



Cooperation between science and industry in aeronautical sector in Poland in the Centre of Advanced Technologies AERONET Aviation Valley



Gdansk, May 12, 2011

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Centre of **Advanced Technologies AERONET Aviation Valley**, Rzeszów

Topics

- **Research capacity in aeronautics in Poland**
 - *Innovation Centers and Technological Parks in Poland, Centres of excellence and centres of advanced technologies*
 - *The system of research and implementation of innovation and technology in Poland*
- **CAT AERONET Aviation Valley**
 - *structure, partners, mission and activities*
- **Main projects overview**
 - **No. PBZ-MNiSW-03/I/2007 DEVELOPMENT OF MANUFACTURING TECHNOLOGY FOR TURBINE ENGINE HOT SECTION COMPONENTS USING DIRECTIONAL CRYSTALLIZATION METHOD – 2007-2011**
 - **No. PBZ-MNiSW-01/I/2007 DEVELOPMENT OF TECHNOLOGY FOR SURFACE LAYER MODIFICATION OF ADVANCED STRUCTURAL MATERIALS – 2007-2011**
 - **INDIVIDUAL KEY PROJECT No. POIG.01.01.02-00-015/08 MODERN MATERIAL TECHNOLOGIES IN AEROSPACE INDUSTRY – 2008-2013**



The system of research and implementation of innovation and technology in Poland

- **Research networks;** *They are formed as joint structure of regional research and education centres,*
 - **Maria Curie Centres,**
 - **Centres of Transfer of Technologies - CTT,**
 - **Technology and Research Parks,**
 - **Incubators,**
 - **Pre-incubators**
 - **Centres of Excellence**
- additionally*
- **22 technological platforms**

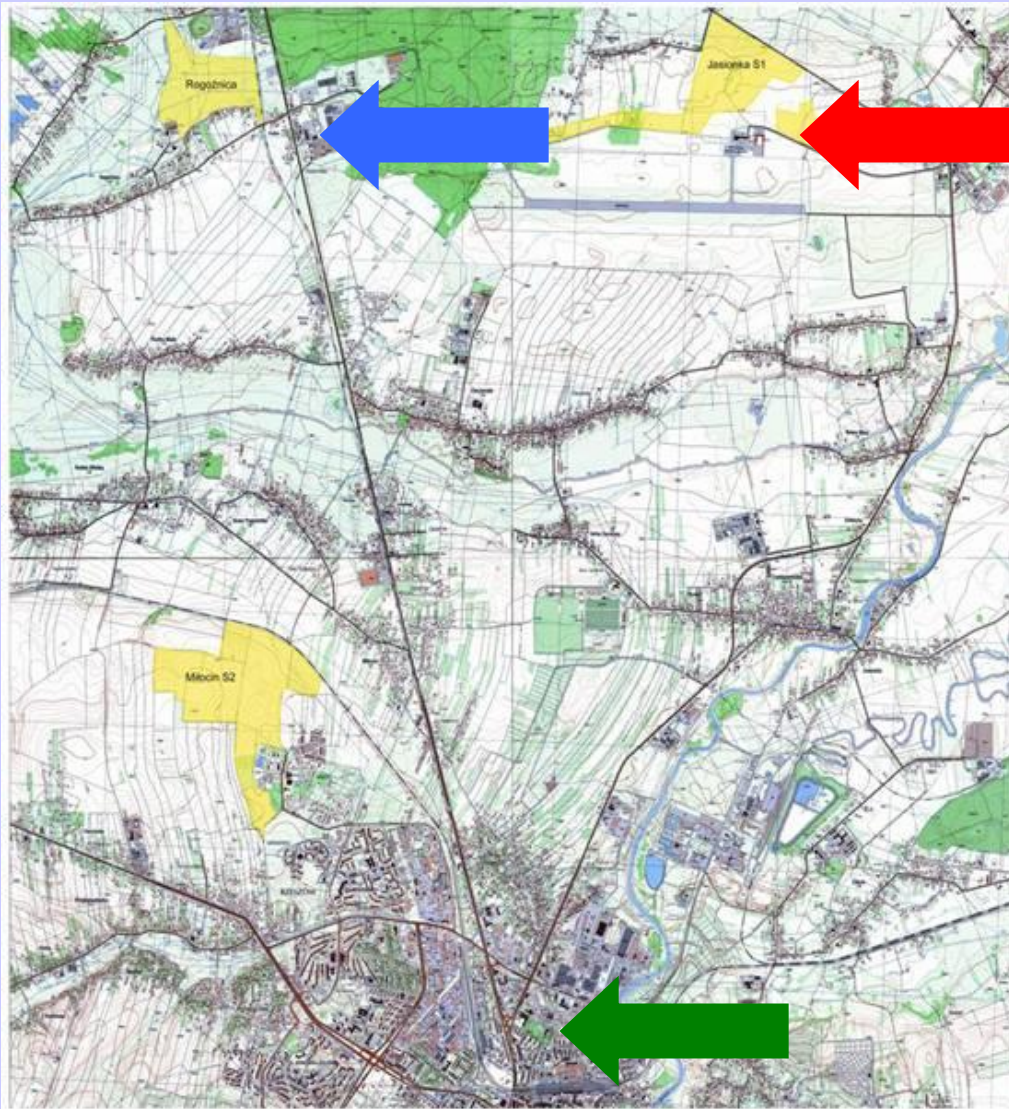
Polish Technological Platforms

- **PP of Materials**
- PP of Innovative Medicine
- PPT of the Internal Security
- PPT of Work Safety in the Industry
- PPT of the Biotechnology
- PPT of Construction
- **PPT of Aviation**
- PPT of Metals
- PPT of Environmental Protection
- PPT of Opto- and Nanoelectronics
- PPT of Production Processes
- PPT of The Textile Industry
- PPT of Forestry and wood
- PPT of Safety
- PPT of Communication and mobile Technologies
- **PPT of Road Transport**
- **PPT of Rail Transport**
- **PPT of Water Transport**
- PPT of Hydrogen & Fuel Cells
- PPT of Sustainable Chemistry
- PPT of Sustainable Energy Systems & Clean Carboenergy
- PPT of Food



An example of Technology and Research Park near Rzeszów

Location and zones of the Park



S1 zone - situated around Rzeszów Jasionka Airport; 70 hectares, green-field,

S2 zone - situated in the Glogow Community, 47 hectares, green-field,

S3 zone - Academic Preincubator located on the area of Rzeszów University of Technology.

S1 Zone - Situated around Rzeszów Jasionka Airport

Area about 70 ha;

- Industry and high technology services, aviation industry, information technology, chemical, electromechanical industry ;
- Infrastructure:
 - Road network, natural gas, water network, sewage system (construction started in May 2007 and will be completed till December 2007);
 - Electricity network (the construction project is at a final stage of completing);
 - Sewage-treatment plant and water purification plant (planned to be completed in July 2007);
- Special Economic Zone;
- Updated spatial development plan.

S2 Zone – the zone of Enhanced Business Activity

- Area about 40 ha;
- Less technologically advanced industry, logistic;
- Infrastructure:
 - Rebuilding of community road is at a final stage of completing (linking S2 from south with road No. 9);
 - Creating of infrastructure in progress (project - VIII 2007);
 - Total infrastructure will be available in June 2008;
- Special Economic Zone – in the zone since 2007;
- Updated spatial development plan.



The Polish Information and
Foreign Investment Agency

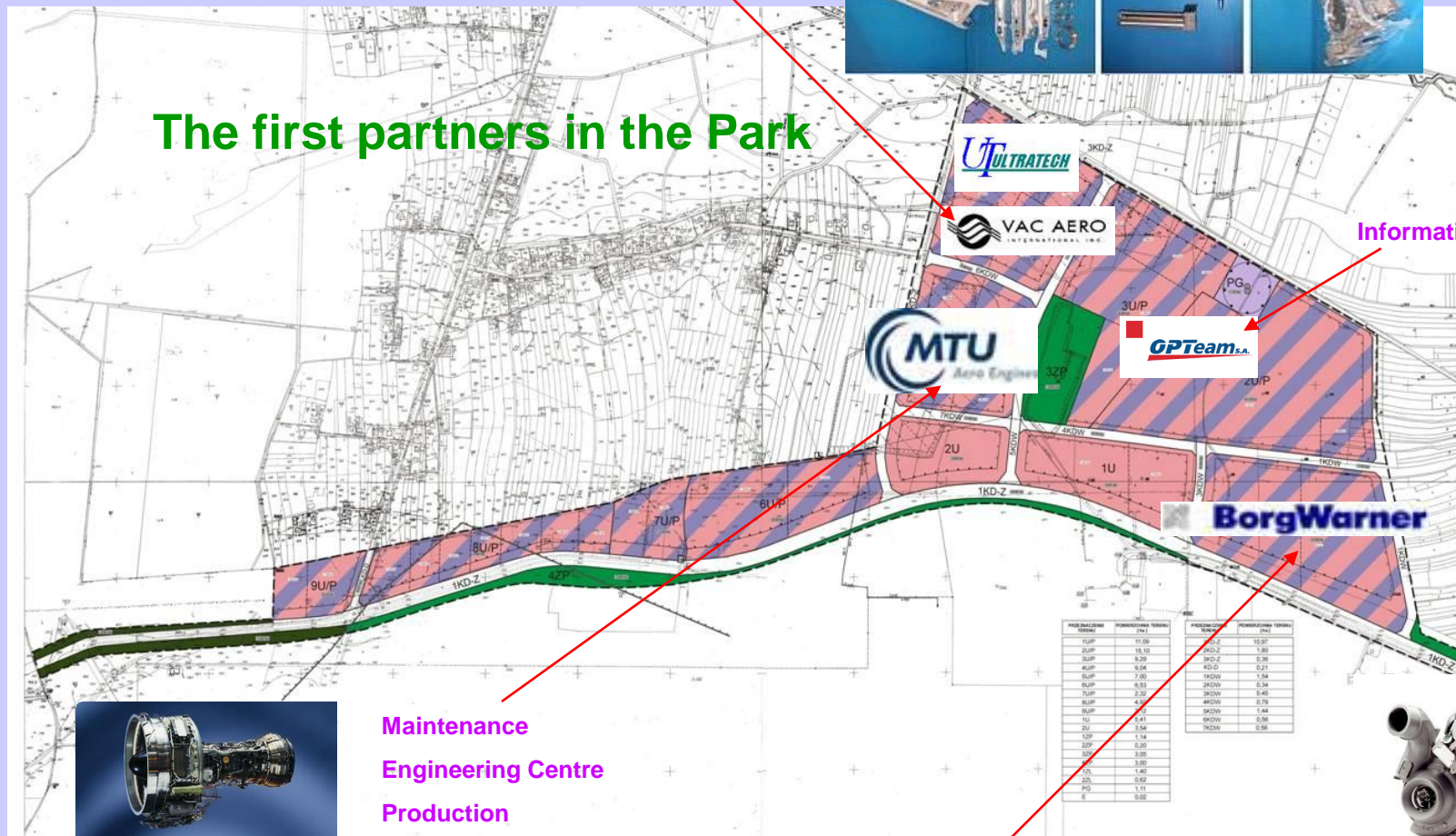


Landing gear parts (Boeing 737 X, CRJ 700)
Door parts (Boeing 757 plane)

- Industry, installations overhaules
- Vacuum brazing
- Nonorganic varnish coatings
- Plasma coatings
- Instruments for aviation



The first partners in the Park



Informatics systems



Maintenance
Engineering Centre
Production



Turbochargers with variable turbine geometrie (VTG) for diesel and gasoline engines



PROJEKTOWANE TYPY	PROJEKTOWANE TYPY	PROJEKTOWANE TYPY	PROJEKTOWANE TYPY
(m)	(m)	(m)	(m)
1U/P	11,08	2KD-Z	10,97
2U/P	15,10	3KD-Z	1,80
3U/P	9,20	4KD-Z	0,56
4U/P	9,04	KD-D	0,21
5U/P	7,00	1KOW	1,54
6U/P	6,83	2KOW	0,34
7U/P	2,30	3KOW	0,48
8U/P	2,30	4KOW	0,79
9U/P	2,30	5KOW	1,44
1U	2,41	6KOW	0,56
2U	2,44	7KOW	0,95
3U	3,00		
4U	1,40		
5U	0,60		
6U	1,31		
7U	0,02		

Centres of Excellence and Centres of Advanced Technologies

- more than **150 entities** have been qualified as the **Centres of Excellence**
(*within the framework of special awarding procedure executed Ministry of Science and Informatics – now Ministry of Science and Education*),
25 of them are involved in environmental technologies.
- **26 Centres of Advanced Technologies** (Polish acronym: **CZT**) have been established,
half of them area involved in environmental technologies development.



Centre of Advanced Technologies

- **The CAT are interdisciplinary scientific consortia** consisting of scientific entities leading of research and development on top-level as well as from other entities involved in research and development works, and implementation of innovation.
- *The main objectives of these centres are with the aim commercialization of new (mostly national) technologies, products and services in the priority fields of Polish Economy*





The Centre of Advanced Technologies "AERONET - Aviation Valley" was founded in order to realize interdisciplinary, collective and long-term research and training programme as well as effective implementation and commercialization of new technologies aimed at the aerospace industry.

The logo features the words 'AVIATION VALLEY' in dark blue capital letters. Below the text is a red swoosh that ends in an arrowhead pointing to the right.

The main goals are:

to improve the existing manufacturing base,

to create a strong and reliable network of subcontractors and a low-cost supply chain,

to attract foreign investment,

to develop a relationship with other European centres of the aerospace industry,

to promote joint cooperation of the industry with universities of technology, and research centres.



Centre of Advanced Technologies AERONET Aviation Valley



- **Scientific partners**

- **Rzeszow University of Technology** – coordinator
- **Czestochowa University of Technology** – partner
- **Lublin University of Technology** – partner
- **Lodz University of Technology** – partner
- **Silesian University of Technology** – partner
- **Warsaw University of Technology** – partner
- **University of Rzeszow** – partner
- **Institute of Aviation** – partner
- **Institute of Fundamental Technological Research Polish Academy of Science** – partner
- **The Szwedzki Institute of Fluid-flow Machinery Polish Academy of Sciences** – partner
- **Air Force Institute of Technology** – partner
- **Industrial partners**
- **Aviation Valley Association (currently 83 members)** – partner





The Centre of Advanced Technology **AERONET - Aviation Valley** became active in the following main scientific fields pertaining to aviation and related areas:

- Design and testing of aviation structures and propulsions
- Aviation teleinformatics and avionics systems
- Modern materials and surface engineering processes
- Modern production techniques in the aerospace industry
- Aerodynamics



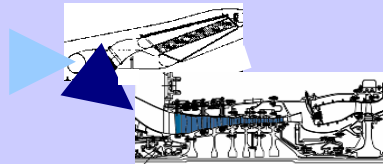


Experience of of AERONET members in realisations of the projects in FP 5,6,7 Examples

EU FP 5, FP 6

Aviation Valley Association companies

- ADLAND, STREP, Adaptive Landing Gears for Improved Impact Absorption, PZL Mielec
- CESAR, IP, Coste Effective Small Aircraft, PZL Mielec
- MagForming, STREP, Magnesium Forming technologies development for the aeronautic industry, ULTRATECH Rzeszow
- FILMFREE – novel digital radiography technology, WSK Rzeszow
- NEWAC, Nickel Alloy Machining Optimization , WSK Rzeszow
- VITAL, New Aero Engine Concepts , WSK Rzeszow



EU FP 7

Rzeszow University of Technology - Projects: HIRF, SCARLETT, FUSETRA



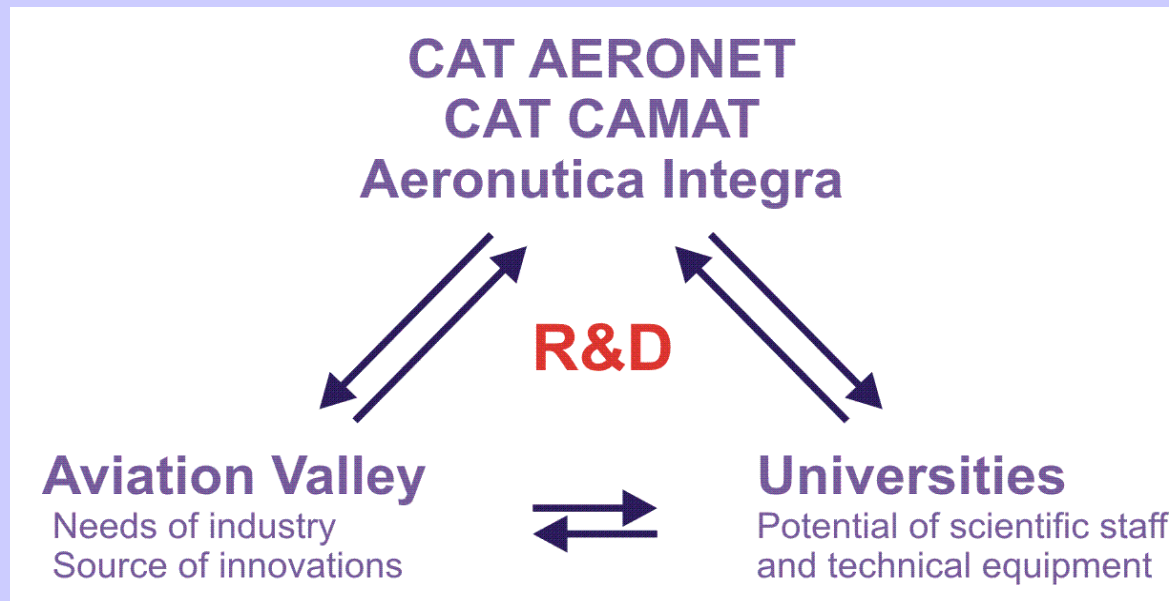
Aviation Valley Association – industrial cluster – partner CAT

- Local initiative
- Supply chain
- 80 Y of tradition
- **90 companies**
- 23 000 employees
- **Rzeszow University of Technology**
- Airport



Main projects overview

The projects are realized as a joint initiative of the **Advanced Technology Center “AERONET”** coordinated by Rzeszow University of Technology.



Aeronautics material testing lab – Poland

How Structural Funds can support Research and Innovation

This project is part of the “**Improving the Competitiveness of Enterprises**” objective and receives a total amount of 25.506.000 PLN (€6.7 million),

75% from the ERDF (about €5 million) and 25% from the public funds of the Ministry of Education and Science).

The main aim of the project, was realized, **to improve competitiveness and innovation by setting up a modern laboratory for R&D activities in the area of aeronautical material testing.**

- currently **next project** is realized to developed this laboratory.





AREAS OF RESEARCH WORK

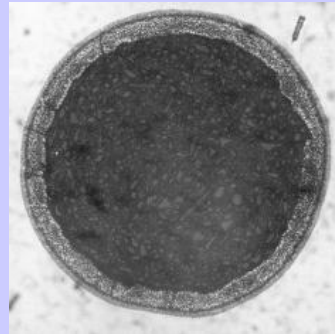
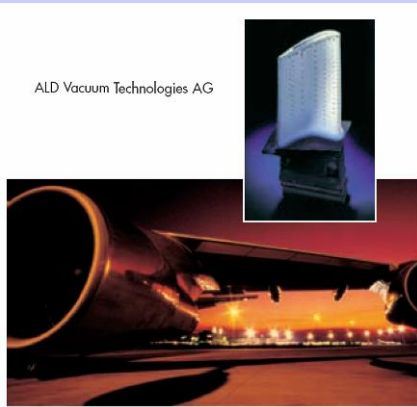
Subject area of scientific research
in R & D Laboratory

Monocrystals
Directional crystallization

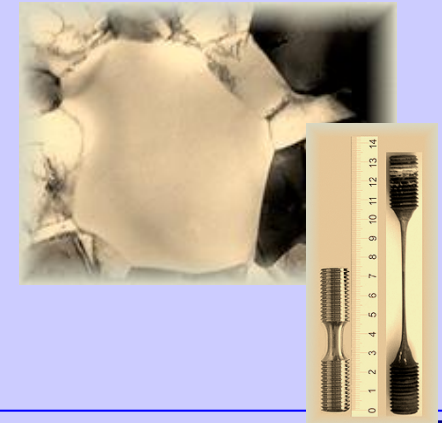
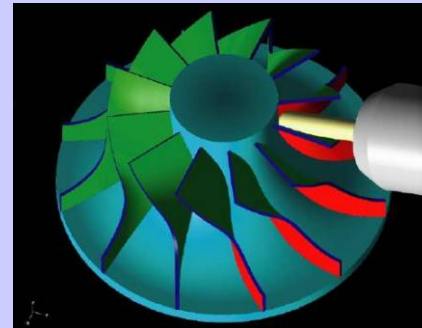
Heat and creep resisting
coatings (CVD)

High speed machining
(HSM)

Materials characterization

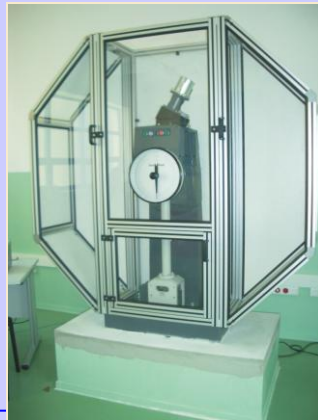


Hot section turbine blade
metallographic cross section of a channel
with 0.5 mm diameter



Main Equipment of the laboratory:

- Gas analyser
- Glow discharge spectroscope (GDS)
- X-ray fluorescence spectroscope (XRF)
- Optical emission spectrometer ICP
- Scanning electron microscope (SEM) with EDS
- Transmission electron microscope (TEM)
- Deformation dilatometer
- Dual-station creep-testing machines - 2 units
- Laboratory furnace for heat treatment
- Digital temperature recorders
- Ultrasonic defectoscope
- Devices for sample preparation
- Standards and elements for spectroscopy
- Mechanical testing machine UTS
- Diffractometer (Rtg) ARL
- Spectrometer (sparc) ARL 3460
- Vacuum furnace BALTZERS



- Vacuum furnace for directional crystallization
- Equipment for generating of CVD coatings
- High speed machining center (HSM)
- Pulsator for fatigue tests
- Hardness tester
- Temperature scanner
- Balancer for rotational tools
- Light microscope equipped with digital image analyser
- Stereoscopic microscope
- Vibration measurement system OUPN
- Impact tester
- Ion milling device
- Calorimeter SETARAM
- Hydraulic testing machine INSTRON

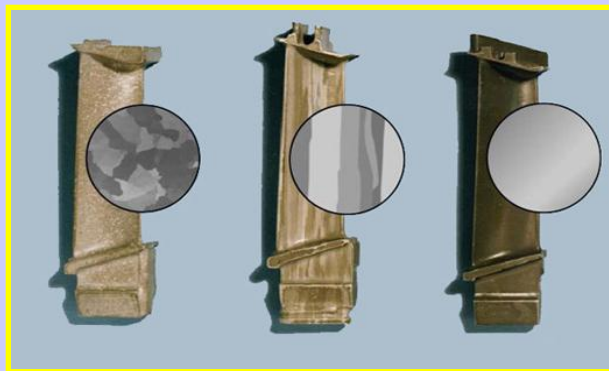
Main projects overview



PROJECT No. PBZ-MNiSW-03/I/2007
**DEVELOPMENT OF MANUFACTURING TECHNOLOGY FOR TURBINE ENGINE
HOT SECTION COMPONENTS USING DIRECTIONAL CRYSTALLIZATION
METHOD – 2007-2011**

under auspices of the MINISTRY OF SCIENCE AND HIGHER EDUCATION

Research and implementation of the technology in the area of directional crystallization and single crystal growing of the nickel base alloys (e.g. turbine blades).



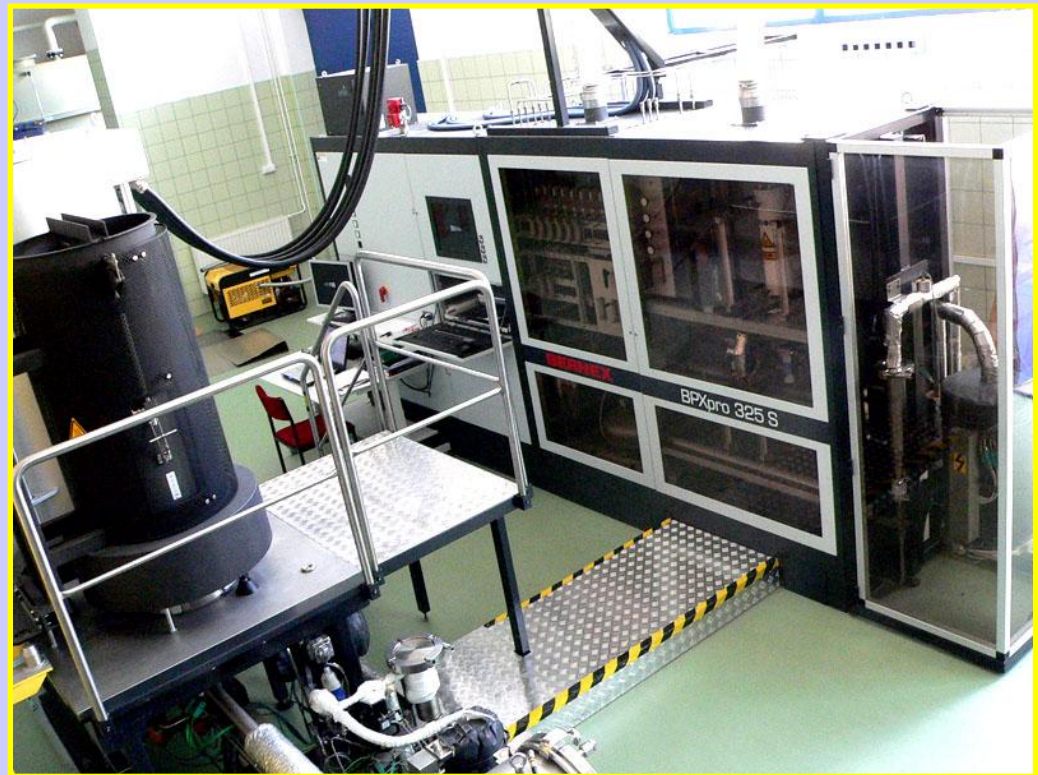
PROJECT No. PBZ-MNiSW-01/I/2007
**DEVELOPMENT OF TECHNOLOGY FOR SURFACE LAYER
MODIFICATION OF ADVANCED STRUCTURAL MATERIALS**
2007-2011

under auspices of the MINISTRY OF SCIENCE AND HIGHER EDUCATION



Thermal barrier coatings
for hot part of engines
e.g. for turbine blades .

Chamber ; 400x800 mm,
Retort : 400 mm.



HEAT AND CREEP RESISTING COATINGS

Laboratory equipment for CVD coatings deposition (*IonBond*)

Deposition of thermal barrier coatings on blades and other turbine engine elements. Research work will lead to development of fabrication techniques.

Requirements:

Deposition of coatings containing aluminium, hafnium, zirconium, silicon and chromium with heat treatment possibility.

Workspace min. 400x800 mm,
retort diameter min. 400 mm,
capacity min. 150 dm³.



Pt-AI MODIFIED COATINGS





INDIVIDUAL KEY PROJECT (STRUCTURAL FUNDS)

OPERATIONAL PROGRAMME „INNOVATIVE ECONOMY”

Priority 1. **Research and development of modern technologies**

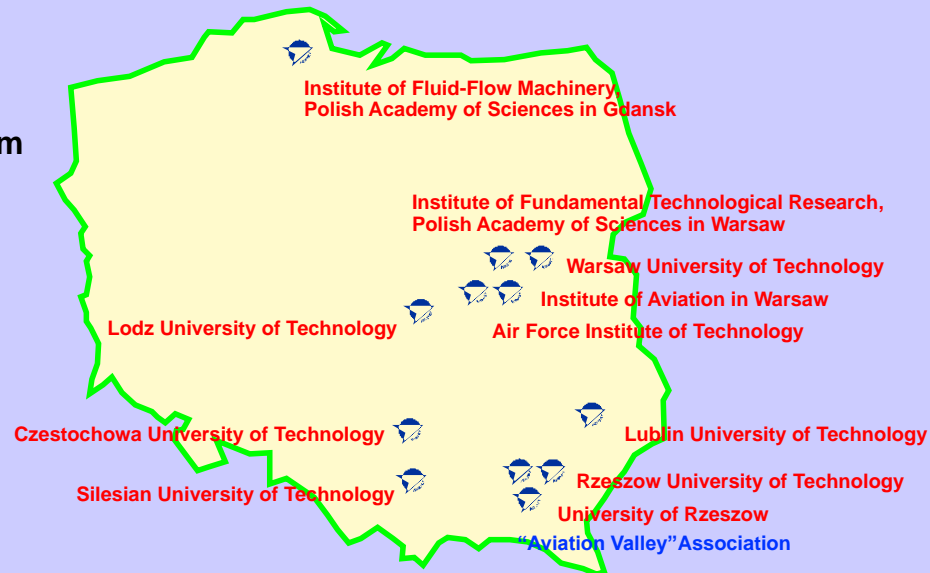
Measure 1.1. **Support of scientific research for the knowledge-based economic development**

Submeasure 1.1.2. **Strategic programmes of scientific research and development**

MODERN MATERIAL TECHNOLOGIES IN AEROSPACE INDUSTRY

2008 - 2013

Project consortium



PROJECT CO-FINANCED BY THE EUROPEAN UNION FROM THE FUNDS OF THE EUROPEAN REGIONAL DEVELOPMENT FUND

Total amount of the project - 85 880 PLN (23.9 mln Euro)

The aim of the project

- **focusing the research work in the field of aviation on the areas which will improve the competitiveness of the Polish economy, particularly the “Aviation Valley” firms.**
- **technological solutions arising from the project will positively affect Polish aviation enterprises , which will lead to the development of the regional as well as national economy.**
- **The improvement of the scientific base and research infrastructure will fuel highly advanced research work enabling knowledge to be transferred to the aviation industry.**
- **development of innovative solutions and modernization of the existing technology.**
- **increasing the competitiveness of our industries and scientific research units.**

Means of realization of the project

Research works realized mainly via :

- **MSc final projects**
- **PhD thesises**
- **Habilitations research works**
- **Innovation solutions (patents)**
- **Obtained technological advanced solutions**
- **Practical applications**
- **Commercialization of B+ R results of the project**



The description of the project

There are fifteen main research tasks realized within the project aimed at the most advanced and rapidly developing area of materials engineering, surface engineering and cutting edge manufacturing technologies in the aerospace industry.

Basing on the results of FORESIGHT project related to materials and technologies in aerospace

The segments of the project were formulated :

ZB1. Development of advanced processes of HSM of almost unworkable aeronautical alloys.

ZB2. Modeling, construction and control of the HSM process taking into consideration the configured machine-instrument-detail system.

ZB3. Development of the technology of effective design and production of cone gear using Gleason Phoenix system.

ZB4. Development of a new, simpler and cheaper toothed gear in place of complicated and expensive planetary gears.

ZB5. Modern mechanical working of magnesium and aluminium alloys.

ZB6. Composite materials of increased strength and thermal resistance with the use of polymeric resins applied in aviation.

ZB7. Plastic forming of magnesium alloys (precision forging, stamping, extrusion and the like).

ZB8. Plastic forming of aeronautical Al (including Al-Li) and Ti alloys.

ZB9. Composite metallic materials in aviation applications (including Glare-type materials).

ZB10. Modern barrier coatings on critical engine parts.

ZB11. Aeronautical materials of advanced structure (monocrystal, directional crystallization).

ZB12. Precision casting of Ni alloys on critical parts of aircraft engines.

ZB13. Development of the technology of remelting nickel alloys with the use of nanopowder modifications.

ZB14. Smart embedded systems based on intelligent materials.

ZB15. Unconventional technologies of joining elements of aeronautical constructions.



Reasons for international collaboration

- Possibilities of conducting European-scale research
- Long tradition of polish aerospace industry
- Active cooperation between science and industry

