RZESZÓW UNIVERSITY OF TECHNOLOGY
FACULTY OF ELECTRICAL AND COMPUTER ENGINEERING
Deptartment of Electronic and Communication Systems
ul. W. Pola 2, 35–959 Rzeszów, Poland; tel.: +48-17 8544708

SEVENTH FRAMEWORK PROGRAMME

AERONAUTICS
and
AIR TRANSPORT

SYNTHETIC ENVIRONMENT RESEARCH PROGRAM
HIRF

HIRF SE

High Intensity Radiated Field Synthetic Environment

PRz Team:
Włodzimierz KALITA, Kazimierz Kamuda, Dariusz KLEPACKI, Wiesław SABAT

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
Duration: 2008-2012

Beneficiares: 44 participants from 11 countries

Overall EU budget : ~18 mln EUR (Rzeszów University of Technology: 115 000 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 in EMC area.

- **Object of investigations**

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

- **Potential benefits to aeronautic industries:**

– 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 and cost effectiveness of EMC testing (i.e. reduced costs for airliners, 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).

- **WP's *(PRz participation in red)*:**

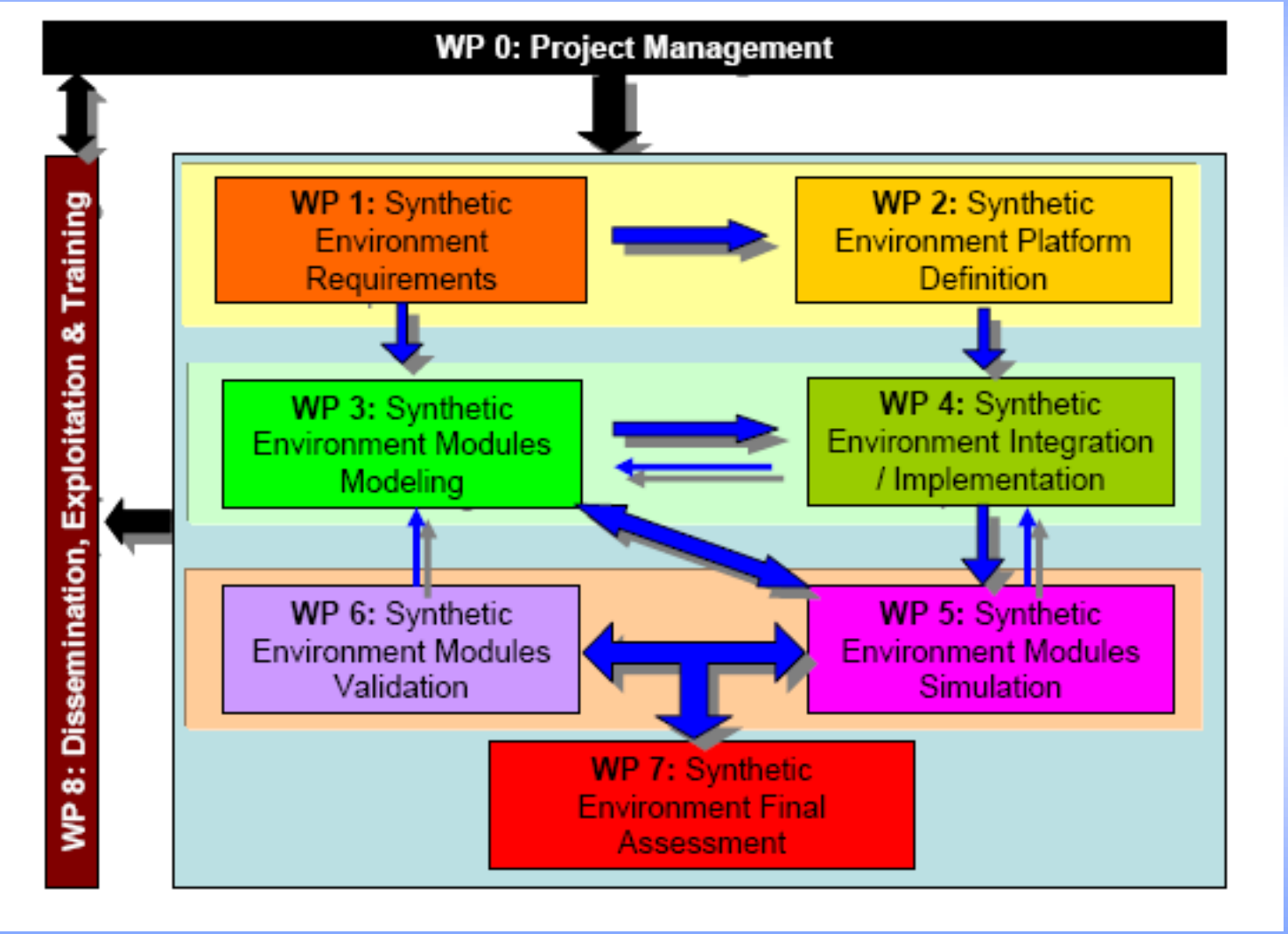
- WP0: Project Management
- WP1: Synthetic Environment Requirements
- WP2: Synthetic Environment Framework Definition
- WP3: Synthetic Environment Modules Modelling
- WP4: Synthetic Environment Integration / Implementation
- WP5: Synthetic Environment Modules Simulation
- WP6: Synthetic Environment Modules Validation
- WP7: Synthetic Environment Final Assessment
- WP8: Dissemination, Exploitation and Training

- **General role of PRz in HIRF SE project**

Mathematical modelling, simulation and experimental verification of long wire bundles and selected equipment used in air vehicles as well as dissemination of results (scientific papers, trainings, etc.).

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

- **HIRF SE global workflow**



- **WP3 – Synthetic Environment Modules Modelling**

Task 3.3 – Equipment modelling (SG4-2)

The selected object for equipment modeling is fuel gauge PPM-1B (Avionics Institute Warsaw) from series mounted M-28 Bryza aircraft manufactured by PZL Mielec. The autonomous system with capacitive sensors controls and measures the fuel level in the main and additional fuel tanks of considered aircraft.

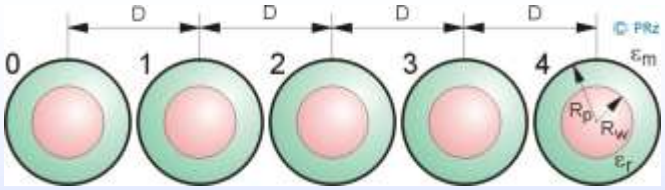
At this stage of task the technical documentation was studied as well as during technical meetings in PZL Mielec the operation conditions were determined.

- **WP3 – Synthetic Environment Modules Modelling**

Task 3.4 – Cable modelling (SG5-2 – MTLN Network Modelling)

The contribution of PRz in sub-group SG5.2 consists in application of CANCAN_2D module (elaborated in PRz) for determination per-unit-length parameters of cylindrical cables configurations characterized by different geometrical and electrical parameters of used structural materials.

The moments method was used for problem solution of per-unit-length parameters determination.



R', mΩ/m				**L'**, μH/m				**C'**, pF/m				**G'**, μS/m			
5 wires, reference wire: 0															
101,5	50,7	50,7	50,7	0,541	0,394	0,351	0,331	93,2	- 43,2	- 2,36	- 2,13	8,79	- 4,1	- 0,22	- 0,20
50,7	101,5	50,7	50,7	0,394	0,789	0,595	0,531	- 43,2	93,4	- 43,2	- 2,36	- 4,1	8,8	- 4,1	- 0,33
50,7	50,7	101,5	50,7	0,351	0,595	0,943	0,732	- 2,36	- 43,2	93,2	- 45,5	- 0,22	- 4,1	8,79	- 4,29
50,7	50,7	50,7	101,5	0,331	0,531	0,732	0,1063	- 2,13	- 2,36	- 45,5	54,6	- 0,20	- 0,33	- 4,29	5,15

Example of calculations

- **WP3 – Synthetic Environment Modules Modelling**

  Task 3.5 – Model Tuning

- **WP5 – Synthetic Environment Modules Simulation**

  Task 5.2 – Test Case Simulation (TC5 – Multiconductor Cable Bundle)

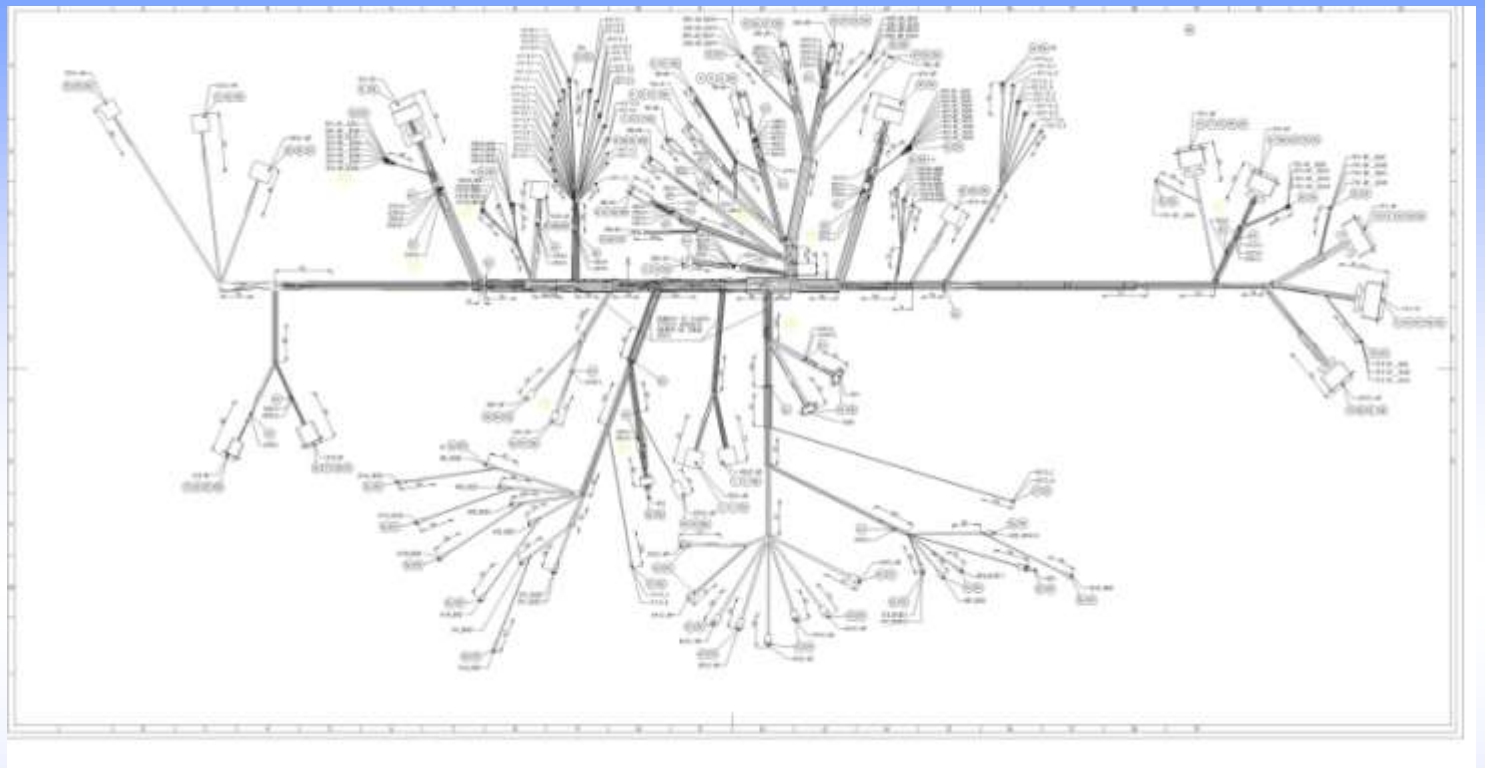
  Analysis of propagation process of conducted and radiated disturbances in long wire bundles structures for different types of input functions and load conditions at low frequency range.

  Task 5.3 – Results Analysis

- **WP6 – Synthetic Environment Modules Validation**

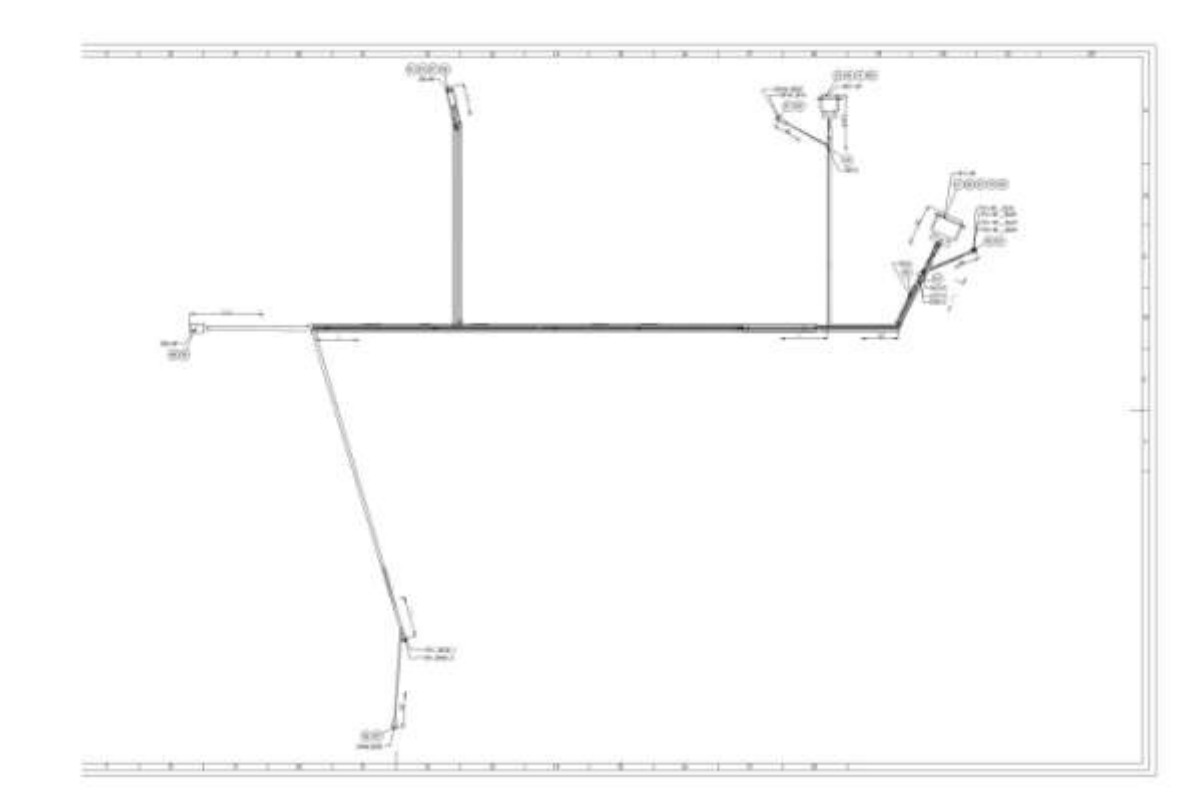
  Task 6.1 – Experimental Measurements for Model Validation

VUT100 Cobra prototype cable #1



Lengths of the conductors in the bundle are 44 up to 2526 mm and the bundle consists of: 1 double-shielded twisted pair used as 125 ohm data bus CAN (ECS P/N 322402) , 51 shielded twisted pairs MIL-C-27500-22TE2T14, 10 shielded twisted triplets MIL-C-27500-22TE3T14 and 6 shielded single wires MIL-C-27500-22TE1T14 used for various ARINC 429 as well as RS232 data buses, 291 unshielded single wires MIL-W-22759/16-18 up to 22 - 9 and 10 unshielded twisted pairs MIL-C-27500-20-TG2U14 used for grounding, power supply and discrete signals of the units installed on the instrument panel. Two circle 100-pin MIL-150-1815 type connectors (PFD and MFD mating connectors) and various D-Sub type connectors (normal and high-density types)

VUT100 Cobra prototype cable #2



Lengths of the conductors in the bundle are 104 up to 6408 mm and the bundle consists of: 1 shielded twisted pair MIL-C-27500-22TE2T14, 1 shielded single wire MIL-C-27500-22TE1T14 used for RS 232 communication line of the AHRS unit, 2 unshielded twisted pairs MIL-C-27500-20-TG2U14 used for the AHRS power supply, 1 coaxial cable MIL- C-17/60-RG142 used for marker antenna and 8 short grounding single unshielded wires. D-Sub type connectors (RS232 and Power supply) and one 50 ohm coaxial connector.

- **WP8 – Dissemination, Exploitation and Training**

  Task 8.2 – Publications, Conferences

  Task 8.3 – Training (Professional courses, Young Scientist Programme)

SUMMARY

- **Currently oriented research, staffs and laboratory basis allow to realize the integrated and comprehensive investigations in EMC area.**
- **The PRz Team can continue investigations in EMC area for avionics industry with essential support in organization, co-operation and financial aspects.**
- **EU Projects can be „the driving force” scientific and laboratory base development .**

THANK YOU
FOR YOUR ATTENTION