



## Polish National Maritime Safety System - Objectives of the Establishment, Structures and Tasks

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### ABSTRACT

The European Commission expanded the scope of operation of the Vessel Traffic Monitoring and Information System and ships reporting formalities established according to the requirements of the Directives 2002/59/EC and 2010/65/EU. Member States of the European Union were required to introduce the legislation implementing the revised requirements of amended directives and organizational means and technical systems necessary to attain them. In Poland requirements of these directives are introduced by acts of the Polish parliament and regulations of the Polish Minister of Transport, Construction and Maritime Economy. As a mean of enabling organizational and technical implementation of legal requirements has been put into operation the Polish National Maritime Safety System (KSBM) established in the scope of project co-financed by the European Union. Paper presents requirements of the Polish legislation implementing the provisions of the above mentioned directives and objectives of the establishment of KSBM and structure and tasks of this system. The article ends the authors' comments on the directions of the further development of presented system in relation to the necessity to implement the requirements of the Directive 2010/65/EU of the European Parliament and of the Council of 20 October 2010 on reporting formalities for ships arriving in and/or departing from ports of the Member States.

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## 1. Introduction

Coastal states need to guard against the threats to maritime safety, to the safety of human life and to the marine and coastal environment created by incidents and accidents at sea and by the presence of polluting waste or packages drifting at sea. Knowledge of the current position of the vessel in distress, its type and number of persons on board and the positions and parameters of other ships in the vicinity affects the efficiency of search and rescue (SAR) operation.

Information on dangerous or polluting goods being carried on ships and on other relevant safety data, such as relating to

navigational incidents, is essential to the proper preparation and effectiveness of operations to tackle pollution or the risk of pollution at sea.

Due to the mentioned facts, there are several mandatory ship reporting systems, vessel traffic services and ships routing systems established in the European waters in accordance with the relevant rules adopted by the International Maritime Organisation (IMO), mainly in areas considered as congested or hazardous to navigation. They play an important role in the prevention of accidents and pollution at sea. It ought to be ensured that ships comply with the reporting requirements in force under reporting systems, use vessel traffic services and that they follow the rules applicable to established ships routing systems.

Efficient service in the ports of ships undertaking international voyages requires sufficiently early messages by these vessels with the information required by the ports, customs, border and sanitary authorities. Ships leaving or bound for ports must notify this information to the competent authorities of the port states. Due to their behaviour or condition, some ships pose

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potential risks to the safety of shipping and the environment. Coastal and port states should pay particular attention to the monitoring of such ships, take the appropriate measures to prevent any worsening of the risk they pose and send any relevant information they possess on these ships to the other states concerned.

In order to comply with these tasks, the coastal states shall introduce appropriate legislation and build infrastructure needed for monitoring vessel traffic and communication with ships by means of the nets of coastal AIS, radar and radio stations. Each state shall establish national and local centres responsible for monitoring, communication and exchange of information with other states directly or through the regional, e.g. Baltic, and European Union (EU) centre. The obligations in this regard of the EU Member States and the central authorities of the European Community determine:

- Directive 2002/59/EC of the European Parliament and of the Council of 27 June 2002 establishing a Community vessel traffic monitoring and information system (VTMIS) and repealing Council Directive 93/75/EEC (Directive, 2002), amended by the Directives: 2009/17/EC of 23 April 2009 amending Directive 2002/59/EC (Directive, 2009a) and Directive 2009/18/EC of the same date establishing the fundamental principles governing the investigation of accidents in the maritime transport sector and amending Council Directive 1999/35/EC and Directive 2002/59/EC (Directive, 2009b), Commission Directive 2011/15/EU of 23 February 2011 amending Directive 2002/59/EC of the European Parliament and of the Council establishing a Community vessel traffic monitoring and information system (Commission, 2011) and Commission Directive 2014/100/EU of 28 October 2014 on the same subject (Commission, 2014); and
- Directive 2010/65/EU of the European Parliament and of the Council of 20 October 2010 on reporting formalities for ships arriving in and/or departing from ports of the Member States and repealing Directive 2002/6/EC (Directive, 2010). Requirements of the above mentioned directives should be implemented in the legal systems of EU Member States.

## 2. Polish legal acts introducing EU requirements regarding VTMIS and ship reporting

Requirements of mentioned EU directives are introduced in Poland by the Polish Act of 18 August 2011 on maritime safety (Act, 2011) and of 24 July 2015 amending the act on maritime safety and some other acts (Act, 2015) and the regulations of the Polish Minister of Transport, Construction and Maritime Economy issued on the base of these acts, e.g.:

- Regulation of 4 December 2012 on National Vessel Traffic Monitoring and Information System (Regulation, 2012a);
- Regulation of 8 February 2012 on the operation of an electronic database of ships of Polish flag (Regulation, 2012b);

- Regulation of 8 March 2012 on Maritime Telemedical Assistance Service (Regulation, 2012c); and
- Regulation of 16 May 2012 on a plan to grant refuge to ships in need of assistance in Polish maritime areas (Regulation, 2012d).

According to these legal acts, the National VTMIS, called the National SafeSeaNet System, was established to ensure the acquisition, storage and exchange of data and information about ships and events necessary to ensure the safety and security of the Polish maritime areas and the adjacent coastal zone, especially (Act, 2011, Act, 2015, Regulation, 2012a):

- Posing a potential hazard to shipping or a threat to maritime safety and security, the safety of people or the marine environment, the effects of which may extend to the Polish maritime areas or maritime areas in other Member States of the European Union; and
- Necessary to effective organization and conducting of the SAR operation, vessel traffic monitoring comprising the management and surveillance of ship movements and affective work of the Polish ports and harbours.

The main elements of the National SafeSeaNet System are (Regulation, 2012a):

- Technical infrastructure;
- SafeSeaNet Coordinator; and
- SafeSeaNet users.

The technical infrastructure creates (Regulation, 2012a):

1. Vessel monitoring subsystem consisting of:
  - Long and short range coastal radars;
  - Net of the AIS shore based stations;
  - Net of the shore radio stations enabling communication with vessels in the VHF band; and
  - National contact point of the Long Range Identification and Tracking (LRIT) System.
2. Information exchange system consisting of:
  - Polish Harbour Information and Control System (PHICS), with the exception of the STCW component containing a database of seafarers' documents, including databases of: ships of Polish flag, ships entering Polish ports and dangerous cargoes loaded and unloaded in Polish ports; and
  - Electronic System for the Exchange of Maritime Safety Information (SWIBZ), called the National SafetySeaNet.

The coordinator acts as the National Competent Authority (NCA) mentioned in the Interface and Functionalities Control Document (IFCD). He determines and maintains the National SafeSeaNet Service, operating around the clock, 7 days a week. The main tasks of the National SafeSeaNet Service include, among others (Act, 2011, Act, 2015, Regulation, 2012a):

- Providing information required by the competent authorities from other European Union Member States; and
- Immediate notification of the National SafeSeaNet users on received information from the European SafeSeaNet system on ships or events that constitute a potential danger to navigation or a threat to maritime safety or security, the safety of people or the marine environment, the effects of which may extend to the Polish sea areas.

Electronic database for ships of Polish flag contains information (Act, 2011, Act, 2015, Regulation, 2012a):

1. For each vessel regarding:
  - Its identification;
  - Recognized organization involved in its classification and certification;
  - Carried out flag state inspections: the body which carried out the inspection, date of the inspection, its results and issued certificates;
  - The body which carried out the inspection of the vessel in the framework of the Port State Control, date of the inspection and its results, in particular concerning deficiencies and ship's detention; and
  - Marine accidents and incidents involving the vessel in question.
2. Identifying vessels that changed their flag from Polish to the foreign in the past 12 months.
3. Other data deemed relevant by the maritime authorities.

Database is administrated by the Director of the Maritime Office in Gdynia. Accesses to collected data have, through the National SafetyNet, authorised employees, inspectors and officers of the Polish (Regulation, 2012a, Regulation, 2012b):

- Maritime administration (ministry supports the minister responsible for maritime economy and local maritime administration - maritime offices in Gdynia, Szczecin and Slupsk);
- State Commission on Marine Accident Investigation;
- Search and Rescue Service;
- Coast Guard;
- Customs Service;
- Recognized organizations authorized to carry out the tasks of the Polish maritime administration;
- Maritime Chambers leading Polish register of maritime ships;
- Sports association leading Polish register of maritime yachts;
- Hydrographic Office and Maritime Operations Centre of the Polish Navy;
- Marine fisheries authorities;

- Entities managing sea ports or harbours;
- Sea and port pilot stations;
- State Sanitary Inspection;
- The regional governmental authorities; and
- Other entities, which the administrator provides access to the database because of their responsibilities related to the needs of the maritime administration.

Additionally, information collected in the database is available for the (Regulation, 2012a):

- Authorities of the Member State of the EU if it is necessary to ensure the safety and security of shipping and marine environmental protection of that country; and
- European Commission to ensure maritime safety and security and protection of the marine environment of the Member States of the EU. Polish SAR Service participates in the exchange of information about the threat to human life at sea, threat of pollution of the marine environment and information related to the received security alert. Naval Hydrographic Office participates in the National SafeSeaNet as the National Coordinator for navigational warnings in the exchange of cartographic, hydrographic and nautical information (Regulation, 2012a).

Information is delivered to the database by ship-owners of Polish vessels, Flag State Control and Port State Control inspectors, inspectors of recognized organizations, Polish entities responsible for the investigation of marine accidents and incidents and entities leading Polish registers of maritime ships and yachts. The information contained in the database is updated continuously. Delivered information is introduced to the database within 7 working days from the date of receipt. Entering information into the database, its update, and delete from the database are recorded and kept in the memory for at least two years (Regulation, 2012b).

VTS, in the area of its activity, performs the following tasks (Regulation, 2012a):

- Conducts control and vessel traffic management by giving instructions, recommendations and orders;
- Supervises compliance by vessels with the rules in force in designated routes, traffic separation schemas and ship reporting systems;
- Conducts monitoring of ships considered potential dangerous, it means, posing a potential danger to navigation or posing a threat to maritime safety or security, the safety of people or the marine environment;
- Receives reports of vessels transferred in accordance with the requirements of current international, national and local regulations;

- Disseminates by radio in the VHF band navigational and hydro-meteorological information and warnings in accordance with the IMO guidelines;
- Broadcasts by radio in the VHF band warnings on potential dangerous ships and events creating a hazard to navigation in the area of its activity;
- Provides maritime assistance and traffic organization services in accordance with the IMO guidelines;
- Liaises and maintains communication with the captains and ship-owners of vessels carried on dangerous goods and the owners of this kind of goods carried on ships, as required by the Polish Act of 16 March 1995 on prevention of pollution from ships (Act, 1995);
- Performs the tasks described in the Polish plan to grant refuge to ships in need of assistance in the Polish maritime areas;
- Acts as the regional contact point for security purposes;
- Retrieves information about ships from European SafeSeaNet; and
- Provides information through the National SafeSeaNet to its users.

According to the legal requirements, Information and Communications Technology (ICT) systems operating within the National SafeSeaNet shall (Regulation, 2012b):

- Have an availability of not less than specified in the IFCD drawn up by the European Commission in cooperation with the EU Member States and defining detailed requirements for the operation, technical standards and operational procedures of national SafeSeaNet systems and the central part of SafeSeaNet system;
- Provide the ability to archive and recover data for the period specified in the document IFCD;
- Allow the transmission of information 24 hours a day, 7 days a week;
- Allow the transfer immediately after receiving the request, to the competent authorities of the EU Member States, information on ship and dangerous or polluting goods carried on board the ship;
- Maintain constantly required level of IT security; and
- Provide access to the information to authorized users only.

Exchange of information using the telephone, fax or e-mail shall be ensured in the event of a failure or planned downtime of the ICT systems operating within the National SafeSeaNet.

Information on ships sailing to the Polish ports is collected mainly from reports sent to the harbour masters by ships' masters, owners or their representatives. According to the regulations, the operator, master or agent of the ship heading the

Polish port is obliged to provide the harbour master information concerning the identity of the ship, port of destination, estimated time of arrival at the port, estimated time of departure from port and the total number of persons on board (Act, 2011, Act, 2015, Regulation, 2012a):

- At least 24 hours prior to arrival;
- No later than when the ship leaves the previous port, if the journey takes less than 24 hours; or
- When the port of destination is not known or changes during the journey - immediately after obtaining such information.

Additionally, the captain of a ship in the Polish maritime areas immediately inform the nearest coastal radio station or Vessel Traffic Service about all incidents which (Act, 2011, Act, 2015, Regulation, 2012a):

- Affect the safety of the ship, such as collision, stranding, damage or malfunction of the ship's equipment, flooding or shifting of cargo, damage to the hull or structural elements of the ship; and
- Threaten maritime safety, such as equipment failure which may affect the ship's manoeuvrability or fitness for navigation, including affecting the propulsion system, steering system, power generation, navigational equipment or means of communication.

Transmitted information shall contain (Act, 2011, Act, 2015):

- Ship's identification, position, ports of departure and destination;
- Address data entity in possession of information on dangerous or polluting goods, if they are carried on the ship;
- Number of persons on board; and
- Event details and other information necessary to conduct rescue operations, in accordance with the requirements laid down by IMO on the reporting systems and reports from ships incidents relating to dangerous goods, harmful substances and pollutants.

VTS or coastal radio station, after receiving the notification about the threat to human life or the threat of pollution to the marine environment, shall immediately notify the Maritime Rescue Coordination Centre of the Polish SAR Service.

In the cases referred to in the Act of 16 March 1995 on prevention of pollution from ships, director of maritime office with jurisdiction over the place where the ship is, in order to ensure the safety of life at sea, safety of navigation and protection of the marine environment, may (Act, 1995, Act, 2011, Act, 2015):

1. Order master of the ship in distress or of the ship in need of assistance to execute commands, concerning in particular:

- Restriction in the movement of the ship or following with specific course; the command does not affect the master's responsibility for the safe navigation of the ship;
  - Taking the necessary measures to stop or minimize the threat to the environment or maritime safety caused by the ship;
  - Proceeding to designated place of refuge; and/or
  - Usage of the pilot and/or towing service.
2. Examine on board vessel the level of hazard posed by the ship to maritime safety and safety of marine environment and provide the master of helping to improve the situation, informing about taking action the VTS Service.

Maritime Telemedical Assistance Service (TMAS) was established in order to perform tasks related to the granting of medical advice to the ships by radio. Service is performed by the University Centre for Maritime and Tropical Medicine in Gdynia. It performs its tasks without interruption 24 hours a day, 7 days a week, with the help of doctors on duty having (Regulation, 2012c):

- Experience as a ship's doctor or training in the basics of marine and tropical medicine;
- The ability of oral and written communication in Polish and English;
- Knowledge about the principles of SAR service functioning and its fitting with medicines and medical equipment; and
- Knowledge of medical equipment and medicines carried on ships in accordance with the recommendations of IMO, EU and the World Health Organization (WHO) and qualifications of ships' captains and crew members in first aid and medical care for patients.

Advice provided by TMAS shall assist and facilitate decisions that take the captain of the ship. It may include (Regulation, 2012c):

- Assisting the captain or crew member in the diagnosis, help in choosing medical practices and medical support of person sick or injured on board a ship;
- Provision of advice relating to a decision to carry out a medical evacuation;
- Provision of advice to help the master or a crew member of the vessel to take a decision on changing the port of destination in order to provide medical help to the sick or injured person; and
- Assisting the SAR Maritime Rescue Coordination Centre in making decisions related to planning and carrying out rescue operation of the sick or injured person depending on his condition.

### 3. KSBM - objectives of establishment, structure and tasks

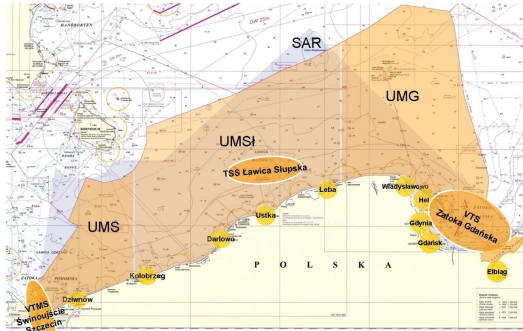
In order to enable the Polish maritime administration to fulfil the requirements imposed on it by EU and national legal acts, has being put into operation the Polish National Maritime Safety System (KSBM) established in the scope of project co-financed by the European Union. The direct beneficiary and the applicant of the project was Maritime Office in Gdynia in collaboration with Maritime Offices in Slupsk and Szczecin and Polish Search and Rescue (SAR) Service. Maritime Office in Gdynia was doing its job based on the agreements of 29 January 2008 and 25 February 2010 signed by the Directors of three Polish Maritime Offices and Polish Maritime SAR Service. The project was implemented in two stages: KSBM-I and KSBM-II. The project KSBM-I (No OPI & E 7.2-6) was located on the main list of individual projects of the Operational Programme 'Infrastructure and Environment' for 2007-2013 and was realized with the support of EU funds financed in the Priority VII 'Environmentally-friendly transport' under Measure 7.2 'Development of Maritime Transport'. The amount of co-financing from EU funds was up to 85%. The works based on contracts for stage I (KSBM-I) signed 28.02.2011 and for stage II (KSBM-II) - 20.12.2012. The first stage involved the purchase and installation of radar, computer and radio equipment and construction of radio communication network, the second - mainly the project and building of wire communication network, so called Pomeranian Telecommunication Bus, along the Polish coast and connecting all sources of data, decision-making centres and National SafeSeeNet users. The system covers Polish coastal waters and seaports from Szczecin and Swinoujscie in the west to the border with the Kaliningrad Region of Russia in the east.

Implementation of the project was done in the system 'design and build'. It means that the investor required the contractor to develop and submit for approval of the project in accordance with the description of the objects of the contract, complying with applicable Polish and European standards and regulations, under the conditions specified in the agreement, the General Conditions of Contract (HVAC) based on Contractual Conditions for Devices and Design and Construction for Electrical and Mechanical Equipment and Engineering and Construction Works Designed by the Contractor (FIDIC 1999, 4th edition, 2008) and the Special Conditions of Contract (SCC) (Krolkowski & Wawruch, 2016).

The national system of maritime safety encompasses areas of responsibility of the Directors of Maritime Offices in Gdynia (UMG), Slupsk (UMSI) and Szczecin (UMS) shown in Figure 1, in particular: approaches to ports, their roadstead, anchorages and coastal areas.

Each of the regional authorities of Polish maritime administration, for the management of its territory, has local centre, which is subordinated to the national maritime safety centre co-operating with domestic and foreign institutions, services and authorities, including Helsinki Commission (HELCOM) and EU institutions.

Figure 1: Areas of responsibilities of particular Directors of three Polish Maritime Offices, Polish Maritime Search and Rescue Service, VTMS Szczecin - Swinoujscie and VTS 'Zatoka Gdanska' and harbour masters



Source: Authors

### 3.1. Main objectives and tasks of the project

The main goal of the project was to establish a monitoring and control system for unified management of safety and security in the maritime areas of Poland by the Polish maritime administration and the exchange of information concerning the safety and security of shipping and environmental protection with collaborating national and international institutions and services. Implementation of the project was to enable inter alia (Krolkowski & Wawruch, 2016):

- Adaptation of measures and actions of the maritime administration to the regulations under law: national, regional - regulations issued by the European Union and Helsinki Commission and international - requirements, guidelines and recommendations issued by IMO, regarding the safety and security of shipping, security of ports and marine environmental protection; and
- Establishing a system for monitoring and analysis of the situation, warning about the dangers and providing information relating to maritime safety and security and pollution threat in order to prevent maritime accidents and pollution of marine environment and coast and to conduct efficient action in the event of their occurrence, including: supporting search and rescue and pollution combating actions, supporting the decision making process for granting place of refuge and respond to custom threats, supporting safety and security management and assistance in the accident investigation and detection of polluters through the use of identification, tracking and data archiving systems.

Main tasks of the project were (Krolkowski & Wawruch, 2016):

- Increasing the level of safety and security and environmental protection in Polish maritime areas;
- Establishing a system for monitoring and managing maritime traffic in sensitive areas, so called Marine Traffic Surveillance and Monitoring System (MTSMS), based

on: modern radars, VTS, AIS, LRIT, system of video cameras and VHF radio communication;

- Modernization and integration of the data archiving and exchange systems;
- Modernization of the Polish DGPS shore stations infrastructure;
- Building a new system of operational communication for the Polish Maritime Search and Rescue (SAR) Service; and
- Construction of the Pomeranian Telecommunications Bus along the Polish coast.

### 3.2. Stage I of the project

Stage I of the project comprised (Krolkowski & Wawruch, 2016):

- Completion of the national network of AIS shore base stations and a national network of marine DGPS;
- Establishing MTSMS for monitoring and managing maritime traffic along the Polish coast and to and from Polish ports particularly in sensitive areas;
- Building a modernized system of operational communications for the Polish SAR Service; and
- Establishment of the Early Warning System (EWS) for marine areas of Poland.

Completion of the net of Polish AIS shore base stations covered (Krolkowski & Wawruch, 2016):

- Increasing the coverage of the vessel traffic monitoring by installation of five additional AIS base stations, including one placed on the offshore drilling unit "Baltic Beta" situated approximately 110 km to the north from the Polish coast; and
- Ensuring homogeneity of the stations and monitoring capabilities of their system through the exchange of base stations in the western part of the Polish coast.

Now, the AIS network marked as AIS-PL consists of 12 stations grouped into three subnets managed respectively by Directors of the Maritime Offices in Gdynia, Slupsk and Szczecin and connected into one national network with its centre in the Maritime Office in Gdynia. AIS-PL is an element of the:

- Regional Baltic AIS monitoring system introduced according to the requirements of the Declaration on the Safety of Navigation and Emergency Capacity in the Baltic Sea (HELCOM Copenhagen Declaration) adopted on 10 September 2001 in Copenhagen by the HELCOM Extraordinary Ministerial Meeting; and
- EU AIS net creating part of the European VTMS as required by the Directive 2002/59/EC (Directive, 2002).



National network of marine DGPS serves as the main Polish marine radio navigation system. The network consists of two modernized in the scope of project shore stations located in Rozewie and Dziwnow with ranges shown in Figure 2, the main control station in Gdynia and remote monitoring stations of the radio signal placed in: Jaroslawiec on the central part of the Polish coast, Gdansk and Gdynia in the Gulf of Gdansk and Swinoujscie in the western part of the coast near the boundary with Germany. Signals from these stations are transmitted to the main control station in Gdynia. The needs of hydrographic and land surveying and, in the future, pilot operations and docking of ships require the use of GPS Real Time Kinematic (RTK) technique. In a further phase of development of the radio navigational infrastructure on the approaches to the Polish harbours and inside ports is planned to install fixed and mobile reference stations enabling the use of this technique.

An essential part of the KSBM creates MTSMS, which enables an efficient realisation of tasks related to ensuring the safety and security of maritime traffic and emergency response. The system consists of:

- Operating already in the Polish waters vessel traffic service 'VTS Zatoka Gdanska' and vessel traffic management service 'VTMS Szczecin - Swinoujscie' along with their technical equipment already existing, modernized and new installed within the investment KSBM-I: and
- New regional KSBM centres located in the Maritime Offices in Gdynia, Slupsk and Szczecin and national centre situated in Gdynia and cooperating with the European VTMS.

Figure 2: The actual range of the Polish DGPS stations



Source: Authors

In the scope of the project were installed (Krolkowski & Wawruch, 2016):

- 28 shore based radars with tracking facilities, installed as VTS, VTMS, port and shore remote controlled sensors;
- 26 video cameras located in ports and on the fairway Szczecin - Swinoujscie;
- 5 radio direction finders (RDF) working in the VHF band;
- 12 VHF shore stations; and

- 14 hydro-meteorological stations.

The investor distinguished, according to the IALA recommendation V-128, three types of coastal radars which were the subject of purchase (Wawruch, 2015):

- Basic - applicable to VTS performing information service and, where applicable, navigational assistance service;
- Standard - applicable to all types of VTS as identified by IMO conducting information service, navigational assistance service and traffic organization service in areas with medium traffic density and/or without major navigational hazards; and
- Advanced - applicable to VTS working in areas with high traffic density and/or specific major navigational hazards.

Using a public tender procedure, were chosen, depending on the functions requirements for implementation, including required range of work, accuracy of indications, etc., following numbers of particular types of pulse radars manufactured by the Danish company Terma (Krolkowski & Wawruch, 2016, Wawruch, 2015):

- 3 basic radars - single frequency TERMA SCANTER 2001 radars fitted with 3.66 m long scanners;
- 18 standard radars, including 14 completely new radar stations and 4 replaced radars currently in operation - single frequency TERMA SCANTER 2001i radars with scanners 5.49 m long; and
- 6 advanced radars - Terma SCANTER 2001i FD radars with frequency diversity fitted with scanners 5.49 m long - one radar and 6.405 m long - other radars.

Purchased radars work in the X band. They have available several functions such as: programmable Pulse Repetition Frequency (PRF), programmable Pulse Width (PW) and random stagger to enable task-specified setup of the transceiver, Auto-adaptive Sensitivity Control (ASC) to provide automatic two-dimensional Sensitivity Time Control (STC) to eliminate need for operator's settings of the radar during normal operation and Digital Fast Time Constant (FTC), sweep-to-sweep correlation (white noise suppression) and sweep-to-sweep integration to improve signal-to-noise ratio. They are designed for remote operation and have Built-in Test Equipment (BITE) function providing continuous information on the transceiver condition. Independently from this function, each radar has small display unit mounted together with transceiver for service work, additional to the operational display unit designated for installation in the traffic control centre. Remote Transceiver Control and Monitoring (RTCM) software and so called Static Map Tool (SMT) provide remote radar control and transmission of radar video images using the network (Krolkowski & Wawruch, 2016, Wawruch, 2015).

The investor planned for installation in several places Frequency Modulated Continuous Waves (FM CW) radars but he

resigned with this investment mainly due to the high cost of these devices. More detailed information about installed shore radars is presented in (Wawruch, 2015).

In order to ensure effective voice communication for SAR purposes were installed 8 shore remote controlled VHF DSC stations connected to the Maritime Rescue Coordination Centre in Gdynia and Maritime Rescue Coordination Sub-centre in Swinoujscie.

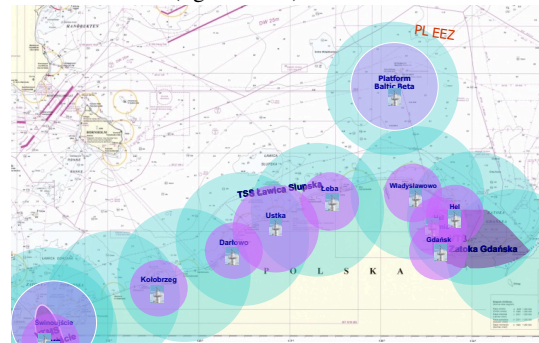
Areas covered by radar surveillance calculated using Computer Aided Radar Performance Tool (CARPET) prepared by Toegepast Natuurkundig Onderzoek (TNO) Physics and Electronics Laboratory in Netherlands and ranges of the new VHF coastal stations are presented in Figure 3.

The last task of the stage I of the project was establishment of the Early Warning System (EWS) for marine areas of Poland. Following main technical and investment works have been undertaken to carry out this task (Krolkowski & Wawruch, 2016):

- Development of the innovative applications of the Electronic System for the Exchange of Maritime Safety Information (SWIBZ) already implemented and operated by the Maritime Office in Gdynia to ensure its functionality as a tool for continuous monitoring of the situation and risk assessment and as the operating platform for cooperation between the institutions and services responsible for maritime safety and security and environmental protection;
- Ensuring an efficient system of communication and data transmission along the Polish coast allowing communication between coastal stations and KSBM centres,
- communication between traffic control departments of the maritime offices and communication for Polish SAR Service;
- Modernization of the telecommunication networks of maritime offices;
- Delivery and assembly of network security systems;
- Modernization of radio communication systems; and
- Preparation of the infrastructure of crisis management centres in three maritime offices and development of systems and applications supporting safety and security management, including PHICS, SWIBZ and detailed data base of results of inspection conducted on ships under Polish flag - so called e-inspection.

According to the already mentioned agreements of 29 January 2008 and 25 February 2010 signed by the directors of three Polish Maritime Offices and Polish Maritime SAR Service were established: one national maritime safety centre located in Gdynia, two such sub-centres in Szczecin and Slupsk and four VTS centres located in Gdynia, Szczecin, Swinoujscie and Ustka. Shown in Fig. 1 harbour masters offices in Polish ports and harbours in Darlowo, Dziwnow, Elblag, Gdansk, Gdynia, Hel, Kolobrzeg, Leba, Szczecin, Swinoujscie, Ustka and Wladyslawowo were equipped with new port radars described earlier.

Figure 3: Areas covered by radar surveillance (dark circles) and ranges of VHF coastal stations (light circles)



Source: Authors

National maritime safety centre and sub-centres are responsible for: risk assessment, early warning, crisis management and exchange of information concerning safety and security of shipping and environmental protection including ISPS, SafeSeaNet, CleanSeaNet, etc. They are equipped with the SWIBZ software realizing following functions (Krolkowski & Wawruch, 2016):

#### 1. Presentations of:

- Data received from KSBM inner sensors: VTS, VTMS, port radars, hydro-meteorological sensors, AIS-PL, RDF, database of vessels, e-inspection, etc.;
- data from outer AIS systems operated by HELCOM and European Maritime Safety Agency (EMSA);
- Data from outer radars (Polish Coast Guard and Polish Navy); and
- Weather forecasts and navigational and hydro-meteorological warnings.

#### 2. SafeSeaNet notifications.

#### 3. Modelling the drift of oil pollution.

#### 4. Risk assessment.

#### 5. Supporting crisis management and exchange of information suitable for this purpose.

According to the Polish national regulations main SWIBZ users are:

- The minister responsible for maritime economy and maritime offices;
- Polish Maritime Search and Rescue Service;
- Maritime Department of the Polish Border Guard (Polish Coast Guard);
- Maritime Operations Centre of the Polish Navy;
- Governmental Crisis Management Centre and its regional branches;
- Customs and police;
- Hydrographic Office of the Polish Navy;



- Maritime Branch of the Polish Institute of Meteorology and Water Management;
- Port authorities; and
- Sanitary and veterinary services.

The system is also available for EMSA in Lisbon and NATO Management Centre in Northwood (UK).

### 3.3. Stage II of the project

The main tasks of the second stage of the project were (Krolkowski & Wawruch):

- Providing reliable and secured transmission medium for Maritime Offices in Gdynia, Szczecin and Slupsk, Polish Maritime Border Guard, Polish Navy and Polish Maritime Search and Rescue Service;
- adoption of the standards for maritime supervision and monitoring to the objectives set out, among others, in the Communication from European Commission on an integrated maritime policy for the European Union, so called "Blue Book", adopted by the European Council on 14 December 2007 and the Communication from the Commission to the Council and the European Parliament, the European Economic - Social Committee and the Committee of the Regions 'Towards the integration of maritime surveillance: A common information sharing environment for the EU maritime domain' of 15 October 2009; and
- Ecological safety of maritime operations and, if necessary, support action involving the liquidation of consequences of natural disasters and ships' accidents and at sea.

The specific objectives of the second stage concerned to support the implementation of the KSBM functions by providing links with adequate bandwidth for this purpose, in particular Automated Radar Surveillance System in the Polish maritime areas. They included (Krolkowski & Wawruch, 2016):

- Increasing the EU's external border security at sea;
- Increasing the capacity of the environmental protection;
- More efficient monitoring of maritime traffic;
- Ensuring adequate transmission medium for the supervision of the exploitation of the Polish maritime areas and compliance by vessels regulations in force in those areas;
- More effectively protection of the economic interests of Poland in Polish maritime areas; and combating of poaching at sea.

As part of KSBM II were realized following tasks (Krolkowski & Wawruch, 2016):

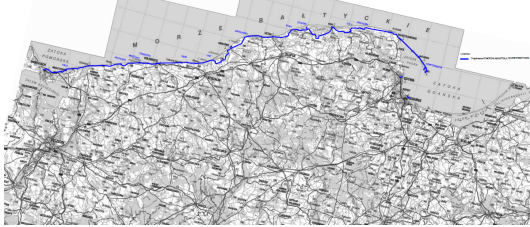
- Construction of shown in Figure 4 telecommunications infrastructure for maritime safety and monitoring systems and exchange of information, so called Pomeranian Telecommunications Bus;
- Completion of the GMDSS modernization;
- Designation and construction of places of refuge together with their necessary infrastructure for ships in distress and threatening an ecological disaster;
- Modernization of the shore and floating aids to navigation on routes and approaches to the Polish ports;
- Modernization of the floating stock of the maritime offices; and
- Modernization of the VTS 'Zatoka Gdanska'.

Second stage of the KSBM project was divided into a few parts. Stage II A provided design and construction of the Pomeranian Telecommunications Bus in the form of fibre optic cable between Gdynia and Swinoujscie to provide the ability to transmit voice and data to remote locations. The investment included (Krolkowski & Wawruch, 2016):

- Construction of the cable pipeline 3xRHDPE 40 mm and the system of micro duct 1xDB7 in relation Swinoujscie - Hel;
- Construction of the main fibre optic cable with a capacity of 144 fibres G.657, and taps into additional locations in the form of fibre optic cable with a capacity of 24 fibres;
- Construction of the offshore cable section in relation Hel-Gdynia with a capacity of 24 fibres G.657;
- Delivery and installation of Dense Wavelength Division Multiplexing (DWDM system for the relations Hel-Gdynia-Gdansk;
- Supply and construction of Multiprotocol Label Switching (IP/MPLS) network with speeds of 10 Gbps between nodes and endpoints of the net;
- Delivery and installation of optical fibre fault detection system with fixed reflectometers and optical switches;
- Construction of 19 containers for nodes and installation of network terminations in 22 endpoints; and
- Delivery and installation of Novus Management System (NMS) network management system.

Shown in Figure 4 Pomeranian Telecommunications Bus has over 600 km of new fibre-optic cable and 21 km of new submarine cable. System management centre is located in the Maritime Safety Centre of the Maritime Office in Gdynia.

Figure 4: Pomeranian Telecommunications Bus



Source: Authors

#### 4. Conclusions

Described in this paper KSBM, after completion of its implementation and passing with positive results Side Acceptance Tests procedures, met all requirements for VTMS presented in the Directive 2002/59/EC of the European Parliament and of the Council of 27 June 2002 establishing a Community vessel traffic monitoring and information system and repealing Council Directive 93/75/EEC, as amended and is able to meet the requirements for receiving reports of ships and transported them passengers and cargo as defined in the Directive 2010/65/EU of the European Parliament and of the Council of 20 October 2010 on reporting formalities for ships arriving in and/or departing from ports of the Member States and repealing Directive 2002/6/EC. Its implementation provided the technical measures necessary Polish maritime administration to ensure safety and security of shipping and protection of the environment and economic interests of Poland in Polish maritime areas by effective monitoring and control of maritime traffic and economic activities in these areas. It provides information necessary to make decision regarding granting place of refuge and enables increasing efficiency of the search and rescue operation, protection of the environment and action involving the liquidation of consequences of natural disasters and accidents with ships at sea. Data obtained from the system are useful to other services and institution related to maritime safety and security, border protection, maritime economy and port activities.

Currently, work is underway to establish national and regional single windows in accordance with the European Union requirements that will meet future tasks assigned to the single point of contact in the projects: e-maritime implemented by the EU and e-navigation developed by the IMO. Established in Maritime Office in Gdynia national single window has passed successfully the test in the field of automatic data exchange with

EMSA.

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