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Ryszard WAWRUCH¹

CONCEPTION OF THE POLISH NATIONAL SHIPS MONITORING SYSTEM BASED ON AIS TECHNIQUE

Polish Maritime Administration shall introduce ships monitoring system required by the European Union and Helsinki Commission. Paper presents basic information about automatic identification system, requirements for the monitoring system, its components and legal aspects of introducing and use. Suggested scheme of the system structure is described.

KONCEPCJA POLSKIEGO KRAJOWEGO SYSTEMU MONITOROWANIA STATKÓW Z WYKORZYSTANIEM TECHNIKI AIS

Polska Administracja Morska powinna wprowadzić system monitorowania statków wymagany przez Unię Europejską i Komisję Helsińską. Artykuł prezentuje podstawowe informacje dotyczące systemu automatycznej identyfikacji, wymagania dla systemu monitorowania, jego składniki i aspekty prawne wprowadzania i eksploatacji. Opisana jest sugerowana struktura systemu.

1. LEGAL ASPECTS

Signing by the Polish Minister of Transport and Maritime Economy Declaration on the Safety of Navigation and Emergency Capacity in the Baltic Sea Area adopted on 10 September 2001 in Copenhagen by the Helsinki Commission Extraordinary Ministerial Meeting (HELCOM Copenhagen Declaration) and accession to the European Union (EU) are the reason, that the Polish Maritime Administration has to build and introduce national maritime ships, passengers and cargo monitoring system capable to automatic data exchange on the international level in the frame of so called European SafeSeaNet.

System has to comply with the requirements defined in:

- Above mentioned Copenhagen Declaration;
- Regulation 1406/2002 of the European Parliament and of the Council of 27 June 2002 establishing an European Maritime Safety Agency (EMSA);

¹ Faculty of Navigation, Gdynia Maritime University, Al. Zjednoczenia 3, 81-345 Gdynia, waw000@am.gdynia.pl

- 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/EC; and
- Council Directive 98/41/EC of 18 June 1998 on the registration of persons sailing on board passenger ships operating to and from ports of the Member States of the Community. According to Section IV of the Copenhagen Declaration, all Baltic countries shall:
- Establish national, land-based monitoring systems for ships, based on AIS signals. A full
 monitoring of the Baltic Sea Area within the range of the shore-based VHF radio stations,
 (so called A1 sea area) shall take place not later than 1 July 2005;
- Establish a common Baltic Sea monitoring system based on and with access to all national Baltic AIS monitoring systems; and
- Provide the Secretariat of the Helsinki Commission (HELCOM) with specified and conformed AIS data in order to enable the Secretariat to prepare an annual report containing reliable statistics on ships traffic in the Baltic Sea Area as a basis for risk analyses.

EU Regulations and Directives require, that all Community Member States shall:

- Monitor, that all ships entering the areas of mandatory: ship reporting systems, ship routing systems and Vessel Traffic Services operated by one or more Member States, participate in, and comply with, the rules of these systems and services;
- Receive by radio, fax or e-mail:
 - Ships' notification required by the Directive 2002/59/EC and sent prior to entry into port of the Member State; and
 - Information about passengers and dangerous or polluting goods carried on board ships and required by the Directives 98/41/EC and 2002/59/EC;
- Establish databases to store described information relating ships sailing to the ports located in the Member States, leaving these ports or being actually at sea in the EU or Baltic waters; and
- Establish communication system to exchange of the above-mentioned data with the EMSA, HELCOM and other Member States.

Particularly, according to the Articles 9 and 14 of the Directive 2002/59/EC, Member States shall:

- Take all necessary and appropriate measures to provide themselves gradually, on a timeschedule compatible with required by this Directive, with appropriate equipment and shore based installations for receiving and utilising the AIS information taking into account a necessary range for transmission of the reports;
- Complete the process of building up all necessary equipment and shore-based installations for implementing this Directive by the end of 2007;
- Ensure that the appropriate equipment for relaying the information to, and exchanging it between, the national systems of Member States be operational at least by the end of 2008; and
- Cooperate to ensure the interconnection and interoperability of the national systems used to manage required data.

2. BASIC REQUIREMENTS

Basic functions of the analysed monitoring system are collecting, storage and dissemination of following information received from different sources (national net of automatic identification system - AIS shore-based stations), vessel traffic services, ship reporting systems, ship owners, operators and agents, port authorities, etc):

- Ships identification, actual positions and parameters of movement;
- Detailed data about marine pollutants and dangerous substances carried at sea;
- Detailed information about passengers on board sea going vessels;
- Detailed information about incidents with ships and cargo at sea and in the ports; and
- Information about violence of regulations concerning: sea safety, protection of environment and ships security and traffic.

To achieve these goals, it is necessary to create of an European and regional (Baltic) platform for maritime data exchange between maritime administrations of the Member States of the European Union and HELCOM, by:

- Setting-up a telematic network between all maritime EU Member States and Member States of the HELCOM for exchange of information and cooperation in search and rescue operations, preventing accidents at sea and maritime pollution; and
- Creating this network taking into account new technologies in radio and telecommunication such as long-range application of the automatic identification systems, XML and the Internet/TESTA network, making it flexible to cooperate with future technological developments.

Established network shall facilitate communication of the competent maritime authorities at local, national, regional (Baltic) and central (EU) levels and their activities with regards to:

- Prevention of accident at sea;
- Prevention of maritime pollution;
- Collection and dissemination of data;
- Harmonised exchange of information;
- Efficient implementation of the EU and HELCOM legislations concerning maritime safety, security and sea environment protection; and
- Control of compliance with the above mentioned legislation by ships, their owners, companies etc.

Adopted communication systems must display the following features:

- Be centralised on the national level;
- Data exchange must be electronic and enable messages to be transmitted, received and processed automatically in real time, 24 hours a day;
- Allow the Member States to react more efficiently in crisis situation;
- Provide a cost-effective means of exchanging information using modern communication technique;
- Support message implementation in EDIFACT and XML;
- Be able to include new requirements resulting from new EU and HELCOM legislations, new types of messages and methods of their transmission, new members in the network, etc;
- Ensure required level of the security of stored and disseminated data by respecting the confidentiality of information;

- Be independent of national information handling system;
- Each state must be able, upon request, to send information on the ship, passengers and dangerous or polluting goods on board without delay to the competent authority of another state; and
- Be user-friendly.
 - There should be designated:
- National Competent Authority (NCA) responsible for proper work of the system on the national level and data exchange with the EMSA, HELCOM and NCA in all EU and Baltic countries; and
- Local Competent Authority (LCA) responsible for proper work of the system on the local (port or regional) level and data exchange with the NCA and neighbouring LCA. System should consist of:
- National net of the AIS shore-based stations;
- Local terminals for data entering and exchange situated in cargo and passenger terminals, ships companies, operators' and agents' offices, and local offices of the Maritime Administration;
- NCA terminal;
- Consolidated or distributed databases;
- Telematic network between above mentioned terminals, data bases, particular LCA and NCA; and
- Telematic network between NCA and EMSA, HELCOM and NCA in all Baltic countries and EU Members.

3. SOURCES OF STORED AND DISSEMINATED INFORMATION

Described system has two sources of information:

- Data introduced into the local databases by ships' operators and agents, local maritime administration officers and ports and terminals authorities; and
- Data received by the automatic identification system (AIS) shore VHF and satellite stations.

Information shall be stored as long as, respectively:

- Ships are in the EU or Baltic sea area or ports, or are sailing to the EU or Baltic ports; or
- Passengers embarked in EU or Baltic ports or dangerous or polluting goods loaded in these ports are on board, irrespective of ships' present positions.

4. AUTOMATIC IDENTIFICATION SYSTEM (AIS)

AIS is an autonomous and continuous broadcast system, operating in two dedicated channels in the VHF maritime mobile band and additionally through the satellite communication system INMARSAT-C (in so called long range application). It handles multiple reports at rapid update rates in autonomous and autonomous and continuous or pulling modes. In normal (VHF) application AIS can use both 25 kHz and 12,5 kHz simplex channel bandwidths. One 25 kHz simplex channel enable to transmit with the rate of 9600 bits

per second about 2000 standard position reports per minute. 12,5 kHz channel enables transmission with the rate of 4800 bits per second about 1000 standard position reports per minute. Simultaneous application of two designated VHF channels increases system capacity twofold. There are internationally agreed 22 standard and 7 binary messages [1, 2]. For the monitoring purposes will be useful following types of them:

- Position reports (standard messages No 1, 2, 3, 18 and 19);
- Static and voyage related data (standard message No 5);
- UTC/date response (standard message No 10);
- Safety related message (standard messages No 12 and 14);
- Ship waypoints and/or route plan report (international function message No 17);
- Number of persons on board (international function message No 40); and
- Dangerous and polluting goods on board (actually introduced international function message without designated identification number).

All reports are transmitted and received automatically. In the autonomous mode they are transmitted with the frequency depending on the vessel speed and stability of its movement. Minimum rate (for ships in ports and at anchor) is equal to one report per six minutes, maximum – one report per 2 seconds. Additionally there is a possibility to call for reports in pulling or continuous mode, particular types of ships (passenger vessels or ships carrying dangerous or polluting goods etc.) independent on their present positions or ships being actually in defined sea area (using digital selective calling technique - DSC).

According to the present requirements of the International Convention of Safety of Life at Sea (SOLAS) ship-borne AIS equipment shall be on all passenger ships irrespective of size and all other vessels of 300 gross tonnage and upwards engaged on international voyages and cargo ships of 500 gross tonnage not engaged on international voyages. In near future this requirement will be extended on all seagoing ships including fishing vessels and pleasure crafts. In the West European and Baltic waters equipment shall be activated all time, even when the ship is in the port.

5. TELEMATIC NETWORK OF THE POLISH NATIONAL MONITORING SYSTEM

Structure of the system shall be adequate to the structure and domains of competency and responsibility of the Polish Maritime Administration. Due to that there shall be designated:

- Ministry of Infrastructure as NCA; and

- Directors of Maritime Offices in Gdynia, Słupsk and Szczecin as LCA.

Direct exchange lines shall connect particular LCA with the shore-based AIS radio stations working in VHF band and situated along the Polish coast in the areas of responsibility of the Directors of Maritime Offices. Additional direct exchange lines have to be built between:

- Particular LCA to secure exchange of information about ships sailing along the Polish coast;
- Particular LCA and NCA;
- LCA in Szczecin and LCA in Germany to data exchange about local ships traffic in Pomorska Bay and Zalew Szczecinski;

- LCA in Gdynia and LCA in Kaliningrad to data exchange about local ships traffic in the Bay of Gdańsk and Zalew Wiślany; and
- NCA and:
 - Satellite station in Psary;
 - Maritime Rescue Coordination Centre (MRCC) and Maritime Assistance Service (MAS) located in Gdynia;
 - Head Quarters of the Polish National Security Forces (Polish Coast Guard and Navy) located in Gdańsk and Gdynia; and
 - EMSA, HELCOM and NCA of other Baltic and EU states.

Due to the legal regulations in the area of responsibility of the Director of Maritime Office in Gdynia and specific character of the ships traffic in the Zalew Wiślany, there shall be separate sub-centre responsible for ships monitoring in the Zalew Wiślany, connected to the terminals in ports and harbours in this area and equipped with one shore-based VHF AIS radio station.

Described system network reflects structure and competency of the Polish Maritime Administration but is expensive and has disadvantages. Officials in the Ministry of Infrastructure and Maritime Offices work eight hours a day, excluding Sundays and holidays. Continuous watches keeps only staff employed in the centres of Vessel Traffic Services (VTS), MRCC, MAS and Polish Coast Guard and Navy. Two existing Polish Vessel Traffic Services: Szczecin-Świnoujście and Bay of Gdańsk are already responsible for radio communication with the ships, their safety and security and protection of sea environment in the areas of responsibility of the particular centres. They have computer databases about ships and personnel necessary to keep technical equipment in working conditions. It seems to be sensible to utilise them in building described Polish ships monitoring system. Low density of sea traffic alongside the central part of the Polish coast allows dividing it between two existing VTS centres and subordinate ships monitoring to them. One of these centres shall be designated as NCA. Each centre shall collect data about ships received from shore AIS VHF stations and passengers and cargo terminals, harbours and ports located in its area of responsibility. Databases may be located in the VTS centres and connected to the computers installed in ports, harbours and terminals, or distributed between them. Distributed data bases have to be continuously accessible in the automatic manner for VTS personnel. Each VTS centre shall be equipped with separate monitors to allow control of ships and their traffic in following areas:

- Main ports (Szczecin and Świnoujście and canal between them or Gdańsk and Gdynia);
- Zalew (Szczeciński or Wiślany);
- Bay (Pomorska or Gdańsk); and
- Open sea costal waters.

At the project stage shall be considered, as far as possible, possibilities of building exchange lines together with the Polish Coast Guard introducing shore-based radar system to monitor the Polish sea areas. This system will use additionally information received from the network of shore-based AIS VHF stations. It will be with economical profit to use, where it will possible, one optical waveguide to send radar information (target tracks and plots) and AIS data.

The scheme of suggested system is presented on Fig.1.



 Fig.1. Suggested network of the Polish national ships monitoring system LT − local terminal,
 Y − shore based AIS VHF radio station

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Reviewer: Prof. Bernard Wiśniewski