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STUDIES ON SATURATION DIVING IN POLAND AND PRACTICAL APPLICATIONS OF THEIR FINDINGS PART 8. PEOPLE

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ABSTRACT

This part of the study focuses on the people involved in Polish saturation diving: divers, dive supervisors, coordinators, technical staff and the doctors responsible for overseeing the dives. Moreover, it discusses the requirements for obtaining qualifications to perform specific roles, the career paths of individual practitioners, and distinctions between Polish regulations and those of other countries.
Keywords: saturation diving, saturation divers, underwater operations managers, saturation diving coordinators, diving safety doctor.

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SATURATION DIVERS ENGAGED IN LONG-TERM UNDERWATER WORKS

Between 2011 and 2022, the dives were carried out by Polish divers serving as Navy reservists, supported by civilian divers trained in Poland. In 2017, the team of saturation divers was joined by a diver trained at the National Hyperbaric Centre in Aberdeen. Given the frequency of saturation dives carried out in Poland, the cost of the training course in Scotland could be recovered within over a dozen or so years. However, the training costs were largely offset earlier, due to the aforementioned diver's participation in deep dives, for which a saturation diving course is not required.

The fact that the Polish Navy had a team of divers trained in saturation diving earned widespread recognition following Poland's accession to NATO and was supported by the Navy Command. These divers were being trained to operate the planned new Navy rescue vessel. Unfortunately, to date, the 'Ratownik' [Lifeguard] programme – which was intended to feature a built-in hyperbaric diving system and was designed as a DSV (diving support vessel) – has not been put in place. This vessel would have resolved the paradox of having two (theoretically, as one has not had UDT certification for years) land-based diving systems in the city of Gdynia and would have provided opportunities for economic and defence operations within the depths of the Polish exclusive economic zone in the Baltic Sea.

The deep dives carried out using the Af-2 system on behalf of Petrobaltic provided the basis for training the diving team in the operation of this system's technology, particularly in preparing them to operate the diving bell and for divers to remain for extended periods under conditions of elevated pressure, enabling them to carry out underwater works on a large scale and with high efficiency. These skills and experiences have been, and continue to be, utilised to improve processes related to saturation diving, as well as to maintain a repository of experience and the skills required to apply them.

Divers were employed by a private company AquaWorks, whose owner took part in a training course for deep-sea divers on the diving system MONBUR using trimix diving technology organised at the Department of Diving Equipment and Technology of Underwater Works [Polish abbr. ZSNiTPP] of the Polish Naval Academy in 1999. Until to date, that was the only training course for 1st class divers organised by the Department of Technology of Underwater Works [ZTPP] for this company, which marked the beginning of further courses for divers, including those in saturation diving. Out of eight divers recruited from civilian companies, six successfully completed the course. The team of divers was supplemented with six reservists from the Naval Academy, who were also trained at the ZTPP and performed tasks on PIAST-type rescue ships.

Ultimately, the diving team comprised between 8 and 10 divers. Fortunately, over time, no radical changes to the team composition were required. The composition of the team of divers was occasionally supplemented when divers were leaving for random or personal life reasons. It was not until the COVID-19 pandemic that bigger changes to the team were forced out, not just among divers.

The core of the team included;

Divers reservist from the Naval Academy - from 2011: G. Mączka, Z. Jabłoński, A. Biegalski, T. Dec, R. Makarow and M. Ozga until 2018;

Divers trained in Poland: T. Palacz, A. Rosołowski, P. Żyła, J. Kur.

Diver trained at NHC Aberdeen, Scotland – F. Jakubiak.

Saturation divers work under high physiological, psychological, as well as environmental stress resulting from being confined in a small space and exposed to high pressures. Physiological tests cannot assess a diver's psychosocial aptitude. This trait can only be verified by the actual conditions in which divers prove themselves. The team of Polish divers passed this test by carrying out underwater tasks to the client's satisfaction. The only criticism that needs to be noted is a certain over-zeal in their actions and habits from deep diving, where the diver has very limited working time, resulting in either rushing or, conversely, slowing down to 'qualify' for a longer decompression stop, which has financial implications. These habits were quickly eliminated, as during saturation dives the diver does not need to rush. Preparing to work inside the bell and exiting it to begin work took a relatively long time (up to half an hour), which led to justified dissatisfaction on the part of the clients. The longer preparation time for the diver to exit the bell and begin work in the water also has the advantage that the pre-dive check and test dive are carried out very thoroughly and monitored by an ROV camera. After putting on the helmet and equipment inside the bell, the diver would submerge into the water to carry out a test dive to check the operation of the equipment, the primary and emergency power supplies, breathing apparatus, and communications, as well as to adjust buoyancy and set the flow of the suit's heating water.

TECHNICAL STAFF SECURING SATURATION DIVES AND UNDERWATER WORKS

The technical staff comprises the team from the Department of Underwater Works Technology (currently the Chair of Underwater Works Technology) at the Naval Academy, which has been a crucial link in the execution of saturation dives since the early 1990s. Without the knowledge, experience (and determination) of this team, no saturation dives would have taken place. The core of the team consisted of three people who built diving systems and carried out saturation dives at the Szczecin Shipyard in the late 1980s. They were involved in research into the Polish saturation diving system as early as the 1980s.

Deep and saturation dives allowed to change the composition of the technical team of the Naval Academy by replacing experts and technicians who left to join the Department of Underwater Works Technology (in 2006 the Department of Diving Equipment and Technology of Underwater Works changed its name to the Department of Underwater Works Technology to become the Chair of Underwater Works Technology in 2020). They were replaced by graduates in Navigation and Underwater Works (taught at the Polish Naval Academy between 2005 and 2009) and reservists - divers and technicians from the Navy. Nine graduates joined the team and worked in an alternating manner, as that was the only possibility to learn in practice how to handle, provide, and organise backup to secure the operation of the system.

The technical team of the Polish Naval Academy consisted of the following people who were, or still are, technicians specializing in the diving system:

- St. Wiśniewski and J. Pawalak who worked since 1985;
- P. Nawrocki who has been working in the team since 2008 when he replaced St. Wiśniewski who died suddenly;
- since 2007 R. Kuffel, an engineer, graduated from the Naval Academy in Navigation and Underwater Works, who as a result of his commitment, knowledge, and experience became the leader of the team;
- and G. Mączka – saturation diver with the longest career in deep dives (since 1986) and saturation diving (since 1995) in Poland.

The following were diving system operators:

Navy reservists: M. Kaszorek and late K. Opaliński – saturation divers in the team of the Naval Academy since 1989 and in Petrobaltic since 1995.

The team of graduates in Navigation and Underwater Works since 2008 has been including: M. Zawieja, R. Kuffel, M. Adamski, J. Kulik, B. Trybulec, Sz. Urbanowicz, A. Ziemski, and W. Pytlak.

After 2016 the above team was joined by Navy reservist divers A. Wojciechowski and Ł. Jagiełło.

Following the training for diving system operators, the team was expanded by technicians: R. Olejnik (2016) and R. Krzyżek (between 2016 and 2020).

There were also other people employed at the Department or candidates for a job taking part in aptitude tests (altogether over a dozen of people) who acted as team members on a temporary basis.

Like divers, the technical support team is subject to stress and physical and mental strain, which manifests itself during their work; both during the preparation for and the execution of a saturation dive. A very important quality is the ability to work as a team and provide mutual support, as well as an understanding of operations and

tasks, and the ability to react immediately (to rectify faults) so that interruptions to the dive are kept to a minimum and the weather window allowing for diving is utilised to the fullest. There was some tension between the supervisors and the divers, as the team from the Naval Academy (which was already experienced in conducting saturation dives) shared their expertise, which was not always welcome, particularly during later dives when the supervisors had already developed their own habits.

UNDERWATER WORKS SUPERVISORS

The permit given by the Maritime Administration of the Maritime Office for the performance of underwater works in maritime areas, which lists the underwater works supervisors and permits for long-term underwater works involving saturation diving, is issued for a period of six months. The permit specifies the location and type of underwater works. For example: the Baltic Sea, oil fields B-3, B-8 and B-27. Work area, e.g.: "Underwater structures located in the vicinity of the 'Balic Beta', 'Petrobaltic' and 'GIANT Petrobaltic' drilling platforms". When carrying out underwater works involving saturation diving, the person authorised to supervise is someone holding a Class I underwater works supervisor's licence and appointed by the organiser of the underwater works. Poland is unique in this respect, as the number of Class I supervisors exceeds the number of saturation divers. Unfortunately, the qualifications of most of these supervisors are not backed up by experience, as no experience is required of them by, the domestic regulations, unlike at the international level where the requirement is 2,400 hours of experience in saturation diving, a threshold very difficult to meet in the Polish reality.

In the Polish team the saturation dives were led by: J. Maculewicz (who began his career as a deep-sea diver; a supervisor with many years of experience in deep-sea work on the Polish offshore platform, who supervised all difficult underwater operations carried out on the Polish continental shelf), M. Wojdowski (a Navy Reserve officer, experienced in supervising deep-sea dives using a diving bell from PIAST-class vessels and in participating in saturation dives conducted at the Department of Underwater Works Technology), J. Pomian (a Navy Reserve officer, experienced in performing saturation dives conducted at the Department of Underwater Works Technology between 1986 and 1990; currently the Chairman of the Qualification Committee for Divers at the Maritime Office), S. Skrzyński (author of this article), who over his long career, has supervised (since 1976) operations in the Baltic Sea for Petrobaltic and the Navy, as well as research projects related to underwater work technologies for industry and defence. On top of that, he conducted training courses for underwater operations supervisors and divers in deep-sea and saturation diving techniques. He is the principal author of the underwater operations procedures for bell diving for the Polish team. Since 1992, he has been responsible for safety and the execution of dives in the 50–90 m depth range at ORLEN Petrobaltic (formerly LOTOS Petrobaltic).

The above-mentioned supervisors oversaw underwater operations until the pandemic, i.e., until 2020. In subsequent years, the team of supervisors was supplemented by Navy reservists trained at the Department of Underwater Works Technology of the Naval Academy: P. Juźkiw, M. Ozga , T. Cisek, and M. Ortmann.

Article 8 of the Underwater Works Act requires the organiser to appoint an underwater works supervisor [1]. The lead supervisor, who directs the other supervisors carrying out specific (watch) duties, is accountable vis-à-vis the client – the organiser of the underwater works. According to one of the models of dive organisation used worldwide (and adopted by the Polish team), it is assumed that the lead supervisor is the 'superintendent', to whom two supervisors – working on two shifts – report. The responsibilities of the watch supervisors are as defined by the Underwater Works Act, with the additional proviso that they report, both substantively and in terms of organisation, to the lead supervisor, who is responsible for the entire dive. The supervisors' shift lasts 12 hours, during which they oversee the entire diving operation, including the on-board support crew (5–6 people): life support system operators, gas storage operators and the safety diver team. In addition, the diving supervisor is in close contact with the underwater works coordinator representing the client, the supervising inspector or underwater works designer, as well as designated platform positions or watch officers on the vessel.

PHYSICIANS SUPPORTING DIVES

The qualifications of the doctor are set out in the Regulation of the Minister of Health of 17 September 2007 [2]. The organiser of underwater works must ensure

medical supervision of the work being carried out. In accordance with the Regulation, a physician specialised in anaesthesiology and intensive care or emergency medicine, who has completed a course in diving physiology and hyperbaric therapy, must be present at the site where the works are carried out.

This is extremely problematic, as apart from the fact that both of the above-mentioned specialisations are in short supply, their curricula make no mention whatsoever of diving or hyperbaric medicine. Unfortunately, the Regulation overlooks the medical specialisation specifically designed to support works at sea, namely maritime and tropical medicine, formerly known as transport medicine. This absurd situation has been dragging on for several decades and significantly hinders professional diving, including saturation diving, in Poland.

Initial examination is carried out by the physician responsible for the medical supervision of saturation dives, and divers who pass this examination are referred for specialist medical examinations.

In general, medical support was provided by doctors from the Military Medical Academy, part of Prof. R. Olszański's team, who personally participated in the research programme and operational dives from 1995 onwards. Notable figures here include Dr Bogdan Filipek, Dr Maciej Konarski, and Dr Maciej Pachut, as well as the shore-based medical support provided by Dr Piotr Siermontowski, Prof. Romuald Olszański, and Dr Tomasz Wójtowicz. The physician from the 'civilian' sector was Zdzisław Sićko, who, after stepping down from his role as head of the Department of Hyperbaric Medicine at the then Institute of Maritime and Tropical Medicine, served as the safety doctor with only brief interruptions from 2011 to 2021. He also served as a consultant doctor, a position very rare in the diving practice. By taking part in these dives, he could see how poorly the Regulation of the Minister of Health [2] of 17 September 2007, which he co-authored, actually works in practice. Unfortunately, Dr Sićko has practically monopolised medical support for an extended period, which has had both positive and negative aspects, namely the inability to gain experience.

The Regulation of the Minister of Health of 17 September 2007 on the health requirements for underwater works addresses only the strictly medical aspects, ignoring such important matters as hygiene supervision in hyperbaric conditions, the diver's work, nutrition, and rest. Nor does it include official decompression tables for saturated dives, therapeutic recompression tables, or the so-called 'aboard table' guidelines relating to emergency decompression following the interruption of compression, when we must adopt a calculation method based on the duration of exposure to pressure. The tasks of a physician participating in the dive are limited to monitoring the divers' well-being, prescribing treatments and managing infections, injuries, etc. In accordance with Polish regulations, physicians act in an advisory capacity, as decisions are made by the dive supervisor, who is responsible for the conduct of the dive. Physicians should also be prepared to provide medical assistance in hyperbaric conditions and to apply therapeutic recompression procedures. The supervision of decompression carried out by the physician in the case of saturated dives is incomplete, as he is not familiar with the technical details and is unable to fully understand the diving system, since he only steps in 2–3 days before the dive.

In the diving world, the absence of a physician at the dive site is addressed by ensuring that one diver from the team in the chamber has completed an advanced medical first aid course, and ideally holds a paramedic qualification. The other divers should have at least a basic life support (BLS) qualification. In Western countries, to obtain their qualifications, underwater works supervisors must demonstrate knowledge not only of diving and underwater works, but also of medical issues and diving hygiene, and must confirm this periodically (e.g., every 5 years) before an appropriate committee (a solution not provided for by regulations binding in Poland).

COORDINATORS OF UNDERWATER WORKS

Pursuant to the Underwater Works Act, the organiser is responsible for the provision of equipment, the safety of the diving team and technical safety measures at the dive site; staff from the Marine Operations Department act on the organiser's behalf during the dive. The success of the operation depends on their performance, efficiency and coordination at all stages of the dive. This department recruits underwater works coordinators, who are present directly at the site of the works and provide shore-based support on land. For 20 years, this team has been led by Marek Rewers, who prepares his staff to carry out tasks that are challenging both at the substantive and organizational levels. Every member of this Department has completed diving training conducted in collaboration with the Department of Underwater Works Technology and has undergone specialist training in extraction within the company and on external courses. The demanding role of the coordinator has been held by M. Rewers, M. Czerwiński, A. Wróbel and A. Wolszczak, with Patryk Beyrowski being the most junior member of the team.

In accordance [1] with the Act on Underwater Works Art.8.P.1, the organiser of underwater works (represented by the coordinators) is responsible for the safety and hygiene at work and for the appointment of the supervisor of underwater works. The same department deals with the preparation of construction and assembly related matters, as well as permits, in collaboration with the constructors, mainly W. Kwiek and, previously, M. Hołownia, whose works are of major importance.

This publication lists individuals who had been part of the hyperbaric diving team for more than two years; this applies to divers as well as technical staff and supervisors

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