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Final results of the research on the use of Digital Selective Calling (DSC) system at sea

SUMMARY

This paper contains results of the research on Digital Selective Calling (DSC) carried out in real conditions of sea voyages during the last year of GMDSS implementation. The results make it possible to estimate a degree of DSC system usefulness in achieving its assumed functions within GMDSS.

INTRODUCTION

In 1999 the worldwide implementation period of the new Global Maritime Distress and Safety System (GMDSS) was completed. In this system an important role was given to an entirely new subsystem, i.e. the Digital Selective Calling which permits, within the system and through terrestrial communication, to automatically create radiocommunication links, as well as to establish communication of the distress, urgent, safety and routine type.

The author of this paper carried out two-stage research on usefulness of the system in real sea conditions during operation of ships equipped with GMDSS devices.

Results of the first-stage research were already published [9]. In this paper results of the second-stage research and final conclusions are presented. From the combined data it results that the DSC system has been practically accepted, although with some difficulties, and in spite of complicated operational procedures it fulfils its presupposed functions.

DESCRIPTION OF 2ND STAGE RESEARCH

In 1998, i.e.during the last year of implementation of the GMDSS, 2nd stage of the operation study of DSC system was carried out in real conditions at sea with the use of DSC equipment installed on board m/s NAVIGATOR XXI (MMSI-261187000), training ship of the Maritime University of Szczecin.

The investigations (called further „current”) were carried out during voyages on the following ship route : Baltic Sea - North Sea - English Channel - Bay of Biscay - Atlantic Ocean, from March 21 to July 26, 1998.

Instrumentation

The ship was equipped with the instruments of SAILOR – SP RADIO make, consisting of :

- RM-2042 VHF DSC
- RT-2048 VHF Transceiver
- RE-2100 MF/HF/SSB
- RM-2150 MF/HF/DSC watch keeping
- RM-2151 MF/HF/DSC telex

Results of the current measurements and their comparison with the previous data [9]

The current measurement results were analyzed in the same way as those described in the paper [9] in order to compare the two groups of results i.e. those obtained in the first and the last year of the GMDSS implementation. The current results are presented in Fig.1 to 4 below.

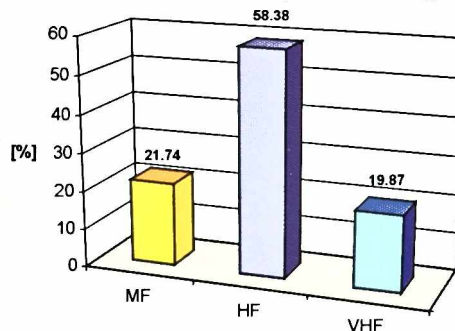


Fig.1. Percentage distribution of the DSC callings received within particular frequency bands

It results from Fig.1 that the highest number of callings through DSC system took place on HF band frequencies (58.38% of all callings), the next (21.74%) within MF band and the lowest (19.87%) within VHF band.

The following conclusions may be drawn from comparison of these data and the relevant, six-year old data shown in Fig.2 of [9] :

- During the GMDSS implementation period the distribution of callings through DSC system and the traffic on particular frequencies within MF, HF and VHF bands were very different.
- The use of DSC system callings within HF band increased to a large extent : from 2.67% of all callings in 1993 to 58.38% in 1998, i.e. nearly over twentytwo times. Hence the DSC system, in line with its preliminary assumptions, has been adopted at sea as an important instrument of establishing communication first of all for distress calling within HF band, which assures direct radiocommunication links for distant connections, done only with the help of ship appliances and a shore station - without any use of satellites.
- The use of VHF band frequency (channel 70) also increased : from 5.61% of all callings in 1993 to 19.87% in 1998, i.e. over 3.5 times. So, in the coastal zone (i.e. A1) the DSC system assures direct (also automatic) radiocommunication links with shore stations, or - through them - with a subscriber on land.
- On the other hand the traffic on MF band frequency decreased : from 91.3% of all callings in 1993 to 21.74% in 1998, i.e. more than 4 times. Hence it can be concluded that during the GMDSS implementation period the traffic on DSC frequency within MF and VHF bands was of almost equal intensity. It means that DSC system is used in a similar way for establishing radiocommunication links in the coastal zone A1 up to 25nm and in the distant zone A2 up to 150nm.

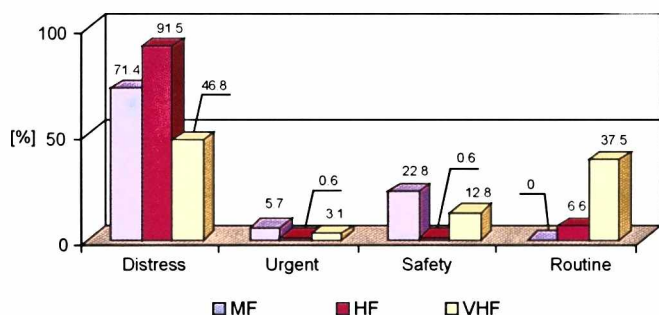


Fig. 2. Percentage distribution of the DSC callings received in the particular frequency bands in function of the communication categories

Fig.2 shows the percentage distribution of the DSC callings received in the particular frequency bands in function of the communication categories. The comparison of the current results with the results achieved six years earlier, presented in Fig.3 of [9], revealed that the tendency of using DSC system to perform distress function on HF band frequencies remained prevailing ; and a small increase of the traffic was only noted from 90% of all callings in 1993 to 91.5% in 1998.

Large increase in the number of *distress* callings within MF and VHF bands was also noted : from 6.7% up to 71.4% i.e. more than 10 times, and from 19% in 1993 to 46.8% in 1998, i.e. 2.5 times, respectively.

Hence in the last year of GMDSS implementation the DSC system was accepted by its users first of all to perform distress duties on frequencies within all three bands in question. However many events of message corruption and information transposition, especially within the HF DSC system, were noticed. It was also observed that many DSC alerts had been instantly relayed and acknowledged which might create false alerts and interferences.

As far as the use of DSC system for *urgent* communication is concerned, a slightly higher number of callings within MF band was noted in comparison with those recorded in the first year of GMDSS implementation, namely from 1.2% to 5.7% only.

However in the use of communication on HF and VHF band frequencies a decrease was noted from 10% to 0.6% and from 9.5% to 3.1%, respectively.

Also, the use of DSC system to perform *safety* callings was significantly changed : the use of MF band decreased from 84% of all callings in 1993 to 22.8% in 1998, and of VHF band - from 71.4% to 12.8%, i.e. more than five times ; in the use of HF band a slight increase only was noted - from 0% to 0.6% in the same period.

As far as *routine* callings are concerned a significant increase in the use of DSC system to perform this kind of callings in the VHF band was recorded : from zero in 1993 to 37.5% in 1998. This can be explained as the using of DSC system within this band to perform also radiocommunication connections through a coast station to a chosen telephone subscriber on land.

To finally conclude the results shown in Fig.2, it can be said that DSC system was mainly used to perform *distress* callings on frequencies of all three - MF, HF and VHF - bands.

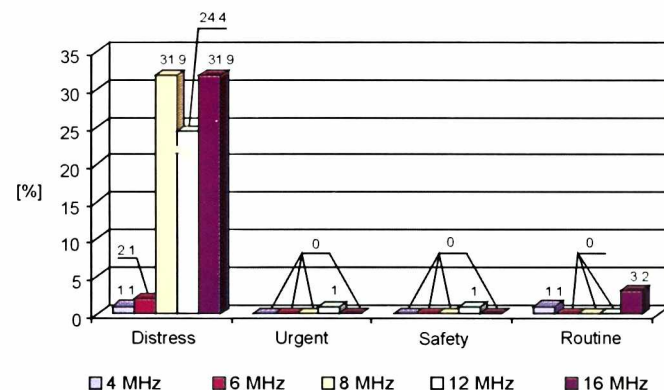


Fig. 3. Percentage distribution of the DSC callings received within the sub-bands of HF range in relation to communication categories

Fig.3 shows the distribution of the DSC callings received within the sub-bands of HF range according to the radiocommunication categories. Basing on these results one may explicitly state that in the case of sending *distress* signals mainly higher frequencies of the HF band are used. Thus the results of the previous research carried out during the first period of GMDSS implementation have been confirmed. 8 MHz sub-band frequency was used to that aim previously for 30% of all callings - now for 31.9%, 16 MHz sub-band - earlier for 40% and now also 31.9% of all callings, and 12 MHz sub-band - earlier for 10% and now 24.4% of all callings. The use of lower frequency bands is negligible : about 1 to 2% of all callings only.

The same tendency as previously is observed in the use of HF band frequencies in other radiocommunication categories, i.e. an insignificant level of using, with the exception of *routine* callings, where frequencies of all HF sub-bands are used at the level of 1% to 3.2% of all callings.

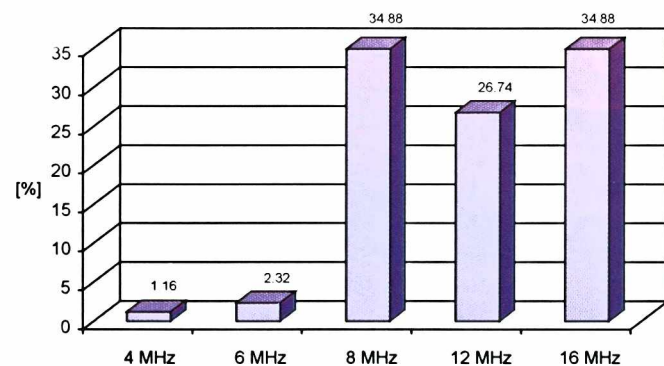


Fig. 4. Percentage distribution of DSC distress callings with HF sub-bands

The results shown in Fig.4 entirely confirm the relevant results presented in Fig. 5 of [9] as well as the conclusions drawn from them.

FINAL REMARKS

The presented results of the operation research on the use of the digital selective calling - the basic and unique way of emergency alarming by means of the GMDSS with the use of VHF, MF and HF communication links - permit to formulate the conclusions which may, however, contain certain errors.

The errors can arise first of all from too small number of performed measurements which should be carried out in various operational conditions, i.e. various propagation conditions, interference levels and coast station - ship distances etc.

The author, being conscious of these shortcomings, is convinced that the observed features as well as their influence on the quality and efficiency of the DSC system, can be deemed useful and general conclusions can be formulated correctly even if the measurement basis is rather deficient.

It should be taken into consideration that the sea waters around Europe and waters of the Atlantic Ocean are overcrowded with ship traffic, therefore the radiocommunication activities are very intensive in this area. Moreover the West European countries are very advanced in application of new techniques and modern maritime radiocommunication systems. Hence in the author's opinion the experience gained during the research work carried out in those sea regions, as to the quality of work of DSC system and its importance for the safety of life and property, can be considered representative also for many other sea regions of the world.

Appraised by Józef Modelski, Prof., D.Sc.

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Miscellanea



TOP KORAB in 1999

In 1999, The Society of Polish Naval Architects and Marine Engineers, KORAB, organized, in the same way as in 1998, club meetings devoted to presentation and discussion of selected topics dealing mainly with shipbuilding as well as the wide, maritime economy field.

The papers were presented by the Society's members or visitors, experts in a given issue.

In the last year the following topics were considered:

- ◆ Contemporary ship diesel engines of Wärtsilä NSD Corporation
- ◆ Strategic management of maritime economy enterprises
- ◆ Gdańsk Shipyard: present state and prospects
- ◆ Ship manoeuvrability model tests on the open water area
- ◆ Port state control and flag state responsibility
- ◆ Corvettes - their modern technical solutions and role within NATO naval forces
- ◆ Gdańsk Shiprepair Yard's activity in the area of offshore technology
- ◆ Problems of the world and Polish shipbuilding at the turn of the century

Additionally, a trip was arranged to Tezew where a branch of the Central Maritime Museum is located. Its participants had an occasion to be acquainted with history of the branch and to visit interesting gear exhibitions presenting the development of inland navigation along the Vistula and over its basin, as well as to familiarize themselves with protection technique of wooden exhibits and reconstruction processes of boat structures.

MARINE TECHNOLOGY TRANSACTIONS

- MTT is a publication of the Marine Technology Committee of the Gdańsk Branch of the Polish Academy of Sciences.
- It presents (in English) results of interesting original research projects in the area of marine technology, carried out by Polish scientists.
- In each year one volume of the journal is issued, which contains carefully selected and reviewed, experimental and theoretical papers devoted to the theory of structures, machinery and equipment of ships as well as marine and ocean structures.
- It is edited in co-operation with Faculty of Marine Technology, Technical University of Szczecin, Faculty of Ocean Engineering and Ship Technology, Technical University of Gdańsk and Institute of Hydroengineering, Polish Academy of Sciences, Gdańsk.

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