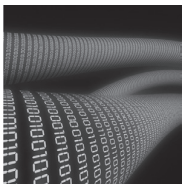

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GMDSS - System for Operational Work OE_GMDSS in Polish Rescue Radio

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ABSTRACT
Officially, at the end of 2019, a correction of the Baltic Sea Location was published in the Sailing News, which at the same time informed about the change of the operator of the Polish GMDSS Responsibility Zone, excluding Witowo Radio so far and transferring the Polish Rescue Radio (SPL) service. Starting from 2020. PSL began operational service of GMDSS in Poland. This article is the first presentation of the experience from the implementation of this project "Construction of maritime communication system in danger, GMDSS-PL". mainly focusing on the OpenEye_ GMDSS operating system. In addition to the technological layer of the project, the procedural and organizational part of the GMDSS service has been equally important. The maritime emergency response system can be compared to the operation of 112 on land. The operation and efficiency of this system directly translates into human health and life as well as the quality of the marine environment around us. The technical means provide a high quality and certainty of business continuity. Communication in danger is one of the basic and most important tasks of the Polish maritime service. At this point, all operators and GMDSS services in the Maritime Office in Gdynia and Szczecin deserve praise.

KEYWORDS: monitoring system, safety at sea, GMDSS

1. Introduction

Since 1959, when the International Maritime Organisation (IMO) was established in close cooperation with the International Communications Union (ITU) and the other meteorological (WMO), hydrographic (IHO) and satellite (IMSO) organisations, there has been a common understanding to provide radiocommunications in distress situations at sea. This cooperation resulted in the first GMDSS in 1999.

The old maritime distress and safety regime, as defined in Chapter IV of the 1974 SOLAS Convention, in force until 1 February 1992, was based on the requirement that certain classes of ships at sea should have radio equipment capable of transmitting within a minimum specified range on the international emergency frequencies allocated in accordance with the ITU Radio Regulations. The Shipmaster at sea should receive a signal that a ship, aircraft or survival craft is in distress, and at the same time inform those affected that he is doing so. The IMO has defined the minimum requirements for the radio communication range from the ship as distance:100-150 Mm. Assistance to a ship in distress could generally only be provided by other ships in the vicinity of the incident, which means that the old system was primarily intended for ship-to-ship operations.

As the situation and the maritime transport sector has developed, it has become clear that the organisation of aid to people at sea cannot be mainly dependent on the provision of aid by nearby ships. Therefore, the natural development of the GMDSS system has been to expand it by increasing the range of communication using the space segment and by creating coordination centres on land.

The new definition and scope of the GMDSS is as follows: The GMDSS is a radiocommunications system comprising a set of technical and organisational (including procedural) measures designed to ensure the safety of life at sea regarding radio communications. In order to achieve this objective, it has been established that all ships subject to the SOLAS Convention must be

equipped with radio equipment and systems capable of performing the following essential functions [1]:

1. transmit alarms in distress from ship to shore by at least two separate and independent means of communication, each using a different radio service,
2. receiving shore-based distress alerts on board
3. transmitting and receiving distress alerts between ships,
4. two-way (transmit and receive) coordination communication in search and rescue operations,
5. bi-directional communication at the accident site,
6. transmitting and receiving location signals,
7. transmission and reception of maritime security information,
8. bidirectional general communications through coastal radio systems or telecommunications networks,
9. bidirectional bridge-to-bridge communication.

Due to technological limitations and physics of operation of radio communication, the GMDSS system was divided geographically into zones:

1. Sea area A1 area within the radiotelephone range of at least one VHF coastal station where continuous digital selective call signaling (DSC) is available,
2. Sea area A2 area, excluding sea area A1, within the radiotelephone range of at least one coast MF station with DSC continuous alert,
3. Sea area A3 area, excluding sea areas A1 and A2, within the range of the Inmarsat geostationary satellite, where continuous alert is available;
4. Sea area A4 area outside sea areas A1, A2 and A3.

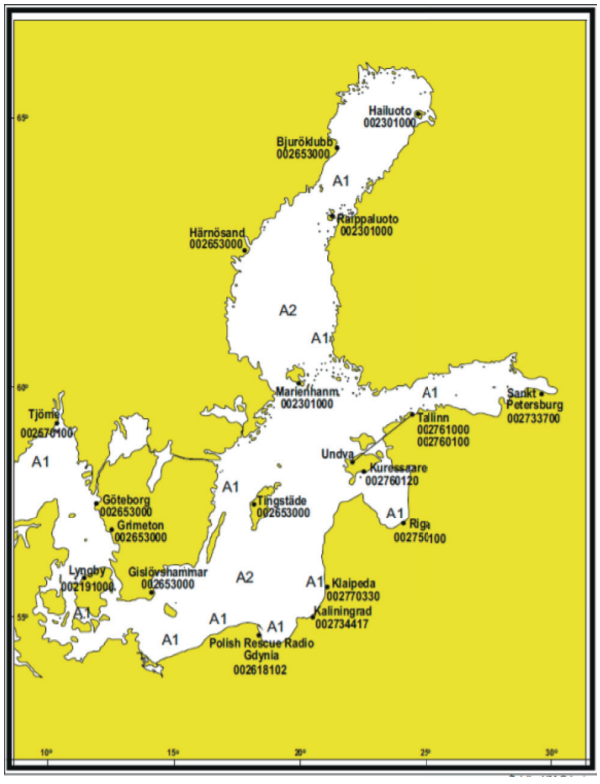

Fig. 1. GMDSS - Baltic Coast Stations [2]

Each maritime broadcasting station in the GMDSS system has its own unique identifier. The GMDSS uses a nine-digit number called Maritime Mobile Service Identity (MMSI) to identify the ship or coast station. Three of these digits indicate the geographical area of the administration in charge of the station and are known as Maritime Identification Digits (MID).

An integral part of the GMDSS is the handling of DSC (Digital Selective Calling) messages, which are used to transmit distress alerts from ships and to send the relevant acknowledgements from shore stations. It is also used by ships and shore stations to transmit distress alerts and other urgent and emergency calls. Trials of DSC systems were coordinated by the CCIR Interim Working Group 8/10 in 19821986 and included tests of HF, MF and VHF DSC systems. The system was launched and became permanently operational at sea.

Poland has been a member of the IMO since 1960. Under the agreement we have assumed all obligations resulting from this membership, including the organisation of the GMDSS sector on the Polish coast.

2. Scope of implementation

The implementation and launch of the Polish GMDSS service is called Polish Rescue Radio and can be divided into main areas [1]:

1. Design and construction of support structures for antenna systems or installation and adaptation of existing facilities to function as edge stations of the system,
2. Adaptation of rooms to serve as Radio Communication Centres and Management Centres with installed communication infrastructure,
3. Construction of a radio system for emergency communications in accordance with international GMDSS standards,
4. Construction of an IT system to ensure the correct handling of received alarm calls, their verification and handling.

Due to the size of the project and the degree of complexity, this article will discuss only the scope of building an IT system supporting the work of GMDSS operators. OE_GMDSS system was one of the key factors of the project's success and is a Polish original solution (manufacturer of WASKO S.A.) for the needs of ensuring operation of GMDSS system. Visualization and alarm system OpenEye_GMDSS is an umbrella system containing functionalities known from SCADA-type system.

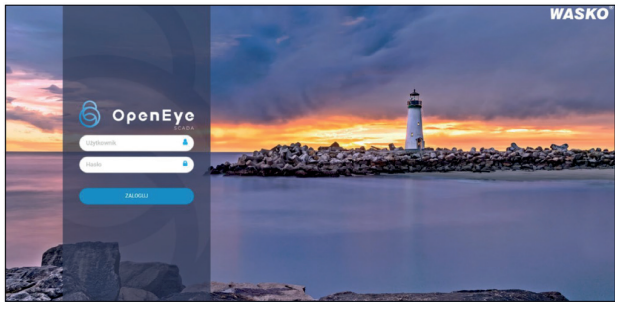

Fig. 2. Login window for OE_GMDSS [own study]

3. GMDSS architecture

The GMDSS system architecture consists of the following components:

1. Radio Transmission and Reception Centre in Gdynia - ensuring operational and separate operation of the system in basic mode,
2. Radio Transmission and Reception Centre in Świnoujście - providing operational and separate back-up operation of the system,
3. Zone A1 Shore stations - providing means of radio communication operating in maritime V-band in cooperation with the Radio Transmission and Reception Centres in autonomous mode,
4. Zone A2 Shore stations – providing radio means of communication operating in the intermediate wavelength band operating in autonomous mode with Radio Transmission and Reception Centres,
5. Server rooms of the Radio Transmission and Reception Centres – providing a place of work of the infrastructure necessary for the correct operation of the system.

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Communication in distress and to maintain safety at sea.
GMDSS A-2 zone
the range: 150 Nm (Ustka)
MF DSC hearing 2187,5 kHz (H24)
MF Radiotelex Call Signal (SEL CALL): 2934; hearing 2174,5 kHz (H24)
MF Phonia Hearing 2182,0 kHz (H24)

GMDSS A-1 zone

VHF DSC Kanał VHF 70 (H24)
Location (name and geographical position) and range (nm) exposure:

6. Police 53˚33,9'N 014˚35,1'E 24 Mm
7. Kikut 53˚58,9'N 014˚34,8'E 29 Mm
1. Niechorze 54˚05,7'N 015˚03,9'E 25 Mm
2. Gąski 54˚14,6'N 015˚52,4'E 23 Mm
3. Jarosławiec 54˚32,4'N 016˚32,6'E 24 Mm
4. Czołpino 54˚43,1'N 017˚14,5'E 25 Mm
5. Stilo 54˚47,2'N 017˚44,0'E 29 Mm
6. Rozewie 54˚49,8'N 018˚20,2'E 28 Mm
7. Gdańsk 54˚22,2'N 018˚46,7'E 23 Mm
8. Krynica Morska 54˚22,9'N 019˚25,3'E 24 Mm

The exhibits are remote stations managed from the Maritime Safety Centre of the Maritime Office in Gdynia.

VHF Fonia Hearing Channel VHF 16 (H24)
Location (name and geographical position) and VHF exposure channels:

1. Police 53˚33,9'N 014˚35,1'E 16, 61
2. Kikut 53˚58,9'N 014˚34,8'E 16 , 5
3. Niechorze 54˚05,7'N 015˚03,9'E 16, 62
4. Gąski 54˚14,6'N 015˚52,4'E 16, 61
5. Jarosławiec 54˚32,4'N 016˚32,6'E 16, 62
6. Czołpino 54˚43,1'N 017˚14,5'E 16, 5
7. Stilo 54˚47,2'N 017˚44,0'E 16, 61
8. Rozewie 54˚49,8'N 018˚20,2'E 16, 62
9. Gdańsk 54˚22,2'N 018˚46,7'E 16, 5
10. Krynica Morska 54˚22,9'N 019˚25,3'E 16, 61

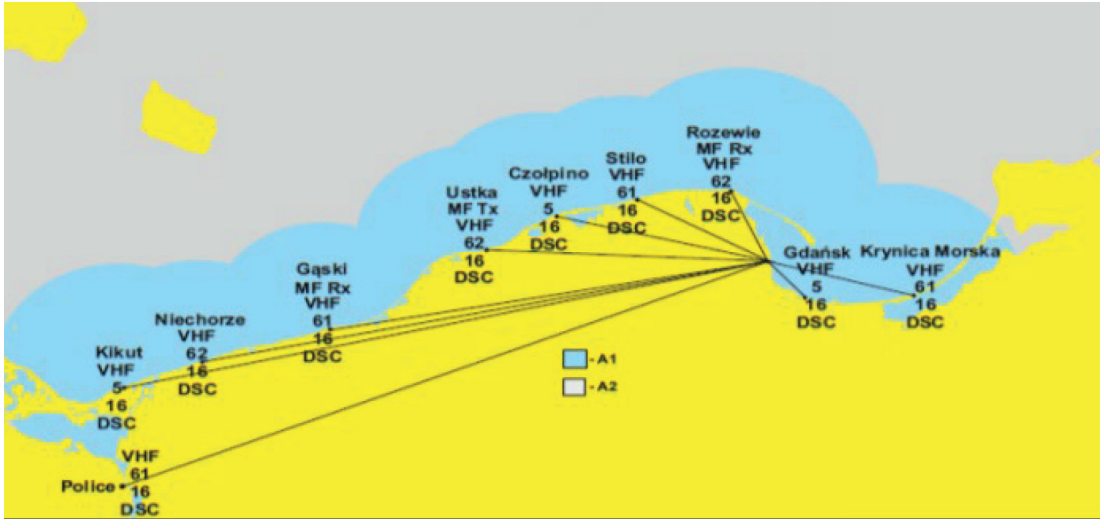

Fig. 3. GMDSS station layout diagram [2]

The exhibits are remote stations managed from the Maritime Safety Centre of the Maritime Office in Gdynia.

The basic functionalities of the GMDSS system are:

1. Conducting voice communication correspondence in distress through the Receiving Centres in sea areas A1 and A2 of the Polish SAR responsibility zone and the Polish exclusive economic zone (EEZ),
2. Support for a digital communication carried out in the DSC system by Radio-telecommunication Centres Receiving Zones A1 and A2 of the Polish SAR Responsibility Zone,
3. An information system providing:
   - proper handling of incoming emergency calls,
   - assessment of the surface situation, together with mechanisms for verifying the notifications received,
   - download and present data on units in available national and international systems
4. Providing the necessary radio communication mechanisms with wired connectivity for additional services,
5. MSI (Maritime Safety Information) broadcasting support.

4. Development of OpenEye_ GMDSS

The following panels are pre-configured in OE_GMDSS:

1. The Baltic Sea
2. Current events
3. DSC event history
4. Recordings
5. Navtex
6. Hydro Meteo
7. System operator monitor
8. Radar control
9. Weather forecast

The panels are fully configurable and managed from the user level, who can adjust the order and position of the displayed panel to his needs. The main panel giving an overview of the entire surface situation, which is used for a quick identification of the event and subsequent coordination of the action is **the Baltic Sea** panel.

This window presents data from all possible sources including the most important ones:

1. Presented position of vessels with their destination port data, speed, course based on AIS data.
2. Presented radio sightings (red lines) with the specified listening channel and transmitter direction.
3. Presentation of radar echoes from coastal radars.
4. Presentation of GMDSS coast stations as well as Transmission and Reception Centres.
5. Presentation of excluded/hazardous areas.
6. Presentation of both automatic (DSC) and manual assistance call signals.
7. Presentation of the allocation of SAR (Search and Rescue) service units.

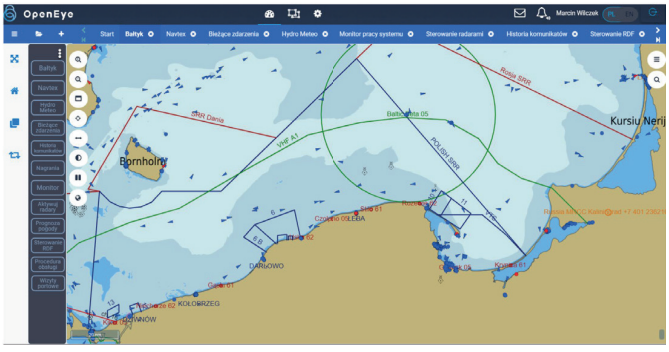

Fig. 4. GMDSS operator main control panel - Baltic [own study]

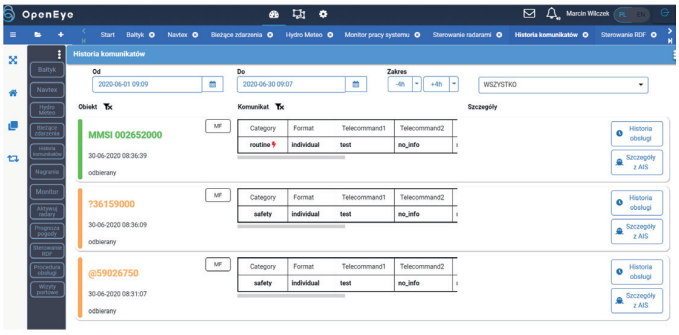

Fig. 5. Current events panel OE_GMDSS [own study]

The main objective of the GMDSS system is to ensure the handling of events at risk and therefore to handle the messages contained in the Current Events panel.

You could say that this panel is the main element of the system. It shows details of a distress call. Outgoing DSC messages appear in it and at the same time are graphically presented in the Baltic panel. From this place the operational work of the GMDSS operator begins, which first of all consists in the verification of the call and confirmation of its takeover. Due to the geographical location of the Baltic Sea in our responsibility zone we do not have A3 zone, but part of the sea is A2 zone. The characteristics of medium-wave propagation (MF) cause that messages from outside the area of responsibility, e.g. the North Sea or even the Atlantic Ocean, are also received in the system, so each of such messages must be verified.

The next step after identifying the event as "ours" follows the procedure of service and the next sequence of events notifying the Maritime Rescue Service (SAR), land-based services (Police, Fire Brigade, Army, Health Service, etc...). The DSC message schema is strictly defined and the same throughout the GMDSS.

This panel is connected to the following panels presenting the history of events, service, messages and recordings of calls via radiotelephones.

The handling of an incident in danger itself is a series of procedures that cannot be presented in a condensed form. It is important that, as in most alarm systems, we have different levels of danger. The success of any rescue operation requires the good cooperation of many services. In the OE_GMDSS system, apart from collecting and presenting events, there is a separate module for planning the rescue action. From the action planning panel the operator has the possibility to limit the search area, to select units for rescue action, to track and predict the location of the unit calling for help, to search for additional data in port registers about visits of this ship, etc.

Another panel of the system is the NAVTEX panel, i.e. the system for transmitting warnings and navigation messages to ship crews.

From one place, the operator has the possibility to view the situation with regard to safety messages for shipping, weather, marine works and switched/closed areas. NAVTEX is another international system for navigational safety. The structure for our Baltic Sea area is defined in the figure below.

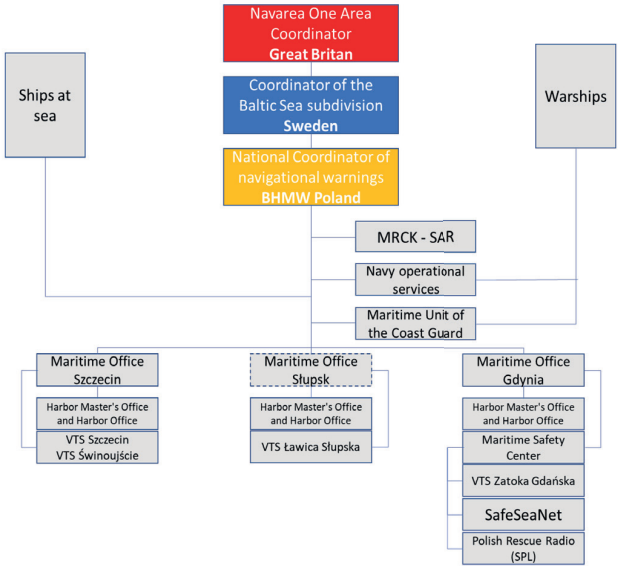

Fig. 7. Navigational warning circuit diagram [3]

Part of the work of GMDSS operators is broadcasting weather, navigation warnings and ice messages which are transmitted in Polish and English in the MF band on f=2591 kHz after the announcement on f=2182 kHz in the VHF band on channels 5, 61 and 62 after the announcement on channel 16 VHF and on request. Navigation warnings are broadcast 6 times a day, every 4 hours from 0133 to 2133 UTC. Weather messages are broadcast 4 times a day at 0135, 0735, 1335 and 1935 UTC. Ice messages shall be transmitted at 1035 and 1335 UTC. These messages shall be pre-prepared in the system and shall be broadcast by voice by the GMDSS operator for the whole Baltic Sea at a specific time.

The widest and most complicated in terms of conditions is support in search of survivors. Finding a man who has fallen off the ship into the sea is extremely difficult and, in most cases, ends in failure. However, it is always human life at sea that is most important and, in any situation, saving it is mandatory. There are several

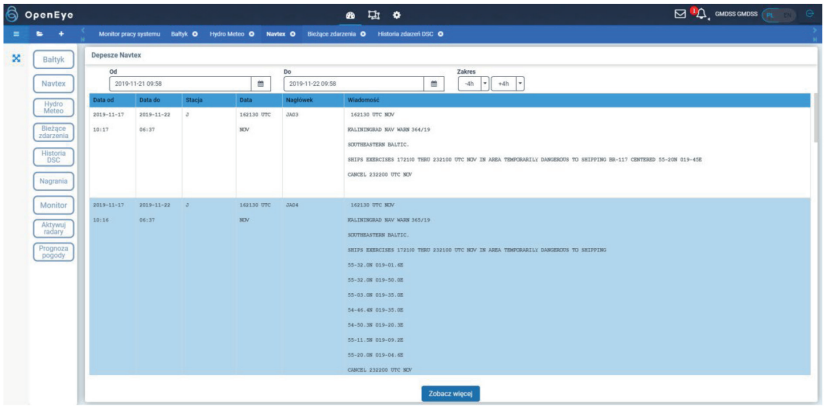

Fig. 6. NAVTEX OE_GMDSS Panel [own study]

panels in the system where data are presented in combination with each other to help in this difficult rescue operation. In one panel we integrate radar indications, weather conditions (wind strength and direction - drifting). Thanks to the operator's efforts and their experience, they are able to **narrow down the search area** for SAR and Military vessels at sea.

The last but not least important panel of the OE_GMDSS system is the **System Work Monitor**, in which current diagnostics of all subsystems and interfaces to external systems are conducted.

5. Conclusion

Implementation, launch and maintenance of the GMDSS system for the Maritime Office in Gdynia is one of the most difficult projects, both organisational and technical. Due to the complexity of the system and many variables and data concerning practically the whole globe of the Earth, the construction of the GMDSS system for Poland **does not differ from** the one in Norway, the Netherlands, Canada or Australia. The progressive technological development of ships and the demand for maritime transport, which, due to its characteristics, is the most economically viable in the world, means that the **safety and operational sector** must also be constantly developed. For this reason, this article is the beginning of events which we hope will open the gate of Polish technical thought to the world and they will result in taking further scientific activities in order to understand the mechanisms of synergy and optimization of rescue operations in sea conditions as deep as possible, validate the system in the post-implementation period as well as start further analyzes and studies of the level of maritime safety in the area of OE_GMDSS impact.

The publication on OE_GMDSS will also contribute to increasing the openness of the maritime sector to Polish technical thought in the field of maritime safety management.

Bibliography

[1] FUNCTIONAL AND UTILITY PROGRAM Construction of a marine communication system in distress, GMDSS-PL - Maritime Office in Gdynia]
[2] NOTICES TO MARINERS December 20th 2019 ISSN 2657–4705 Nr 51-52 (563 – 572), HYDROGRAPHIC OFFICE OF THE POLISH NAVY
[3] GMDSS Manual 2019 Edition