# Aeronautics related RTD activities in Poland

Fifth Community Aeronautics Days Sustainable Solutions for New Horizons

Zbigniew Turek

National Contact Point, Institute of Fundamental Technological Research, Polish Academy of Sciences Zbigniew.Turek@kpk.gov.pl

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# **Aeronautics R&D Potential**

- **16 Technical Universities**
- 15 Universities
- 2 Aeronautics Institutes
- 14 Aeronautics related Institutes



University / Faculty	Chemistry and Chemical Engineering	Electronics and Electronic Engineering	Information Technology, Science and Systems	Physics and Technical Physics	Power Engineering	Process Engineering	Aeronautics and Aeronautical Engineering	Materials Science and Engineering	Transport	Production Engineering	Electrical Engineering	Computer Science and Engineering	Mechanics and Mechanical Engineering	Physics and Mathematics	Informatics and Telecommunications	Mechatronics	Microsystems
W arsaw University of Technology	х	х	х	х	х	х	х	х	х	х				х		х	
Lublin University of Technology											х	х					
Lodz University of Technology	х	х		х							х	х	х	х			
Silesian University of Technology	х	х						х	х		х	х	х				
Rzeszów University of Technology	Х						х				х	х	Х				
W roclaw University of Technology	Х	х			х						х	х	х				Х
W arsaw University	х												х	х	х		
Radom University of Technology									х				х				
Białystok Technical University											х		х				
Częstochowa University of Technology											х	х	х				
Gdańsk University of Technology	Х										х		Х	х	х		
Szczecin University of Technology	Х		х			Х					х	х	х				
Poznań University of Technology	х								х		х	х	х				
Opole University of Technology	х										х	х	х	х			
Koszalin University of Technology		х									х		х				
Kielce University of Technology											х	x					
AGH University of Science and Technology											х	х	х	х			
Cracow University of Technology											х	х	х	х			
University of Bielsko Biała												х	х				
Jagiellonian University	х											х		х			
Białystok University	х													х			
Gdansk University	х													х	х		
University of Silesia	х							х				х		х			
Marie-Curie Sklodowska University in Lublin	х											х		х			
University of Lodz	х													Х			
University of Opole	х													х			L
Adam Mickiewicz University in Poznan	х											х		Х			
University of Szczecin														Х			
M. Kopernik University in Torun	х													х	х		L
University of W roclaw	х											х		х			
University of W arm ia and Mazury in Olsztyn												х		х			
University of Zielona Gora											х	х	х	х	х		1

Aeronautics Institutes	City
Air Force Institute of Technology	Warsaw
Institute of Aviation	Warsaw

N<sup>2</sup>

Aeronautics Related Institutes	City	
The Szewalski Institute of Fluid-Flow Machinery	Gdansk	
Foundry Institute	Cracow	
The Metal Forming Institute	Poznan	
Military Institute of Armament Technology	Warsaw	
Telecommunications Research Institute	Warsaw	
Tele & Radio Research Institute	Warsaw	
Institute of Non-ferrous Metals	Warsaw	
Institute of Applied Optics	Warsaw	
Institute of Precision Mechanics	Warsaw	
National Institute of Telecommunications	Warsaw	
Industrial Research Institute for Automation and Measurements	Warsaw	
The Institute of Advanced Manufacturing Technology		
Institute of Fundamental Technological Research, PAS		
Stanislaw Staszic Institute for Ferrous Metallurgy	Gliwice	

## Aeronautics virtual consortia

- Aeronet
- > Aeronautica Integra
- R&D Potential of Polish Technological Platforms:
  - Aeronautics
  - Advanced materials
- > Technology Partners
- KMM-NoE

#### Centre of Advanced Technologies AERONET "Aviation Valley"

The Centre of Advanced Technology "AERONET - Aviation Valley" was founded in order to realized 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 Centre of Advanced Technologies "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



Rzeszow University of Technology
Lublin University of Technology
Lodz University of Technology
Silesian University of Technology
Warsaw University of Technology
University of Rzeszow
Institute of Aviation
Institute of Fundamental Technological
Research Polish Academy of Science
Aviation Valley Association

- coordinator
- partner

#### Scientific Network "Aeronautica Integra"

The scientific network "Aeronautica Integra" was established as an initiative of the Department of Aircraft and Aircraft Engines at the Faculty of Mechanical Engineering and Aeronautics, Rzeszow University of Technology in 2005.

#### Mission and main goals:

- to integrate and to increase the activity of Polish scientific groups working in the area of aviation technologies (scientific and industrial partners) within research and education
- to build sound foundations for transfer of knowledge
- ✓ to increase participation of Polish partners in the EU Framework Programmes projects
- ✓ to develop co-operation between Poland and foreign partners
- ✓ to publish the Journal of Aeronautica Integra® (JAI)
- ✓ to join European scientific networks and ESTP

#### Partners:

- Rzeszow University of Technology- Coordinator
- Lublin University of Technology
- Lodz University of Technology
- Silesian University of Technology
- ✓ Warsaw University of Technology
- University of Rzeszow
- ✓ Aviation Valley Association
- Institute of Aviation
- ✓ Institute of Fundamental Technological Research Polish Academy of Sciences

Sieć Naukowa



#### **R&D** Potential of Polish Technological Platforms

**Polish Technology Platforms - basic facts** 

- 26 PTPs
- started to form in 2004
- official start 10 January 2005, during special conference in the Ministry of Science and Information Society Technologies
- PTPs consist of: major industrial partners, commercial chambers, professional associations, research institutes, universities; including Centres of Advanced Technology, CoE
- PTPs are supported by Ministries of: Science; Economy and Work; Agriculture; Environmental Protection; and Defense http://www.kpk.gov.pl/ppt/ (in Polish)

# Polish Technology Platform of Advanced Materials



# **TECHNOLOGY PARTNERS**

#### **Members**

- Central Institute for Labour Protection National Research Institute
- Polish Packaging Research and Development Institute
- Institute of Applied Optics
- Tele- and Radio Research Institute
- IOS Institute of Advanced Manufacturing Technology
- METALCHEM Institute for Plastics Processing
- Institute of Natural Fibres
- Institute of Non-Ferrous Metals
- Metal Forming Institute
- Institute of Precision Mechanics
- TMBK Partners (consulting company)

Reasons for establishing Technology Partners :

- To achieve a critical mass for performing of multidisciplinary research
- To ensure visibility and representation of Polish leading R&D Institutes
- To develop international co-operation

Benefits of this approach :

- Achieving critical mass
- Synergy effect of technology capabilities
- Diffusion of knowledge and the best practices related to the research and management activities
- More effective co-ordination of research projects

**Basic data** 

## **TECHNOLOGY PARTNERS** in brief

50 000 000 USD annual revenue 800 research staff 600 R&D projects performed annually Co-operation with partners from over 30 countries **Co-operation principles** 



#### **Milestones**

- **2000** a group of Polish Research Institutes and the technology consulting company TMBK Partners decide to create a new organisation, the TECHNOLOGY PARTNERS Consortium
- 2001 first EU project submitted and accepted
- **2002** offices established in Berlin and Brussels
- 2004 co-organisation and hosting EIRMA Round Table "Environment for Industrial Research and Technology Transfer in Eastern Europe" (40 participants from 13 countries)
- 2004 Advanced Technology Centre status awarded
- **2005** co-organisation and hosting EARTO Annual Conference "Research to Business" (over 100 participants)
- **2006** co-operation with AIRBUS initiated (first joint projects in September)



### **KMM-NoE**

### Network of Excellence on "Knowledge-based Multicomponent Materials for Durable and Safe Performance" Successful project of NMP priority 1st call of FP6

# MULTIFUNCTIONAL MATERIALS IN TRANSPORT



Type of Project: FP6 Priority Coordinator: EU contribution: Number of partners: Number of countries: Project duration: Continuation: Network of Excellence NMP IPPT Warsaw 8.1 M€ 36 (ca. 200 researchers) 10 4 years KMM Virtual Institute



### **CONSORTIUM**

<u>SME</u>		INDUSTRY	2
MCL	(Leoben, A)	EADSG	(Muenchen, D)
INASMET	(San Sebastian, E)	EADSF	(Paris, F)
MERL	(Hertford, UK)	SNECMA	(Paris, F)
NETCOM	(Chesterfield, UK)	PZL	(Swidnik, PL)
ATECA	(Montauban, F)	FIAT	(Orbassano, I)
IFM	(Gliwice, PL)	ALENIA	(Napoli, I)



#### NRT1-1: Intermetallics for High, Moderate, Low Temperature Applications (HiMoLo)

#### γ-TiAl based materials:

- Automotive applications:
- turbocharger turbine wheels
- valves
- connecting rods
- piston pins

**Aerospace applications:** 

- turbine blades
- divergent flap situated in the exhaust nozzle
- nozzle side wall
- compressor case



NRT1-1: Intermetallics for High, Moderate, Low Temperature Applications (HiMoLo), cont.

FeAI based materials:

Aerospace applications:



engine pylon



applications on helicopter

Automotive applications: piston valves and rings exhaust manifolds catalytic converters substances NRT2-2: New Particulate AI and Ti Matrix Composites Produced by Self-high Temperature Synthesis (PARTMMC)



Connecting rods (CRFIAT)



Brake drums, brake discs (CRFIAT, MERL)



Helicopter rotor components (EADSF)





NRT2-3: Direct Powder Deposition (DPD) of MMC for Aerospace Components with Tailored Functionality (DEPOSITCERMET)

rapid manufacturing technique to produce small series of complex shaped MMC parts for aerospace industry

> NRT2-4: Metal-ceramic Nano-structured Bulk Composites and Coatings (NANOCERMET)

- rotary engines
- automotive engine cylinder
- brake discs
- heat resistant coatings



NRT3-2: New Multi-functional 3D Cellular/Porous Metallic Materials/Assemblies with Graded Pore Density/Geometry (CELMET)

Development of new multi-functional 3D cellular/porous material with graded pore density/geometry from any base metal/alloy for applications in aeronautical/aerospace industries (inspired by EADSF)

**Requirements:** 

- high energy absorption capacity at low and high velocity impact
- high vibration damping
- Iow thermal conductivity
- high noise suppression required

# FP5 and FP6 participation outcomes

- Participation of RTD Scientific units in FP5
- Statistics of Polish participation in 6th FP in Aeronautics priority
- Examples of Polish RTD scientific and industrial participation in Aeronautics FP6 projects
- FP6 research projects coordinated by Poland

## **Participation of RTD Scientific units in FP5**

- EU GROWTH Project Structural Assessment Monitoring and Control, SAMCO, TN, 2002-2006
- EU Research Training Network, New Materials, Adaptive Systems and their Nonlinearities: Modeling, Control and Numerical Simulation, SMART-SYSTEMS, 2002-2006
- HELIX, Innovative aerodynamic high lifts concepts, RTD,
- NAS-TAURUS, Technology development for aeroelastic simulations on unstructured grids, RTD,
- HiReTT, High Reynolds Number Tools and Techniques for Civil Transport Aircraft Design, RTD,
- UAVNET, Civilian UAV Thematic Network: Technologies, Application, Certification, CA,
- X2-Noise, Air external noise network, phase II Thematic Network,
- VIEWLS, Clear Views on Clean Fuels Diamond VIP member ship.

# Statistics of Polish participation in 6th FP in Aeronautics priority

# **Overview of three main Calls**



# Comparison of Instrument "Success level" in three main Calls

80%

70%

60%

50%

40%

30%

20%

10% 0%





## Polish cooperation with coordinators and partners from Memeber States



## Examples of Polish RTD scientific and industrial participation in Aeronautics FP6 projects

# **Participation of Scientific RTD units**

Acronym	Title	Instrument	Duration
ECO-ENGINES	Energy Conversion in Engines	NoE	2004-2008
NACRE	New Aircraft Concepts Research	IP	2004-2009
ExtreMat	New Materials for Extreme Environments	IP	2004-2009
МСМАСМ	Modern Composite Materials Applied in Aerospace, Civil and Mechanical Engineering: Theoretical Modelling and Experimental Verification	ТоК	2005-2009
FUSION	Fundamental studies of transport in Inorganic Nanostructures	STREP	36 months
ADLAND	Adaptive Landing Gears for Improved Impact Absorption	STREP	2003-2006
AERONET III	Coordination Action Aircraft Emissions and Reduction Technologies		
Scratch IV	Services for CollaboRative SMEs Aerospace Technical research, IV	SSA	
HISAC	Environmentally friendly high speed aircraft	STREP	
UFAST	Unsteady effects of shock wave inducedseparation	STREP	
ERA_NET	Air transport Net	СА	
SAFE PIPES	Safety assessment and lifetime management of industrial piping systems	STREP	2005-2008
UPWIND	Integrated wind turbine design	IP	2006-2011
AEROCHINA	Promoting scientific cooperation between Europe and China in the field of multiphysics modeling, simulation, experimentation and design methods in aeronautics	SSA	2005-2007

### Participation of companies in 5 and 6 FP Aeronautics projects

Acronym	Title	Company
CAST	Crashworthiness of Helicopter on Water: Design of Structures using Advanced Simulation Tools	PZL Swidnik
MALVINA	Modular Avionics for Light Vehicles in Aeronautics	PZL Swidnik
COCOMAT	Increasing safety and MATerial exploitation of COmposite airframe Structures by accurate simulation of Collapse	PZL Swidnik
FRIENDCOPT ER	Integration of technologies in support of a passenger and environmentally FRIENDdly heliCOPTER	PZL Swidnik
HELISAFE TA	HELIcopter Occupant SAFety Technology Application	PZL Swidnik
ADVICE	Autonomous Damage Detection and Vibration Control Systems	PZL Swidnik
SPIDER-WIN	Supply Information Dynamic Exchange and Control by Web-based Interaction Network	PZL Swidnik
KMM-NoE	Advanced Multicomponent MAterials for Durable and Safe Structures	PZL Swidnik
AVALON	Multifunctional textile structures driving new production and organizational paradigms by textile SME. Interpretation Across high-added-VALue SectOrs for knowledge-based product/service creatioN	PZL Swidnik
ADLAND	Adaptive Landing Gears for Improved Impact Absorption	PZL Mielec
CESAR	Coste Effective Small Aircraft	PZL Mielec
MagForming	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

## FP6 research projects coordinated by Poland

# **ADLAND - Partners involved**

IFTR	Institute of Fundamental Technological Research, Warsaw	<b>Research institute Co-ordinator</b>	Poland
EADS	EADS Deutschland, MA, Munich	Industrial end-user	Germany
PZL	Polskie Zaklady Lotnicze, Mielec	Industrial end-user	Poland
IA	Institute of Aviation, Warsaw	Research institute	Poland
FhG-ISC	Fraunhoffer Institute, Wuerzburg	Research institute	Germany
CEDRAT	CEDRAT Technologies, Grenoble	SME company	France
USFD	University of Sheffield, Sheffield	University	U.K.
MD	Messier-Dowty	Industrial end-user	France

# **ADLAND** project objective



- to develop a concept of adaptive shock-absorbers
- to develop technology for actively controlled shockabsorbers applicable in landing gears (MR fluidbased or piezo-valvebased
- to design, produce and test in flight the chosen full-scale model of the adaptive landing gear

## **Strategy of Ministry of Science**

### **Strategy of Ministry of Science**

- Increase of research expenditure (25% annually until 2010)
- National Center for Research and Development
- National Framework Program (research priorities)
- Polish Technology Platforms (cooperation with industry) Polish Platforms estimate costs of strategic research programmes for 3 billion PLN annually
- Fechnological clusters, technological parks and incubators
- Support for young researcher development and researchers mobility
- Optimal use of structural funds (e.g. research infrastructure)
- Better participation in FP7

### **National Centre for Research and Development**

#### Centre vision

Reaching high level of basic research and strategic development research for economical growth of Poland

#### Centre mission

- Coordination and management of research programmes in strategic research areas
- Modernazation and building of research infrastructure
- Supporting actions for R&D transfer and commercialisation
- Supporting the development of scientific personnel, especially young scientists
- Participation in creation of ERA

### NCRD activity

Effective implementation of NCRD objectives is based on cooperation with all sectors of science: PAS and its research establishments, industrial R&D units, universities as well as industry

### > Research Programmes

NCRD is to administer entrusted research programmes by signing realisation agreements with consortia, which will show proper critical mass.

The above mechanism will support the consolidation of research units and help them establish cooperation with industry.

### NCRD activity

# > Research infrastructure

NCRD will give access to scientific&research equipment and research infrastructure to all entities cooperating with Centre by agreements on research tasks realisation.

NCRD should be based on 8-10 regional integrated Centers of Advanced Technologies

#### **National Centre for Research and Development**



Neccessary expenses for infrastructure are estimated on 1350 mln euro for 2007-2013





Modern laboratory for material research for aircraft industry (to be finished by the end of 2007)

### **Realisation of the Structural Founds Project**

- cooperation between CATs AERONET and CAMAT within creating the new modern laboratory for material research
  modern research work methods
  - new technologies
  - •new products

Subject areas of the research work in the frame of R & D Laboratory

#### for aerospace materials

- Monocrystals Directional crystallization
- Heat and creep resisting coatings (CVD)
- High speed machining (HSM)
- Materials characterisation

## **NCP and support for aeronautics**

- National Contact Point Network
- NAoMITEC SSA project
- Don Q Air SSA project

# PL NCP Network

### National Contact Point, Warsaw

- reflecting the FP6 structure: coordinators of priorities and actions + Mobility Centre
- coordinators = national delegates to the Programme Committees
- advisors in legal and financial matters, structural funds
- Advisors to some ministers (e.g science, economy)
- Members of National Technology Platforms

### NCP Network

- 20 Regional Contact Points established at National Technology Platforms run by industry
- 50 Thematic Contact Points for specific fields of science (run by universities, research institutes, agencies, associations)
- ca 150 Local Contact Points

#### **NCP-POLAND NETWORK**

2003



#### **Project objectives:**

- Promoting the participation of SMEs in IPs and NoEs to make sure that SMEs will participate in the action spurred by FP6 (FP7) to foster research and technological innovation in Europe
- Focusing attention on projects referring to micro- and nanotechnologies in the most important industrial sectors
- ICT
- Automotive
- Health Care
- <u>Aerospace</u>
- Environment

#### Project tasks:

- Assessing situation and perspectives in the countries participating in the project with respect to microand nanotechnologies and the five sectors of application selected to pin point SMEs, research structures and facilities, technological incubators, large enterprises etc.
- Identifying the SMEs that, with reference to the above sector, are most active and qualified. Assessment of their needs and plans.
- > Identification IPs and NoE that can fit with needs and plans of SMEs.
- Establishing contacts, promote co-operations, identify research facilities and industrial incubators that could be instrumental for the creation of national and trans-national networks, make evident synergies between projects.
- > Assisting the SMEs to join the above said projects assuring the quality level of this participation.



Don Q Air seeks to provide SMEs with both information and resources to participate in R&D activities in a European context. Don Q Air will increase the awareness of Polish, Romanian, and Turkish SMEs about EU activities in the aeronautics sector and will encourage their participation in RTD and cooperative research actions.

#### Don Q Air goals:

- Contact at least 250 aeronautic-related SMEs
- Analyse the technological situation of at least 170 SMEs related to the aeronautical sector (including suppliers) – 60 in Poland, 40 in Romania, and 70 in Turkey).
- Inform about RTD actions and European RTD Programmes to 170 SMEs through the celebration of 3 training seminars in each targeted country (9 seminars throughout the project).
- Support and tutor directly **90 SME**, through the creation of a Direct Support Information Area. These 90 will be integrated in a First **Excellence Club**, for further collaboration.
- Perform 50 detailed technological diagnoses, with first assessment on possible improvements. A Top 50 SMEs will be include in the Permanent Exchage Ideas Network, in order to facilitate future contacts and project cooperation.
- Develop, from 30 Project Ideas, at least 15-20 project dossiers involving various SMEs from targeted countries, training SMEs in developing good ideas, finding partners, planning resources, and fitting the proposal to the proper instruments and calls.
- > **10-12 SMEs** involved in European RTD projects/proposals.
- **5 Full Proposals**, ready to be submitted, if proper call appears.



## <u>EPATS – Future for European</u> <u>aeronautics</u>

# Question: is it possible replacing by personal aircraft car trips on a distance above 300 Km?





#### **EPATS**

### **Our Challenge:**

European air and ground transportation infrastructures are reaching saturation; main airports are congested, while small domestic airports are under-used and smaller cities lose air service.

21<sup>st</sup> century transportation and mobility demand cannot be satisfied only through investments in the hub-and-spoke and highway systems. For most of the European routes "doorstep to destination" travel time is shorter for a small executive airplane with speed 300 km/h, than for an airline airplane with speed 800 km/h.

**The challenge is** how to accommodate an expansion of travel demand, and how to increase "doorstep to destination" speed in the existing situation. One of the ways is to develop and deploy in EU an European Personal Air Transportation System (EPATS).

The way is using small aircraft, to serve small communities, served by small airports.



### European personal Air Transport System



Airborne GNSS system and easy of use through MFD &PFD graphics will assist pilots in all flight phase in all weather condition.

faster.

#### **EPATS**



#### Proposal abstract:

The EPATS (European Personal Air Transportation System) for Target Concepts: Highly Customer Oriented, Time and Cost Efficier and Pioneering the Air Transport Towards the Future.

The Future EPATS will explore a niche between Surface and Scl

The EPATS will provide wider use of small aircraft, served by access to more communities in less time.

The goal of the SSA proposal is to evaluate the needs, and to prepare new European Air Transportation System, based on society needs an

The EPATS study will address the following issues:

- The potential new market for personal aviation up to 2020.
- The impact of this new way of transport on the European ATM, a as well as the environmental, safety and security issues involved.
- The technical requirements for this class of aircrafts.
- The R&D programme, to be include in the European Research A

The deliverable of the study will be an added value for E requirement, R&D programme as a recommendation for FP-7, and ir

A dissemination workshops will share the results of the stu stakeholders - to promote the EPATS idea, create new market ses revitalisation of the European General Aviation Industry.

The EPATS SSA proposal fits in the framework of FP6-2002-Aerc area of Aeronautics Specific Support Actions", especially: "De strategy in the sector", "Promoting SME participation" and "Promo participation".

#### Main challenge of EPATS:

• To explore a niche between Surface and Scheduled Air Transport.

 To provide wider use of small aircraft, served by small airports, to create access to more communities in less time, and revitalization European General Aviation Industry.

To reduce **"doorstep to destination"** travel time, and increasing daily radius of action of people.

#### Main objectives of EPATS SSA proposal:

• To identify the new market for personal aviation in Europe, to define "feasibility study" (impact on ATM, airport infrastructures, environment, safety, security) and preliminary "road map" of EPATS implementation.

• To define "Key Players", and to organize "work shops" for public discussion about EPATS.

To finalize "Road Map" of EPATS implementation, and to prepare set of EPATS goals to Strategic research Agenda and FP 7. **EPATS – Specific Support Action** 

6th Framework Programme 1.4 Aeronautics and Space

#### AERONAUTICS SPECIFIC SUPPORT ACTION Proposal

#### **EUROPEAN PERSONAL AIR**

#### **TRANSPORTATION SYSTEM**

Proposal Title:

EUROPEAN PERSONAL AIR TRANSPORTATION SYSTEM

- EPATS -

Institute of Aviation Eurocontrol Experimental Center Institut du Transport Aerien M3Systems National Aerospace Laboratory Polskie Zaklady Lotnicze sp. z o.o. w Mielcu Rzeszow University of Technology WSK PZL Rzeszów S.A.

Warsaw, 2005

# **EPATS**

Institute of Aviation	Poland
Eurocontrol	Belgium
Institute Transport Aerien	France
M3Systems	France
National Aerospace Laboratory	Netherland
Polskie Zakłady Lotnicze sp. z o.o. w Mielcu	Poland
Rzeszów University of Technology	Poland
WSK PZL Rzeszów S.A	Poland

# Thank you for your attention

## National Contact Point

www.6pr.p



Zbigniew.Turek@kpk.gov.pl Telephone +48 22 828 74 95 Fax +22-828 53 70

> ul. Świętokrzyska 21 00-049 Warszawa Instytut Podstawowych Problemów Techniki