EDUCATIONAL AND SCIENTIFIC ACTIVITY OF INSTITUTE OF MOTOR VEHICLES AND TRANSPORTATION FACULTY OF MECHANICAL ENGINEERING MILITARY UNIVERSITY OF TECHNOLOGY

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Abstract

The paper presents some information about the Institute of Motor Vehicles and Transportation. The presented information is about history, current structure and staff of the Institute of Motor Vehicles and Transportation. The Principals of the Institute since his establishment are mentioned. In this article are also presented educational activity of the Institute i.e. stationary and non-stationary commercial studies (1st and 2nd degree), Ph.D. studies (3rd degree), post-graduated studies and specialized courses. In the article are presented example educational and research equipment. Moreover, priority scientific and research areas and selected research results and applications carried out at the Institute of Motor Vehicles and Transportation, i.e. at his three departments are presented here. Scientific research projects realized nowadays, which are financed by the Ministry of Science and High Education, also are specified. The selected awards and commendations are presented too.

Thus it is clearly visible that the Institute of Motor Vehicles and Transportation actually is good arrangement to education the civilian and military students as well as to realization the research work, particularly for Military Forces.

Keywords: *history, educational scientific and research areas, awards and commendations*

1. Introduction about history of the Institute

The Institute of Motor Vehicles and Transportation is the continuator of didactic and scientific-research activities of the Tanks and Motor Vehicles Departments of Military University of Technology, since her establishment i.e. from the 17th April 1950.
The first institute structure in the Faculty of Mechanical Engineering was established in 1967. In that time, the Institute of Motor Vehicles and Working Machines, among others, was appointed.

His name was changed in 1974 on the Institute of Motor Vehicles. The Principal of the Institute from 1967 to 1981 was Col. Prof. Stanisław Kocańda, PhD., D.Sc., Eng. On 15th April 1971 from this Institute was evolved the Institute of Motor Vehicles Maintenance, and in 1974 was evolved the Institute of Working Machines. The Principals of the Institute of Motor Vehicles Maintenance, from 1971 to 1975, was Col. Prof. Michał Hebda, PhD., D.Sc., Eng, and from 1975 to 1981 – Col. Assoc. Prof. Jan Leśniewski, Ph.D., Eng.

In 1981 Institute of Motor Vehicles and Institute of Motor Vehicles Maintenance were connected. Principal of the new Institute of Motor Vehicles was designated Col. Remigiusz Moraczewski, Ph.D., Eng. (1981-1982). The successive Principals were: Col. Assist. Prof. Jerzy Cypko, Ph.D., Eng. (1981-1985); Col. Prof. Leon Prochowski, Ph.D., D.Sc., Eng. (1985-1992); Col. Prof. Wacław Borkowski, Ph.D., D.Sc., Eng. (1992-2002) and Col. ret. Assoc. Prof. Jerzy Walentynowicz, Ph.D., D.Sc., Eng. (2002-2008).

Since October 2008 the Director of Institute of Motor Vehicles and Transportation is Col. ret. Prof. Tadeusz Kałdoński, Ph.D., D.Sc., Eng.

2. Current structure and staff the Institute

At present, the educational and research equipment of the Institute is placed into 8 buildings. There are, among others, 15 lecture rooms and 35 department laboratories. Moreover on institute region are the repair shop of vehicles, motor school and two diagnostic stations of motor vehicles. The localization of Institute buildings on the plan of Military University of Technology and the current structure of the Institute are presented below (Fig.1, Fig. 2).

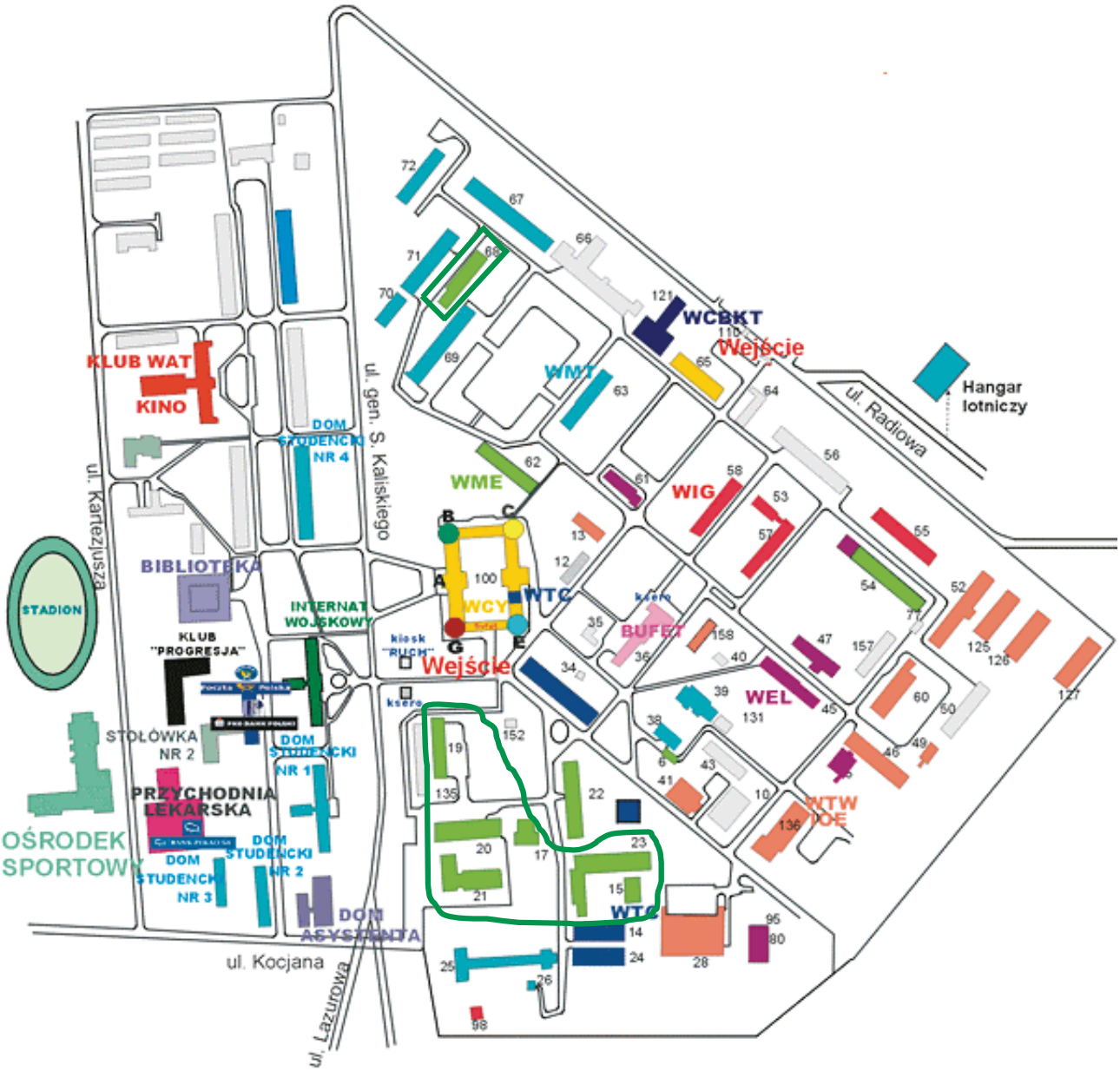


Fig. 1. The general plan of Military University of Technology and localization of Institute buildings (green line)

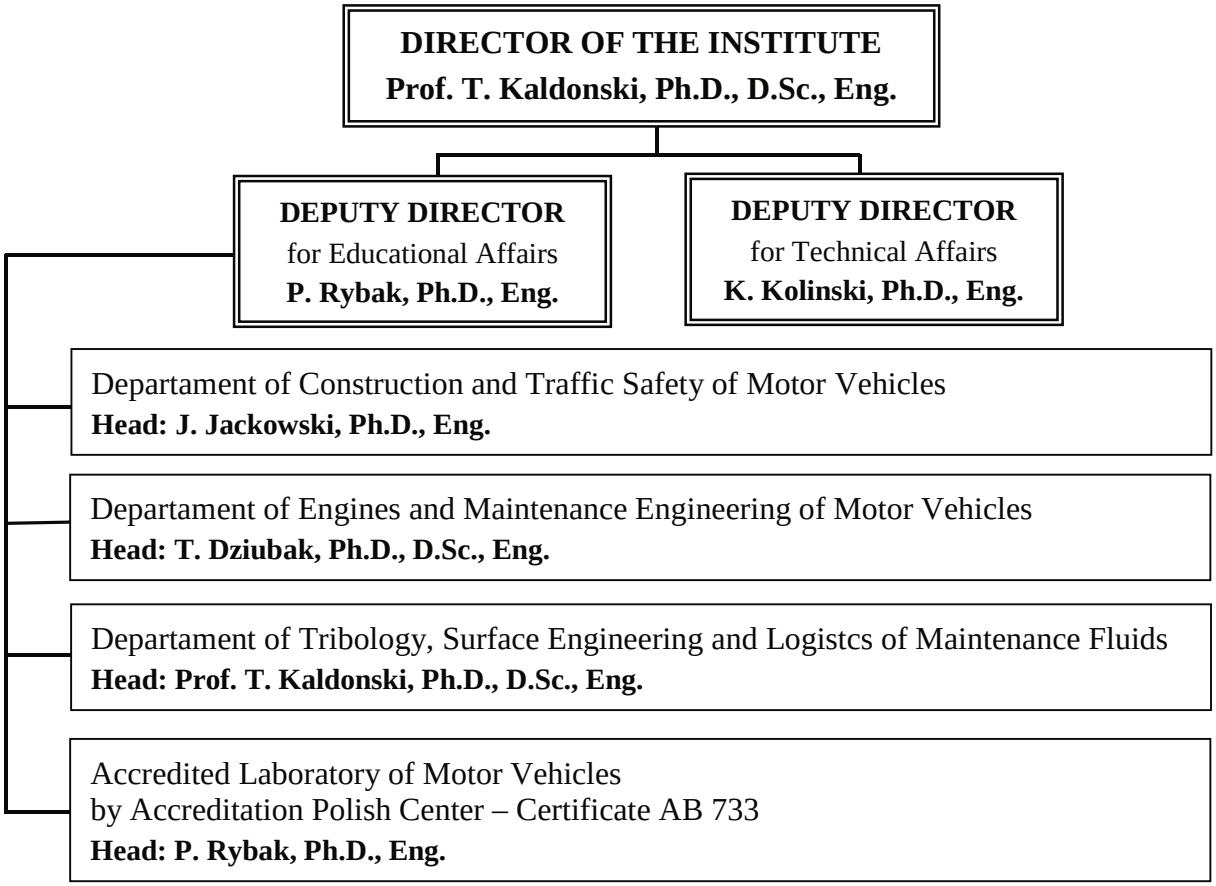


Fig. 2. The current structure of the Institute of Motor Vehicles and Transportation

The current staff of the Institute constitute: 3. full professors, 4. associate professors, 19. PhDs, 7. MScs and about 15. technicians. Moreover, periodically are engaged about 15. experts and lectures, for example for traffic safety, law, etc.

3. Educational activity of the Institute

At the Institute are realized variety types of teaching:

A: Stationary and non-stationary commercial studies (1st and 2nd degree) for specialities (for example):
- motor vehicles (cars and tractors),
- maintenance engineering of motor vehicles,
- mechatronics and ecology for motorization,
- logistics and application of petroleum products.

B. PhD. studies in the following areas (3rd degree):
- mechanical engineering and machinery maintenance,
- mechanics.

C. Post-graduated studies for specialities (for example):
- control electronics system of motor vehicles,
- propulsion systems and motor vehicle maintenance,
- safety of road traffic and motor-car expertise,
- logistics and ecology in motorization back-up facilities,
- rationalization and normalization of petroleum products consumption.

D. Specialised courses (for example):
- electric and electronics system of motor vehicles,
- mechatronics of propulsion systems,
- tribology and tribotechnology,
- ecological aspects of motorization,
- I. C. engine and motor vehicle testing technology,
- storage and distribution of petroleum products,
- contemporary repair technologies of motor-car,
- economy and organization of operating systems,
- new concept of propulsion systems …..

The example educational (and research) equipment is presented below (Photo. 1 - 12).

Photo. 1. Mechatronic educational equipment of motor vehicle

Photo. 2. The great dimension law temperature chamber

Photo. 3. Station for running wheel investigations

Photo. 4. Station for dynamic tests of truck tyre

Photo. 5. Station for dynamic tests of ride cars

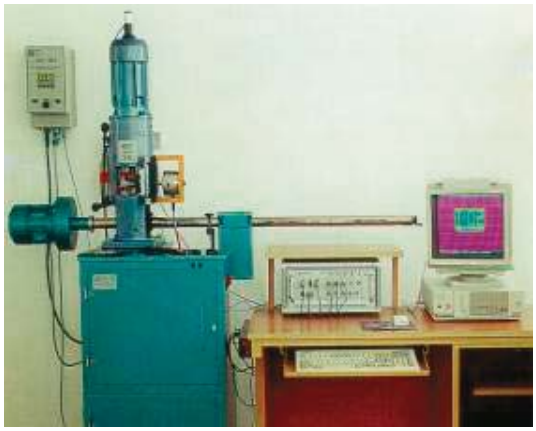


Photo. 6. Four-ball wear tester

Photo. 7. Block-on-ring wear tester

Photo. 8. Spectrometer FTIR

Photo. 9. Spectrometer AA

Photo. 10. Stand for investigations of self- lubricating bearings

Photo. 11. Pin-on-disc wear tester

Photo. 12. Ravenfield HT/HS viscometer

4. Scientific and research activity of the Institute

The priority scientific and research areas of the Institute are:

A. Diagnostic and modernization of combat vehicles and means of road transportation, petroleum storage, transportation and distribution equipment, the development operating and servicing systems.

B. Modelling, design, modernization and exploration of hydrostatic and hydrokinetic power transmission systems, their automation and control as well as operation in extreme weather conditions.

C. Research into fatigue life of new construction materials with special focus on the phenomena occurring in these materials and on laser-based methodologies of surface layer processing.

D. New construction and utilization materials, their manufacturing, processing and durability testing fatigue and fracture development testing, tribology tests, physical and chemical properties investigations, and other research ordered by the Polish Army.

5. Selected research results and applications

The extensive expertise and unique facilities of the Institute have been and are used for scientific research commissioned both by military and civilian industries. Their main focus areas in the last time included modernization of combat vehicles and means of transportation, and development of their operations and maintenance systems.

The selected important topics as well as selected research results and applications, which were realized by scientists from Institute of Motor Vehicles and Transportation, are presented bellow.

5.1. Constructed and investigated fuel transportation and distribution equipment

Fuel transportation and distribution equipment was constructed and investigated by scientists from Department of Tribology, Surface Engineering and Logistics of Maintenance Fluid, for example the new ø150 field pipeline with cone shaped quick – release snap – type connectors (two Polish patents).

Photo. 13. Field pipeline Ø 150 with self-locking catch destined for fuel transportation

Photo. 14. Self-propelled pump station cooperating with field pipeline

5.2. Investigations of engine fuels and lubricants for technical equipment

Research was and is conducted in connection with selection of maintenance fluids for technical equipment, ageing processes, tribological and low temperature properties of engine fuels and lubricants. Problems of fluid alignment with NATO requirements, including the F-34 single fuel have also been tackled. These problems are realized in Department of Tribology, Surface Engineering and Logistics of Maintenance Fluids.

a) Putting into practice an idea of battle-field single fuel in the Land Forces

Photo. 15. Durability of injection systems investigation stand

Photo. 16. Operating investigation of F-34 fuel

b) Elaboration and putting into practice a biodegradable launch grease

Photo. 17. Launching of the ship at dock

Photo. 18. Investigations of grease layer in real launching conditions

5.3. Evaluation of technical conditions and diagnostic of vehicle engine

This area embraces works on selection of fuel substitutes for engines, investigations of power transmission systems of motor vehicles, investigations of hybrid propulsion with fuel cell. It also

covers the analysis and selection of parameters and design of diagnostic procedures and equipment geared towards process automation. These problems are solved in Department of Engines, and Maintenance Engineering of Motor Vehicles.

Photo. 19. Diagnostic computer set KZD-1 for Diesel engine diagnosis

Photo. 20. Testing station with Euro 2000 diagnostic line

Photo. 21. Investigation of hybrid propulsion with fuel cell

Photo. 22. Investigation of injectors with electronic control

5.4. Research into traction systems of motor vehicles

Work is carried out on problems of mathematical modelling and forecasting of dynamic loads and durability of suspension components and traction systems of motor vehicles. Unique test bed allow to conduct research into car motion safety and dynamics, efficiency of braking systems, selection of tires and suspension components and measurements of internal and external levels of

noise emitted by vehicles. These problems are solved in Department of Construction and Traffic Safety of Motor Vehicles.

Photo. 23. Dynamometric trailer in road tests

5.5. Studies of track-laying combat vehicles

Investigation of impact strength of load carrying structures of combat vehicles based on FEM and computer simulation methods are realized by scientists from Department of Construction and Traffic Safety of Motor Vehicles.

Photo. 24. Experimental examination of impact strength of tank

Photo. 25. Experimental-examination of dynamics of tank power transmission systems

6. Selected scientific research projects realized nowadays

Research Grants

- Analysis on influence of new constructions of tyres on safety of motor vehicles in curvilinear motion (manager: W. Luty, Ph.D., Eng.).
- Analysis on possibility of correction of effective and durability parameters of power unit of infantry combat vehicles BWP1 (manager: G. Trawiński, Ph.D., Eng.).
- Definition of influence of single fuel F-34/35 with biocomponents on work of high – pressure feeding system type Common Rail (manager: M. Karczewski, Ph.D., Eng.).
- Investigations on application ability of laser ablative microtreatment for forming processes of operational properties of I. C. engine elements liable to heat shocks and tribological wear (manager: Prof. T. Burakowski, Ph.D., D.Sc., Eng.).
- Design of new high – temperature cooling system for I. C. engine (manager: Assoc. Prof. J. Walentynowicz, Ph.D., D.Sc., Eng.).
- Modern materials on the base of Fe-Al phase for application in self – lubricating sliding bearings (manager: B. Giemza, Ph.D., Eng.).
- Compilation of bases for production engineering and regeneration of military motor vehicles elements utilizing the laser rebuilding and for investigation of operational properties of laser rebuilding layers (manager: St. Kowalczyk, Ph.D., Eng.).
- Compilation of bases for modification engineering of superficial layers of monoblock cylinders and cylinder liners of I. C. engines utilizing the laser micro – treatment (manager: A. Woźniak, Ph.D., Eng.).
- Evaluation of mating course of tribological junction elements utilizing the triboelectrical effect (manager: E. Cypko, Ph.D., Eng.).
- Analysis and forming of dynamical loads of wheel multi axial armoured personal carrier in aspect for accommodation of the base version to development of special version and modernization (manager: Prof. W. Borkowski, Ph.D., D.Sc., Eng.).
- Investigation of ageing processes and definition of limiting values of parameters of lubricating oils in selected process for porous sliding bearings (manager: A. Król, Ph.D., Eng.).

- Compilation of laser ablative technology of micro-and-nano-treatment for aircraft industry and motorization (manager: W. Napadłek, Ph.D., Eng.).
- Complex evaluation of usability of ionic liquids for lubricating engineering (manager: Cz. Pakowski, Ph.D.).

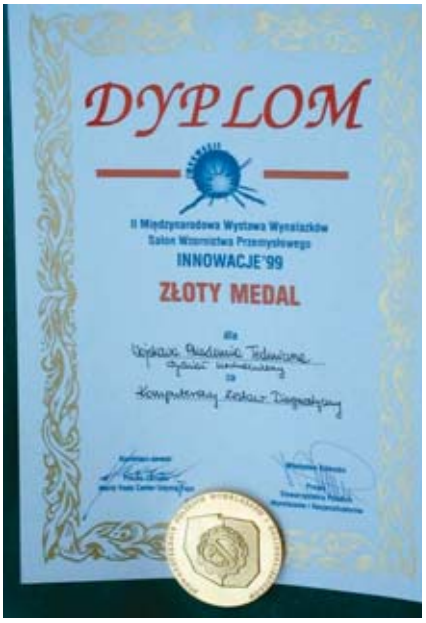
Research – development Grants

- System of concrete protective barriers and dissipative of collision energy of motor vehicles for highway with high intensity traffic volume and high road accident hazard (manager: Prof. W. Borkowski, Ph.D., D.Sc., Eng.).
- Elaboration, investigation and preparation for practical application in military technology the porous sliding bearings of new generation with increase capacity and lengthen the life, impregnated ecological lubricants containing selected surfactants including ionic liquids (manager: Prof. T. Kałdoński, Ph.D., D.Sc., Eng.).
- Compilation of modern technology for preparation of surfaces from selected metal alloy for creep-resisting layers and coats (CVD, TBC and others) applied on constructional elements (manager: W. Napadłek, Ph.D., Eng).
- Light tank on the base of multipurpose combat platform (manager: P. Rybak, Ph.D., Eng.).

7. Selected awards and commendations

The staff of the Institute have been awarded with many prizes and commendations, including:

- 1 nominated to prize by President of the Polish Republic,
- 4 state prizes,
- 7 prizes by the Minister of Defence,
- 8 prizes by President of the Polish Academy of Sciences,
- 9 prizes by Minister Education,
- 15 other ministerial prizes,
- 35 prizes by the Rector of the Military University of Technology.



Awarded titles and degrees

- Full professors - 8,
- Associate professors - 18,
- PhDs - 80.

Publications:

- Monographs - 40,
- Academic books - 80,
- Papers over - 2000.

Polish Army Inventor

8. Conclusion

In conclusion it is to emphasize that the Institute of Motor Vehicles and Transportation has a considerable role at the Faculty of Mechanical Engineering, Military University of Technology.

The correct progress of scientific-workers, modern curriculums, research laboratories, competence and authority of the staff cause that the Institute of Motor Vehicle and Transportation actually is good arrangements to education the civilian and military students as well as to realization the research works, particularly for Military Forces.