THE ACTIVITY OF THE DEPARTMENT OF UNDERWATER WORKS TECHNOLOGY OF THE POLISH NAVAL ACADEMY OF GDYNIA (P. 2)

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ABSTRACT

The article outlines the activity of the Department of Underwater Works Technology of the Polish Naval Academy of Gdynia. This is the second part of the material aimed at presenting research and educational activity of this organisational unit. The first part provided a brief historical background related to the foundation of the department, as well as the main elements of its research infrastructure. For over 30 years the department has been engaged in a broad spectrum research related to underwater works technologies and to date it is the only research unit of this type which offers complex solutions to the related issues.
Key words: underwater works technology, marine engineering.

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INTRODUCTION

The first part of the material concerned with the Department of Underwater Works Technology of the Polish Naval Academy of Gdynia specified the purpose for its foundation, its scope of operation and the planned structure of employment.

Moreover, it defined the department's place in the organisational structure of the Academy, as well as the individual units within it with specification of their basic research infrastructures, which may be effectively used only on condition of being provided with a proper personnel potential.

In the case of the department, the staff comprises a group of specialists with diversified educational background. Its core is constituted by a group of research and teaching staff with academic degrees or titles (19% of the personnel). Over 40% of the department's staff are employees with higher technical education, grouped into a research team.

Moreover, the department also has an operational team involved in the constant performance of service and research tasks at sea (37% of employees). The teams work quite vigorously and have the capability to obtain funds for the implementation of research, which is manifested with a high parametric score with regard to scientific activity.

For instance, in 2010 the parametric score of the department constituted nearly 45% of its total, that is nearly 20 of the points gained by the whole Academy. Teams perform various tasks, from purely didactic to those involved in the implementation of scientific research and activities related to the popularisation of research results.

DIDACTIC ACTIVITY

The research and teaching staff of the department deliver classes within the first and second cycle of studies realised in the parent department, and in the remaining faculties, for example in the course of post-graduate studies.

Besides that, the didactic activity of the department consists in the implementation of a number of specialised courses for the staff of the Ministry of National Defence stemming from the Minister's regulation related to qualifications of persons performing or supervising the performance of underwater works in the Ministry. The current didactic offering of the department includes the following types of training:

1) Physiopathology of diving and first-aid
2) First aid and the principles of treating decompression
3) Pressure training for scuba divers
4) Pressure training for mine-searching divers
5) Management of diving processes and underwater works performed utilising the procedures for long-term underwater works
6) Performance of underwater works and rescue activities utilising the procedures for long-term underwater works
7) Methodology of decompression procedure with the use of various types of decompression chambers
8) Practical introduction to decompression with the use of various types of hyperbaric facilities
9) Preparation of breathing mixes and the service and maintenance of systems used in their preparation
10) Service and maintenance of a decompression chamber and associated systems and devices
11) Service and maintenance of diving equipment
12) Principles of decompression treatment
13) Training within the use of the rescue-diving hyperbaric kit called "Sercówka"
14) Training of underwater vehicle operators (ROV)
15) Advanced training of underwater vehicle operators (ROV)

For safety reasons, training courses utilising decompression chambers for the practical application of hyperbaric techniques are delivered to small groups of students, a situation that allows the department to deliver courses tailored to meet specific needs.

Additionally, thus far the department is the only training centre in Poland which offers specialised training enabling certification for the operation of remotely controlled unmanned vehicles. Such courses have been implemented as a mandatory standard for ROV operators and were prepared on the basis of methodology worked out by the department staff in accordance with international standards.

Moreover, each of the training courses realised by the department vary greatly from the courses of the same kind organised by similar military training centres. This is mainly due to the fact that the instructors are at the same time the authors of the discussed technologies. What is more, the trainees participate in classes with the creators of the techniques that they later encounter in their daily professional practice.

Practical classes are conducted with the use of the department's entire available infrastructure. Education on the subject of pressure for mine searching or scuba divers is carried out in a diving simulator, whereas the training of ROV operators takes place in a test pool and involves the use of all available ROV systems.

In 2013 the department's relatively small didactic team realised a series of courses for the staff of the Ministry of National Defence, which were successfully completed by 200 trainees, with over 500 individual exposures performed in decompression chambers (Fig. 1).

Fig. 1. The level of participation in training organised by the department in 2013.

RESEARCH ACTIVITY

The area of interest for academic workers of the department is mainly connected with underwater works technology, diving, technological security of long-term underwater stays and works, as well as new technologies using unmanned surface and underwater vehicles. In the course of the last 14 years the department has implemented over 20 research projects supported from various sources of financing:

1) Mathematical models of atmosphere ventilation in breathing apparatuses with partial regeneration of the breathing mix MNiSW (Ministry of Science and Higher Education) No. 0T00A07218
2) Deep diving for the needs of marine rescue MNiSW 148308/C-T00/2001
3) Principles for conducting interrupted ventilation of diving complexes during hyperbaric air exposures MNiSW no. 7T07C03419
4) Validation of decompression tables/schedules Project for the NATO Standardization Agency
5) Life support systems on submersible vessels Armament Policy Department no. 20/DPZ/3OTM/S/WR/MON/2002/706
6) Rescue-medicinal container hyperbaric kit MON (Ministry of National Defence) DPZ/4/TM/W/3.5.3.1/2004/WR
7) Carbon dioxide chemisorption in military applications MNiSW No. 148-414/C-T00/2004
8) Underwater works technology with the participation of divers in the depth zone 80 – 120 meters and technology development. Research project commissioned by Petrobaltic plc. involved in the search and exploration of oil deposits.
9) Preparation of concepts and tactical-technical assumptions for an unmanned system of underwater search for the needs of water – diving rescue. Research project commissioned by Seabed Poland Ltd.
10) Preparation and performance of a visual system for the purpose of a spatial observation of underwater objects in real time. Research project commissioned by Pomeranian Centre of Environmental Research Envia Ltd., a partner of the Pomeranian Scientific-Technological Park.
11) Preparation of methodology of saturation dives – research work of MNiSW, project no. R00-O0014/3 implemented between 2007-2009
12) New generation hyperbaric breathing simulator – research work of MNiSW No. O N504 497734, implemented in the period between 2008-2010
13) Designing decompression in combat missions – developmental project no. O R0001 08, implemented in the period between 2009-2011
14) Visual diagnostics of underwater objects – statutory research work, implemented in the period between 2009-2011
15) Testing of an evacuation apparatus for the crews of armoured vehicles ATE-1 – research work implemented in 2009
16) Detection and counteraction of terrorist underwater threats on the part of divers – cooperation in research project of MNiSW No. OR00009811 in the period between 2010-2012
17) Integrated system for planning perimetric protection and monitoring of sea ports and critical facilities based on autonomous unmanned vessels, research developmental project no. O R00 0106, implemented in the period between 2010-2012
18) Hyperbaric exposures in the DGKN-120 complex with the risk of an occurrence of decompression sicknessbeing estimated using the Doppler method – research work implemented in 2010
19) Measurement of the scale of damage and dimensions of underwater objects with the light pattern method – research project of MNiSW no. O N502 274039, implemented in the period between 2010-2012
20) Concept of a miniature underwater inspection system – statutory research work implemented in 2012
21) Preparation of a feasibility study in relation to the Strategic Programme for State Security and Defence entitled "Unmanned marine surface and

underwater platforms supporting the activities of OPM vessels and non-dedicated platforms in countermine activities" – commissioned by the National Centre for Research and Development (NCBiR) in consortium with the Gdańsk University of Technology, Marine Technique Centre and ITTI Ltd., research work implemented in 2012

22) Chemical Munitions Search & Assessment CHEMSE – an international research project co-financed from the European Regional Development Fund
23) Autonomous surface platforms No. DOBR-BIO4/090/13137/2013
24) Autonomous underwater platforms with silent undulating propulsion for underwater reconnaissance, NCBiR No. DOBR-BIO4/033/13015/2013
25) Designing decompression for MCM dives DOBR/0047/R/ID1/2012/03
26) Modulal underwater inspection system POIG 01.4.00-04262/13, project realised in cooperation with PBP Forkos Sp. z o.o Partner of the Pomeranian Science and Technology Park in Gdynia.

The main axis linking all the implemented projects is the provision of solutions in the areas concerned with security and defence, as well as maintaining a close cooperation with industry in the field of technologies utilised in the research and exploration of the marine environment.

Quite often the implementation of research works is associated with a broad cooperation with other research centres. An example is the cooperation of the Military Medical Institute within marine and hyperbaric medicine, with the company LOTOS Petrobaltic plc. during the technical realisation of long-term underwater works carried out in the Polish shelf zone. The department enabled the conduction of experiments during the research activities of the academic workers of the Ludwik Rydygier Collegium Medicum in Bydgoszcz, the Medical University of Białystok, the West-Pomeranian Technological University of Szczecin and others.

Moreover, the department implements research projects within scientific-industrial consortia. The currently active consortia are composed of: the Research & Development Institute of the Maritime Technique Centre; the Technological University of Gdańsk; the Technological University of Warsaw; the Technological University of Cracow; the Industrial Institute of Automatics and Measurements and the companies Technika Podwodna Ltd., Research and Production Enterprise Forkos Ltd., ITTI Ltd. and others.

By the end of 2013 an international project involving cooperation between 11 scientific centres from various countries was completed (in Poland: WAT, IO PAN i AMW), in Sweden: the Swedish Defence Research Agency, the Swedish Maritime Administration, the European Chemical, Radiological Nuclear and Explosive Centre; in Finland: the Finnish Institute for Verification of the Chemical Weapons Convention, the Finnish Environment Institute; and in Germany: the Federal Research Institute for Rural Areas, Forestry and Fisheries, the Alfred Wagner Institute for Polar and Marine Research and in Lithuania: the Lithuanian Environmental Protection Agency.

For the purposes of the Ministry of National Defence, the department also implements research on individual resistance to increased oxygen partial pressures during breathing in hyperbaric conditions, realised for professional soldiers from the armoured units of the Polish Armed Forces and the students of the Higher School of Officers of the Land Forces in Wrocław.

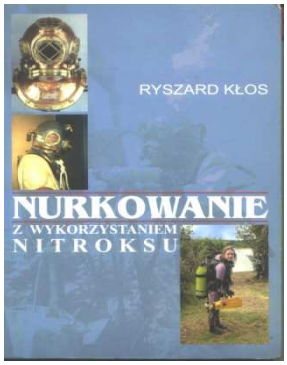
The continuous cooperation on matters related to science and research within the industry relies, for instance, on providing supervision over a serial production of decompression chambers designed by the department and manufactured by PHU PEBUCH Ltd.. or acting as PRS plc.'s laboratory within the research on product compliance with PN EN 250 for diving breathing apparatuses.

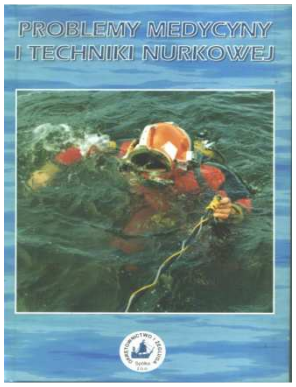
Other areas are concerned with the performance of tests commissioned by economic entities within the verification of hyperbaric techniques consisting in the carrying out of tests in high pressure conditions, e.g. for ABB Poland, PBP Forkos Ltd., PHU PEBUCH plc., PHU AQUATICUS and others.

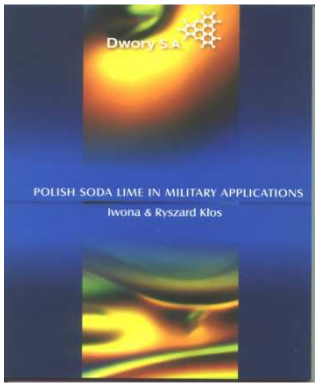
A broad scope of research works and a large number of implemented research tasks have resulted in significant activity with regard to the popularisation of scientific research results in the form of monographs, articles and reports during national and foreign scientific conferences.

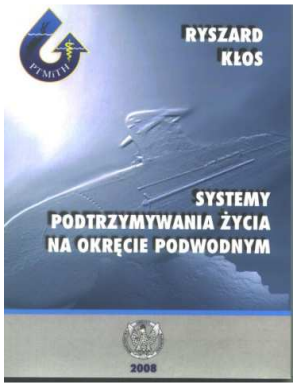
During over 30 years of the department's activity its employees have published several dozen monographs, with such works as the classic guidebook written by the first head of the department Cmdr. M. Przylipiak – "Diving equipment and works – guidebook" published by the Ministry of National Defence in 1981 (Fig. 2).

Only in the last six years the employees have published or delivered 84 papers during conferences, published approximately 70 scientific and popular science articles in various periodicals, as well as authoring or co-authoring ca. a dozen monographs.









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