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# Maritime Communications in RIS System for Inland Navigation

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ABSTRACT: The article presents the VHF communications system architecture for inland navigation within the area of operation of the RIS-PL Centre.
The author has described the communication system modules used in the RIS on the Lower Oder stretch and presented the relevant equipment specification.
The present condition of the system has been described, taking into consideration the location of its components, both in the field and in the environment, of key importance for VHF communication.
The feasibility of implementation of GMDSS subsystems for integrated navigational data transmission in maritime and inland navigation at the RIS-PL Centre has been discussed.

## 1 INTRODUCTION

Harmonisation of river information services is one of the key objectives of the EU transport policy. In order to adjust the Polish inland transport to modern logistics solutions and integrate it into the intermodal transport network, the River Information Services (RIS) system has been developed.

Vessels used in inland waterway transport are smaller than those in use in maritime shipping, and are often pushed or towed units. A modern inland vessel has relatively low energy consumption and so is environmentally friendly and safe.

In order to implement the RIS system in the territory of the European Union, it is necessary to develop and deploy a communications system which will enable exchange of all the information required for safe inland navigation. RIS system modules must ensure integral data exchange, achieved through standardization of the applications and technologies used.[1],[8]

The strategies outlined in the relevant EU directives encourage the use of high-end radio communication solutions in the management of inland waterway traffic and transport.

The RIS Centre archives, processes and provides information to masters of inland navigation vessels and supports the processes of planning and management of river traffic and transport. The possibility of implementation and use of the Global Maritime Distress and Safety System (GMDSS) in inland navigation is one of the factors linking the two transport branches – inland waterway transport and maritime shipping.

## 2 GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM [2],[3]

Implementation of the GMDSS by the International Maritime Organization (IMO) in collaboration with

the International Telecommunications Union (ITO) has made it possible to send automated distress calls in emergency situations.

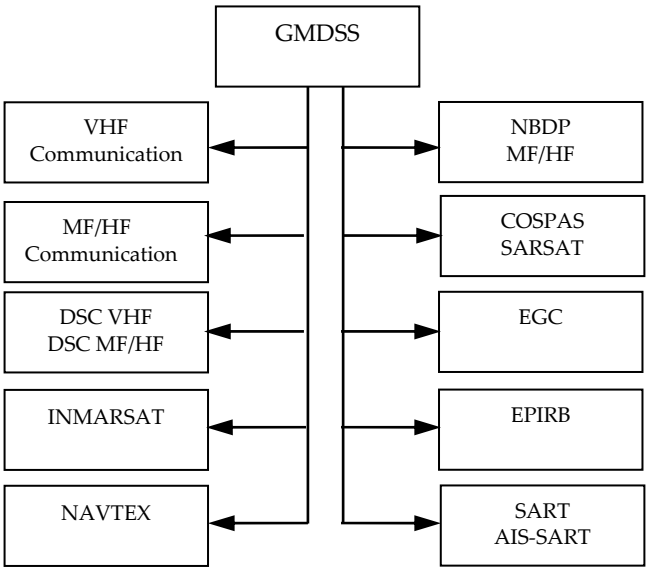


Figure 1. GMDSS subsystems. [12]

The system is designed to minimise the time required for sending a distress alert, locate the vessel in distress and ensure communication on site required for coordination of the search and rescue operation.

In the development of both analogue and digital radio communication, several GMDSS subsystems have been isolated. (Fig. 1)

The radio infrastructure of data transmission in inland shipping should be compatible with the GMDSS in use at sea, with its operation based on terrestrial transmission channels, wireless Internet and satellite transmission channels. Digital data processing systems DSC (Digital Selective Calling) and VHF radio communication systems ensure reliable vessel-to-shore and vessel-to-vessel communication in inland navigation.

## 3 VHF COMMUNICATION SYSTEM ARCHITECTURE FOR THE POLISH RIS SYSTEM ON THE LOWER ODER STRETCH [4],[6],[12]

One of the main characteristics of the River Information Service is efficient and reliable flow of information. It can be effectively achieved in real time through VHF communication, which is of key importance in maritime navigation and has been implemented to meet the requirements of inland waterway shipping services.

VHF communication is in use in inland navigation to ensure safe flow of information among vessels and services coordinating SAR operations within the RIS-PL system operation range.

### 3.1 *RIS-PL Operating Centre [14],[15]*

The Operating Centre is the heart of the River Information Services system. Based in the building of the Inland Navigation Office (*Urząd Żeglugi Śródlądowej*) in Szczecin at pl. Stefana Batorego 4, it was officially launched on 16 May 2014 (see Fig. 2).

Figure 2. Building housing the RIS-PL Operating Centre. Source: Own work, based on [15].

Within a usable floor area of 200 sq m, a room has been arranged for the maintenance of constant radio watch by three system operators who control the system modules. The foreground item of the equipment is a display consisting of six LCD screens. It displays a view of the AIS and views from CCTV cameras, which, combined, support real-time view of the situation on the river. The RIS Centre also provides electronic charts for the purposes of the Inland ECDIS, transmits Notices to Skippers (NtS), receives ERI messages and ensures system users reliable VHF radio communication.

The RIS-PL covers a total area bounded by:
- the village of Ognica – southern end (697 km of the River Oder),
- Western Oder – northern end (36.55 km of the River Oder – the Trasa Zamkowa route),
- Eastern Oder at the mouth of the River Regalica to Lake Dąbie – northern end (741.6 km), and
- Lake Dąbie.

### 3.2 *Location of VHF communication modules in the RIS-PL system [12],[14]*

#### 3.2.1 *VHF network node – Ewa Grain Elevator [11]*

The primary VHF network node of the RIS-PL system is the base radio station located on the roof of the Ewa Grain Elevator. Owing to its location (in position 53.4373°N, 14.5842°E, on the grounds of the Szczecin Harbour) and the implemented technology, the radio station enables VHF communication throughout the RIS-PL area up to (and including) the village of Ognica. The existing building has been altered for the installation of antennas as well as the required power sources and base radio station devices on its roof.

VHF communication is carried out through four device modules: two universal radiotelephones Motorola GM360 without a DSC unit, and two Sailor series 6222 VHF DSC units. For the purpose of vessel traffic supervision, the base radio station on the Ewa Grain Elevator is equipped with two Inland AIS – SAAB R40 devices. Each VHF radio station has a separate LAT EYVYS beam antenna.

Fig. 3 presents the Ewa Grain Elevator base radio station. The location of the RIS modules is marked in red.

Signals received by VHF radio stations are transmitted directly to the RIS-PL Operating Centre via a relay network, using optical fibre cables for the transmission of data incoming from sensors, radiotelephones and AIS receivers.

Fig. 4 presents a block diagram of the arrangement of short-range communication devices at the Ewa Grain Elevator base radio station.


Figure 3. Ewa Grain Elevator base radio station with the location of RIS modules marked in red.
Source: Own work, based on [15].

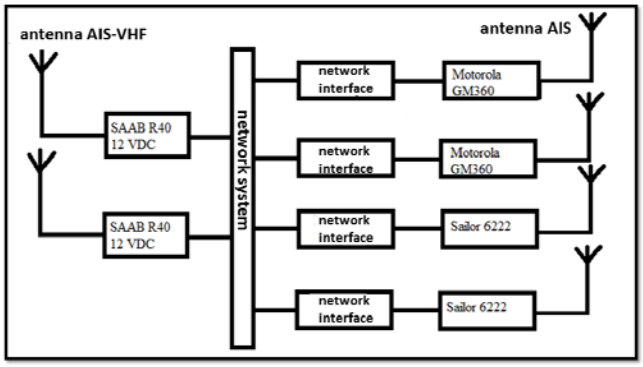


Figure 4. Arrangement of VHF communication devices at the Ewa Grain Elevator base radio station.
Source: Own work, based on [1],[5].

A CCTV camera mounted at the Ewa Grain Elevator base radio station provides undisturbed view of the situation in the fairway. The high-quality image enables monitoring of vessels passing under the Trasa Zamkowa route (distance: 1 500 m). At the control panel installed at the RIS-PL Operating Centre, one can select an image from the desired CCTV camera out of 36 cameras operating in the entire area.

### 3.2.2 *AIS-VHF network node – the Widuchowa Weir [11],[14]*

Another location of great importance for VHF communication in the RIS-PL system is the Widuchowa Weir AIS base station (53.14461°N, 14.3861°E). Here, the River Oder splits into two branches – the Western Oder and the Eastern Oder. Meteo sensors, a radar and two CCTV cameras have been installed on the roof of the building administered by the Regional Water Management Authority.

Fig. 5 presents a block diagram of the arrangement of VHF communication devices at the Widuchowa Weir base station.

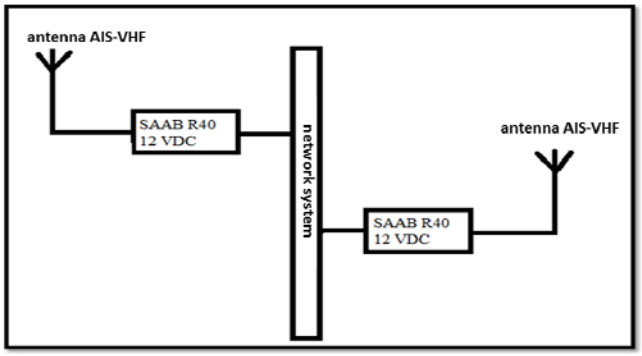


Figure 5. Arrangement of VHF communication devices at the Widuchowa Weir base station.
Source: Own work, based on [1],[5].

## 4 VHF RADIO COMMUNICATION IN THE RIS – PL SYSTEM AT THE LOWER ODER STRETCH [1],[4],[5]

Operation of the RIS-PL system is supported by the VHF base radio station with its receivers mounted on top of the Ewa Grain Elevator building. Communication is carried out via three radiotelephone channels, monitored at the RIS-PL Operating Centre:

1 VHF channel 10 – 156.500 MHz, simplex,
2 VHF channel 74 – 156.725 MHz, simplex,
3 VHF channel 79 – a) 156.975 MHz ; b) 161.575 MHz, duplex.

1 The requirement of reporting on VHF channel 10 (156.500 MHz) applies to all vessels passing the Długi Bridge and the Trasa Zamkowa route (it should be noted here that left-hand traffic applies on the stretch from the Jaskółcza Island to the Długi Bridge), and vessels on the stretch from Klucz to Ustowo, where the safety of inland navigation is undermined due to a narrow fairway.
2 VHF channel 74 (156.725 MHz) is used for communication among the RIS-PL Operating Centre, administrators of the waterway and vessels within the system range. The RIS-PL system sends information concerning the safety of navigation, such as bridge clearance heights or the operation of locks and bridges. When navigating under the bascule bridge 733.7 km up the River Regalica, vessels are required to report to the switch tower on VHF channel 74 in order to arrange the time for lifting the bridge.
3 The duplex VHF channel 79 (156.975 MHz, 161.575 MHz) is used for communication among the administrative authorities, i.e. the Inland Navigation Office, the RIS-PL Operating Centre and the Regional Water Management Authority in Szczecin.

### 4.1 *RIS system radio communication devices at the Lower Oder [7],[9]*

Two companies, Belgium-based Periskal CVBA and Croatia-based RGO Komunikacije d.o.o., are responsible for the VHF communication equipment in the RIS-PL system.

The RIS-PL Operating Centre is equipped with two workstations for remote control of the devices located at the VHF base radio station, by means of a touchscreen and a microphone/speaker unit for transmitting and receiving messages. (Fig. 6)


Figure 6. VHF operator workstation at the RIS-PL Operating Centre.
Source: Own work, based on [15].

Communication in the RIS-PL system is registered 24 hours a day and is open, i.e. the operator can identify stations transmitting data on particular channels.

Dedicated local connection register software (Rejestr połączeń lokalnych) enables identification of senders of the messages received by the devices at the base radio station. The register records the ATIS number, consisting of encrypted MMSI and MID numbers preceded by "9", which is sent automatically at the release of the transmission button on the VHF radiotelephone.

Fig. 7 presents the interface of the software which recognizes VHF message senders.

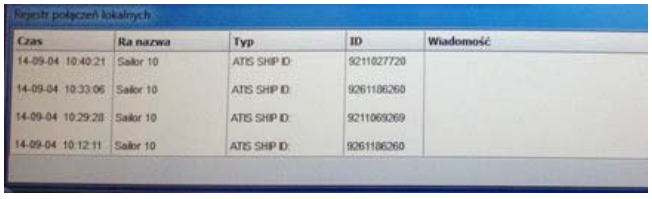


Figure 7. Interface of the VHF message sender identification software.
Source: Own work, based on [15].

The *Mimer Soft Radio – VoiceLog* software implemented at the RIS-PL Operating Centre enables registration of all VHF communications. The operator can select a channel to be monitored as well as replay any message which has been sent.

## 5 OPPORTUNITIES FOR APPLICATION OF GMDSS RADIO COMMUNICATION SYSTEMS IN THE DEVELOPMENT OF INLAND WATERWAY SHIPPING AND UPGRADE OF THE RIS-PL OPERATING CENTRE [12],[13]

Of all the GMDSS subsystems, the VHF radiotelephony, DSC VHF, AIS-SART, INMARSAT, EPIRB and NAVTEX meet the requirements of communication and data transmission in inland waterway shipping.

In order to ensure compatibility of information exchange between inland and sea-going vessels in criss-cross maritime and inland fairways, integration of the AIS, Inland-AIS, Inland ECDIS and the positioning system modules at the RIS-PL Operating Centre is required. The state-of-the-art Inmarsat Fleet 77 system will complement the information sent to inland shipping vessels and provide constant Internet access.

Further upgrade of the RIS-PL Operating Centre will require implementation of the DGT Multifunctional Communication System, which integrates digital and analogue radio communication systems.

## 6 SUMMARY

Implementation of an integrated river information system which allows for instant messaging to support the navigational decision making by vessel masters is crucial for improvement of inland navigation safety.

River Information Services is a modern inland navigation management system using one of the main subsystems of the GMDSS – the VHF radiotelephone communication.

Integration of harmonised information services on the RIS-PL stretch in cross-border cooperation with Germany is an important stage in the process of development of the Oder Transport Corridor.

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