

WORKSTATION FOR TRAINING ASW HELICOPTER NAVIGATORS AND ANALYSING REAL FLIGHT DATA

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The article presents a training and diagnostic workstation designed for Polish Navy ASW helicopter navigators. Installed at the helicopter base, the workstation is used for training and instruction in operating the device and analysing information gathered by navigators during the flight using the ASW onboard sonar, sonobuoy receiver and magnetometer. The workstation allows instructors to task two operators and monitor their performance under conditions resembling those onboard a plane. The tasks involve the operation of the consoles and collecting information during tactical situations, diagnosing damage and analysing flight data in office environment. The objective is to ensure proper helicopter navigator training and experience given the limited possibility of training flights.

INTRODUCTION

The Navy Air Force's fleet includes modernised helicopters for detecting underwater objects equipped with a hydroacoustic system for detecting and tracking submarines and with systems that are less difficult to interpret, i.e. magnetometric and sonobuoy listening systems. Consequently, operators must be instructed and trained in operating the systems and in developing and conducting analysis of data, i.e. files with flight information. If carefully analysed, the materials will improve the effectiveness of onboard systems.

Training was normally provided individually for each navigator-operator onboard a helicopter. However, the confined space on board the helicopter made it difficult and ineffective. In addition, training one operator takes many flying hours and is very costly. Training

workstations can significantly reduce the number of flying hours and the training costs. When supported by simulators, training is more thorough, better paced and allows experienced instructors to train many operators. Enhanced with special procedures simulating a variety of tactical situations and hydrological conditions, flight information can be used to develop an effective training method. Instructor-led exercises can be tailored to the level of skills of operators which is difficult to achieve during a regular helicopter flight.

The training, diagnostic and data analysis workstations have been designed by the people who modernised underwater acoustic stations which are currently operated on ASW helicopters and successfully used during NATO exercises. Because there were no workstations for analysing signals recorded during flights, the data was stored on magnetic media but could not be used for further training or help with identifying detected and tracked underwater objects while in combat.

The workstation was installed in a specially arranged room at the ASW helicopter base.

1. STRUCTURE OF THE WORKSTATION

The workstation equipment and setup were specified by its future users. Two training consoles and one instructor console were ordered. The room was furnished with bookshelves, a navigation map table and a kitchenette.

The instructor console is a typical computer workstation with commercially available equipment. It is arranged at some distance from the training consoles. Communications with the consoles is via Ethernet. The instructor and operators use acoustic communication, an imitation of onboard communication.

Each of the two training consoles has a set of five navigator panels taken out of disused helicopters. The panels are used for training operators to switch on, operate and switch off onboard systems controlled by the navigator as set out in helicopter instructions.

A special new feature are control systems for simulating the functions of the panels. Because of the big number and variety of operations, the control systems are grouped in four modules. The most extended module has three microcontrollers with extra equipment: optoisolator and interfaces. The less complicated modules are responsible for controlling the lighting of signal lamps and simulating onboard radio and power failure.

The consoles of the ASW sonar have exactly the same layout and functionality as onboard consoles but with a significantly simplified and altered structure. This includes heavy duty computers replaced with commercial computers, a change made possible by the absence of operating risks and the resulting possibility of damage. The keyboard, manipulator and monitor are exactly as used onboard helicopters.

The magnetometer both onboard a helicopter and at the workstation has a dedicated specialised keyboard on the console and the sonar monitor.

Listening to sonobuoy signals onboard the helicopter involves the use of the keyboard with a standard key layout, heavy duty computer and monitor. The training workstations use commercially available equipment.

Power supply for the panel's electronic systems, control block and sonar console is provided by a large 27V DC/25A power supply simulating the helicopter's electricity network and two smaller low voltage power supplies and a special 115V 400Hz generator which also simulates an onboard network.



Fig. 1 shows training console 1 and Fig. 2 shows both consoles. In the left lower corner you can see the ASW sonar console and magnetometers, on the table is the keyboard and monitor of the sonobuoy system, on the wall is a set of five navigator panels.

2. PRINCIPLE OF OPERATION

The workstation supports three types of tasks:

- operation of helicopter navigator's operator panels,
- operation of ASW systems,
- registration, segregation and analysis of flight information.

The first type of task involves simulating navigator operations and their effects using panels. The simulation is supported by special peripheral equipment and software for three microcontrollers in the control block. Systems controlling navigator's panels are used to simulate the results of navigator operations on N1 - N5 panels and check if they are correct. The systems:

- check the position and sequence of changes to panel switches,
- initiate the responses; indicator lights are switched on or parameter values are displayed on the panels,
- communicate with operator computers using RS links and with the instructor's computer via Ethernet.

In the second type of task computer programmes generate images, sounds and other effects of a selected system as instructed by the instructor and provide the instructor with feedback. The programmes also provide navigation data displayed on the panels. The images, sounds and effects are simulated by the programme. The simulations are based on real situations recorded during training flights. It is a difficult task because the images of signals, interference, moving objects are generated continuously, with no repetition in loops.



Fig.1. Layout and equipment of training console 1



Fig.2. Layout of both training consoles

The software for the workstation was developed in the popular and non stressful WINDOWS XP Professional system using the tool Visual Studio 2005. From the user's perspective all windows and images look exactly like they do when real stations are operated: the ASW wide-ranging sonar, magnetometer and two sonobuoy listening systems (modernised Soviet and modern systems).

The operator in training (navigator) will first simulate the switching on of the appropriate settings on his five panels. The instructor can view the sequence of switching and the switch status.

The second type of task must be pre-defined by the instructor who will give the parameters of the tactical situation and any failures. He can also view the responses of the operators.

The instructor follows the regular procedure for switching on commercial computers and uses his console to define:

- the area of operation for both consoles including the parameters such as the shape, size, weather and hydrology;
- a shared tactical situation or different tactical situations for both consoles: number of ships and submarines, their trajectories and other movement parameters;
- separate or the same parameters of helicopter movement: blue (console 1) and orange (console 2), i.e. the area, shape and size of movement trajectory;
- equipment failure, if any, which the navigators must deal with.

The instructor collects recordings of onboard equipment from pilots. He uses his workstation to review and select the materials and then transfer them to each workstation to an appropriate catalogue or sub-catalogue depending on the system.

Training consoles are switched on by switching on power supply in surge protectors. These also supply systems for controlling navigator panels. Commercial computers in the consoles must boot before they can go on to further operations.

The operator can then switch on:

- the ASW sonar or magnetometer operated from the sonar consoles (interchangeably) by computer one;
- interchangeably by one of the two listening systems or sonobuoys on computer two.

Generally, each trainee on their console has:

- the image of the area and the objects on the water as defined by the instructor,
- a moving helicopter icon pre-defined by the instructor (course, speed, altitude, bearing on the buoy are also displayed on the navigator's controls).

The operator himself sets the length of the sonar or magnetometer cable line and depth of sonar array submersion. Unless the settings are right, the sonar or magnetometer simulation will not work properly.

On-board communications is simulated through the use of microphones and headphones by operators. The instructor can listen to them talk and operate the switches on the appropriate panel just as in a real on-board system.

Workstation operations must be simulated according to the procedures given in system operation documentation. All communications between the workstation and the helicopter's external communications system in the simulator are considered transmission (in the required procedure) to/from the instructor's console.

Detailed instructions for the instructor and trainees are given in the 'help' menu on each monitor. It folds out to a thematic sub-menu. Access to 'help' is given by hitting F1. Help is addressed and is linked with the windows that are open when the 'help' button is used.

The figures below show examples of windows from the instructor's console. The reason why they contain little text is because the text is in Polish which does not correspond to the language of this paper.

The images on trainee operators monitors are no different from those on real systems. There have been numerous examples of those before [1] - [7] which is why they are not given in the article.

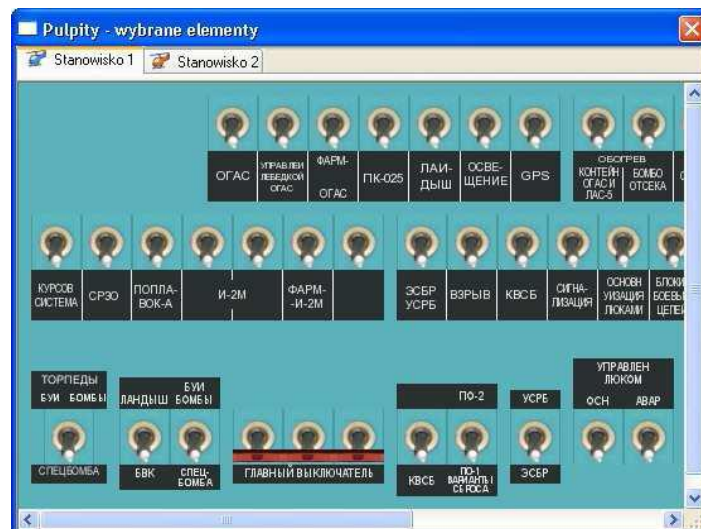


Fig.3. Window 'Panels – selected elements' on the instructor's monitor for checking the switches made by the trainee operators

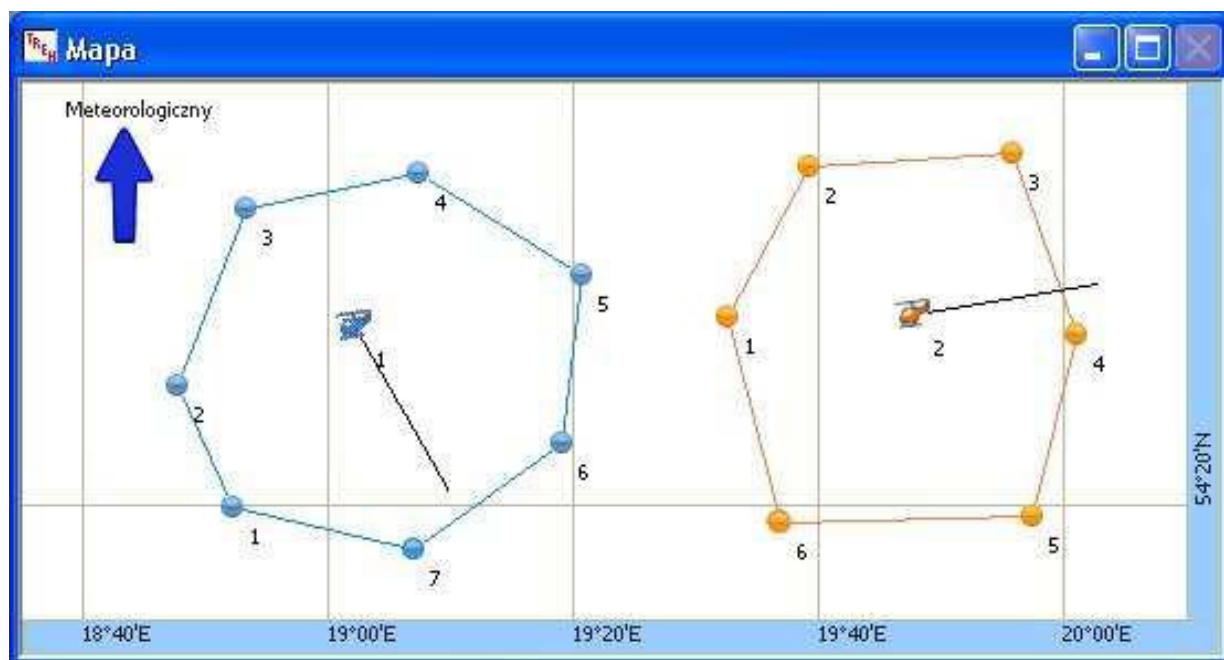


Fig.4. Helicopter trajectories designed by the instructor: console 1(left) and console 2 (right) in map view and open view of trajectory editing

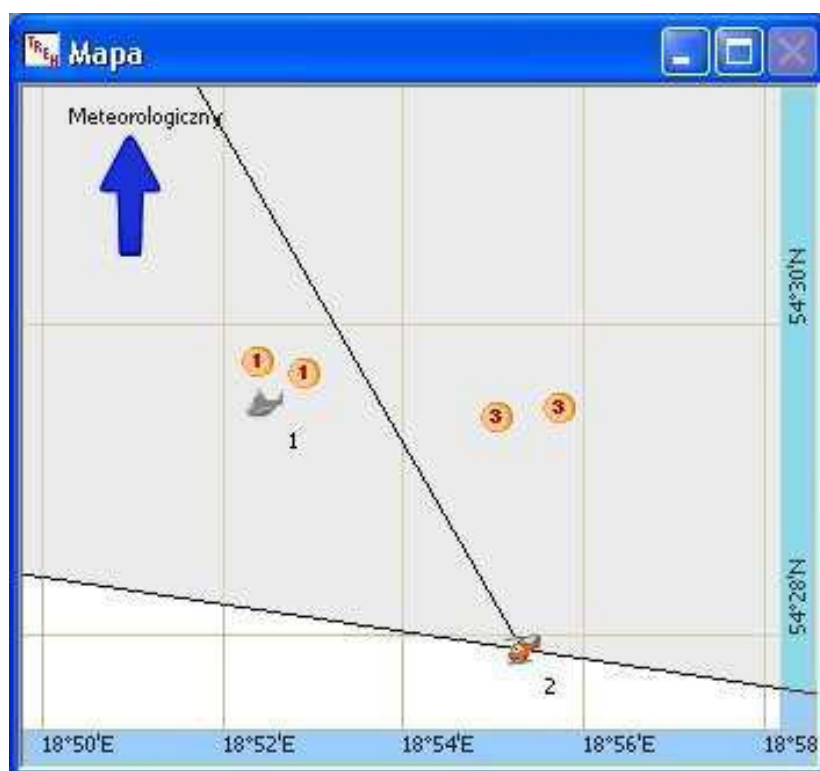


Fig.5. Example of target markers 1 and 3 from the magnetometer of the console of operator 2



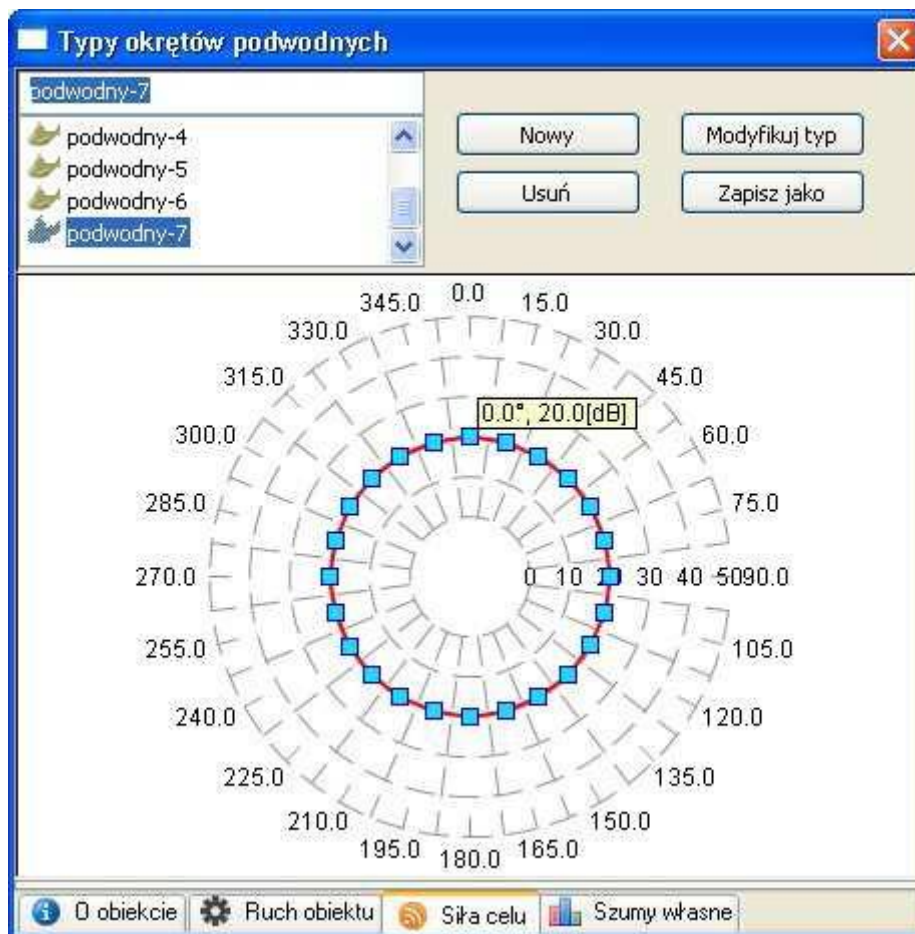


Fig.6. Window for designing the type of submarines with target strength view

4. CONCLUSION

Tactical simulators and workstations for analysing data including databases are frequently used for training the crews of aircraft, warships and combat vehicles. It makes every sense to use them because the cost of real craft is very high and the training involves some risk. The training and analytical workstation seems to offer a successful combination of all the advantages. Because it has been in operation only since last year, it is too early for a full evaluation. But it is quite likely that it will be further developed and modified both in terms of its database and functions.

Despite the workstation's positive reception, it will be some time before the instructors will have mastered all of its training functions.

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