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Developments of Interface for VHF, MF/HF Communication Using DSC in GMDSS Services in the Framework of E-navigation Concept

V.M. Koshevyy & O.V. Shyshkin
National University "Odessa Maritime Academy", Odessa, Ukraine

ABSTRACT: It is proposed the description of interface for VHF/MF/HF for simplification of DSC communication for implementation in the frame of conception developments in GMDSS services, applied to Maritime Mobile Services. This interface is realized within its integration with INS by an appropriate way on the base of common communication protocol for all three DSC communication sub bands in standardized and harmonized format and significantly simplifies the DSC user interface. It is very important for application in Maritime services, including GMDSS services, VTS services and SAR service. Suggested approach for improving DSC communication is based on the three main outputs of e-navigation strategic direction development related to the integration of communication and navigation equipment/systems, including standardized mode of operation. Implementation of the standardization demands to include in this integration the satellite AIS system. The feasibility of the proposal is supported by the existence of relevant IEC standards and IMO documents.

1 INTRODUCTION

Under consideration the outcome of NCSR 6, the Maritime Safety Committee adopted resolution MSC. 467(101) on Guidance on the definition and harmonization of the format and structure of Maritime Services in the context of e-navigation and approved MSC.1/Circ.1610 on Initial descriptions of Maritime Services in the context of e-navigation.

In [23] these questions were considered in the frame of conception developments in GMDSS services, applied to Maritime Mobile Satellite Services GMDSS. Namely the proposed amendments to the Interim Iridium SafetyCast manual (it is new name of the Iridium enhanced group call service manual (MSC. 1/'Circ.1613; outcomes MSC 101 and NCSR 7)) were considered. In [1] analysis and assessment of the GMDSS performance of Inmarsat, as a mobile-satellite communication system recognized to operate in the GMDSS were provided (MSC.450 (99); A.814 (19) and A.1001 (25)). Analysis and assessment of the GMDSS performance of Iridium, as recognized mobile satellite communication services in the GMDSS were provided in[2] (MSC.451 (99); A.814 (19) and A.1001 (25)).

This article was devoted to the developments of VHF/MF/HF communications using DSC in Maritime Mobile Services GMDSS and other Maritime Services in the framework of e-navigation concept. The E-navigation Strategy Implementation Plan (SIP) – update 1 (MSC.1/Circ.1595) approved by it, in particular, the need to harmonize the exchange of maritime-related information and data to enhance berth-to-berth navigation and related services for safety of navigation and security at sea and protection of the marine environment.

2 BACKGROUNDS

In document MSC.467(101) it is noted that available Maritime Services are shared with providing of exchange maritime information and data with shipping related, but not limited to, vessel traffic service information, navigational assistance, traffic organization, maritime safety information, pilotage, tugs, vessel shore reporting, telemedical assistance, local port information, nautical charts and publications, ice navigation, meteorological, hydrographic and environmental information, search and rescue and other Maritime Services that may be developed and implemented in the future.

It is pointed to the need to work in collaboration with all involved international organizations in order to harmonize the exchange of maritime information and data provided through different Maritime Services, including Maritime Mobile Satellite Services and Maritime Mobile Services GMDSS.

The ship's bridge team needs up-to-date information for the ship's planned operation. The information flow also comprises ship-to-shore communications, in particular prior to entering the coastal waters of a State, as ships are usually requested to provide details of their voyage, cargo, crew and passengers on board, advising on the next port of call and other information. Shore-to-ship, ship-to-ship, ship-to-shore and shore-to-shore information exchange enable new services and technologies to improve safety and efficiency of shipping. All those marine information services, referred to as Maritime Services in the SIP (MSC.1/Circ.1595, as may be revised), are being considered to be transitioned from conventional transmission methods to contemporary digital technologies.

The purpose of Guidance, describing in MSC. 467(101), is to ensure that Maritime Services are implemented internationally in a standardized and harmonized format. To support this purpose, a template to describe Maritime Services is provided in appendix 1 and descriptions of Maritime Services are consolidated under MSC.1/Circ.1610, as may be revised, as appropriate.

The E-navigation Strategy Implementation Plan requires that all Maritime Services be S-100 conformant as a baseline. The International Hydrographic Organization (IHO) S-100 framework standard specifies the method for data modelling and developing product specifications. It is also true, for example, for Maritime Mobile Services GMDSS.

3 DEVELOPMENTS OF VHF/MF/HF COMMUNI8CATIONS USING DSC IN MARITIME MOBILE SERVICES GMDSS

At MSC 95, it was approved that a planned output on "Additional modules to the revised performance standards for INS (Resolution MSC 252(83)) related to the Harmonization of Bridge design and display of information; "the development of draft Guidelines for the harmonized display of navigation information received via communication equipment" and "Guidelines on standardized modes of operation" be included in the High-level action plan as item 2.6.2.

These outputs relate to e-navigation solution, particularly to integration and presentation of available navigation related information exchange via communication equipment.

In documents NCSR 3/6/1 (Submitted by China) and NCSR 3/6/2 (Submitted by Norway) proposals to the new modules to the Performance standards for integrated navigation system (INS) (Resolution MSC 252(83)) relating to display of information received via communication equipment were provided. The last revision of the Performance standard for INS made the performance standards modular. That gets the possibility for any new facility to be added to the performance standards by adding appropriate module for that facility. The modular concept of INS Performance standards provides provisions for individual configurations and extensions by adding new modules with new demands and standards as the industry and technology develop new systems. It is important as for integration of the navigation safety related information received via communication equipment into INS and also for the information exchange between ships (ships –shore, shore-ships) on the base of integration navigation and communication equipment and those both are directly connected with implementation High level solution S4 of the SIP.

The INS performance standard will require two new modules so that that information received by communications equipment can be integrated as well as properly displayed. The proposed two new modules relate to: 1) harmonization of bridge design (A new module on harmonization of bridge design will assist designers in realizing an ergonomic design of the bridge, with the objective of improving the reliability and efficiency of navigation. This module will support the provisions of SOLAS regulation V/15 relating to bridge design and arrangement of navigational systems and equipment and bridge procedures); 2) display of information (A new module on display of information will ensure that the INS can display the information received via communications equipment. This module will outline the standardized interfaces for data exchange to support transfer of information from communication equipment to an INS interface so that information received via such equipment can be processed, filtered, routed and displayed on the navigational system. This module should take in to account the new guidelines being drafted for the harmonized display of navigation information received by communications equipment).

The added new modules for the purposes of information exchange must contain a dedicated gateway supported two way connections between navigation equipment and communication equipment. Consideration should be given to the functionality of conning display bringing all the relevant and important information for conning the ship to one place (NCSR 3/6/2). International standard IEC 61924-2 refers to INS. An overload of information given by different displays for navigation, communication and operational information prevents the officer on watch (OOW) from accessing prioritized information due to confusing arrangements of information displays. Integration of various systems

and the development of the concept of the integrated navigation bridge allow operating a vessel from one workplace – operator of Information display fulfilled on the platform INS.

That last is very important for chosen proper solutions under bridge design. These solutions should maximally consider ergonomically and economical factors according to demands of e-navigation concept.

In document NCSR 3/6 (Submitted by the IEC) IEC proposes a new edition of IEC 61162-1 (Maritime navigation and radiocommunication equipment and systems-Digital interfaces - Part 1: Single talker and multiple listeners) for the purpose to display information received via communication equipment, using standardized interfaces.

As reported in document NCSR 2/22/4 IEC informed that a new standard was being developed – IEC 62940: Integrated communication system (ICS). This standard would specify a Human Machine Interface to allow operation of the communication equipment designed so that it can be made available on a bridge workstation dedicated to communications with multi-function display which combined interfaces of different kind of communications by itself for remote control purposes. This kind of integration does not give the possibility to improve quality of DSC communication. Because ICS based on IEC 62940 standard that isn't destined for loading up electronic charts and creating graphic display by this, to contrast with INS. Only integration navigation and communication equipment on the base of platform INS give real possibility to improve quality DSC communications. That's why we had refused from realization DSC and navigation systems integration combined with ICS. It is only one variant exist for that – including in structure ICS, based on IEC 62940 standard, one more else Information display fulfilled on the platform INS (additional to one that should be realized in the frame of module F for navigation purposes) and this is absolutely no admissible from ergonomically and economically points of view. ICS (IEC 62940) would be used for providing communications according its own standard. For example for providing satellite communications and all other communications, when Information display is busy by the solving urgent complicated navigational tasks. What is essential is that the manual method of forming/viewing calls on the base ICS will be preserved as a supplementary means to the automatic method of forming/viewing calls in the integrated navigation and communication equipment system on the base of platform INS, when is something wrong with soft of INS. Distress calls would be sent as by means integrated on the platform INS system with the modernized its module C for the requirements of the Alert management, so by means ICS (IEC 62940). It is important to be noted, that all systems, sources and sensors, incorporated sensors connected to the INS should be part of the alert management (MSC.252 (83), paragraph 26.1.1). Besides ICS (62940) with additional interfacing module, fulfilled on the base of IEC 61162-1, would be used for supplying the information MSI to Information Display (Conning display) INS and for the purposes of two-way information exchange between DSC controllers, including in ICS, and Information Display INS.

The comments and proposals related to the development of Guidelines for the harmonized display of navigation information received via communication equipment were provided in document NCSR 3/9/1 (Submitted by Norway). It was pointed that MSI information, for example, is displayed as task-oriented on the bridge and harmonized with other navigation oriented information without obscuring critical navigation information. This information should be available in an interoperable way and be transferable to an integrated information display. Also that consideration of an information display (Conning display) at the conning station and other workstations on the bridge should be noted, bringing all the key information together. This display is for use in demanding operations where the OOW attention must be mainly focused on the outside situation while also being depended on additional decision support by electronic means. The description the contribution of the IHO to the harmonized display of navigation information through the S-100 Framework was done in document NCSR 3/9 (Submitted by IHO). The implementation of one of the five prioritized e-navigation solutions on which the e-navigation SIP is based, namely S4 – integration and presentation of available information in graphical displays received via communication equipment requires the development of a Common Marine Data Structure (CMDS) based on the S-100 data model adopted by International Hydrographic Organization (IHO). Therefore, the development of guidelines for the harmonized display of navigation information must be closely synchronized with the development of the CMDS.

Report of the Correspondence Group on the Development of additional modules to Performance Standards for Integrated Navigation System (INS) was presented in document NCSR 4/7 [9]. The report summarizes and presents the results of the comments and proposals received. The draft text of module E on Harmonized bridge design and module F on Display of information received from communication equipment are contained in annexes 1 and 2 respectively, of this report. First draft of the Guidelines for the harmonized display of navigation information received via communication equipment was given in document NCSR 4/8 [11]. These Guidelines identify human factors principles relevant to the display of information to ensure effective situational awareness and assessment. Navigation information received via communication equipment should be displayed in a timely, unambiguous and harmonized manner [24].

In documents NCSR 4/7 [9] (annex 2) and NCSR 4/8 [11] (annex) also there were pointed out communication equipment/systems, which may be interfaced with an INS including VHF/MF/HF DSC in the frame of e-navigation concept. More over as it is pointed in document NCSR 4/7 "the data exchange and interface requirement in module F should support two-way communication between INS and communication equipment/systems'. Additional symbols for possible addition to SN.1/Circ.243/Rev.1,

including g the symbols for the purposes of two-way DSC communications were represented in document NCSR 4/8 [11], annex (appendix), and see also [20]. In document NCSR 4/7/1 [10] was drafting proposal to provide for two-way connections of communications equipment, including VHF DSC controller, with INS.

E-navigation concept is supposed to simplify the exchange of information between ships, as well between ships and shore by means effective, user-friendly tools with human factor principles consideration (MSC 95/19/8). This solution must be based on agreed guidelines.

In document NCSR 5/6/1 [12] the drafting of Guidelines for integration and presentation of available navigation-related information exchange provided via communication equipment by means of interfacing VHF/MF/HF DSC with an Information display (Conning display) was proposed. This display, in turn, is integrated within an INS (including AIS, ECDIS, and satellite AIS). All actions on information exchange by means of DSC are performed using software of the Information display on the base of standardization of DSC interface using the common communication protocol for VHF DSC controller as well as MF/HF DSC controller.

The suggested interfacing realizes user-friendly solution with human element consideration as a result of DSC integration with INS threw the Information display. This integrated system allows getting the new quality which could not be reached using any of specified systems separately. Such an integrated system should enhance the quality of information available to the officer of the watch and thus requires special connection (two way connection) between Information display and DSC controllers. The feasibility of the proposal is supported by the relevant IES standards and IMO documents. Particularly IEC 61097-3: edition 2.0 2017-10 "Global maritime distress and safety system (GMDSS)-Part 3: Digital selective calling (DSC) equipment" is the revised of former standard and part of this revision is development of universal NMEA sentences to be used for remote control of the DSC functions which could already address the issue raised in document NCSR 5/6/1.

The Information display would be incorporated into the new module F. A common maritime data structure, based on the work of IHO and their S-100 data structure may be proposed for used in that Information display (NCSR 4/8/1 (Submitted by IHO)). The principle of multiple layers of information which can be displayed on top of each other is supposed be used.

The standardization of interface for VHF, MF/HF communication using DSC within its integration with INS helps to realize that integration by an appropriate way on the base of common communication protocol for all three DSC communication sub bands and significantly simplifies the DSC user interface. This approach is based on the three main outputs of e-navigation strategic direction development related to the integration of communication and navigation equipment/systems, including standardization of operation. Standardization calls for all navigation and communication systems in the future to have a standard user interface for key tasks, be-cause of the increasing complexity and functionality of navigation equipment, a need has arisen for navigation and communication systems to have more standardized functionality to enable better operation to support good decision making.

Increasing the operability in address communication may be used in VTS operation for increasing quality of VTS services (NCSR 3/INF15 [8]).

Implementation of the standardization due to a need of providing common communication protocol for VHF DSC and MF/HF DSC demands to include in this integration the satellite AIS system (for MF /HF DSC).

In document NCSR 6/11/1 [15] (Germany) the First draft of resolution A.806 (19) was presented. The draft refers to revision of SOLAS chapters III and IV for modernization of GMDSS. Particularly Germany proposes to introduce the new text in the part A, section 4, suggested to implement a simple process to connect station based on the MF/HF DSC protocol namely:

"4.2 The equipment should provide a standard interface to enable the selections of frequencies and setting of MMSI to be called from remote control unit (e.g. INS) by using standardized interfaces.

A function to establish a connection between stations of the mobile maritime service by simple means using DSC should be implemented."

Simplification interface of DSC communication by means using graphic display of distressed vessel may be used in SAR service. The document "Displaying distress alert relay information on shipboard navigation display systems". NCSR 5/9/4 (United States) [13] particularly posed the question on graphic display of distressed vessel on a navigation display unit and its possible linking to available target information, noting that "… no recognized symbology currently exists for displaying a distressed vessel. In addition, digital selective calling also is capable of providing both distress alert information from vessels as well as distress alerts relays broadcast from shore."

In document NCSR 6/7 [14], paragraph 12, it was pointed out that the guidelines' conformance requirements would need to state that "conformance with Appendices 2 to 5 of these guidelines was demonstrated by meeting the applicable requirements of the Performance standards for the presentation of navigation related information on shipborne navigational displays (resolution MSC 191(79) and IEC publication 62288) and could not conflict with applicable performance standards for navigation equipment and would also mean adherence to the principles of human-centred design.

3.1 *Discussions*

The standardized interface implies presentation of information and controlling DSC communication equipment in the VHF / MF / HF bands.

DSC is a mandatory GMDSS procedure prior to the subsequent communications of all priorities, which provides by means special equipment. Subsequent types of communication are voice communication,

providing by radiotelephone, and text communication, providing by telex over radio (TOR), or coming new systems of data communication in MF/HF frequency band. For VHF frequency band the subsequent type of communication right now is only voice communication, providing by radiotelephone. Due to DSC while introducing GMDSS for example was eliminated the Watch on radiotelephone channels. That's why address communication by radiotelephone should be provided only together with DSC procedure using identity number. However, in practice, DSC often is not used due to the complexity of the protocol [3] and the interfaces diversity of radio communications equipment. Existing DSC require numerous additional manual operations to establish the communication, which slows down the information exchange. Thus entering only Maritime Mobile Service Identity (MMSI) needs nine elementary actions at DSC controller key board. So any DSC call, however simple it would be, require more time than picking up the handset and making a call on radiotelephony. For instance, in urgent situations navigators usually ignore DSC and instead pick up the telephone on channel 16. Channel 16 is unique telephone channel which been reserved on watch. However this channel is the channel of common access and gives not the possibility to accelerate the information exchange. Therefore shunning DSC and switching the VHF telephone does not really improve matters. Time is wasted trying to establish who needs to talk to whom. The navigator making the call has to quickly and clearly announce their intended recipient, while officer-on-the-watch on vessel in the vicinity need to discriminate whether or not they are that recipient, based on understanding of their location and other traffic in the area. Too many wards are needed for describing all of these. Consequently in its present incarnation DSC/radiotelephone does not lend itself to quick operational communication and needs to be modified. Besides, DSC interfaces variations between different manufacturers are wide. Navigators are needed that be standard user interface.

A lot of attempts to improve DSC communication interface were not successful because they dealt only with the DSC controllers themselves. The new approach had been worked out on the base of integration DSC communication equipment and navigation equipment which gives the real possibility for significant improvements operational properties DSC with realising standard user interface. . The idea of integration VHF DSC and navigation systems in the frame of e-navigation concept was first proposed in the document COMSAR 14/7, 2009 [4] and then was represented in scientific article [21]. This integrated system enables a level of quality to be achieved which could not be reached using any of the specified systems separately. It greatly simplifies VHF DSC communication and fully meets the needs of navigators (Nautical Institute, COMSAR 15/INF.3 [5]). After document COMSAR 14/7 the number of other documents in which was presented the results of our deeper learning considered integration had been worked out. Namely: Nav 59/12/2 [7]; MSC 94/18/2 [16]; NCSR 3/INF.15 [8]; MSC 97/19/9 [6]; NCSR 4/7/1 [10], and [17–21].

Presentation of communication related information can be realized on the ECDIS display or on separate Information display (Conning display). Since ECDIS is already sufficiently saturated with the functions necessary to solve navigation tasks, the alternative means for presenting information is the pointed Information display.

Further development of the integration idea of communication and navigation systems was presented in document NCSR 5/6/1 [12]. Integrating of data received via communication equipment into the integrated navigational system makes it possible to optimize control of a vessel and to avoid possible misses and incorrect decisions by the navigator. The Information display may be implemented in the frame of INS-Module F for integration and presentation of available navigation-related information exchange provided via communications equipment. This Information display should be capable of displaying VHF/MF/HF DSC information and integrated with appropriate communications equipment and with Integrated Navigational System (INS).

In order to provide connection to VHF DSC controller and to MF/HF DSC controller the same protocol may be used, which is described in NCSR 3/INF.15, paragraph 8 [8]; MSC 94/18/2, paragraph 10 [16]; MSC 97/19/9, paragraphs 4, 5, 6 [6]; NCSR 4/7/1, paragraph 6 [10], where instead of the software ECDIS the software of Information display is used:

clicks on the vessel's AIS mark on the Information display for automatically sending the MMSI from Information display to DSC controller by transferring controlling commands to DSC for providing DSC call by this;

display the calling vessel by a blinking AIS mark on the called vessel's Information display (a red blinking mark in case of distress call), transferring MMSI from DSC controller to Information display automatically for identification of the calling vessel on Information display by this; and

open exchange of information, without wasting any time on working out who is who. The working channel (frequency) can be set by default (or maybe chosen manually, if necessary, using standard computer actions).

The additional connection Sat-AIS to the Information Display should be done (for MF/HF DSC). All actions according to the protocol are fulfilled using special software of the Information Display using of a common maritime data structure, based on the work of IHO and their S-100 data structure. The principle of layering of new information over existing one may be used. All of these enable to avoid introducing changes to PS ECDIS (resolution MSC. 232 (82)) for implementation of the communication protocol.

In the case of distress call a red blinking AIS mark is displaying on the Information displays of other vessels and shore stations.

It should be noted that in distress situation not obviously of using AIS signals or Sat-AIS signals for graphical displaying distress vessels. Because distress DSC call format also contain information about coordinates of distressed vessel and also may be used

for graphical displaying of distress vessels on other vessels and shore stations Information displays as blinking red point with corresponding coordinates due to special connections DSC controllers with the Information display.

For information exchange can be used local area network in the Light-Weight Ethernet (LWE) standard [19]. LWE standard is intended to provide intermodule connections on the lower layers (Instrument and Process). LWE network is specially aimed to settle information provision on a ship's board. This standard was worked out coming from limitation on technology complexity and special needs from the maritime industry and up and down compatibility.

The peculiarity of integrated interface for VHF, MF/HF communication using DSC is based on using convention's communication and navigation equipment and doesn't demand new equipment and leans on development corresponded software and controllers for connection communication equipment in LWE Network. These controllers with supporting control commands in correspondence with NMEA 0183 (National Marine Electronics Association) may be fulfilled on the base of microcontrollers STM32 for example. The Integrated interface should correspond to IEC standards: IEC 61097-3, 2017; IEC 61162-460, 2015.

Satellite-based AIS (Sat-AIS) uses existing AIS technology to improve tracking capabilities and overall maritime surveillance. Sat-AIS is based on monitoring signals from ship's AIS transponders using low-Earth orbit (LEO) satellites [22]. The satellites receive AIS information from the vessels and transmit the AIS information to ground elements and/or other vessels and coast stations. The main problem in Sat-AIS operation is the separation of signals received by the satellite simultaneously from a large number of ships borne AIS. Because of Doppler frequency shift arising from the satellite motion the received signals may be selected by frequency. Another factor that is the difference in time delay transmission from each vessels. Also is used spatial selection of signals on the base of Synthetic Array Patterns realized due to satellite motion So, Sat-AIS is able to receive and distinguish messages from various vessels in satellite foot-print area.

The additional parameters of signals due the Doppler effect, pointed above, may be used also for increasing of Sat-AIS cybersecurity comparatively to usual vessel's AIS, which is very vulnerable to different sorts of cyber attacks and demands additional defence of GPS channels.

For using Sat-AIS technology it should be foreseen of using part of Information display screen, if necessary, to interface the region where a vessel is located for MF/HF communication.

In the Guidelines should be described additional symbols for possible addition to SN.1/Circ.243/Rev.1. When the sources are DSC the additional symbols may be used as presented in document NCSR 4/8, appendix (see also [20] Figure 2). Particularly, these additional symbols include symbols for graphically displaying of distressed vessel on Information display and can be used for both dis-tress alert information from vessels as well as dis-tress alerts relays broadcast from shore (see document NCSR 5/9/4, paragraph 4 [13], and [20])). In document NCSR 5/6 (Submitted by Norway) the outcome of the discussions in the Correspondent Group on the development of the draft Guidelines for the harmonized display of navigation information received via communication equipment and draft of the Guidelines for further consideration were presented.

4 APPLICATION IN OTHER MARITIME SERVICES

Standardized interface for addressed DSC VHF communication may find its application in VTS Maritime Services, which are described (as well as other Services) in document MSC.1/Circ, 1610. There are three different types of services provided by a Vessel Traffic Service (VTS): Information Service (MS1), Traffic Organization Service (MS2) and Navigational Assistance Service (MS3).

According to resolution A.857 (20) on Guidelines for Vessel Traffic Services:

1)"the information service" is provided by broadcasting information at fixed times and intervals or when deemed necessary by the VTS or at the request of a vessel, and may include for example reports on the position, identity and intentions of other traffic, waterway conditions, weather, hazards, or any other factors that may influence the vessel's transit;

2) "the navigational assistance service" is especially important in difficult navigational or meteorological circumstances or in case of defects or deficiencies. This service is normally rendered at the request of a vessel or by the VTS when deemed necessary.

3) "the traffic organization service" concerns the operational management of traffic and the forward planning of vessels movements to prevent congestion and dangerous situations, and is particularly relevant in times of high traffic density or when the movement of special transports may affect the flow of other traffic. The service may also include establishing and operating a system of traffic clearances or VTS sailing plans or both in relation to priority of movements, allocation of space, mandatory reporting of movements in the VTS area, routes to be followed, and speed limits to be observed or other appropriate measures which are considered necessary by the VTS authority.

Information provided in a digital format could complement and/or replace verbal/voice communications (which forestalled by the addressed DSC). The steps to achieve this transition to digital information exchange may vary in different areas and for different types of vessels. Details about digital information exchange should be published by the VTS authority. The information could be, as an example, portrayed as a layer on the ECDIS or in a graphical display.

4.1 *Relation to other Maritime Services*

All of three different types of services provided by Vessel Traffic Service (MS1, MS2, and MS3) have a relationship with each other and with other Maritime Services, described in MSC.1/Circ. 1610, MS4÷MS15 and MS16 – Search and rescue (SAR) service. Therefore exchange the information between them may be provided by using suggested technique. In the case of MS9 – Telemedical assistance service (TMAS) exchange of information this is today mostly done by voice communication using VHF, MF or short wave radio and standardized interface for VHF/MF/HF DSC may be used.

Application in MS16 – Search and rescue (SAR) service. SAR service should provide coordination, communication and effective exchange of information. The coordinating RCC must be able to share and receive information quickly and easily and then deliver this important information about the SAR situation to a graphical display shared with the on-scene commander, search resources and all partners involved, improving communications and increasing situational awareness for everyone.

Suggested standardized interface for VHF/MF/HF DSC communication gives the possibility in graphical displaying distressed vessel on a RCC Information display unit due to corresponding integration of DSC controllers with Information display.

5 CONCLUSIONS

The possibility of improving the quality of the Maritime Services in general due to using standardized interface implies presentation of information and controlling DSC communication equipment in VHF/MF/HF frequency bands was shown, taking in to account recommendations in the corresponding sections. The integration navigation and communication equipment on the base of platform INS give real possibility to improve quality DSC communications.

ICS (IEC 62940) would be used for providing communications according its own standard. For example for providing satellite communications and all other communications, when Information display (INS) is busy by the solving urgent complicated navigational tasks. What is essential is that the manual method of forming/viewing calls on the base ICS will be preserved as a supplementary means to the automatic method of forming/viewing calls in the integrated navigation and communication equipment system on the base of platform INS, when is something wrong with soft of INS. Distress calls would be sent as by means integrated on the platform INS system with the modernized its module C for the requirements of the Alert management, so by means ICS(62940).

Besides ICS (62940) with additional interfacing module, fulfilled on the base of IEC 61162-1, would be used for supplying the information MSI to Information Display (Conning display) INS and for the purposes of two-way information exchange between DSC controllers, including in ICS, and Information Display INS.

The number of IEC standards, which are needed for practical realization proposed integration in Maritime Mobile Services, were analysed.

Application in other Maritime Services was considered (including VTS Service and SAR Service).

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