

**RZESZÓW UNIVERSITY OF TECHNOLOGY**  
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# **INVESTIGATIONS OF ELECTROMAGNETIC COMPATIBILITY OF AVIONICS EQUIPMENT AND SYSTEMS**

A large, 3D-style logo for 'EMC' in a dark red color with a white outline. To the left of the logo, there are several overlapping sine waves in white, red, and blue, representing electromagnetic signals.

**EMC**



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## PROBLEMS

- Introduction
    - ⇒ EU Directives – Standards
    - ⇒ Research basis – EMC Laboratory at Rzeszów University of Technology
  - HIRF SE – large scale EU project
    - ⇒ Research basis:
      - Laboratory investigations
      - Simulations
      - Experimental verification – co-operation with PZL Mielec
  - Interactions inside devices
    - ⇒ Theoretical elaborations
    - ⇒ Simulations
    - ⇒ Laboratory tests
  - Summary
- } Specialization of PRz Team

## Research Team:

**Head:** Prof. Włodzimierz Kalita,  
Prof. Marek Gotfryd,  
Dr Kazimierz Kamuda, Dr Dariusz Klepacki,  
Dr Wiesław Sabat – research co-ordinator, Dr Bogusław Wisz

## Investigations of Electromagnetic Compatibility of Avionics Equipment and Systems

- **Electromagnetic compatibility**

The ability of electronic equipment to function properly with respect to environmental electromagnetic interference and electrostatic discharge.

Interferences: conducted and radiated

- **EMC Directive 2004/108/WE**

- **Standards – RTCA DO-160 (civil avionics), MIL STD-461E (military avionics)**



### EMC LABORATORY

⇒ **Requirements: frequency ranges, signals rejection**

⇒ **Conditions: anechoic chamber, open area test site, specialist equipment**

- **Present status**

⇒ **Semi-anechoic chamber from TDK (range 20MHz÷18GHz)**



New building – AL



Anechoic chamber from TDK



Chamber interior

## • Measuring systems

- ⇒ Rohde & Schwarz system for emission measurements of conducted ( range: 9kHz ÷ 30MHz) and radiated (range: 20MHz ÷ 3GHz) disturbances
- ⇒ Rohde & Schwarz system for immunity testing of electrical and electronic devices on radio frequency signals (range: 150kHz ÷ 230MHz)
- ⇒ TESEQ (Schaffner) system for immunity testing of electrical equipment on standard electromagnetic interferences (impulse waves, nano-second impulse wave series, electrostatic discharges, etc.)



- **Future plans: specialization – avionics equipment, military devices, building, automotive**
  - ⇒ **!!! accreditation !!!**
  - ⇒ **open area test site**
  - ⇒ **field research**
- ⇒ **System for emission measurements of disturbances radiated by electrical and electronic devices in frequency range up to 18GHz**
- ⇒ **System for immunity measurements of electrical and electronic devices on electromagnetic field in frequency range 26MHz ÷ 1GHz, 10V/m**
- ⇒ **System for immunity measurements of electrical and electronic devices on electromagnetic field in frequency range 1GHz ÷ 6 GHz, 10V/m**
- ⇒ **System for immunity measurements of electrical and electronic devices on harmonics, inter-harmonics and frequency changes of voltage in supplying circuits**
- **Funds**
  - ⇒ **Subsidy of MNiSW „EMC Laboratory”**  
(Project finished in December 2007, budget - 2 mln PLN)
  - ⇒ **UE funds**
  - ⇒ **Projects for industry**

## INTERACTIONS INSIDE OBJECTS - AIR VEHICLES

- **HIRF SE Project**



**AERONAUTICS  
and  
AIR TRANSPORT**



**Project acronym: *HIRF SE***

**Project full title: *High Intensity Radiated Field Synthetic Environment***

**Grant agreement No.: *205294***

**Call ID: *FP7-AAT-2007-RTD-1-205294***

**Beneficiaries: *44* participants from *11* countries**

**Overall budget : *23* mln EUR (Rzeszów University of Technology: *122 000* EUR)**

- **General idea**

**Mutual co-operation of multi-disciplinary partners including research establishments and high level skilled SMEs, together with the air vehicles manufacturers (both fixed and rotary wing) who are the owners of the real needs and requirements.**

- **Object of investigations**

**Small air vehicles (civil) – planes, helicopters (up to 20 seats)**

- **Potential benefits to aeronautic industry:**
  - easier identification of potential problems in the early stages of design;
  - simplification and reduction of activities and time schedule for achievement of EMC air vehicles certification;
  - saving of testing time improving cost effectiveness of EMC testing (i.e. reduced costs for airlines, reduced energy consumption, reduced EM pollution);
  - easier installation of equipment and configuration changes relevant to EMC aspects;
  - improved understanding of measurement techniques both at air vehicle and laboratory level;
  - improved safety by more detailed and accurate approach (i.e. in a simulated flight condition).

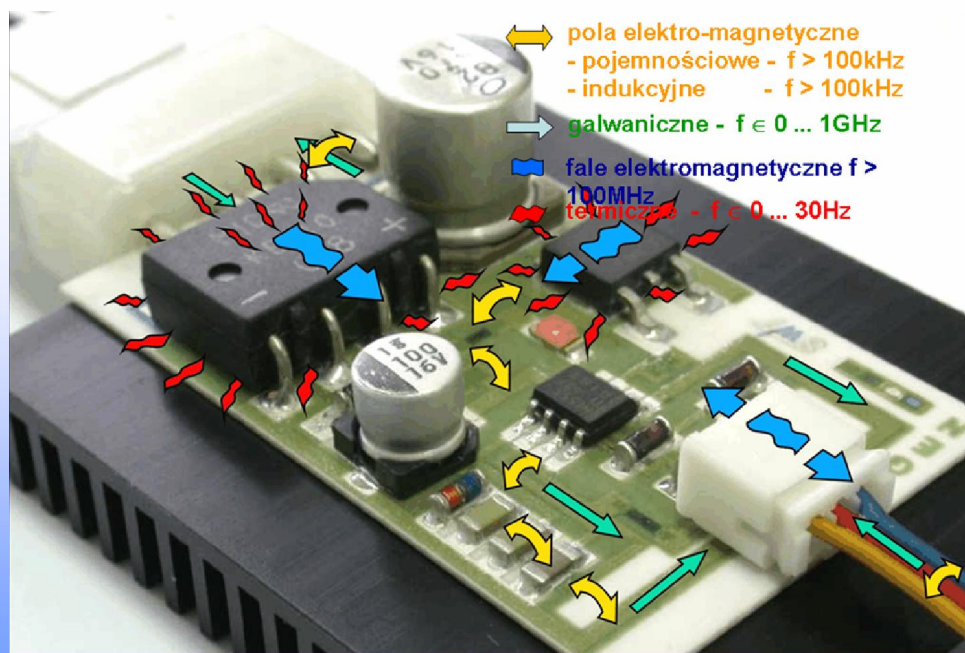
- **Role of PRz in HIRF SE project**

**Mathematical modelling, simulation and experimental verification of long wire bundles used in air vehicles.**

**Close co-operation with PZL Mielec (common investigations, experimental verification of elaborated calculation procedures).**

## INTERACTION INSIDE DEVICES

- Activity areas:
  - ⇒ Condition analysis of immunity on disturbances and interferences emission in electronic planar structures;
  - ⇒ Condition analysis of propagation of electromagnetic disturbances in distributed systems of communication buses;
  - ⇒ Determination of design rules of electronic devices using CAD systems with taking into account EMC aspects.
- EMC-NET – specialization of PRz Team
- Research projects:  
2 Grants for MNiSW
- International co-operation:
  - ⇒ Partners in HIRF-SE project
  - ⇒ Technical University of Kosice



### **SUMMARY**

- **Currently oriented research, staffs and laboratory basis allow to realize the integrated and comprehensive investigations in EMC area.**
- **Harmonious progress of research and manufacturing processes in avionics requires taking into consideration the EMC aspects.**
- **The PRz Team can continue investigations in EMC area for avionics industry with essential support in organization, co-operation and financial aspects.**

**THANK YOU FOR ATTENTION**