

## **THE ACTIVITY OF THE DEPARTMENT OF UNDERWATER WORKS TECHNOLOGY OF THE POLISH NAVAL ACADEMY OF GDYNIA (P. 1)**

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### **ABSTRACT**

The article presents the activities of the Department of Underwater Works Technology of the Polish Naval Academy of Gdynia. This is the first part of material presenting a short historical background concerned with the establishment of the department as well as basic research infrastructure of this scientific and didactic unit. The subsequent part, on the other hand, will discuss the research and didactic activity of the department. For over 30 years the department has been engaged in a broad spectrum of activities related to underwater works technologies and, to date, it is the only research unit of this type offering complex solutions to the related issues.

**Key words:** underwater works technology, sea engineering.

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## INTRODUCTION

The Department of Underwater Works Technology was established by ordinance of the Polish Navy Commander No. 062/Org. as of 29 November 1976. The purpose of foundation of this research unit was connected with the need to accomplish greater effectiveness in the implementation of research topics within the marine armed forces concerned with underwater engineering and maritime rescue technology [1].

The department was initially designed as an experimental research team of the then Higher Naval School in Gdynia (WSMW). In concord with the above ordinance the department was to take over a part of tasks realised by the Experimental-Research Department of Maritime Rescue Command and the Research-Science Section of the Diver Training Centre of the Polish Army as well as the Department of Rescue Equipment Legalisation and Repairs. The department provides 6 (six) officer positions and 8 (eight) work positions for civilian employees (Tab. 1).

Tab. 1

The planned working positions within the Department Underwater Works Technology of the Polish Naval Academy in 1976 [1].

No.	Position	Rank	No. of positions
1	Chief of Staff	Cmdr.	1
2	Head of Physiological Laboratory	Lt. Cmdr./ Cmdr.	1
3	Head of the Institute of technical research on diving and rescue equipment	Lt. Cmdr.	1
4	Head of the decompression chamber complex	Lt. Cmdr.	1
5	Head of division	Lt. Cmdr.	1
6	Deputy head of division	Lt. Cmdr.	1
7	Head of Division	civilian employee	1
8	Technician/craftsman	civilian employee	7
Total:			14

The scope of tasks specified in the ordinance on the establishment of the Department included [1]:

- conducting research works connected with the technical advancement of diving and rescue equipment,
- conducting research works connect with the advancement of medical security of diving,
- continuous and systematic monitoring of achievements in the field of diving and the diving operations within our own and foreign forces,
- collecting materials and data concerning the improvement of equipment used in underwater operations,
- improvement of tactical methods of military divers,
- improvement of principles and applications of new equipment and determination of its usability in naval underwater operations,
- carrying out prototype tests and reliability checks of the diving equipment and devices used in the performance of underwater works.

Any internal redeployment of staff and organisational shifts were to be implemented by the middle of December 1976, and by the beginning of February 1977 the head of the newly established organisational unit was to report task implementation through his superior at the WSMW and the Head of the Navy Staff Organisational Division.

Hence, the official date of commencement of the Department's operation was in fact 5 February 1977. The first Head of the Department was Cmdr. Medard Przylipiak, M.A., Eng. (1976 - 1985) - Photo 1, with the deputy Lt. Cmdr. Marian Pleszewski, M.A., Eng. (1985 - 1990).

His successor for many years to follow was Cmdr. Stanisław Skrzyński, Ph.D., Eng. (1990 - 2003), followed by Cmdr. Ryszard Kłos, Ph.D., Eng. (2003-2008), and next by Tomasz Lus (2008-2011). Since 2011, the Department is managed by Cmdr. Adam Olejnik, Ph.D., Eng.



Cmdr. M. Przylipiak

Lt. Cmdr.  
M. Pleszewski

Cmdr. St. Skrzyński



Cmdr. R. Kłos

Cmdr. T. Lus

Cmdr. A. Olejnik

Fig. 1. Heads of the Department of Underwater Works Technology since 1976.

Initially, the Department operated within the Maritime University (WSM) as a Diving Equipment Institute (until 1994), then as the Department of Diving Equipment and Underwater Works Technology (until 2003), followed by the Department of Diving and Underwater Works Technology (until 2008), and finally as the Department of Underwater Works Technology [2].

Currently the Department is an organisational unit operating within the Mechanical and Electrical Engineering of the Polish Naval Academy as an independent institute (Fig. 2).

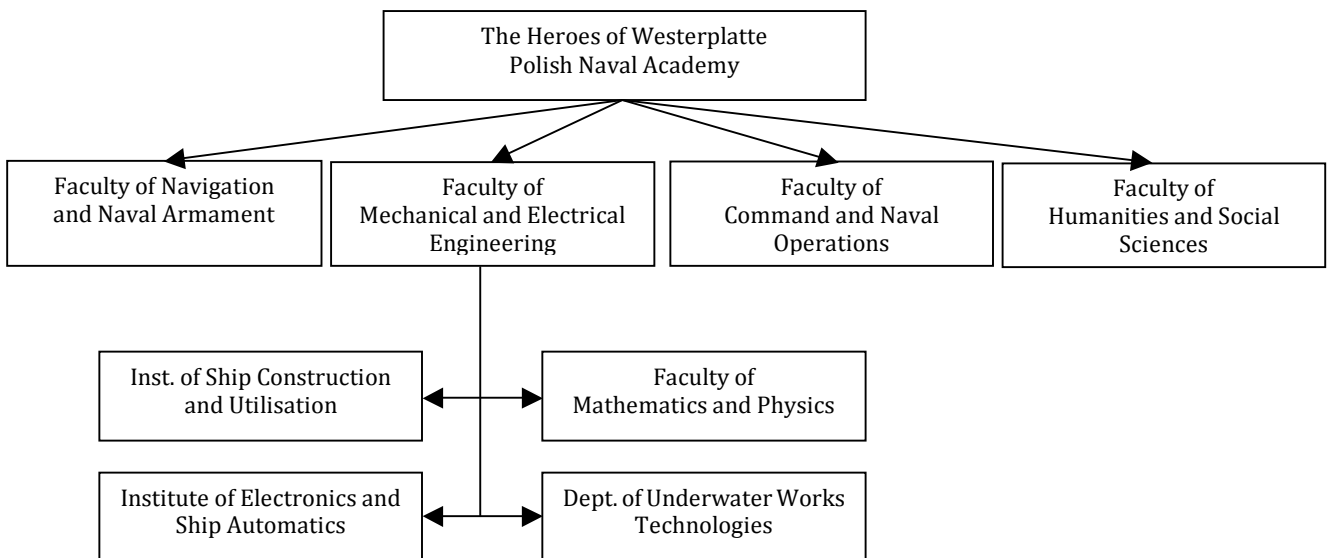
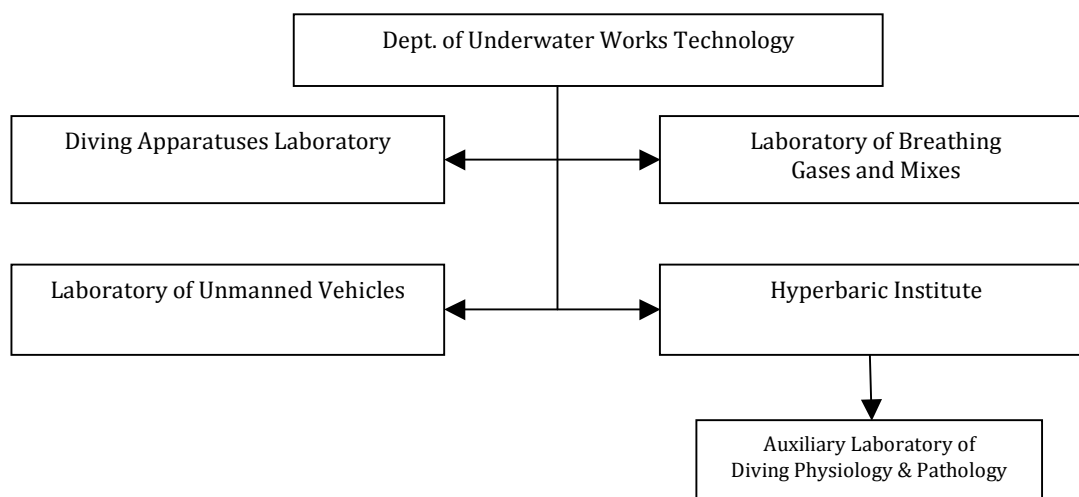


Fig. 2 The position of the Department of Underwater Works Technology in the organisational structure of the Naval Academy in Gdynia.

The present organisational structure of the Department encompasses three specialised laboratories and one workshop combined with an auxiliary laboratory concerned with the physiology and pathology of diving (Fig. 3).



Rys. 3. Current organisational structure of the Department of Underwater Works Technology.

The present scope of activities of the Department remains in concord with the provisions of the ordinance of 1976, it has merely been extended with detailed task specification to encompass the following areas of activity:

- carrying out training and experimental deep-sea and saturated diving exposures,
- preparation of deep-sea and saturated diving technologies,
- design and construction of stationary and mobile devices for diving systems,
- design and production of decompression chamber equipment,
- testing of diving apparatuses and equipment,
- performance of tests, regulations and repairs of the diving equipment,
- underwater service provision for research and inspection purposes, etc.,
- production of breathing mixes,
- didactic activity and training of divers and diving staff of the Polish Army, Police forces, Fire Department,
- preparation of technologies for the utilisation of unmanned vehicles,
- design and construction of small-size submersible devices,
- design and construction of unmanned maritime platforms,
- underwater photogrammetry in engineering applications.

### THE DEPARTMENT'S RESEARCH INFRASTRUCTURE

The main research facility of the Department is situated in the Hyperbaric Institute – the Experimental Deep-Water Diving Complex (DGKN-120).

The DGKN-120 simulator allows for a certain modelling of environmental conditions and technical parameters corresponding to a real diving operation to the depth with equivalent pressure of 1.2 MPa. It is a system of closely collaborating technical devices.

Such a collaboration ensures the possibility to carry out long and safe diving exposures with the use of air and breathing mixes.

The main equipment of the simulator includes:

- high and medium-pressure chamber supply systems with such gases as air, nitrox, trimix, heliox and oxygen;
- breathing atmosphere regeneration systems guaranteeing proper atmosphere composition and the thermal comfort of divers remaining within the habitat;
- an internal sanitary system allowing divers to maintain personal hygiene;
- a two-way communication system with divers with helium speech correction;
- medical and technical parameters measurement systems with registration and archiving;
- automated systems allowing the maintenance of depth and breathing atmosphere composition;
- active and passive fire protection systems;
- control panels enabling the control the simulator's operation;
- a water pool with the volume of 5 m<sup>3</sup> enabling simulation of a diver's stay under water.

Moreover, the simulator enables verification of hyperbaric technique projects in conditions approximated to real conditions. With its help it is possible, among other things, to carry out pressure tests of technical constructions in the conditions of water pressure down to the depth of 120 mH<sub>2</sub>O.



Fig. 4. Diving simulator DGKN-120.

Performance of diving exposures with the use of the simulator requires very close cooperation with doctors specialised within maritime medicine. Their activity involves the use of medical equipment available at the Department, such as the defibrillator, USG apparatus with Doppler scanner and both built-in and mobile stations for performing physical tests on the respiratory and circulatory system.

The second element of the research infrastructure of the department with regard to the level of technical advancement is the Laboratory of Diving Apparatuses. The laboratory is equipped with an artificial lung station consisting of two decompression chambers.

One of the chambers allows testing of diving techniques and determining equipment parameters corresponding to a pressure equivalent to the depth of 500 metres, whereas the other to the depth of 200 metres.



Fig. 5. The equipment of the Laboratory of Diving Apparatuses.

The Laboratory of Breathing Gases and Mixes constitutes a back-up facility for the aforementioned organisational units of the department.

It comprises mechanisms and devices used in the production and monitoring of breathing gases applied in experimental research implemented at the Hyperbaric Institute and the Laboratory of Diving Apparatuses.



Fig. 6. The equipment of the Laboratory of Breathing Gases and Mixes.

Moreover, the laboratory contains auxiliary mechanisms providing independent power supply for the department, which is important for the safety of experiments with diver participation in the diving simulator DGKN-120.

The Laboratory of Unmanned Vehicles is the most recently established unit of the department originally intended to deal strictly with underwater vehicles.

At present, however, due to the scope of research works implemented in the Department, the area of its activity was enhanced to also encompass unmanned surface vehicles.

To date the laboratory has been equipped with the first Polish unmanned surface vehicles - USV - Edredon), two ROVs: Super Achille and LVB 200, and has access to three other constructions of underwater vehicles in the Department's possession: AC ROV and VideoRey.

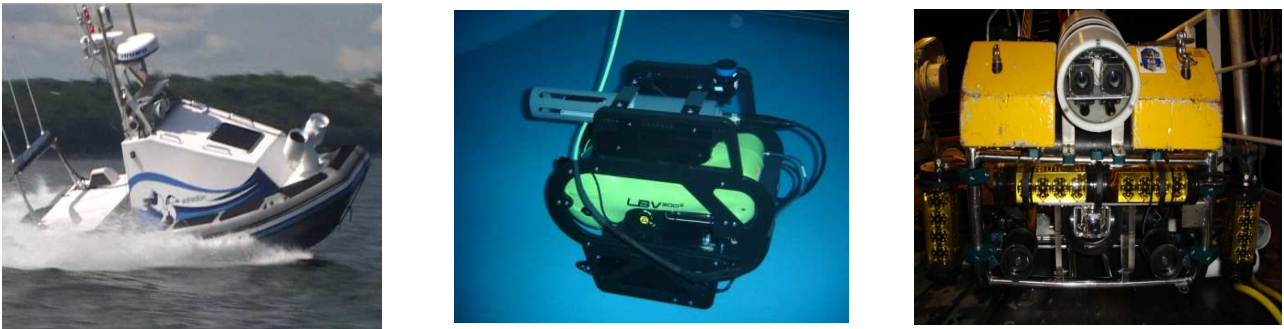


Fig. 7. The equipment of the Laboratory of Unmanned Vehicles.

Additionally, the Laboratory has at its disposal two hydroacoustic underwater navigation systems - USBL, and two sonars used in the investigation of the aquatic environment: a surround sonar operating in a static variant, and a mobile 3D Blue View sonar carried on board one of the vehicles.

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