GDAŃSK UNIVERSITY OF TECHNOLOGY

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Faculty of Ocean Engineering & Ship Technology
GDAŃSK UNIVERSITY OF TECHNOLOGY

DIRECTIONS OF THE SCIENTIFIC RESEARCH CONDUCTED IN THE DEPARTMENT OF MARINE AND POWER PLANTS OF THE FACULTY OF OCEAN ENGINEERING AND SHIP TECHNOLOGY OF THE GDANSK UNIVERSITY OF TECHNOLOGY

Zbigniew Korczewski

Gdansk University of Technology, Poland
Faculty of Ocean Engineering and Ship Technology
Department of Marine and Land Power Plants
11/12 Narutowicza Str., 80–233 Gdansk, phone/fax: 58 347 21 81
e-mail: z.korczewski@gmail.com

Abstract

In this article the short historical outline of the Department of Marine and Land Power Plants of the Faculty of Ocean Engineering and Ship Technology of the Gdansk University of Technology was introduced. Its activity beginnings, in the post-war history of the University, reach 1952. The leading scientific issues, which have been developed for years in three principal directions: design, manufacture and operation of machines and devices installed into marine and land power plants as well as into different type of the offshore power plants. There was given a special focus on the Professors' profiles executing official duties of the Head of the Department (Division) of Marine Power Plants (Marine and Land Power Plants). They were creating its development policy over the last 60 years bringing a substantial contribution towards the present intellectual and laboratory potential, not only to the Department, but also to the Faculty and University.

Keywords: Gdansk University of Technology, Department of Marine And Land Power Plants, scientific research, characteristics.

1. Introduction – Historical background

The Gdansk University of Technology was founded in 1904 and nowadays this is one of the oldest autonomic state universities in Poland and the oldest Engineering University on the present Republic territory - fig. 1. It includes 9 faculties on which 27 thousand students, postgraduates and doctor students study. It employs almost 2500 persons of which approximately 1200 academic teachers.

The first academic year inauguration at the University took place on 6 October 1904 and the Emperor Wilhelm II participating in this event opened officially the King's Technical High School in Gdansk (germ. *"Königliche Technische Hochschule zu Danzig"*). In that time the University had 4 faculties[1], including the Faculty of Shipbuilding and the Marine Machines.

[1] In 1904 the University included four faculties: Mechanical & Electrical Engineering, Chemistry, Civil Engineering and Shipbuilding & Marine Machines, and in 1906 two additional faculties were established: Architecture and General Sciences.

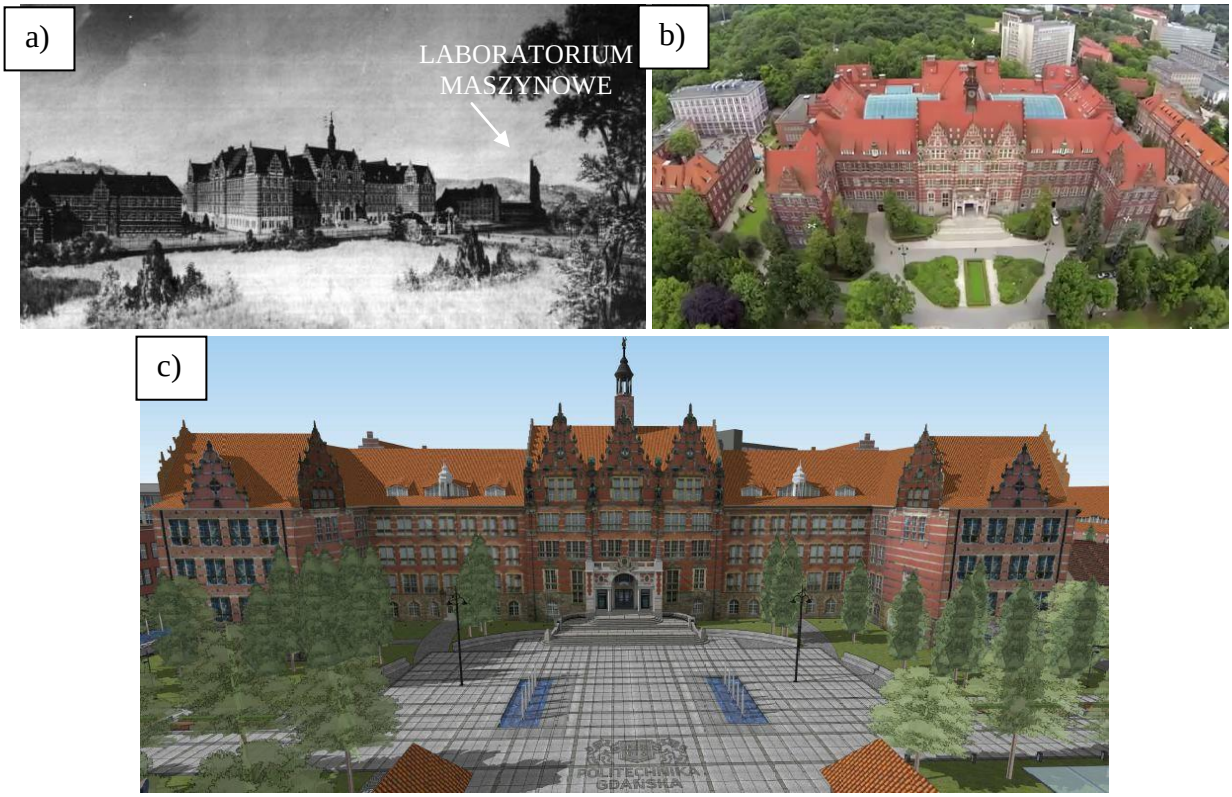


Fig. 1. Campus view of the Gdansk University of Technology: a) as at 1904, b) current state – a bird-eye view, c) visualization according to the project of the reconstruction carried out currently [www.pg.gda.pl; www.trójmiasto.pl; www.danzig-online.pl]

Fig. 2. View of the Main Building of the Gdansk University of Technology just after Gdansk was liberated, in March 1945 [www.pg.gda.pl]

This Faculty had an organisational unit responsible, in its statutory activity, for conducting education and scientific investigations within the range of marine power plants. It was located in the Machine Laboratory which exists till today and remained the World War II almost unharmed. In the

period between the two World Wars the University fates were very turbulent, which had its reflection in the next reorganisations during dynamically changed geopolitical situation. These issues have been analyzed and described in numerous historical publications in detail, national and foreign [1,7,9,13,14].

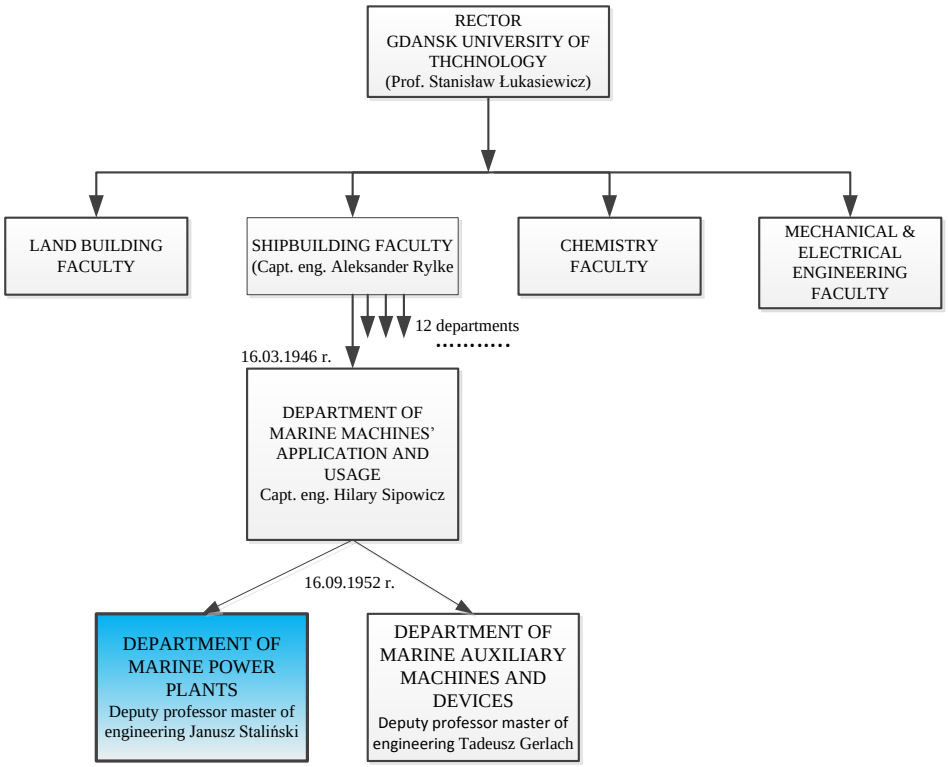
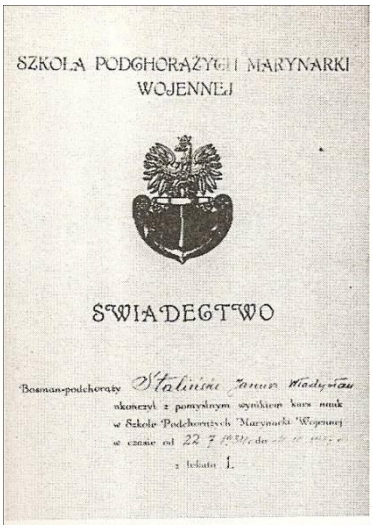


Fig. 3. A fragment of the organisation chart of the Gdansk University of Technology during the first post-war years

After the end of the war the University very quickly "gathered itself" and already on 24 May 1945[2] was revitalised by the Regulation of the Council of Ministers under its today's name. That time University had four faculties: Landbuilding, Shipbuilding, Chemistry and Mechanical & Electrical Engineering - fig. 2 [10,11,12]. It is worth mentioning in this place that the pre-war officers brought the huge contribution to the reconstruction of the Shipbuilding faculty in that period. They were entrusted with essential, managerial responsibilities (key academic positions) – fig. 3 [2,6,8,10,12]. And so the Captain eng. Alexander Rylke was the first dean of the Shipbuilding Faculty, moreover Captain eng. Hilary Sipowicz handled the Department of Marine Machines' Application and Usage. It in next stages of the Faculty reconstruction and further development the Department of Marine Power Plants was created. Its first manager was contemporary deputy professor master of engineering Janusz Staliński – a person particularly distinguished for the University[3]. Prof. J. Staliński fulfilled duties of the Department manager three times, the longest in its post-war history, as follow: 1952-1957, 1960-1977, 1983-1985. Interesting, he had also the military past behind, in the Polish Navy. In 1937 he graduated from the Technical Faculty of the Naval Cadet School in Torun (he finished his military studies as a top student) - fig. 4. Then he fulfilled duties of the 2-nd officer engineer on the warship named ORP Błyskawica (ang. "Lightning"). He was also graduated from the Gdansk University of Technology within the post-war first class and received his master of engineering diploma at the Shipbuilding Faculty in 1949. He involved all his professional life in this Faculty. Prof. J. Staliński conducted scientific investigations in four fundamental areas:

[2] It is worth pointing out in this place that Germans escaped from the University just on the 26 of March 1945.

[3] He held the position of Rector at the Gdansk University of Technology in the period of 1970-1975 and many other honorific positions: academic, industry, state (a Member of Parliament).


SZKOŁA PODCHORĄŻYCH MARYNARKI WOJENNEJ

ŚWIADECTWO

Bosman-podchorąży Staliński Janusz Władysław
ukończył z pomyślnym wynikiem kurs nauk
w Szkole Podchorążych Marynarki Wojennej
w czasie od 22 7 19[illegible] do [illegible]
z lokatą 1.

Fig. 4. Diploma of boatswain cadet Janusz Staliński, a graduate of the Technical Faculty of the Naval Cadet School *in Torun as at 1937 [5]*

- reproduction of the technical-operation documentation of the ships and warships overtaken, remaining after the war;
- design of marine vessels with a special order of the Shipbuilding Industry and the Polish Navy;
- design of decompression chambers for the Polish Navy;
- energy-operational measuremets of the sea-going and inland vessels's power plants.

He is the author of two monographs, at present they are genuine rarities of the old marine engineering literature perfectly known to many generations of shipbuilding faculties' graduates, not only at the Gdansk University of Technology, namely: "Marine Power Plants", published in 1955 as well as "Theory of Ship" - published in 1961.

The next manager of Department of Marine power Plants, within the period of 1957-1960, prof. eng. Hilary Sipowicz. As the graduate of the Machanical Faculty of the Polytechnic Institute in Petersburg from 1915 was qualified to service in Russian Navy. He served as an engineer officer on submarines in the period of the First World War. After his return to Poland in 1919 he fulfilled a series of responsible positions in the Polish Navy as the active service officer, among others, in technical supervision of warships built abroad [8,10]. Then (1932-1939) he acted as the organiser, manager and lecturer of the Technical Faculty of the Naval Cadet School in Torun. It should be emphasised in this palce that he was a teacher of prof. J. Staliński who studied in Torun Alma Mater in that time.

In the first years of occupation prof. H. Sipowicz organised the secret teaching at the Warsaw University of Technology, where he conducted a cycle of lectures devoted to the shipbuilding. Directly after the end of the war he, in the rank of captain, fulfilled duties of the main mechanic of Polish Navy Fleet, however in the period of 1945-1946 he actively participated in reactivation of the Naval Officer Higher School in Gdynia. Simultaneously, he co-organised the post-war activity of the Shipbuilding Faculty at the Gdansk University of Technology.

By his whole professional life prof. H. Sipowicz conducted scientific investigations within the scope of design and operation of the steam boilers and machines. He worked out many engineering and investigative projects, which were implemented into marine power plants of different type of warships, and also merchant ships, powered by steam machines.

Among the academic teachers fulfilling duties of the head of the Department of Marine Power Plants there was also associate professor Przemysław Urbański PhD. He held this position twice: in the period of 1977-1981 as well as 1985-1989. As a fresh graduate of the Shipbuilding Faculty of the Gdansk University of Technology from 1951 he began working at the Sea Technical Institute (later the Sea Institute). In 1953 he passed to the Gdansk University of Technology where he worked continuously at the Department of Marine Power Plants of the Shipbuilding Faculty until his passage

on pension in 1996. In the period of 1970-1972 he was working as a professor at the Technical University in Basrah (Iraq) and in the period of 1981-1983 - at the University in Harbour Harcourt (Nigeria). Prof. P. Urbański carried out operation investigations of machines and propulsion systems applied in sea-going and inland ships as well as warships, with a particular consideration of steam powered systems. He also worked on designing marine machines devices, e.g. turbine heat circulations, initiating the computer methods as well as designing cargo ships for Arctic zones. He is an author of the superb monograph in the scope of marine power plants entitled, as follows: "Two Centuries of the Mechanical Ship Propulsion" (1995) and " Ship's propellers - the History and Development" (2001).

Prof. P Urbański was succeeded in the position of the manager of the Department of Marine Power Plants by prof. Władysław Wojnowski PhD, a graduate of the Shipbuilding Faculty of the Gdansk University of Technology from 1952, who was fulfilling this position in the period of 1989-1992. He started his didactic work in 1940 at the age of 18 as a young village teacher at the Basic School in Lida district and he finished this job in 1992 as a professor of two Universities: the Naval Academy in Gdynia (PNA) and the Gdansk University of Technology. The professor's didactic activity enclosed 52 years, of which 35 years at the Naval Academy and 16 years at the Gdansk University of Technology as well as 6 years at both Universities simultaneously. He fulfilled a lot of organisation positions at the PNA, among others, the Head of Scientific Division, the Head of Department of Marine Power Plants - 14 years, the Head of the Institute of Ship Construction and Propulsion - 8 years, Dean of The Faculty of Mechanical and Electrical Engineering - 14 years. Prof. W. Wojnowski possesses the exceptional skill of teamwork. Investigative teams handled by him worked out many projects of the key meaning for navy development and also shipbuilding industry including, as follows:

- automatic control systems of the marine power plants and the ship as well as the remote control systems of the unmanned (uncrew) warships,
- miniature under-water vehicles designed for scuba divers 's transportation,
- prototype watercraft of the hovercraft,
- energy-saving power plants of ships for the Polish Oceanic Lines,
- computer methods of designing marine propulsions.

These research works became distinguished many times, among others: the prizes of the Scientific Secretary of the Polish Academy of Sciences in 1972 and 1976, registration to the Honourable Book of Acts and Achievements of the Polish Science Year in 1973, team the 1st State award as well as team the 3rd award of the Minister of National Defence.

Prof. W. Wojnowski is an author of the three-part monograph entitled "Marine Combustion Power Plants" (1998-2002), in which the general information associated with designing and performing the machines and devices of the machine power plants have been presented in complex way.

The position of the head of the Department of Marine Power Plants was also fulfilled by prof. Alfred Brandowski PhD - within the period of 1993-1999. He graduated from the Shipbuilding Faculty of the Gdansk University of Technology in 1952 (bachelor degree engineering studies) and in 1957 (master of engineering). He was getting his professional experiences as a worker of the Gdansk Shipyard, within the period of 1952-1955 as well as the Central Office of Shipping Construction No. 1, within the period of 1957-1964. These experiences were very useful in his later didactic-scientific work, not only at the Gdansk University of Technology, but also at the Naval Academy in Gdynia (1950-1969) and at the Higher Nautical School in Gdynia (1973-1981). Prof. A. Brandowski specialised in scientific issues connected with technical systems' safety. He conducted scientific investigations within the range:

- safety engineering of anthropotechnical systems as well as their application, particularly in shipbuilding,
- modelling the risk of sea-going ships,
- analyses of safety of sea-going ships,
- modelling the wear and tear processes of marine power plants' technical objects.

Another person on the position of the head of the Department of Marine Power Plants was Prof. Jerzy Girtler, PhD. retired Captain of the Polish Navy. He was holding this position incessantly by over 12 years, taking over duties from prof. A. Brandowski in February 2000 and delegating them responsibilities to the author of the present article on July 2012. It is important to note that prof. J. Girtler still works in the Department serving with the priceless scientific knowledge and professional experience to his former subordinates as well as doctoral candidate, postgraduates and students cooperating with the Department.

He dedicated the larger part of his professional activity to the Polish Navy and due to circumstance of the Professor's 70 jubilee his curriculum vitae including education, qualifications and previous positions, along with a description of work history will be characterised more in detail. He began service to the Polish Navy in 1965, as a motorman in the mechanical division of the warship named ORP "Seagull". Then, in 1966 he found his way directly from the vessel to the Naval Academy in Gdynia and began studies at the Technical Faculty. After the end of studies, already as a navy sub-lieutenant, he began a teacher's work on his parent Faculty. He simultaneously undertook master degree studies, in extramural mode, which he finalized in 1975. While he was working on her PhD thesis he got to know prof. Alexander Wajand from the, the great scientific authority as well as the sympathiser and the friend of the Polish Navy. Close acquaintance with Professor A. Wajand has always represented a very positive justification for Jerzy Girtler to solve more and more sophisticated scientific problems and to continue the scientific career what he always strongly underlined. He defended his doctor thesis entitled "The comparative analysis of mathematical models for reliability investigations of self-ignition engines" at the Mechanical Engineering Faculty of the Łódź University of Technology on 20 June 1980. As for his habilitation (postdoctoral) dissertation entitled "Marine combustion engines' control process on the basis of the diagnostic decision-making process model" was introduced by him on a professorship colloquium in front of the Board of the Working Machines and Vehicles Faculty of the Poznań University of Technology on 9 May 1990. The professor's appointment handed by President of the Polish Republic on 22 October 1998 constituted a culmination of the Captain J. Girtler's scientific accomplishments. In that time (1995-2000) he handled the Institute of Marine Power Plants' Technical Operation of the Mechanical Engineering Faculty of the Higher Nautical School Sea in Szczecin (at present The Maritime University of Szczecin).

Within Professor Girtler's vast publication record there are numerous books and promissory notes (1995-2000) which enjoyed much popularity among the experts dealing with marine machines and devices operation in the wide meaning. The most important literature positions include undoubtedly the following ones:

- Girtler J., Kitowski Z., Kuriata A.: Bezpieczeństwo okrętu na morzu. Ujęcie systemowe. WKiŁ. Warszawa 1995;
- Girtler J.: Diagnostyka jako warunek sterowania eksploatacją okrętowych silników spalinowych. Studia Nr 28. WSM, Szczecin 1997.
- Girtler J., Kuszmider S., Plewiński L.: Wybrane zagadnienia eksploatacji statków morskich w aspekcie bezpieczeństwa żeglugi. WSM, Szczecin 2003.

He is an author of 357 publications (from what 298 author's), in this scientific articles 204 (from what 159 author's), in this 56 of international range (46 author's), and 153 reports (from what 147 author's), in this 29 lectures delivered on international conferences.

2. Department's present day – Scientific research directions

Since 2012 the Department of Marine Power Plants has been existing under the changed name of the Department of Marine and Land and nowadays stands for one of the six Departments of the Faculty of Ocean Engineering and Ship Technology - fig. 5. Three laboratories represent the basis of its didactic infrastructure. The majority of research works of the experimental nature is carried out over there. Here they are: the Laboratory of Liquid Fuels and Lubrication Oils, the Laboratory of Engines and Compressors Diagnostics as well as the Laboratory of Marine Machines and Systems.

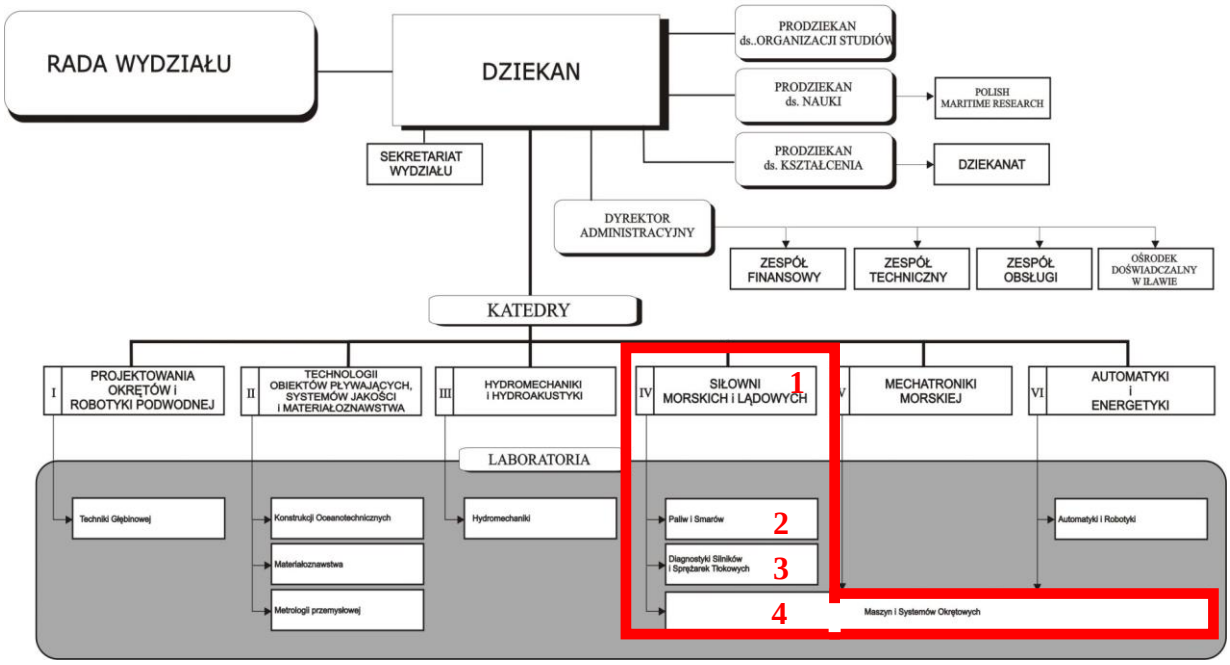


Fig. 5. The original organisation chart of the Faculty of Ocean Engineering and Ship Technology of the Gdansk University of Technology – Department of Marine and Land Power Plants (1) along with Laboratories: Liquid Fuels and Lubrication Oils (2), Engines and Compressors Diagnostics (3) as well as Marine Machines and Systems (4) is marked in red line [www.oio.pg.edu.pl]

Fig. 6. A team of employees of the Department of Marine and Land Power Plants In the group photo standing from left: MSc Eng. Konrad Marszałkowski, PhD Piotr Bzura, PhD Roman Liberacki, MSc Eng. Patrycja Puzdrowska, PhD Paweł Szymański, PhD Ryszard Zadrąg, MSc Eng. Norbert Ochał, MSc Tomasz Hoła; sitting from the left: assistant professor Damian Bocheński PhD, prof. Zbigniew Korczewski (Head of the Department); prof. Jerzy Girtler PhD, PhD Jacek Rudnicki

At present 10 academic teachers and 2 engineering-technical workers are employed in the Department - fig. 6. The teacher staff is represented by two titular professors, one assistant professor, five doctors and two masters in engineering having opened doctorates. Each teacher specialises in scientific issues associated with a design and operation of the complex energy systems' machines and devices applied in marine power plants and different kind of offshore structures.

Crossing to the profile of scientific investigations led in the Department there will be introduced, obviously only in a telegraphic shortcut, the range of undertaken issues as well as research teams that may boast about biggest scientific achievements

A. Energy research of marine propulsion systems with gas turbine and combustion piston engines

Scientific team is headed by prof. Zbigniew Korczewski PhD. The range of investigations involves research issues, as follows:

- Modelling and numeric simulations of the energy processes worked out in engines and working;
- Diagnosing mechanical units of the marine propulsion systems in operation conditions;
- Diagnosing marine engines: piston and gas turbine of limited control susceptibility;
- Industrial endoscopy;
- Expert systems;
- Exhaust desulfurization of the marine engines fed with residual fuels.

B. Theory and practice of the decision steering. Tribology

Scientific investigations within this range are carried out by a team handled by prof. Jerzy Girtler PhD. The research is orientated towards scientific problems, as follows:

- Application of semi-Marcov processes theory and statistical theory of decision within the area of marine power plants' reliability, diagnostics and safety;
- Modelling and examinations of the tear and wear processes of the slide tribological units;
- Energy devices' performance examination and evaluation.

C. Design theory of the special types of ships' marine power plants and technology systems

A group of scientists led by assistant professor Damian Bocheński PhD. specializes in purely design issues, taking into account in particular the following research aspects:

- Energy consumption investigations of the special ships' operation processes (dredgers, fishing vessels, tugboats of the AHTS and PSV type);
- Investigations of an impact of the soil's kind soil (its different parameters) on the working parameters of devices that loosening and transporting the dredging spoil**s**;
- Investigations of an impact of seawater temperature and ship's floatation speed on work efficiency of the sheathing coolers („box cooler" type) in order to make design recommendations;
- Application of probability methods and models in designing power plants and technology systems of the special ships.

Obtained certificates represent the guarantee of the Department's professional activity (fig. 7), including among others:

- Polish Register of Shipping – within the scope of conducting laboratory examinations of liquid fuels and lubrication oils as well as diagnostic investigations of internal combustion engines and compressors;
- Ships owners, and even marine engine producers which order the Department to carry out diagnostic tests of marine engines.

CERTYFIKAT
CERTIFICATE

Przyznany organizacji:
Issued for:
Politechnika Gdańska Wydział Oceanotechniki i Okrętownictwa
Katedra Siłowni Morskich i Lądowych
LaPiS Laboratorium Paliw i Smarów
ul. G. Narutowicza 11/12
80-233 Gdańsk

Biuro Certyfikacji Systemów Zarządzania Polskiego Rejestru Statków S.A., al. gen. Józefa Hallera 126, 80-416 Gdańsk, zaświadcza, że System Zarządzania Jakością wyżej wymienionej organizacji został oceniony i stwierdzono jego zgodność z wymaganiami:

Management Systems Certification Bureau of Polski Rejestr Statków S.A., al. gen. Józefa Hallera 126, 80-416 Gdańsk, certifies that the Quality Management System of the above organization has been assessed and found to be in accordance with the requirements of:

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Zakres certyfikacji:
BADANIA LABORATORYJNE WŁASNOŚCI FIZYKO-CHEMICZNYCH OLEJÓW SMAROWYCH I PALIW CIEKŁYCH. IDENTYFIKACJA STANU TECHNICZNEGO GŁÓWNYCH UKŁADÓW FUNKCJONALNYCH SILNIKÓW SPALINOWYCH I SPRĘŻAREK W OPARCIU O WYNIKI BADAŃ DIAGNOSTYCZNYCH

Scope of certification:
LABORATORY EXAMINATIONS OF PHYSICAL AND CHEMICAL PROPERTIES OF LUBRICATION OILS AND LIQUID FUELS. ASSESSMENT OF TECHNICAL CONDITION OF MAIN FUNCTIONAL SYSTEMS OF INTERNAL COMBUSTION ENGINES AND COMPRESSORS BASED ON RESULTS OF DIAGNOSTIC TESTS

Wyłączenia: 7.3 Projektowanie i rozwój
Exclusions: 7.3 Design and development

Pierwsze wydanie Certyfikatu: 01.12.2004
Certificate first issue:

Certyfikat jest ważny do: 19.11.2016
The Certificate is valid until:

Nr Certyfikatu: NC - 1004
Certificate No.:

Gdańsk, 20.11.2013

Jacek Papiński

AC 014
QMS

WÄRTSILÄ

Wartsila Polska Sp. z o.o.

Gdańsk 20.04.2012 r.

REFERENCJE

Niniejszym mamy przyjemność zarekomendować zespół diagnostyczny prof. Zbigniewa Korczewskiego z Katedry Siłowni Morskich i Lądowych Politechniki Gdańskiej, z którym współpracujemy w zakresie diagnozowania silników okrętowych zainstalowanych na polskich i szwedzkich promach pasażerskich eksploatowanych na Morzu Bałtyckim.

Od września 2011 roku zespół diagnostyczny Politechniki Gdańskiej trzykrotnie, na nasze zlecenie, wykonywał badania diagnostyczne silników typu 12 ZAV 40 S oraz 16 ZV 40 napędu głównego dwóch różnych promów pasażerskich, w sumie 10 silników. Jednym z podstawowych kryteriów wyboru tego wykonawcy był potencjał intelektualny, doświadczenie i uznane osiągnięcia diagnostyczne, a także wyspecjalizowana aparatura pomiarowa stosowana podczas badań silników okrętowych w warunkach bieżącej eksploatacji.

Prace realizowane przez zespół diagnostyczny PG, wykonane zostały zgodnie z harmonogramem, naszymi wymaganiami i oczekiwaniami Armatorów. Współpraca przebiegała bezkonfliktowo i sprawnie.

Planując przyszłe prace remontowe silników okrętowych bierzemy pod uwagę możliwość kontynuowania współpracy z Politechniką Gdańską, którą polecić możemy, jako solidnego partnera, dysponującego doświadczoną kadrą naukowo-badawczą oraz bogatym zapleczem systemów diagnozujących.

Miroslaw Michalowski
Business Development Manager
Wartsila Polska Sp z.o.o
ul.Twarda 12
80-871 Gdansk ,Poland
Mobile + 48 606 456 646
Fax- +48 58 347 8520
miroslaw.michalowski@wartsila.com

Wartsila Polska Sp. z o.o.
ul. Jakuba Kubickiego 13
02-954 Warszawa
Poland
tel. +48 22 550 61 72
fax: +48 22 550 61 73
contact.poland@wartsila.com
www.wartsila.com/poland

Oddział w Gdańsku / Branch Office in Gdańsk:
ul. Twarda 12
80-871 Gdańsk
Poland
tel. +48 58 347 85 00
fax: +48 58 347 85 20

NIP / VAT ID: PL9570419574
REGON: 191120569
Konto bankowe / Bank account:
ABN AMRO Bank (Polska) S.A.
79 1670 0004 0000 8439 9103 3610

Sąd Rejonowy dla Miasta St. Warszawy w Warszawie, XIII Wydz. Gospodarczy Krajowego Rejestru Sądowego,
Nr KRS: 0000165547,
Kapitał Zakładowy: 5 443 000 PLN

Fig. 6. References and certificates obtained by the Department of Marine and Land Power Plants

3. Final remarks and conclusions

Scientific-investigative activity of the Department of Marine and Land Power Plants is tightly associated with didactic process within the frame of study directions carried out in the Faculty of Ocean Engineering and Ship Technology: "ocean engineering", "power engineering" and "transport". The results of scientific investigations are systematically translated on new programme content expanding the education offer. Moreover, investigation apparatus gained during research realization enriches didactic values of the laboratory stands used while courses for students and for marine experts of various levels of the merchant navy management positions are run.

The history of Department is closely related to navy needs, as the personnel resources mainly. Initially German, in particular due to admiral Alfred von Tirpitz, a henchman of German war fleet extension by means of shipyards acting in Danzig and Elblag. The University in Danzig free city was going to deliver qualified engineers for shipbuilding and shipping. Then Polish - which resulted from the need to have the numerous and experienced engineering personnel required for programmes realisation, as follows:

- quick creation of the war fleet of independent Poland (after the end of first world war), on the base of warships bought in Western European countries exclusively,
- reconstruction of the war fleet of the liberated and ruined country based on the national shipbuilding industry as well as on the warships obtained from military surplus.

The employee of Department delegated apart from University occupied special place in this regard. They conducted education in the Polish Navy also as officers - shipbuilding engineers [3,4]. Interestingly, the migration proceeded in both directions and many entitled outstanding and titled academic teachers gained and used their scientific knowledge and professional experience, both at the Gdansk University of Technology as and at The Polish Naval Academy (and its predecessors).

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