

# Increasing Maritime Safety: Integration of the Digital Selective Calling VHF Marine Radiocommunication System and ECDIS

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**ABSTRACT:** A general project for simplification of VHF DSC radiocommunication for navigators and for increasing DSC efficiency by integration of the DSC VHF radio equipment and the AIS – ECDIS vessel's system is presented. Proposed measures are to contribute to further developments in maritime radiocommunication systems, technology and progress of e-navigation strategy.

## 1 INTRODUCTION

Technical progress of modern digital navigating and communication technologies has provided new technical systems appeared and maintained in practical navigation such as: Global Maritime Distress and Safety System (GMDSS), Automatic Identification System (AIS), Global Navigational Satellite System (GNSS), Electronic Chart Display and Information System (ECDIS), etc. At the same time keeping and increasing the level of safety at sea in the conditions of vessel's saturation by navigating and radioelectric devices demands the effective operation of the specified systems under common fatigue of the officer of the watch (OOW).

Not always the practical navigational tasks can be satisfactory provided within the existing shipborne equipment. In particular there is misalignment between decision time and reaction time. It is necessary to provide real time operational procedures.

In Odessa National Maritime Academy at the Electrical Engineering and Radio Electronics Faculty, (Maritime Radiocommunications chair) in the general direction of safety navigation enhancement and development of electronic navigation (e-navigation) since the end of 90<sup>th</sup> years scientific-practical works are carried out in the following directions:

- 1 Improving of the GMDSS Narrow-Band Direct Printing interface for telex communication;
- 2 Radar detection of high-speed vessels with small surface of reflection against interferences from a water surface;
- 3 Automatic identification of VHF radiotelephone transmissions in real time;

- 4 Increasing of DSC efficiency by means of integration with AIS and ECDIS ship systems.

In the present report some results of researches in the fourth direction are presented. The obtained results have been formulated and submitted by Ukraine in the form of the technical proposal for discussion of 14<sup>th</sup> Session of IMO Subcommittee on Radiocommunications, Search and Rescue (COMSAR), that have been passed in London in February, 2010 [1]. The given proposal was unanimously supported by the participants of the Session.

Digital Selective Calling (DSC) is one of the basic features of GMDSS radiocommunication sub-systems. In accordance with International Telecommunication Union Recommendation [2] all radiotelephone transmissions of any priority (distress, urgency, safety and routine) must be preceded by the proper digital selective call. Nevertheless, the procedures of radiocommunication with the use of DSC are often neglected either in cases of distress or with other priorities. In particular, VHF channel 16 is often used incorrectly for any calls attributed with routine priority as it was foreseen in the old system procedure instead of using DSC on channel 70.

The reasons for such neglect were analysed in numerous documents of COMSAR, for example [3]. The main reason for the DSC communication procedure neglect is described in this document as the navigators' nonconformity with the DSC procedures based on:

- difficulty of manual DSC forming procedure;
- different DSC interface provided by manufacturers;
- the overload of the DSC call forming menu by secondary, non-important functions; and

- limited space for all DSC format visualization, etc.

Navigators as usual neglect DSC process and directly pick up the telephone on channel 16. Such elimination of DSC doesn't accelerate reliable and correct VHF communication because a lot of time may be needed for called/calling vessel's verbal specification among other vessels.

An important objective of the VHF radiocommunication improvement is the development and implementation of such technical improvements which could give an ability to:

- 1 simplify the process of providing DSC radio-communication to, practically, the equivalent actions in terms of time and number of operations, as to the usual radio-telephone receiver picking up procedure; and
- 2 select the called/calling vessel among others which are displayed on the electronic navigational chart. This element is specifically important for the urgent reaction of the watch officer on the called vessel under difficult navigation conditions, i.e. to provide the automatic identification of the called/calling vessel in the live navigation situation.

The completion of these two tasks can be achieved within the frames of the currently used vessel equipment through the integration of the VHF DSC controller and the navigation equipment composed of the Automatic Identification System (AIS) and the Electronic Chart Display and Information System (ECDIS). In this case all of the basic functions of integrated systems are preserved.

Currently AIS is an obligatory equipment to be carried on board all vessels. ECDIS has been mandated recently, nevertheless even now it is widely used as a supplement to the traditional paper charts. AIS provides for the exchange of information which includes an identification number (MMSI). ECDIS, while operating with AIS, enables it to indicate vessels on a navigation display within the AIS operating area, i.e. approximately 30 nautical miles, and to reflect them on electronic navigational charts.

The combination of the VHF DSC equipment with the AIS - ECDIS system allows:

- 1 to eliminate, practically, the procedure of DSC forming while substituting manual operations by a computer mouse "click" on the ECDIS display; and
- 2 to provide the authentication of a calling vessel on the electronic chart and thus to make the process of attachment of the called/calling vessel to the navigation situation automatically. A calling vessel can be indicated on the display by a blinking mark which will allow OOW (officer of the watch) of the called vessel to quickly estimate the

navigational situation and make an effective decision.

The unique character of the vessel's authentication is provided by the presence of vessel identifier (MMSI) both in DSC and AIS. In other words, it means that the calling vessel is automatically attached to the current navigation situation represented on a navigation display.

During the manual preparation of the call procedure, as it is provided in the existing system, an operator has to make an individual call to a vessel/coast station and for this purpose has to enter a nine-character long digital identifier (MMSI) and working channel number. While doing this, about 20 pressings of the DSC controller keyboard buttons are required. More difficult calls require more key pressing. The proposed method gives the ability to form a call through a mouse click only on the chosen vessel (or the coast station). The series of parameters, for example, the working channel number, can be set by default (or can be chosen manually if necessary). The entering of the MMSI is not required in the proposed method because it can be sent from the AIS - ECDIS system to the DSC controller automatically.

Integration of the DSC - VHF and AIS - ECDIS may be realized through a separate interface block connected to the DSC equipment of any equipment manufacturers. Replacement of the DSC equipment is thus not required. Appropriate simplified scheme is presented in the figure 1. The scheme includes also navigational sensors and devises that in practice are connected to ECDIS Workstation. Connection of DSC VHF equipment and ECDIS is implemented by means of bidirectional interface.

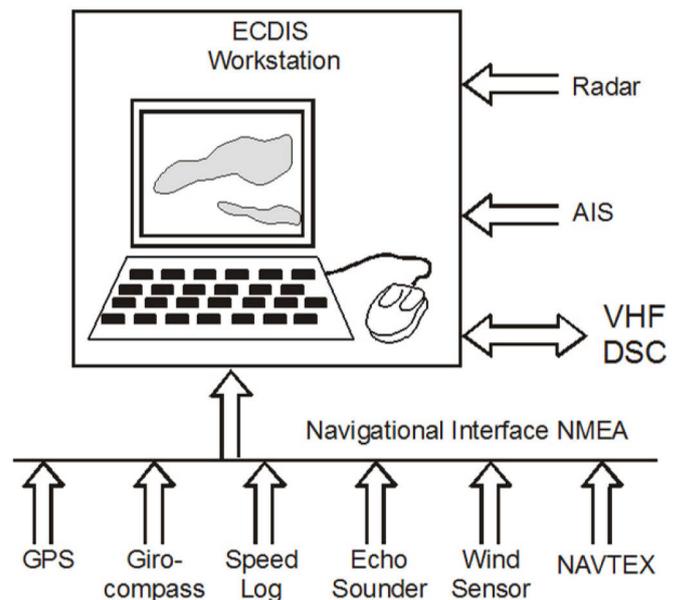


Figure 1. General scheme of ECDIS inputting and VHF DSC connection

Integration of the DSC - VHF and AIS - ECDIS requires no changes to the existing radiocommunication operational procedures. All regular DSC forming and viewing functions are saved. What is essential is that the present manual method of forming/viewing calls will be preserved as a supplementary means to the automatic method of forming/viewing calls in the AIS - ECDIS system.

VHF DSC integration with the AIS-ECDIS will ensure further enhancement of safety of navigation while simplifying the navigator's interface with radiocommunication and navigational equipment and accelerating actions of operator.

The practical problem on the way of such kind of integration is the necessity of ECDIS modernization by means ECDIS - DSC connection and interaction in both directions. Corresponding apparatus means of interface and software tools are developing.

This suggestion is fully compatible with the e-navigation development strategic direction which envisages further development of means of radio-

communications and navigation and the implementation of modern digital information technologies in navigation.

Technical implementation of this suggestion is also compatible with the new regulations for the mandatory carriage requirement of ECDIS.

## REFERENCE

- [1]. Proposal for simplification of VHF DSC radiocommunication and increasing DSC efficiency. Submitted by Ukraine / SUB-COMMITTEE ON RADIOCOMMUNICATIONS AND SEARCH AND RESCUE. 14th session, Agenda item 7. COMSAR 14/7, 27 October 2009
- [2]. Recommendation ITU-R M.493 "Digital Selective-Calling System for Use in the Maritime Mobile Service".
- [3]. Simplification of DSC equipment and procedures. Submitted by Finland / SUB-COMMITTEE ON RADIOCOMMUNICATIONS AND SEARCH AND RESCUE COMSAR 8/4/1, 27 November 2003.