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GLOBAL SHIP REPORTING SYSTEM AND AUTOMATIC IDENTIFICATION SYSTEM

1. Introduction

The Ship Reporting Systems (SRS) contribute to the safety of sailing. The purpose and aim of such SRS is to keep a vigilant eye on the sea traffic. In cases of rendering help, the systems enable to give pieces of information about navigational hazards, medical advice, directing the closest ship towards the vessel in peril, and defining the area of searching.

The ship report is a precondition for giving help. The ship report may be voluntary or obligatory, which depends on the legal stipulations of the state. Ships submit their reports in harmony with pre-determined forms, in regular periods of time, or in some other agreed manner.

The communication among SRS is carried out by means of the Global Maritime Distress Safety System (GMDSS). Reports are usually sent to a coastal radio station. The coastal radio station, then, passes them on to the head office. On the basis of the reports received, the head office follows the sailing of the ships.

By following the sea traffic, the SRS also contributes to the reduction of the time period counting from the moment of the last report and the beginning of search in cases when distress message has not been received.

Depending on the reports time periods, in cases of justified suspicion of a vessel in peril, it may not be possible to define the search area of the appropriate size, which happens mainly in cases of agreed reporting (area entrance or exit). Therefore, it appears to be necessary to reduce the span of time between two reports. But, this is not deemed a good solution due to the fact that on board ships there are comparatively small crews and a lot of work to do.

This is the reason why the Global Ship Reporting System (GSRS) should be developed and adopted. By using the existing equipment onboard and the Internet, the system is expected to transmit essential data in order to follow the position of the sea traffic. By applying modern technological soutions, the application of the system on the global level is anticipated.

2. Ship Reporting Systems - SRS

The SRS may be voluntary or obligatory[1].

The voluntary reporting systems are based on mutual solidarity, and they are usually set up in the areas where unfavorable weather conditions prevail.

[1] Zec, D.: Sigurnost na moru, Pomorski fakultet u Rijeci, Rijeka, 2001.

The obligatory reporting systems rest on the stipulations of the International Convention on the Safety of Life at Sea (SOLAS)[2]. In keeping with these provisions, they only authorised orgganisation for issuing instructions, defining conditions and rules with a view to founding and regulating the SRS is the International Maritime Organisation (IMO). In compliance with the SOLAS, the obligatory SRS may refer to all or some individual types of ships, excepting military and subsidiary merchant shipping, or some other non-commercial types of ships in charge of the Goverment. Ships masters are obligated to send in reports about the movement of the ship:

- Sailing Plan,
- Position Report,
- Deviation Report, and
- Final Report.

There exists an obligation[3] to report in cases of real or possible sea contamination (pollution) through the use of reports on:

- Dangerous Goods Report,
- Harmful Substances Report, and
- Marine Pollutants Report.

The reports are sent in standard forms to the coastal radio stations which pass them on to the head office. The head office of the SRS processes the accumulated data by means of computer systems, and thus establishes the Surveillance Picture (SURPIC), which is always kept update by receiving new reports.

The SURPIC updating depends on the span of time between reports. The longer the span of time, the lesser the value of the established position, and the opposite. However, if the SURPIC was to decrease the span of time between two reports in order to increase the updated quality, that might result in the job blockage of the crew of the ship, which could have a negative effect upon the navigational safety (diverting attention of the officers on duty). Consequently, increasing one part of navigational safety leads to decreasing some other aspect of the safety of navigation.

The problem is expected to be solved by an improved application of the SRS which would use an adjusted Automatic Identification System (AIS) and the Internet. Such a new Automatic Ship Reporting System (ASRS) would make it possible to send data via Internet to the head offfice in short spans of time, and the very procedure of the SURPIC updating would be set up, and thus it would contribute to the value and accuracy in establishing the surveillance picture.

3. Automatic Identification System - AIS

The AIS was founded by the SOLAS Convention[4], and it represents a communication system which operates on Very High Frequencies (VHF). The AIS instruments must be permanently in operation, except in some special cases[5]. The AIS device, by means of the VHF channel, sends data such as:

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[2] SOLAS V/8-1 *Ship Reporting Systems*. The adoption procedure for obligatory SRS is implemented with Resolution A.858(20) *Procedure for the adopting and amendment of traffic separation schemes, routeing measures other then traffic separation schemes, including designation and substitution of archipelagic sea lanes, and ship reporting systems.*

[3] A. 851(20) *General Principles for Ship Reporting Systems and Ship Reporting Requirements, Including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants.* These resolution is in accordance with SOLAS and MARPOL conventions.

[4] SOLAS V/19-1 *Safety of Navigation, Regulation 19 – Carriage requirements for shipborne navigational systems and equipment.*

[5] SOLAS V/19-2 Ships fitted with AIS shall maintain AIS in operation at all times except where international agreements, rules or standards provide for the protection of navigational information.

- statical data,
- dynamic data, and
- voyage details.

The statical data are entered into the AIS instrument by hand, and they include the Maritime Mobile Self-Identification (MMSI), the IMO number, the name of the ship, and the call number, the lenght and the beam of the ship, the type of the ship, the location of the antenna (its distance from the bow, from the stern, and its distance from the starboard and the port quaters).

The dynamic data are automatically entered, which requires integration with the navigation equipment on the bridge. The data include the position of the ship, the area in which the ship is sailing, course over ground, the speed over ground, the course thorough the water, the ships turning characteristics, rudder angle, periods of pitching and rolling, navigation position (whether it navigates, sails, whether it is anchored, on the berth, floating – these data are entered by hand) as well as other available data that we can obtain from the belonging equipment.

The voyage details should be entered by hand. It is left at master's discretion whether he wants to convey those details or not, which depends on the local conditions. The voyage details contain the draught, the name of dangerous goods, port of call and the Estimated Time of Arrival (ETA), as well as the passage plan (optional).

The purpose of the AIS is:

- to identify ships,
- help in the target follow-up,
- information exchange simplification, and
- provision of additional information for the purpose of collision avoidance.

The AIS is primarily meant for improving the Vessel Traffic Service (VTS)[6]. It realizes the aims by means of the following possibilities[7]:

- automatic data transmission to the adequatly equipped coastal radio stations, other ships and aeroplanes, data about the identity of the ship, type of the ship, position, its course, speed, navigational state, and other pieces of safety information,
- automatic reception of such pieces of information from similarly equipped ships,
- supervision and monitoring of ships, and
- data exchange with coastal radio stations.

The application of this concept is thought to be possible within the GSRS. The pre-condition for satisfying these requirements is the following:

- data conveyance via satellite[8],
- software adjustments for collecting, processing, and data transmitting according to standard forms, and
- integration of the Internet into GSRS system.

The proposed changes would be significantly contribute to the reliability of the SRS, and they would be enable its global application.

4. Application of Internet

The Intenet is a modern method of data transmitting that has manyfold advantages, and among them, the most important are the speed of transmission and availability. The Internet application in the SRS implies support in collecting, transmitting and data processing.

[6]IMO Resolution A.857(20), Guidelines for Vessel Traffic Services.

[7] SOLAS V/19 *Safety of navigation*.

[8] INMARSAT.

The support in data collecting may be realized by integrating the existing navigational equipment on board ship with software which will sort out and prepare data for transmitting. The data to be collected are determined by standard forms of Ship Reports, and they include:

- the name of the ship and its port of registration,
- date, time and position,
- actual course and speed,
- port of call and final destination,
- time of entrance and exit from a given area,
- essential data about the ship and its cargo, and
- basic details about the crew and passangers.

There is no need to convey a full description of all required details[9] as they bear no effect upon further work.

Data transmission would be performed by way of satellite communication, that is, through the already existing systems onboard (Inmarsat). It goes without saying that a two way data transmission is involved here – the ship transmits reports and receives processed data referring to the state of traffic in its surrounding. The Head Office receives data, processes them and provides the Surveillance Picture to the users at sea.

The data processing implies the processing of Ship Reports sent to the Head Office, or to a system branch-office. The outcome of such a processing is the creation of the SURPIC. The procedure of making the Surveillance Picture has been greatly automatized. However, it is necessary to introduce standards into all Maritime Rescue Coordination Centres-MRCC. Such standards can be implemented by using uniform software.

The application of the Internet in the SRS system is anticipated to create the basis for automatization and the global use of such a system precisely because of the transmission speed and data collecting.

5. The Model of Global Ship Reporting System

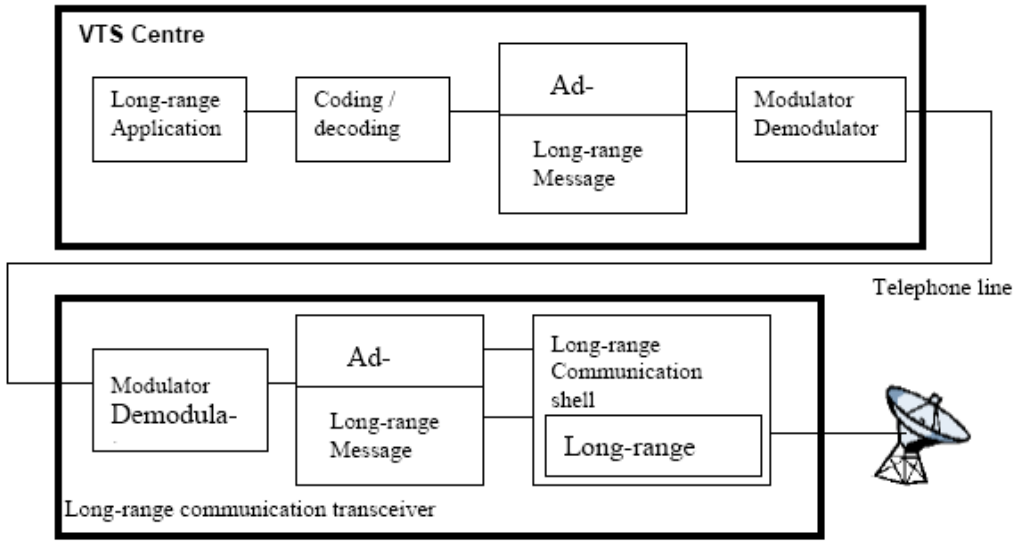
The Ship Reporting System is proposed to be automatized so as to ensure preconditions of its global application. Automatization will be accomplished by introducing software which will ensure uniformity in:

- Data selection,
- Data analysis,
- Data presentation, and
- Observation of danger.

The global coverage of the Ship Reporting System(s) will be achieved by the application of the Internet and the use of the Long Range (LR) system of communication. The IMO has not defined the LR, and therefore, it is the first required step in adopting legal regulatory rules which will determine the standard method of communication. In practice, the INMARSAT C seems to be the most suitable solution.

The next problem lies in the fact that the present AIS standards have not defined the long range systems of communication, and the AIS system operates on IEC-61162-2 interface system which is not supported by the Inmarsat C. Therefore, there is a need to implement a compiler which will translate a high-lever programming language into machine code of the two systems.

[9] For instance *The Commonwealth of Australia Navigational Act 1912 (Division 14 Part IV) – AUSREP (The Australian Ship Reporting System)* gives standard form of Ship report for AUSREP system.



Picture 1. Shore – based functional set – up.

The long-range communication system must meet these requirements:

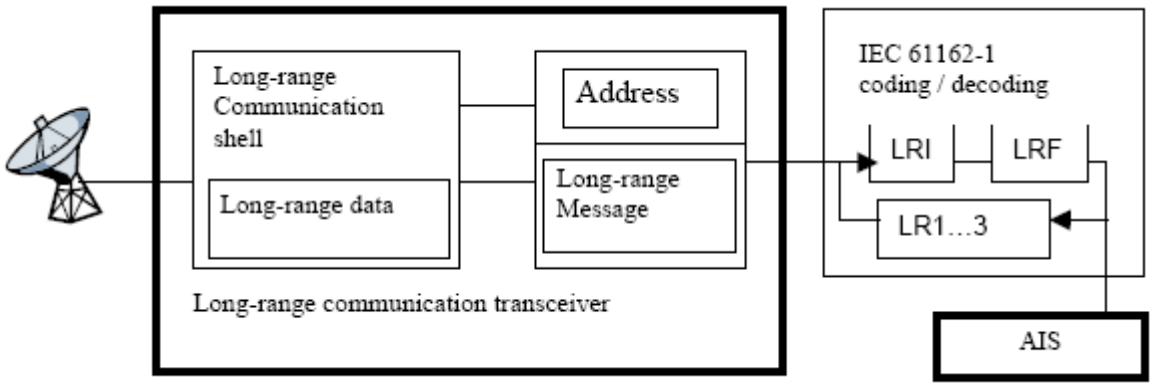
- To exchange data,
- To receive geographically defined calls,
- To select the MMSI ship's number in the receiver system onboard,
- To differentiate the AIS priority messages, and,
- To transmit the LR data from the link into the LR AIS as defined.

For the purpose of developing the Global Method of Ship Reporting System it is of the primary importance to determine the functional forms of the ship and coastal radio stations for the forms of the ship and coastal radio stations for data transmission and method of their passing data on.

As it has been shown in Figure 1, the message which is to be sent to a given ship address, or a particular geographic area, is created at the VTS centre. The message is coded into a long-range message and by way of telephone it is sent to the delivery station. In the delivery station the message is set up into the long-range protective communication shell which it will be stored during transmission. The protective shell contains the address(es) of the recipient or the geographic location where the message should arrive (to all users of the AIS system), and all the details of the message. The protective shell is transmitted by way of Inmarsat C on the land.

It is important to point out that the message transmitted from Inmarsat C land stations is received by all ships in all geographical positions. This is precisely why the precondition is set that the ship's long-range communication system, its receiver, must open the protective shell and read the address. The address which does not correspond to the ship's, or it does not refer to the geographical position where the ship is currently sailing, is not shown in the ship's AIS system. To put it simply, the ship's AIS system neglects it.

The Figure 2 shows the ship's radio stations for receiving and transmitting long-messages. It is consist of the long-range transmitting and receiving set (transceiver), message coding and decoding system, an the AIS.



Picture 2. Functional set – up onboard.

When the message is received onboard, the protective shell is opened, and both the address and the message are decoded. On establishing that the message has been addressed to that ship and its AIS system, then it is passed on the AIS unit and presented to the user.

If the received message requires an automatic reply, two assessment components of the IEC 61162 format[10], the long-range function identification are used. The long-range interrogation assessment component identifies the information that requires a reply. That kind of request refers to a given geographical position in which the ship sailing, or to the wanted AIS unit.

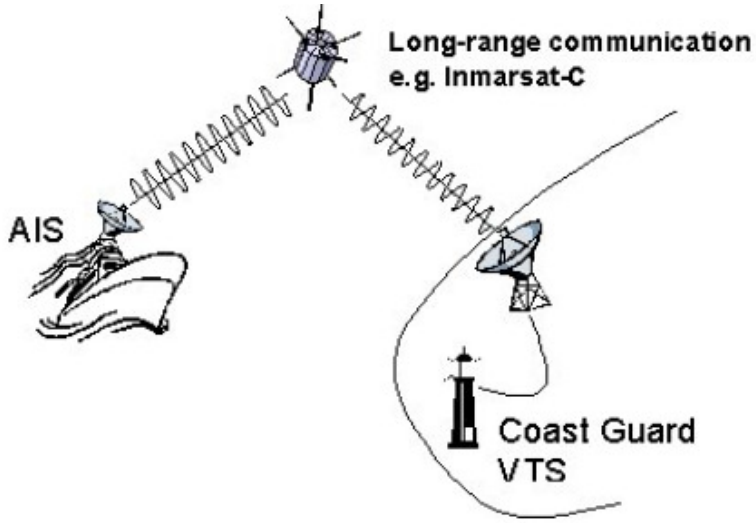
The long-range function identification assessment component determines what kind of information the reply requests. It also reads the name and the MMSI unit number which has sent the request (the address to which the reply is to be sent).

The request may include the following:

- The name of the ship, call sign, the IMO number
- Date and time of writing the message,
- Position of the ship,
- Ship's course over ground,
- Speed over ground,
- Port of departure and ETA,
- Draught,
- Type of the ship and cargo,
- Ship's length and beam, and
- The number of persons onboard.

The coding and decoding systems of the long-range messages in the IEC 61162-1 format may be an integral part of the long-range communication receiver, or they may be separate units.

[10] *IALA Guidelines on Ship-borne Automatic Identification System (AIS), Volume I, Part II, Technical aspests of AIS.*



Picture 3. The functional design of the long-range communication system.

Figure 3 shows a model of the long range communication system which may be used as the basis for the Global Ship Reporting System. The VTS service, or some other interested organization, sends messages by telephone (Internet) to the land Inmarsat C station, where from they are transmitted to the desired addresses (ships, oil platforms, aeroplanes). The messages demanding a reply automatically generate the requested reply by way of return message. The land Inmarsat C station sends the requested reply to the interested organization which then creates the traffic Surveillance Picture. The AIS system plays an important role in the Global Ship Reporting System. Therefore, the global application of such a system of traffic surveillance which will meet the fundamental principles of the VTS service[11] has been proposed.

6. Conclusion

The SRS contribute to the safety of the sea traffic. The increased volume of the sea traffic and numerous threats which endanger the safety of navigation necessitate founding the GSRS and permanent following and surveillance of the sea traffic in the world. Such a global system requires setting up standard procedures in data collecting, processing and transmission.

Data collecting, processing and transmitting necessitate automatized procedure which will integrate the already existing equipment onboard. The AIS device should occupy an essential place in the realization of such a global system. It is possible to perform its application in the GSRS, with some necessary adjustments which include standardizing the method of message transmitting and the use of global maritime satellite communication system such as Inmarsat C.

The GSRS is expected to contribute to the safety of navigation, to reduce dangers at sea, and to favourably affect cutting down costs and expenses in searching and rescuing.

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Abstract

It is presumed that the systems of the marine vessels casualty reports increase the level of navigation safety. This study suggests connecting the adapted Automatic Identification System, and the Internet. Some alterations in the Automatic Identification System are also proposed with a view to supporting the stated application.

Izvadak

Pretpostavlja se da sustavi izvješćivanja s brodova povećavaju razinu sigurnosti plovidbe. U radu se predlaže povezivanje prilagođenog Sustava za automatsko prepoznavanje i Interneta. Također se predlažu izmjene Sustava za automatsko prepoznavanje u cilju navedene primjene.