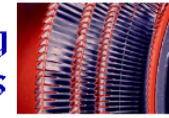


Opportunities to Support EU-Ukraine Cooperation

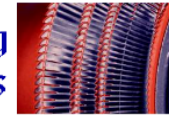
Dr Radosław Przysowa

ITWL - The Air Force Institute of Technology
The TECHNOLOGY PARTNERS Foundation

Zaporozhe, April 25, 2019



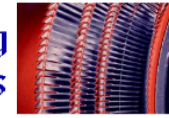
- Research and Technology Organisation, Advanced Technology Centre
- Specialising in RTD and Innovation Management
- Focus on performance of large, interdisciplinary projects
- Private, Non-for-Profit
- Coordinator of the *Cluster*, composed of leading Polish RTOs:
 - ITWL - Air Force Institute of Technology
 - Institute of Advanced Manufacturing Technology
 - Institute of Non-Ferrous Metals
 - Institute of Applied Optics
 - Road and Bridge Research Institute
 - Automotive Industry Institute
- Extensive cooperation with Warsaw University of Technology



- CNT-doped thermoplastic veils for improving electrical and mechanical performance of composites (H2020 PLATFORM)
 - Suitable for Antistatic or EMI Shielding applications.
 - Produced by the use of melt-blown technology.
 - Inserted into GFRP or CFRP during manufacturing of composites using infusion or pressing methods, as well as an autoclave.

- Development of technologies and predictive simulation tools for avoiding or mitigating accretion of ice (H2020 PHOBIC2ICE)
 - Collection of fundamental knowledge of phenomena associated with icephobicity issues.
 - Design and fabrication of icephobic surfaces with improved functionalities by applying innovative simulation and modelling.
 - Development of several types of polymeric, metallic and hybrid coatings using different deposition methods.
 - Preparation of laser treated and anodized surfaces.

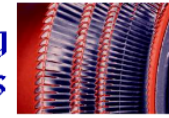
Participation in the AERO.UA project



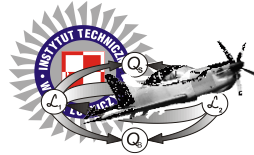
- Work Package 3 Leader – Michal Towpik
- Leader of two Pilot Project
 - Pilot Project 3.1b: Aerospace composite structural health monitoring system
 - Pilot Project 3.2a: Engine health management system
- Participation in three other
 - Pilot Project 3.1a: Advanced design of aerospace composite structures
 - Pilot Project 3.2a: Engine health management system
 - Pilot Project 3.3b: Manufacturing aerospace composite structures

ITWL departments

technology
PARTNERS



Aircraft Engines



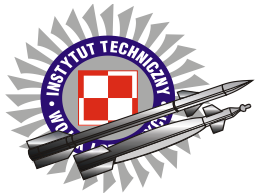
Airworthiness



IT Logistics Support Systems

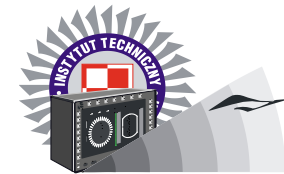


Aeroplanes & Helicopters



Air Armament

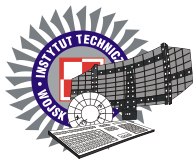
Scientific Category - A
11 R&D Divisions
26 soldiers
579 civil employees
Accredited laboratories – MOD/PCA



Avionics



Airfield Systems



Training Systems



Propellants and Lubricants



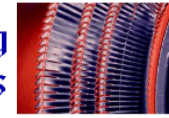
**Composite Aviation
Structures**



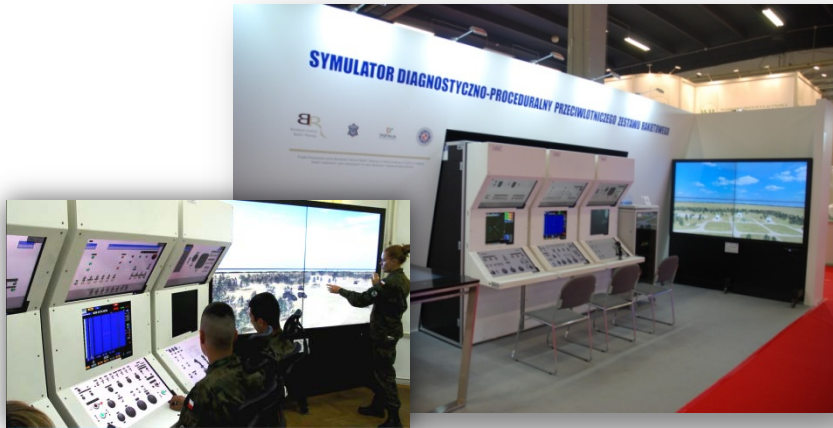
C4ISR Systems Intergration

ITWL- TRAINING SYSTEMS

technology
PARTNERS



Simulators



Augmented Reality - VR



Procedures Simulator



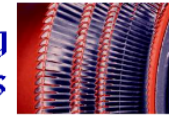
E-learning



IT systems for aviation

technology
PARTNERS





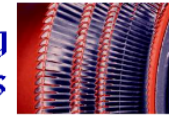
Avionic system upgrade

- ✓ Digitalization of Avionic Systems - open architecture
- ✓ Adaptation to a modern network-centric battlefield
- ✓ Integrated Communication Systems
- ✓ Helmet Mounted Display systems
- ✓ Flight data recorders



UNMANNED AERIAL SYSTEMS

technology
PARTNERS



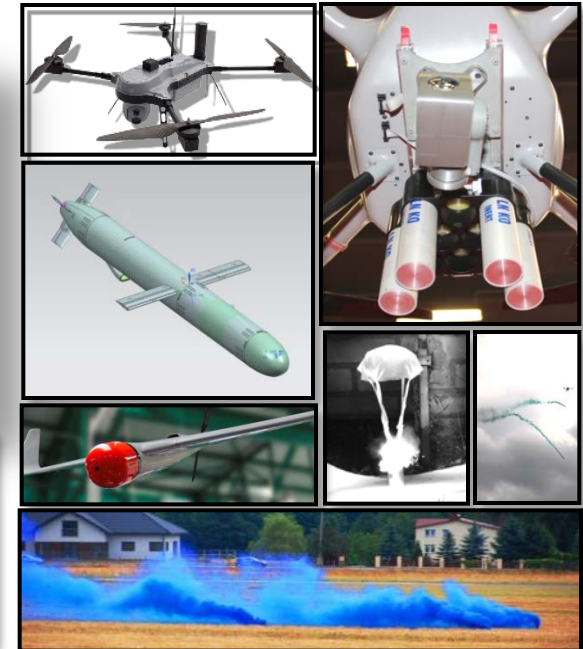
SURVEILLANCE



AERIAL TARGETS



COMBAT



Composites >



Electronics >



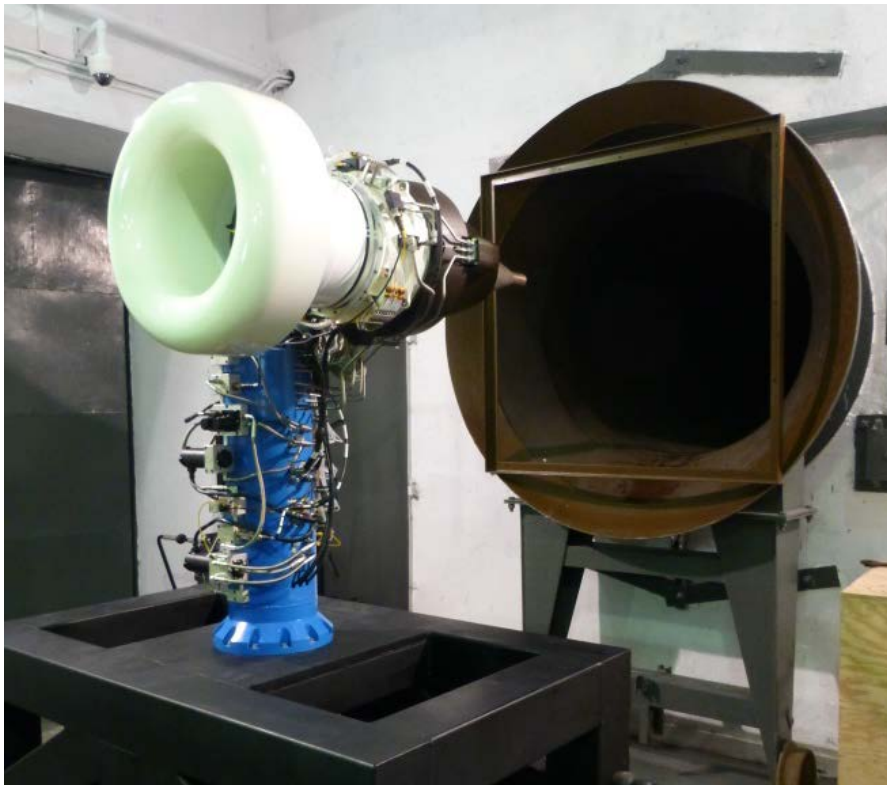
Training >

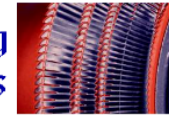


Testing jet engines

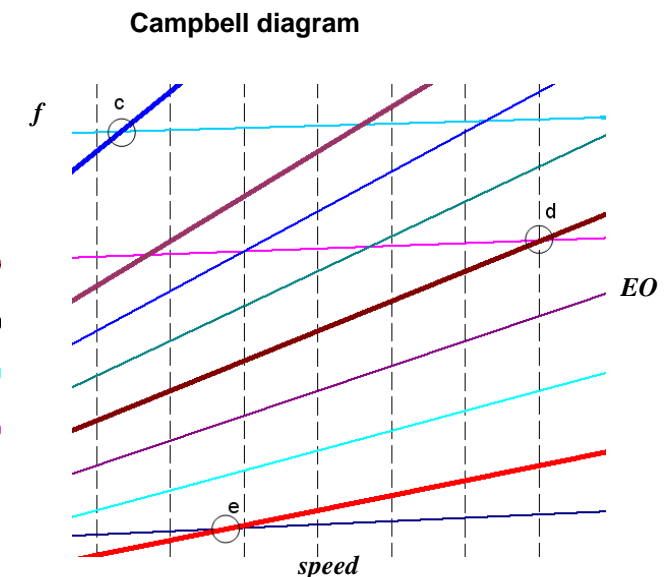
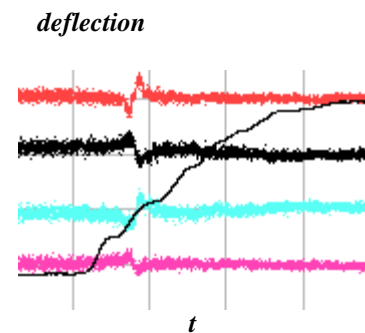
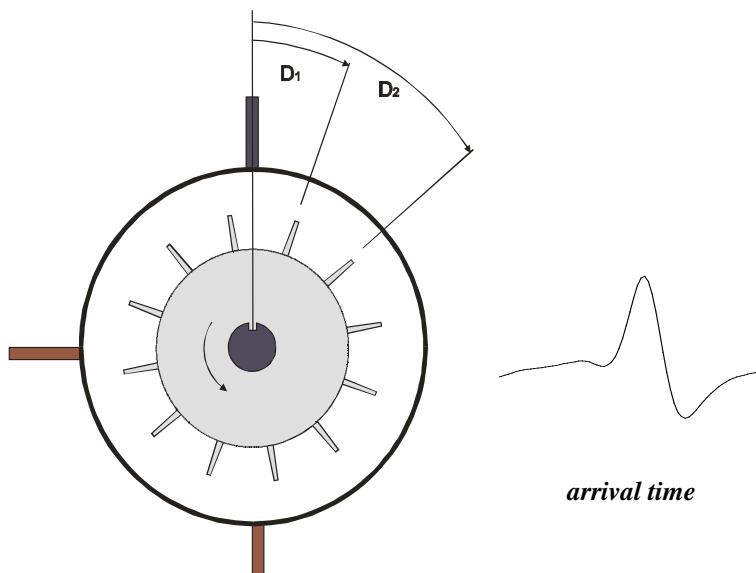


Gas-turbine test cell SO-3 turbojet and DGEN 380





Non contact measurement technique used to estimate blade vibration parameters: amplitude, frequency & stress.



sensors in casing



signal
acquisition

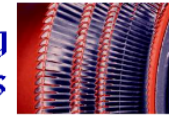


data visualization



vibration parameters
estimation

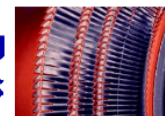
Blade Health Monitoring



- passive magnetic sensors for adverse conditions
- flying on TS-11 trainer since 1992
 - SNDL-1b/SPL-2b system
- life: 5-10 years, 600-1200 flight hours
- > 300 sensors installed on > 100 aircraft

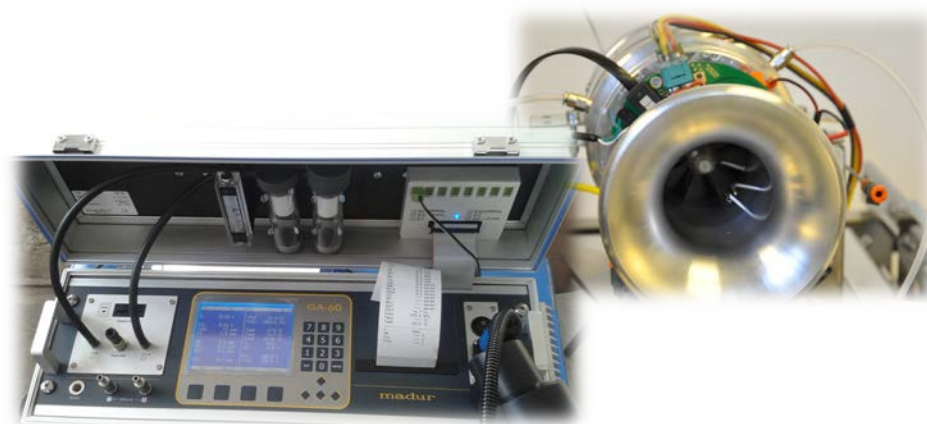
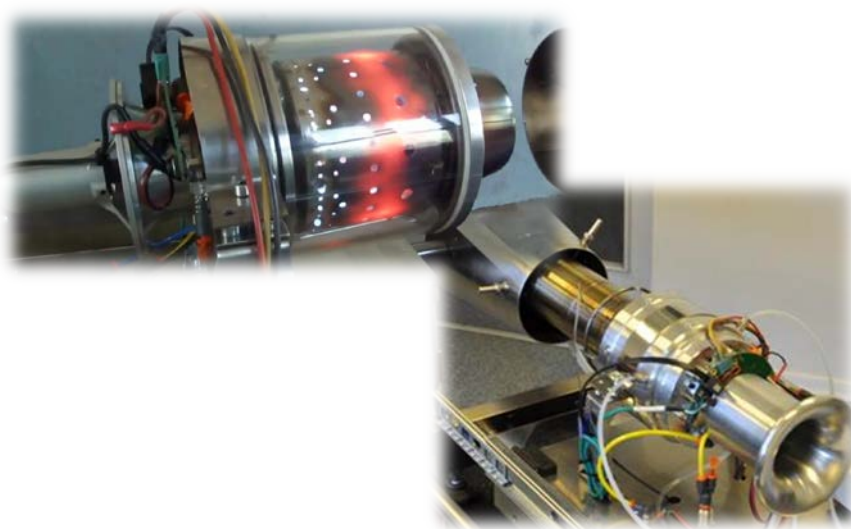


Combustion rig - microturbine

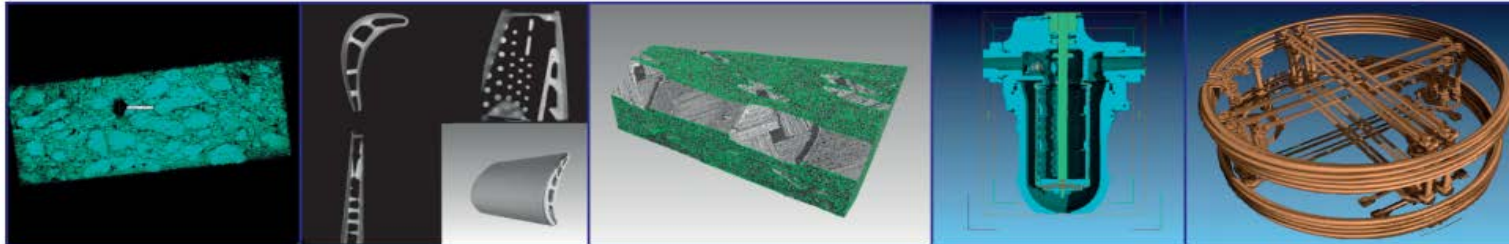
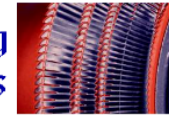


Testing of:

- ✓ new fuel, including biofuels
- ✓ emissions and exhaust gas toxicity
- ✓ new combustor designs



ITWL – X-ray Computed Tomography

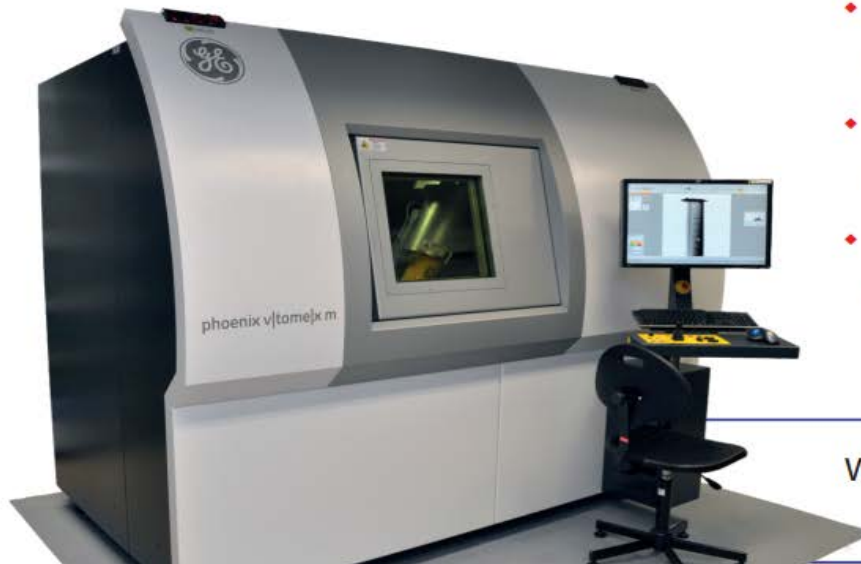


Scientific research and analyses cover the following materials:

- ♦ Titanium alloys
- ♦ Steel
- ♦ Composites
- ♦ Concrete
- ♦ Rubber
- ♦ Others

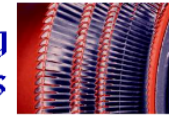
The system offers:

- ♦ Detectability of failures of > 0.5 m with the 180 kV X-ray tube
- ♦ Testing/evaluation of high-density materials (e.g. aircraft engine turbine blades) with the 300 kV X-ray tube
- ♦ Analyses of electronic circuits (integrated circuits (IC) included)
- ♦ Diagnosing of explosives/pyrotechnic compositions
- ♦ Complex diagnosing of aeronautical (sub-)systems

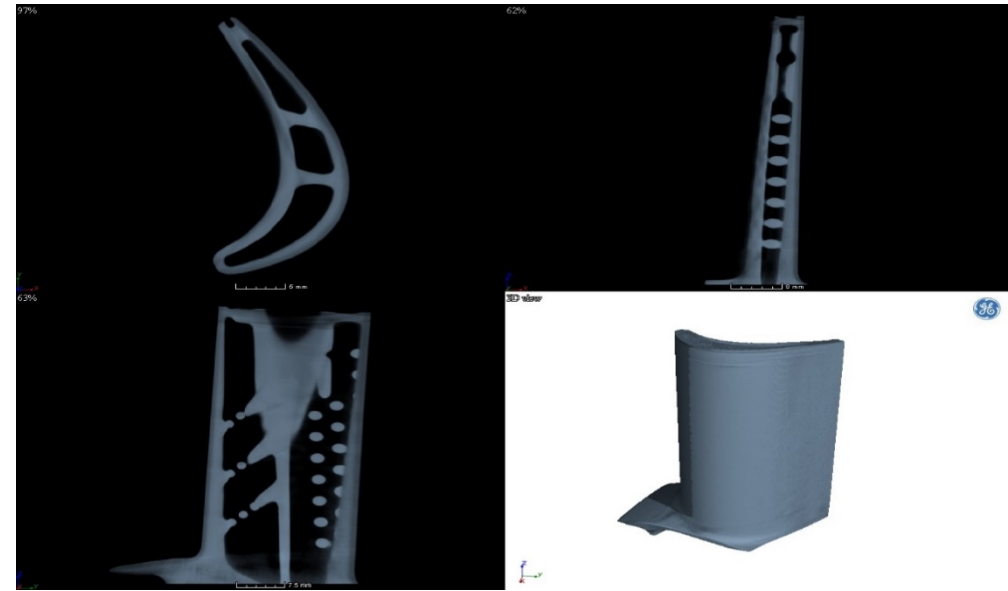
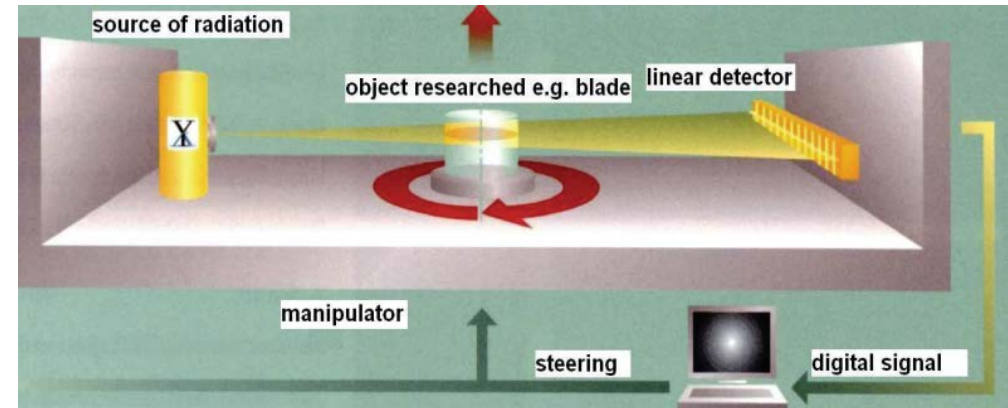
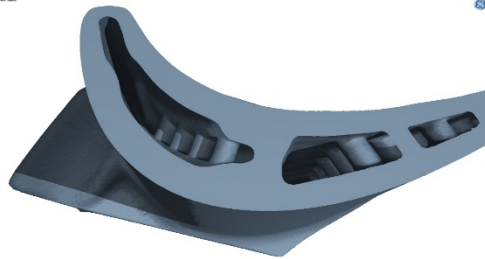
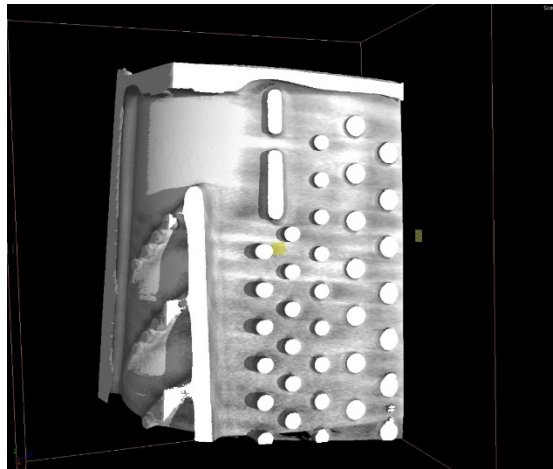


Weight of objects under examination: 50 kg
Approximate dimensions: 50×50×60 cm

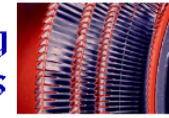
X-ray CT Inspection of Turbine Blades



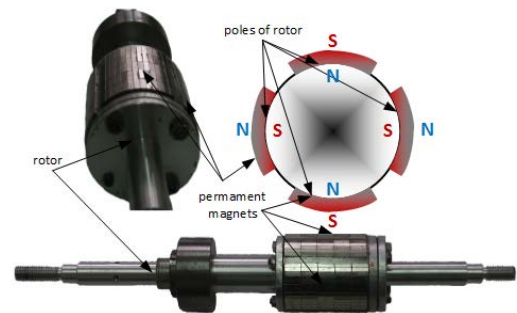
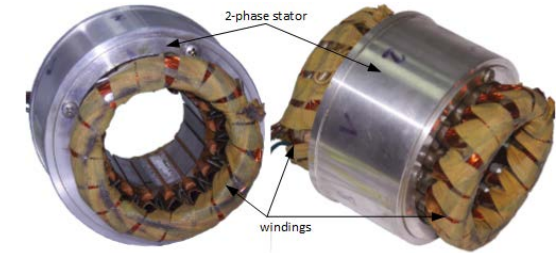
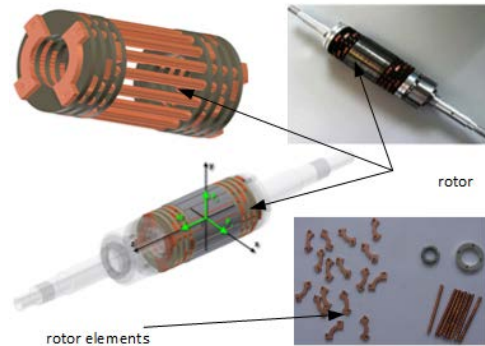
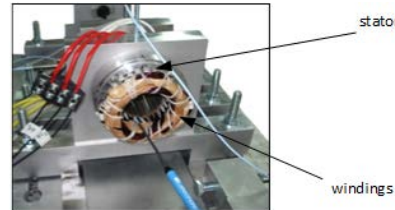
- cooling channels
- manufacturing flaws
- 3d printed components



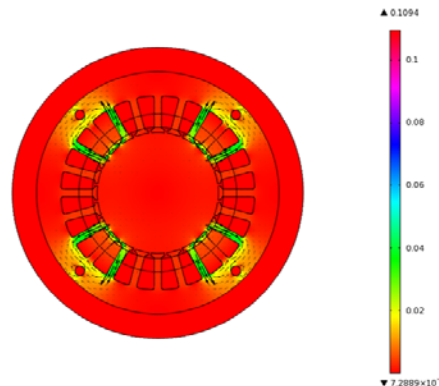
Bearingless electric machines



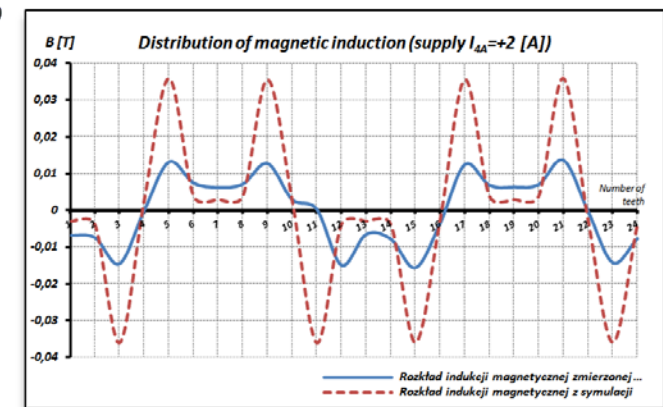
- More Electric Aircraft
- Magnetic suspension systems
- Control of bearingless motors



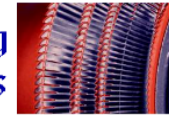
a) Surface: Magnetic flux density norm (T) Arrow: Magnetic flux density



b)



Operational loads monitoring

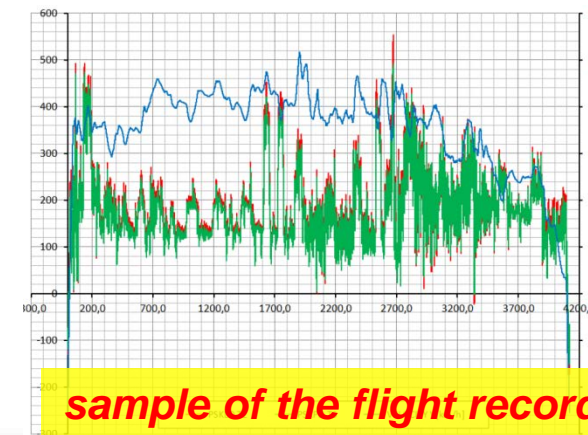


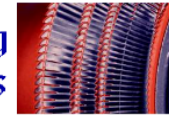
Airworthiness Dep. performs loads monitoring:

- direct - by means of sensors mounted on the aircrafts' structure;
- indirect - by means of a proper set of flight parameters;

for many types of aircrafts, e.g.: F-16, MiG-29, Su-22, PZL-130 Orlik.

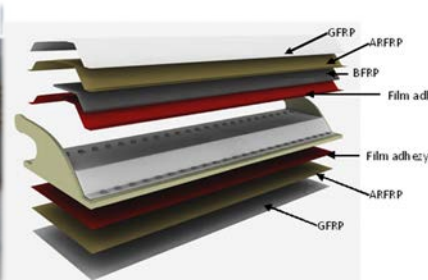
In the future, we are going to develop usage monitoring system for Mi-14 helicopter.



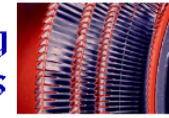


Advanced composites

- manufacturing composite structures (inc. autoclave)
- composite patch bonded repairs (e.g. C-130 Hercules, PZL-130 Orlik, Su-22, MiG-29)
- honeycomb structures repairs;
- modernization of existing aircraft structures (e.g. upper air inlet flaps of MiG-29's engines)
- smart structures manufacturing, e.g. smart patches for repairs monitoring



Non-destructive inspections

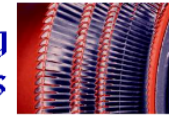


Certification and equipment for most of NDT methods:

- ultrasonic testing (also phased array);
- eddy current testing;
- penetrant testing;
- magnetic particle testing;
- thermography testing;
- laser shearography testing.

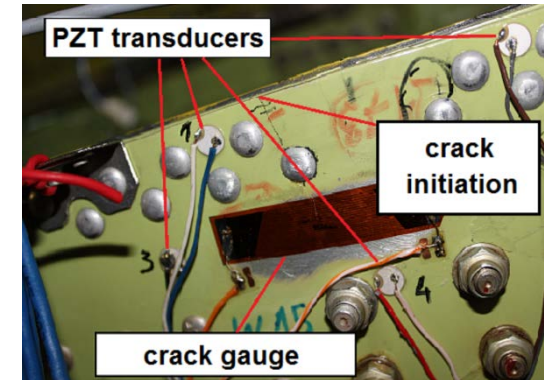
Support in development of NDT and SHM technologies.
Certified IAW EN-4179:



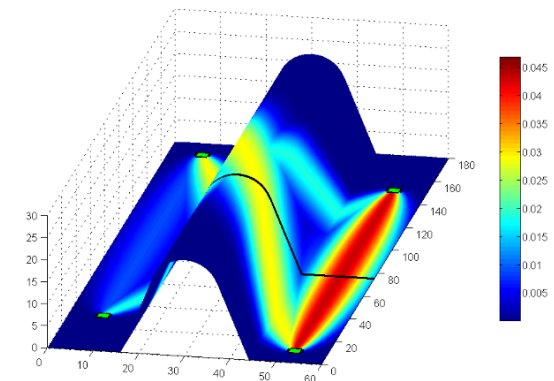


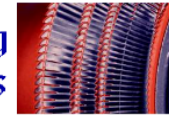
Structural Health Monitoring (SHM)

- different applications of PZT transducers (passive, active monitoring: guided waves and E-M impedance method);
- monitoring of different type of materials and damage: metals, GFRP, CFRP laminates, Fiber Metal Laminates
- developing signal analysis and data classification methods in order to improve performance of the system;
- developing technology of sensors integration with the host structure;
- developing methods for network self-diagnostics;
- increasing technology readiness by improving system stability under varying environmental conditions;
- system validation studies (reliability, PoD);
- developing certification guidelines for system implementation;



damage development indication





Life extension programmes

Military Aviation Works No 1

Air Force Institute of Technology (ITWL)

Life extension of Mil helicopters

Mi-8 up to 45 years

Mi-17 up to 42 years

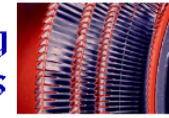
Mi-14 up to 36 years

Mi-24 up to 45 years

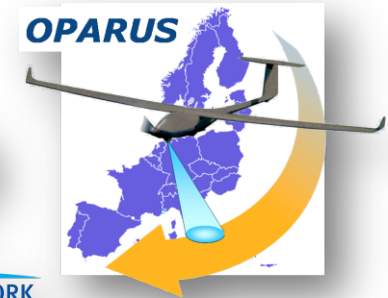


ITWL collaborative projects

technology
PARTNERS



AHEAD



THALES

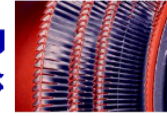


KONGSBERG



Pratt & Whitney
A United Technologies Company





Thank you for attention