

Implementation of the Multifunctional Communication System for RIS Center Supporting Inland Navigation

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ABSTRACT: The article presents the feasibility of implementation integrated digital and analog radio-communications systems in maritime and inland navigation at the RIS Center. Structure of the data transmission in the RIS system was characterized. Integration of the Iridium Satellite System into a Multifunctional Communication System for the RIS Centre was presented. The integrating DSC VHF and DSC MF GMDSS subsystems with Multifunctional Communication System was presented. The possibilities of integrating The LT- 3100S Lars Thrane module for Multifunctional Communication System. was presented. The architecture of Multifunctional Communication Systems implementing distress communication procedures in cooperation between RIS Center and Search and Rescue Centers was presented.

1 INTRODUCTION

Modern radiocommunication and information technologies make it possible to obtain, collect and use navigational information in maritime and inland waterway transport.

In order to implement River Information Services - RIS - in their inland areas, European Community countries have adopted directives on integrated telecommunications systems.

The main task of the RIS Centre is to ensure safety, planning and traffic management in inland navigation.

The integration of navigation data exchange between seagoing and inland vessels and RIS Centre requires the implementation of a Universal Communication Platform.

Systems for processing and sharing radiocommunication data between sea and inland

vessel masters, as well as RIS and VTS systems, use terrestrial and satellite technologies..

Multifunctional Communication System is defined as an integrated maritime and inland communication system cooperating with RIS Centre and Integrated Bridge System(IBS).

2 FUNCTIONAL REQUIREMENTS OF NAVIGATION DATA TRANSMISSION MODULES AT THE RIS CENTRE [13]

RIS Centres operating in the Member States of the European Union in accordance with the directives of the European Commission, shall fulfil the following functional requirements for the processing of navigational information: [12]

- inland traffic management;
- transfer of dynamic travel data at the same time for several participants at the same time;

- information exchange between partners in inland navigation;
- transmission of data packets according to EDI (Electronic Data Interchange) standards;
- introduction of a standard UNTDID (United Nations Trade Data Interchange Directory) data transmission procedure in the European Union;
- transmission of complete information on locks and bridges and on states of natural disasters;
- management of loading and unloading processes and monitoring of container terminal operations;
- control of border crossing points;
- ship passenger services in inland waterway transport

Figure No.1 shows the structure of navigation data transmission in a RIS Centre.

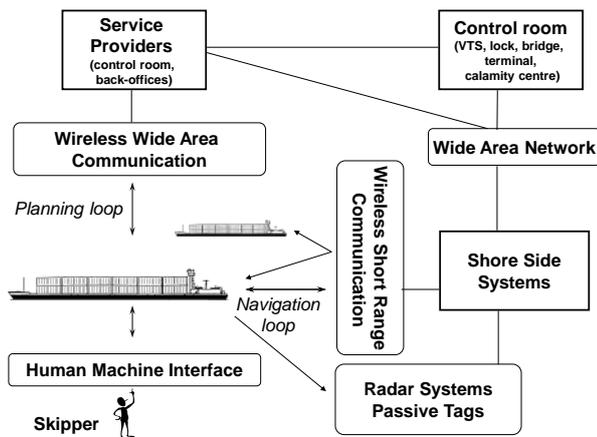


Figure 1. Structure of the data transmission in the RIS system. [12]

3 MULTIFUNCTIONAL COMMUNICATION SYSTEM ARCHITECTURE IN THE RIS CENTRE AND ON THE NAVIGATION BRIDGES OF INLAND WATERWAY VESSELS [4, 6]

The Integrated Maritime and Inland Multifunctional Communication System as a whole is a set of equipment for the exchange of information provided to skippers to support their navigational decisions.

The basic building blocks of communication systems are the two radiocommunication segments: ground and space.(Figure 2). [11]

The ground segment module for the Multifunctional Communication System consists of the following GMDSS subsystems: DSC VHF, DSC MF, NBDP MF, NAVTEX, EPIRB and SART.

The space segment module for the Multifunctional Communication System consists of the following satellite systems: INMARSAT, IRIDIUM, COSPAS-SARSAT, GALILEO, BEIDOU, GPS.

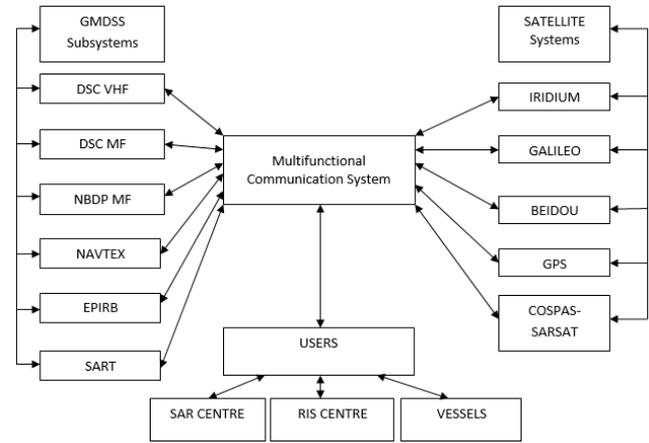


Figure 2. Multifunctional Communication System architecture.[11] [Own work].

Multifunctional Communication System working for integrated navigation bridges realizes the following functions: [5, 8, 9, 14, 15]

- radio navigation and satellite positioning;
- determination of the traffic characteristics of an inland waterway unit;
- obtaining information on the own motion vector;
- image of the navigational situation on the basis of the ECDIS and Inland ECDIS electronic navigational chart system;
- image of the anti-collision situation on the basis of radar/ARPA and automatic identification system (AIS),

4 INTEGRATION OF THE IRIDIUM SATELLITE COMMUNICATION SYSTEM INTO A MULTIFUNCTIONAL COMMUNICATION SYSTEM FOR THE RIS CENTRE [1]

The latest Iridium satellite system technology introduces in the Multifunctional Communication System for RIS Centres in the form of Lars Thrane LT-3100S module the following functions are realized: [1]

- Distress Alert & Safety Voice;
- Transmissions of the Maritime Safety Information (MSI);
- General Message Communication;
- Ship Security Alert System (SSAS);
- Support for external Alarm Panels;
- Support for GMDSS Printer;
- Support for Bridge Alert Management (BAM);
- Long Range Identification and Tracking (LRIT);
- Voice, SMS, SBD and Modem Data (non-priority);
- Single antenna cable solution (up to 500 m);
- High-performance GNSS/GPS receiver;
- Global GMDSS Coverage (Sea Areas A1 to A4),

Figure 3 shows the module concepts for the integration of the Iridium- Lars Thrane LT-3100S satellite segment into the GMDSS for the Multifunctional Communication System. [16]

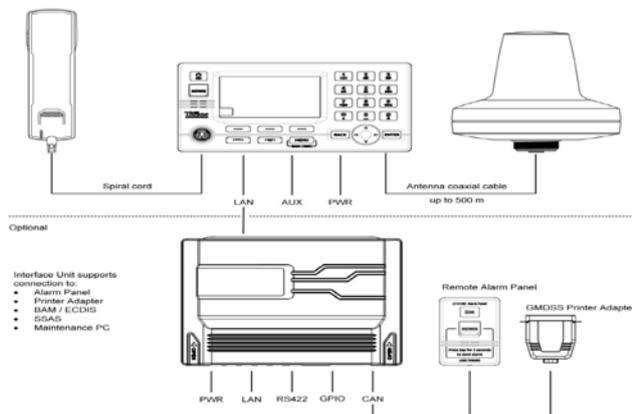


Figure 3. Integration architecture of the Iridium-Lars Thrane LT-3100S satellite segment module with the GMDSS in the Multifunctional Communication System. [16]

5 INLAND NAVIGATION DISTRESS ALERT PROCEDURES USING THE IRIIDIUM SATELLITE SYSTEM INTEGRATED IN THE MULTIFUNCTIONAL COMMUNICATION SYSTEM [16]

In the Iridium system (Fig.4) for inland waterway vessels it is possible to apply alarm procedures by using two methods. [1]

1. Distress Alert can be activated by pushing the DISTRESS button on the front of the control unit. A Distress Alert message will be sent to the Iridium GMDSS Gateway (IGS) and immediately forwarded to the RIS Center and to the Rescue Coordination Center (RCC).
2. Use of the Voice Distress module implemented on inland vessels and the Multifunctional Communication System module in the RIS Centre.



Figure 4. Control panel of the distress communication procedures of the Iridium satellite system in the Multifunctional Communication System. [1]

Multifunctional Communication System at RIS Centre integrated with the Iridium module The LT-3100S Lars Thrane is not only designed for GMDSS services.

It also offers SSAS and LRIT functionalities. It can be used as the primary satellite communication system on inland shipping vessels, covering the Distress, Urgency and Safety communication needs in

terms of connectivity between the inland ships and the RIS system. [16]

The LT-3100S GMDSS modul also provides voice, SMS, data, vessel tracking, and other Iridium services with competitive airtime rates, making it the perfect satellite communication system on board inland vessels.

6 USE OF DSC VHF AND DSC MF IN THE MULTIFUNCTIONAL COMMUNICATION SYSTEM FOR INLAND NAVIGATION AND RIS [3]

Broadcasting and receiving DSC Alerts is one of the major facilities on a VHF and MF band communication. [10]

The types of DSC VHF and DSC MF alerts are classified according to their priority: [7]

- DISTRESS – indicates that a person or a ship, is in grave and imminent danger and requires immediate assistance;
- URGENCY – indicates an urgent call concerning the safety of a person or vessels;
- SAFETY – indicates a call concerning Maritime Safety Information (meteorological forecasts or navigational warnings);
- ROUTINE – indicates a call at the lowest priority concerning routine communication.

System DSC is used for a number of reasons and these are: [4]

- Automatic rather than manual radio watch keeping is available;
- Alerts using DSC are very quick (about 0.5 seconds on the dedicated frequency on marine VHF band, and 6-7 seconds on the dedicated frequency on marine MF band) and do not occupy as much time as a manual voice call. This is very important particularly in inland ship areas where radiotelephone channels are often occupied;
- Distress alerting can be enabled quickly with one press of the "Distress" push button;
- Various categories of alert are available with the following order of priority: Distress, Urgency, Safety and Routine.

The following VHF DSC and MF DSC alerts are available: [2]

- ALL SHIPS – an alert to all inland and maritime vessels received within VHF and MF range of the station sending the alert;
- INDIVIDUAL – an alert addressed and received by only one radio station within VHF and MF range;
- GROUP – an alert addressed and received by all those vessels having the group MMSI within VHF and MF range;
- GEO – an alert to a specified geographical area received by all inland and maritime stations within that area.

7 SUMMARY

RIS Centres in EU countries such as France, Belgium, the Netherlands, Germany and Poland, where

maritime and inland waterway transport cross the waterways, requires the integration of satellite communication systems and terrestrial analogue and digital radio systems processing navigation data and communication events.

The Multifunctional Communication System enables the processing and management of an enormous amount of navigational data, allowing the officer of the watch to make the right decisions in maritime and inland waterway transport.

Enables VTS and RIS Centres for efficient cooperation with SAR rescue systems.

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