Valves,
 - Tubing,
 - Structures.
- Subsystems.
- Integration and testing.

Key products under development:

- Green Liquid Propulsion system for HYPERSAT platform (NCBiR funding).
- Flow control valves for mono and bipropellant RCS thrusters and apogee engines (ESA funding).
- Latch valves (ESA funding).
- Pyrotechnical valves.
- Demisable propellant tank (ESA funding).
- Throttleable Liquid Propulsion Demonstrator (TLPD), utilizing HTP 98% as oxidizer, aims to provide deep-throttle solution for reusability and increased mission flexibility for European Space Transportation Systems (ESA funding).





GREEN PROPELLANTS

The Institute's crucial achievement is the development and commercialization of the method for preparing hydrogen peroxide, in particular High-Test Peroxide – HTP, which is utilized in a wide range of industries.

THE PROPELLANT LABORATORY REALIZES THE FOLLOWING TASKS:

- Research on propellants for novel liquid, hybrid and gel propulsion systems.
- Research on fuels hypergolic with Hydrogen Peroxide.
- Development of low-smoke advanced solid rocket propellants.
- Research on next-generation high performance green propellants.
- Development of catalysts for monopropellant applications.
- Research on chemical compatibility of various engineering materials with propellants.

THE EQUIPMENT WITHIN THE CHEMICAL LABORATORIES INCLUDES INTER ALIA:

- Nicolet iS50 FT-IR Spectrometer with a built-in ATR.
- Vhx 7000 digital microscope.
- Laboratory muffle furnace type FCF 22 SHM.
- Vibratory Sieve Shaker AS Control.
- Planetary Ball Mill PM 100.
- Setup for casting solid rocket propellants equipped with a casting chamber, casting funnel, thermostat, vacuum pump and a vibrating table.



HYDROGEN PEROXIDE

The Space Technology Center has over ten years of experience working with HTP grade hydrogen peroxide. In 2011, scientists and engineers from Łukasiewicz – Institute of Aviation developed a technology for producing hydrogen peroxide with a concentration above 98%. Concentrations up to 99.99% can be obtained. Łukasiewicz Research Network – Institute of Aviation holds several patents for this technology and secured the solution in over 20 countries worldwide.

THE HYDROGEN PEROXIDE LABORATORY FOCUSES ON:

- Development and optimization of modern methods for obtaining HTP.
- Research on HTP storability.
- Analytics e.g. study of trace amounts of metals and determination of trace amounts of ions in accordance with MIL-PRF-16005F, determination of evaporation residue, compatibility tests, organic and inorganic carbon content, microscopical sizing and assessment of the number of particles from aerospace fluids on membrane filters.
- Introducing HTP to the market for the benefit of the European space propulsion community.

THE LABORATORY OFFERS ANALYTICS:

- Study of trace amounts of metals and determination of trace amounts of ions in accordance with MIL-PRF-16005F (Avio 200 ICP Optical Emission Spectrometer).
- Determination of evaporation residue.
- Compatibility tests.
- Organic and inorganic carbon content (Sievers InnovOx ES Laboratory Total Organic Carbon (TOC) Analyzer).
- Microscopical sizing and counting particles from aerospace fluids on membrane filters.



ILR-33 AMBER 2K

The ILR-33 AMBER 2K rocket is a suborbital vehicle of Łukasiewicz Research Network – Institute of Aviation. Fully designed in-house, it proves capabilities in terms of larger system development. It is offered as an autonomous product, as well as a platform providing dedicated services. It has been launched three times and demonstrated successful recovery on both: sea and land. The main stage is propelled by a hybrid rocket motor and is assisted by two solid rocket strap-on boosters, which enable adapting the mission to specific payload needs.

ILR-33 AMBER 2K DATA

Length	4.6 m
Main core diameter	230 mm
Apogee	100 km
Maximum velocity	1300 m/s
Payload	10 kg
Maximum G-force	14 g
Microgravity duration (10 ⁻³ g, 5 kg)	150 s

BOOSTERS

Type	Solid rocket motor
Maximum thrust	2 x 16 000 N
Burn duration	6 s
Combustion chamber	Composite structure

MAIN PROPULSION

Type	Hybrid rocket motor
Oxidizer	Hydrogen peroxide (H ₂ O ₂), concentration 98%+
Fuel	Polyethylene
Maximum thrust	4 000 N
Burn duration	40 s
Combustion chamber	Composite structure





SPACE TRANSPORTATION

Space Technologies Department is capable of launch vehicle design and performance analysis. Mission profiling is within area of Łukasiewicz Research Network – Institute of Aviation’s competences. The ILR-33 AMBER 2K rocket is the workhorse in-flight suborbital test platform. Demonstrated competences and validated systems in the area of suborbital rockets can be upscaled and used in microlaunchers.

Apart from dedication to suborbital rockets, since 2007 small launch vehicle studies have been on-going. Recent efforts have the goal to enable the development of space transportation systems for launching small satellites to Low Earth Orbits and delivering payloads to Sun-Synchronized Orbits, taking the advantage of international cooperation.

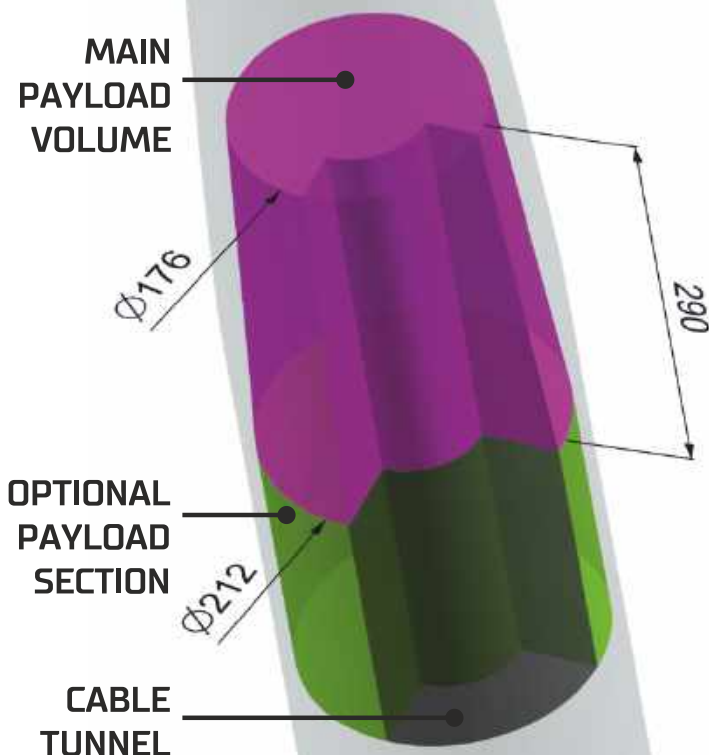
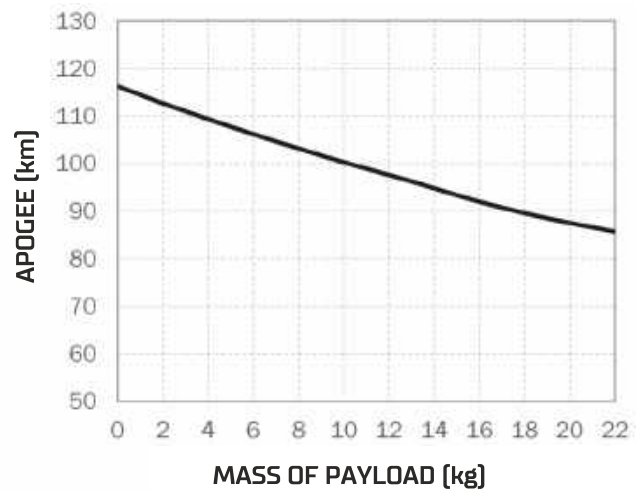
Moreover Łukasiewicz Research Network – Institute of Aviation has also been developing several throttleable rocket engines that will enable reusability of future vehicles, but can be also used for more demanding missions (i.a. lunar, planetary descent and landing). Capabilities of such solutions are verified by the use of different in-flight test platforms (such as FROG, developed in cooperation with ESA and CNES).

A vertical rocket launch is shown against a sunset sky. The rocket is a thin, dark line at the top, with a bright orange and yellow plume of fire and smoke trailing down to a dark silhouette of a mountain range at the bottom. The sky transitions from a deep blue at the top to a bright orange near the horizon. The text "NEW SPACE TRANSPORTATION SYSTEMS" is written in white, bold, italicized capital letters on the right side of the image.

***NEW SPACE
TRANSPORTATION
SYSTEMS***

SUBORBITAL FLIGHT OPPORTUNITIES

The main goal of the ILR-33 AMBER platform is to validate key technologies developed for use in modern suborbital rockets, satellites and small launch vehicles. AMBER is an affordable, scalable and green vehicle, enabling efficient microgravity experimentation and atmospheric sounding. It can provide up to 150 seconds of microgravity environment for a 10 kg payload. The basic version of the vehicle has been successfully validated in flight.





ROCKET TECHNOLOGY ENGINEERING SERVICES

Łukasiewicz Research Network – Institute of Aviation has over 50 years of experience in space technologies. This includes satellite flight hardware and a wide portfolio of rockets and missiles. Pursuing engineering excellence and supporting global sustainable development, Łukasiewicz Research Network – Institute of Aviation is interested in international cooperation. With a wide range of services dedicated to aerospace vehicle design and optimization, unique development capabilities are offered as services.

VEHICLE AND PROPULSION DESIGN

- Solid, hybrid and liquid rocket propulsion systems.
- Mechanisms, valves, bearings.
- Composite structures.
- Navigation and control systems.
- Flight-computers and other electronic systems.
- Structures and simulations (Finite Element Method).
- Aerothermodynamics analysis including rarefaction effects, combustion modelling (Computational Fluid Dynamics).
- System-level studies.

SOFTWARE

- Computational Fluid Dynamics tools.
- 3D solvers for solid and hybrid rocket motor internal ballistics, compatible with CAD software.
- 6-degree-of-freedom simulations of rocket and spacecraft dynamics.
- Cost engineering tools - state-of-the-art parametric and bottom-up methods.

SYSTEM VALIDATION AND TESTING

- Rocket propulsion system and component characterization.
- Non-Destructive Testing.
- Environmental testing.
- Wind tunnel testing.
- Material testing - strength, fatigue etc.
- Chemical characterization.





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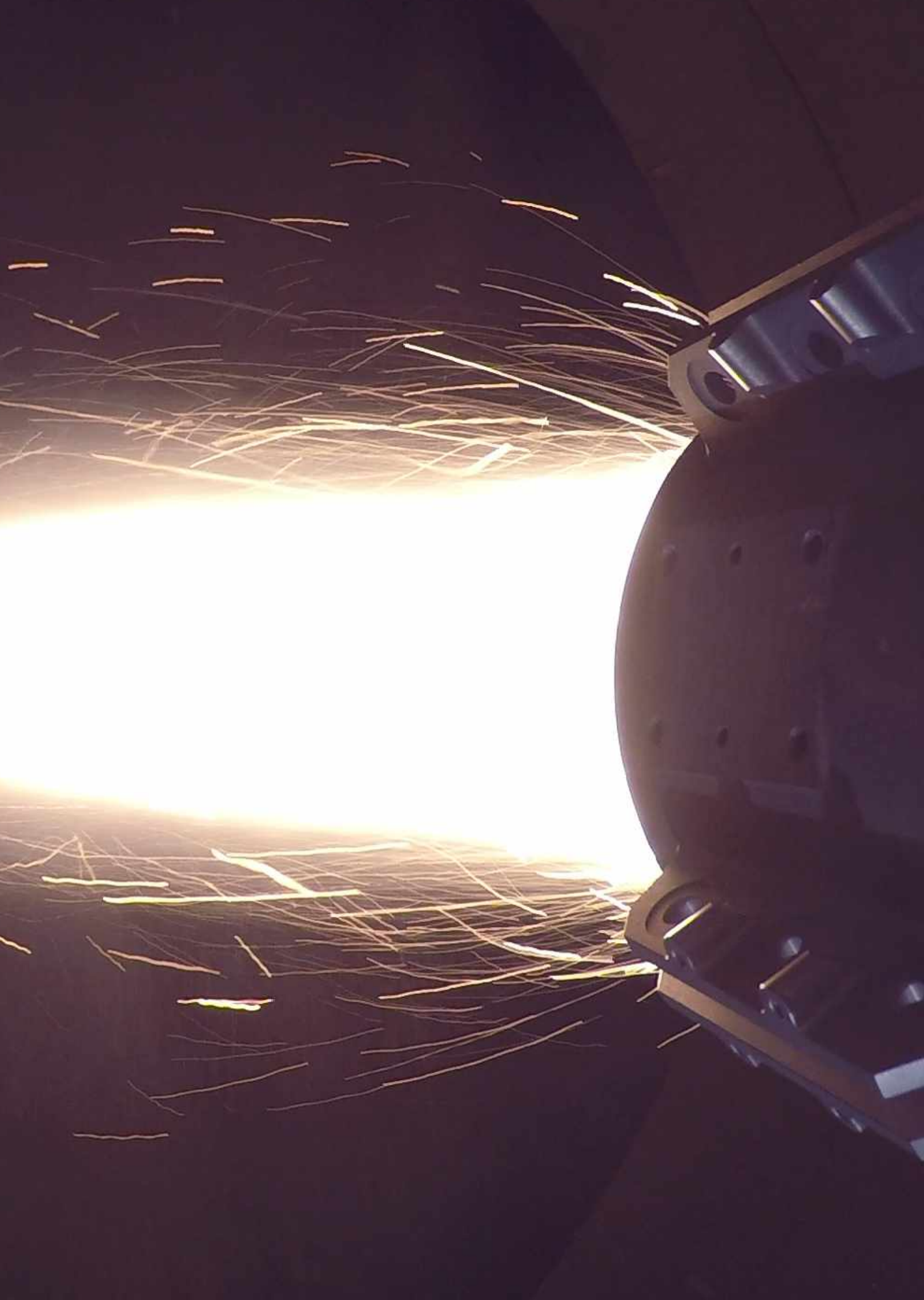
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ROCKET AND SPACECRAFT PROPULSION TESTING SERVICES

Łukasiewicz Research Network – Institute of Aviation’s indoor test bench, equipped with state-of-art measurement systems allows high flexibility and meeting needs off all costumers. The control application is working on a PXI real-time machine what guarantees reliability and security with a minimum delay and high frequency acquisition rates. Adequate procedures include failure modes prediction, what ensures maximum safety of test specimens.

The facility accommodates engine firing setups, feeding systems, an integration room, control room, chemical laboratories and a test stand for injector characterization equipped with a 3D PIV laser measurement system. During the last 3 years, on basis of High Speed Imaging and Thermovision, experience with recording and analysis of ignition devices, combustion chambers, injectors, hypergolic ignition, drogue gun devices and even launches of rockets has been gained.

Tests of systems up to 15 kN of thrust are possible in-house and up to 100 kN using facilities of Łukasiewicz Research Network - Institute of Aviation’s Partners.



ROCKET SUBSYSTEMS AND COMPONENTS

Apart from dedication to propulsion the Institute has developed crucial subsystems for rocket vehicles and spacecraft. Gained know-how enables to design specifically addressed components.

PYROTECHNICAL DEVICES

- Drogue guns, pyrotechnic cutters, cumulative linear charges, pyrovalves, igniters.

RECOVERY SYSTEMS FOR ROCKETS

- Parachute-based systems, wind tunnel testing, utilization of flat spin phenomenon, drop tests, simulations, sea recovery systems.

CONTROL AND ELECTRONIC SYSTEMS FOR ROCKETS

- On-board computers, launch management systems, data acquisition, control systems.

SEPARATION MECHANISMS

- Booster separation systems, main stage separation, retro-propulsion.
- Łukasiewicz Research Network – Institute of Aviation successfully demonstrated the following methods of stage separation:
 - “Fire in the hole”,
 - Pyrotechnical separation,
 - Aerodynamic stage separation.



AVIONICS ROCKET CONTROL SYSTEMS

The Avionics Department at the Łukasiewicz Research Network - Institute of Aviation works on the avionics equipment of rockets in three areas.

MEASUREMENTS

The team has extensive experience in the integration of measurement systems, including basic flight parameters such as linear and angular velocity and the spatial position of the rocket. The team has developed proprietary inertial navigation algorithms that enable short-term autonomous navigation calculations. They were used in the rocket computers developed by the Institute.

CONTROL

Algorithms have been developed to control the flight of rockets made at the Institute. In the AMBER rocket, the on-board computer controls the rocket's flight by means of the coordinated tilting of the steering surfaces, i.e., four canards placed symmetrically at the front of the rocket. In other rockets, this is achieved by means of control engines placed around the rocket fuselage.

SPECIAL FEATURES

Algorithms responsible for the implementation of the assumed flight plan and the electrical initiation of other rocket systems have also been developed, such as: a launch system, a separation system, or a landing part recovery system. One such solution is the designed and manufactured AMBER on-board computer.

The developed algorithms and control methods are implemented by on-board computers that have been designed, performed and tested in a certified laboratory of the Avionics Department.

ONBOARD COMPUTER FOR THE ILR-33 AMBER 2K ROCKET

As part of the ILR - 33 AMBER 2K program projects, the Institute's engineers have developed a mission control computer with the following functionalities:

- Performance of navigation calculations according to the author's inertial navigation system (INS) algorithms.
- Missile flight control.
- Providing telemetry and video communications between the rocket and ground control station over a distance of up to 100 km.
- Starting of rocket pyrotechnic initiators.



ENVIRONMENTAL TESTING OF SPACE SYSTEMS

The Łukasiewicz Research Network - Institute of Aviation conducts research in the field of resistance and endurance to mechanical and climatic exposure, as well as the functional testing of products. Due to the significant development of the space sector in Poland, as well as the projects implemented at the Łukasiewicz Research Network - Institute of Aviation, the scope of the offer has been extended to include the research of products and solutions used in space systems - artificial satellites or rockets.

ENVIRONMENTAL RESEARCH LABORATORY

The equipment currently in our possession enables us to perform various tests according to space standards or manufacturers' guidelines, such as high acceleration vibrations, temperature changes or reduced pressure. It is also possible to use the portable clean room during tests.

Since 1997, the laboratory has been certified by the Polish Centre for Accreditation - Certificate No. AB 132. As part of the accreditation for compliance with the requirements of PN-EN ISO/IEC 17025:2005, the laboratory conducts tests in the following areas: resistance and endurance to mechanical and climatic exposure, as well as functional tests of products.

TVAC CHAMBER

One of the most important aspects in environmental research is the vacuum that can be achieved in specialized chambers. Taking this into account, the decision was made to expand the capabilities of the Environmental Research Laboratory through the planned purchase of a Thermal Vacuum Chamber (TVAC).

In the chamber, the lowest pressure achieved is 10^{-6} mbar. Temperatures can vary from -180°C to $+165^{\circ}\text{C}$ and the usable volume is 3 m^3 . This will be the first such device used in Poland. In combination with the other equipment of the Environmental Research Laboratory, it gives certainty of much greater research possibilities in the country, as well as hopes for faster and more effective development of the Polish space sector.

The Łukasiewicz Research Network - Institute of Aviation plans to establish a unique Small Satellite Research Center. The centre will also be equipped with a TVAC.



IMV SECURE THE FUTURE

RT

750

ROTECNICA

IMV I250/SA4M-CE SHAKER
WITH MEDALLION II CONTROLLER

- Vibration frequency: 5 -2500 Hz.
- Max. displacement amplitude: 50 mm.
- Maximum strength: 40 kN.
- Maximum acceleration:
 - For sinusoidal vibrations: 500 m/s²,
 - For random vibrations (rms): 140 m/s²,
 - For shock: 800 m/s².
- Additional equipment:
 - Sliding table, dimensions: 750 x 750 mm,
 - Head-expander, dimensions: 700 x 700 mm,
 - Head-expander, diameter: 610 mm.

CLIMATS EXCAL 7728-HE ENVIRONMENTAL
TEST CHAMBER WITH COIL CONTROLLER 3

- Working space dimensions:
900 x 950 x 900 mm (770 l).
- Temperature range: -90°C ÷ +200°C.
- Temperature change speed: 17°C/min
in the temperature range from -55°C to +180°C.
- Humidity range: 20% ÷ 95%.

CLIMAS 1000 FCV 70/1 THERMOBLOCK
WITH VS HELIX CONTROLLER

- Working space dimensions:
1000 x 1000 x 1000 mm (1000 l).
- Temperature range: -70°C ÷ +180°C.
- Pressure range:
 - From atmospheric to 10 hPa
- without temperature control,
 - From atmospheric to 50 hPa
- with temperature control,
 - From atmospheric to 1070 hPa.





SATELLITE REMOTE SENSING

An important area of the Institute's activity is widely understood remote sensing, including the acquisition and analysis of Earth observation data. The modern technical facilities and the experience of the employed specialists enable the implementation of interdisciplinary projects. We integrate and process data obtained from numerous sources in order to create operational, competitive tools for modern industry, administration and natural resource protection.

SATELLITE IMAGE ANALYSIS

- Analyses of a specified area in accordance with set criteria, analysis of optimal investment location.
- Integration and development of large data sets with particular emphasis on aerial and satellite images.
- Land Cover classification, creation of algorithms for object detection and identification.
- Creation of raster maps and vector maps.
- Analyses for the needs of modern agriculture and forestry, yield forecasts, creation of fertilization plans, and evaluation of biomass quantity.
- Analysis of vegetation condition and multi-criteria analysis of areas covered with vegetation.

*The Institute has a country-wide unique **Earth Observation Mission Control Centre (Centrum Operacyjnej Misji Obserwacyjnych Ziemi (COMOZ))**, which enables the simultaneous acquisition, processing, sharing, and visualization of data.*

*Among the large-scale key projects that are based on aerial and satellite data is the **FITOEXPORT** project planned for implementation in 2019-2021. One of the core objectives of the project that have been defined for the Institute is the development and implementation of modern remote sensing methods and the support of the activities of the Main Inspectorate of Plant Health and Seed Inspection.*

GNSS USAGE

- Precise positioning and navigation using GNSS and INS.
- Geodetic measurements and vector map creation, support for the investment process.

ATMOSPHERE PROBING

Probing the atmosphere with weather balloons and aircraft

- Measurement from the surface of the Earth up to an altitude of 35 km.
- Atmosphere probing to determine the vertical profiles of wind direction and speed and the distribution of pressure and temperature.
- Detection of gases and determination of vertical profile atmospheric composition.
- Direct measurement with radiosonde and weather balloon.
- Data presentation in both tabular and graphical form.
- Real-time data transmission.

Low ceiling atmosphere probing using unmanned vertical take-off and landing aircraft with integrated electronic wind meter

- Measurement of wind speed and direction by ultrasonic method from the earth's surface up to a height of 2 km.
- Possibility of continuous measurement of wind speed and direction for up to 30 minutes, depending on the height of the probe.
- Detection of gases and determination of the atmosphere composition in the vertical profile.
- Data presentation in tabular and graphical form.
- Real-time data transmission.

Prepared by the remote sensing facility based on Sentinel-2 images.





ASTROBIOLOGY

Łukasiewicz Research Network - Institute of Aviation researches the integration and automated analysis of data from optoelectronic sensors, chromatographs, and spectrometers selected in designed space missions to the ocean worlds of the outer Solar System (Jovian and Saturnian satellites: Europa, Ganymede, Callisto, Enceladus, and Titan). This work aims to develop methods, techniques, and solutions for the remote detection of the potential presence of archaeons and bacteria on their icy surfaces, in geyser plumes, and planetary rings. These research results are also the basis for an automated service for the low-gravity microbiological experiments on suborbital rockets.

EXAMPLES OF CONDUCTED WORKS AND RESEARCH PROJECT

- Remote detection of methanogenic bacteria and archaea in the water plumes of Enceladus, the Saturnian satellite, based on kinetic models of microbiological component transport in the subsurface ocean, through ice crust, and geyser plume to Saturnian E-ring.
- Sedimentation of the organic molecules near geyser plumes origins in Bagdad and Damascus breaks. Cassini probe Imaging System multispectral data investigation. Preparing boundary conditions of the instruments for future astrobiological landing missions.
- Estimation of the influence of biotic component presence on the bubble scrubbing effect under the conditions on the surface of Enceladus. Gathering of reference multispectral data in vacuum chamber experiments as an analog of space conditions. Instrumental analysis (multispectral cameras, mass spectrometers) in proposed missions to the outer Solar System: Enceladus Orbiter (NASA), Enceladus Life Finder (NASA), Explorer of Enceladus and Titan (ESA, NASA) and THEO mission (JPL, MissionX).



IT SOLUTIONS

The Łukasiewicz Research Network - Institute of Aviation creates and delivers original IT solutions. One of the areas of specialization is creating complete IT solutions, with particular emphasis on application development. They support modern management, automation and process optimization in various branches of economy. Activities carried out in the area of new technologies in the IT sector build the potential of enterprises and have a direct impact on the level of development of the country.

AREAS OF SPECIALIZATION:

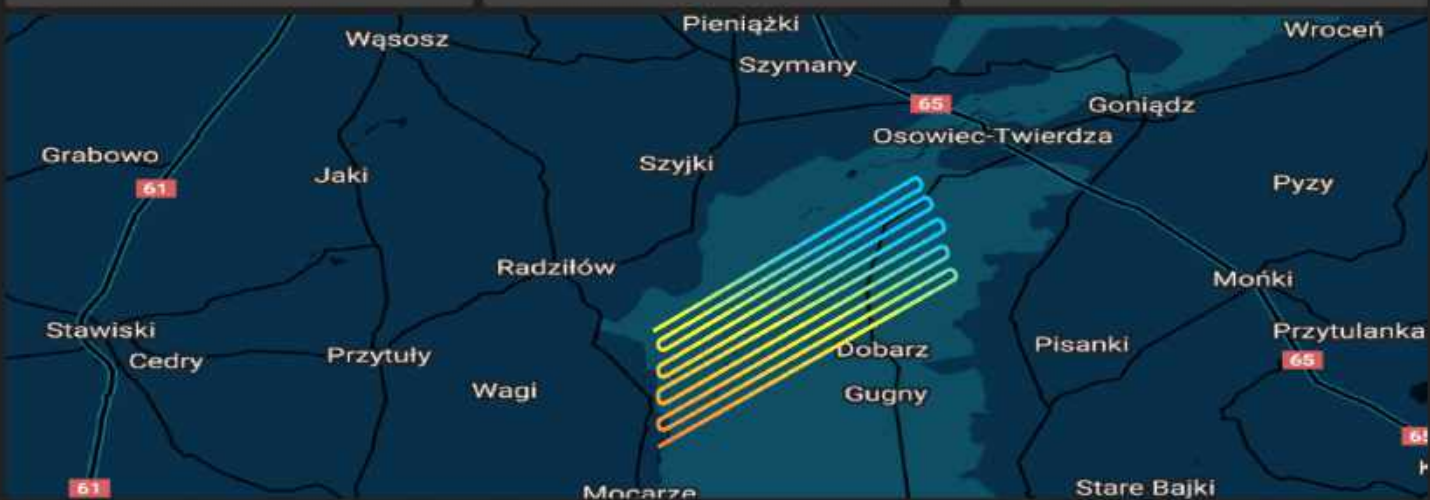
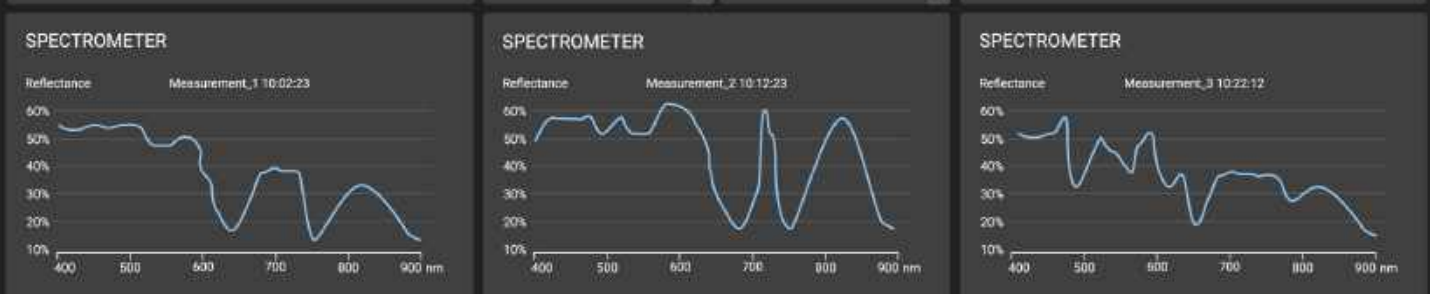
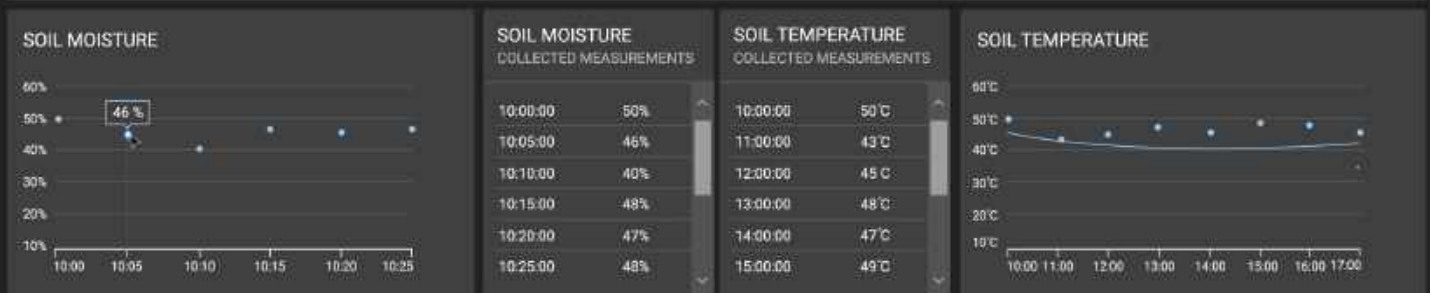
- Creation of Geographical Information System (GIS) and development of software for the modern management and optimization of industrial processes.
- Creation, integration and calibration of modern image acquisition systems including multispectral techniques and the Internet of Things (IoT).
- Advanced algorithmics, integration and automatic development of large data sets with special emphasis on aerial and satellite images:
 - Creation of photogrammetric products,
 - Land cover classification,
 - Object detection and identification.
- Measurement and sharing of spectral signatures of objects, analysis of spectral curves, and extraction of information about biophysical parameters of objects based on their spectral data.
- Advanced visualization of geodata with particular emphasis on 3D modelling and integration of vector, raster and descriptive data.

The Copernicus Masters award in the Sustainable Development Challenge category, received in 2017 by the scientists of the Łukasiewicz Research Network - Institute of Aviation, is still the only achievement of this type obtained by scientists from Poland. The award was granted for creating an innovative web and mobile application for precision farming.

Home > Mission_1

Mission_1

LOCATION	MISSION DATE	START TIME	END TIME	MISSION TIME	ROBOT	MISSION VISIBILITY
Puławy 51.418006, 21.969516	18.03.2020	10:00	10:25	00:25:11	Robot_1	Private



Home

Missions

Mission_1	Puławy		18.03.2020	Robot_1	Private
Mission_2	Wrocław		16.03.2020	Robot	Private
Mission_3	Kielce		16.03.2020	Robot	Private
Mission_4	Karczma Borowa		23.05.2019	HESOFF	Public
Mission_5	Krotoszyn		23.05.2019	HESOFF	Public
Mission_6	Krotoszyn		5.04.2019	HESOFF	Public

COOPERATION

Łukasiewicz Research Network – Institute of Aviation realizes projects from the European Space Agency (ESA), European Commission (EC), European Defence Agency (EDA), Polish Space Agency (POLSA) and National Center for Research and Development (NCBiR). Intensive cooperation with the space technology industry is present, with commercial activities carried out for leading European entities working with space flight hardware.

EUROPEAN COMMISSION	EUROPEAN SPACE AGENCY
EUROPEAN DEFENSE AGENCY	POLISH SPACE AGENCY
THE NATIONAL CENTRE FOR RESEARCH AND DEVELOPMENT	GERMAN AEROSPACE CENTER (DLR)
THE NATIONAL CENTRE FOR SPACE STUDIES (CNES)	THE FRENCH AEROSPACE LAB (ONERA)
SWEDISH SPACE CORPORATION (SSC)	AIRBUS SPACE & DEFENCE
THALES ALENIA SPACE	ARIANE GROUP
OHB SYSTEM AG	NAMMO
AVIO	JAXA
GMV	



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