

Research and Analysis on the Wide Application of Narrowband Direct Printing Telegraph Simulator Design in Navigation Training Institutions

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Abstract

[Objective] The purpose of nbdp simulator is to simulate the nbdp system on board. It is mostly used for GMDSS training for students majoring in navigation and professional seamen in the society. At present, many schools or training institutions do not have such simulators or the simulators used are old ones used on ships many years ago. However, there are great changes in functions and interfaces between this type of aircraft and the equipment currently used on ships, and they cannot be operated by real ships, because the signals will interfere with the normal use of ships on the sea. **[Methods]** Students use nbdp simulator to simulate the real machine operation, It can break through various limitations and realize unlimited use for many times **[Results]** The maximum utilization rate of educational resources can be realized. During the period when students can't be in school (such as during the epidemic), this system can achieve remote practice teaching and realize "0 delay" for education and teaching **[Conclusion]** Considering the above reasons, It is of exploratory significance for the practical education and teaching of navigation students and seafarers trained in the society. Colleges and universities and training institutions can make full use of a small amount of real machine equipment to improve students' intuitive sense of equipment. At the same time, combined with a lot of training in virtual simulation network training system, students' proficiency in equipment operation can be established.

Keywords

Nbdp Simulator; Navigation Training Institutions; Remote Practice Teaching.

1. Introduction

Nbdp (NBDP) is a main terminal of ship radio station in GMDSS ground communication system. It is connected with MF (Medium Fre-Quency)/HF (High Frequency) Single SideBand, SSB) transceiver, which can realize the communication between ships, ships, ship platforms and users of radio stations or international telex network extending through the shore platforms. At the same time, it also has the function of broadcasting maritime safety information. The nbdp simulation system is mainly used to simulate the nbdp system on board. It is mostly used for GMDSS training for students majoring in navigation and professional seamen in the society. At present, many schools or training institutions don't have this kind of simulator or the simulators used are old models used on ships many years ago. However, there are great changes in functions and interfaces between these models and the equipment currently used on ships, and they can't be operated by real ships, because the signals

will interfere with the normal use of ships on the sea. At the same time, restricted by the simulator software electronic dongle, students can only carry out the experimental training of nbdp system in a fixed laboratory, but can't practice freely after class. It is of exploratory significance for the practical education and teaching of navigation students and seafarers trained in the society. Colleges and universities and training institutions can make full use of a small amount of real machine equipment, In order to improve the students' intuitive sense of equipment, and at the same time, combined with a large number of training in virtual simulation network training system, students' proficiency in equipment operation is established.

2. System Introduction and Wide Application of Nbdp Simulator

GMDSS modernization process and ship communication development trend.

In 2009, the IMO 86th Maritime Security Conference approved a comprehensive review of GMDSS elements and procedures, and in 2016, the THIRD MEETING of THE NCSR(Navigation Communications and Search and Rescue Sub-Committee) finally endorsed the work report submitted by the GMDSS Communication Working Group and approved the results of the detailed review At present, the revision of SOLAS Convention is nearing the end of the revision work after the modernization of GMDSS(M- In GMDSS, ship communication consists of four parts, namely satellite communication system, ground communication system, maritime safety information broadcasting system and positioning system. In the future ship communication system, broadband satellite service will become the mainstream service of M-GMDSS IMO has already introduced a new satellite communication system in M-GMDSS, and the US Iridium satellite system has been added to GMDSS. It is certain that China's Beidou system, although a navigation system, is also expected to be added to the SYSTEM because of its short message communication function, so as to avoid the phenomenon of Inmarsat being the dominant one in M-GMDSS However, at present, only Inmarsat and Iridium satellite communication systems are approved by GMDSS. Due to the insufficient bandwidth and high communication price provided by these two satellite communication systems, they cannot fully meet the requirements of ship communication. Moreover, GMDSS cannot authenticate all satellite communication systems So even though VAST systems cannot be added to GMDSS in the future, they will still be favored by shipowners because of their wide bandwidth and low price This will lead to the co-existence of the equipment required by the Convention and the satellite communication equipment chosen by the shipowner in the forthcoming GMDSS, when the satellite communication equipment required by the GMDSS will no longer be just a decoration In ground communication systems, although MF/HF devices are rarely used in conventional communication except for VHF devices, M-GMDSS will be mainly used in distress and safety communication, but some functional requirements will be weakened As for the maritime safety information receiving system,M-GMDSS is still composed of EGC(Enhanced group call receiving equipment) and NAVTEX(navigation warning receiver). However, whether the maritime safety information obtained by other channels or means can be recognized by M-GMDSS is still under discussion IMO seems to recognize the use of other channels or means to obtain maritime safety information, which can be seen from the description of SOLAS Convention /7.1.4 by NCSR6 to NCSR7 at the 6th MEETING of NCSR 2019. Article 7.1.4 is stated as follows: A receiver that receives MSI and SAR related information in two cases: within the scope of the international NAVTEX service; If it exceeds the range, it will be received by the approved mobile satellite service EGC and/or HF direct printed telegraph MSI receiver. However, at the 7th NCSR meeting in 2020, SOLAS Convention No /7.1.4 Amendment requested: In the equipment for receiving MSI(Maritime safety information) and SAR (Search and Rescue information), the specific equipment is no longer specified, indicating that the correct reception of maritime safety information is sufficient Although EPIRB(emergency radiobeacon) and SART(Search-and-rescue radar transponder) have been modified in terms of their performance indices according to the development of related systems, their equipment functions and principles have not changed much.[1].

Design the network training platform of nbdp simulator under GMDSS communication system.

2.1 System Introduction:

NBDP system is a main terminal equipment in GMDSS ground subsystem. It adopts digital communication technology, microprocessor control and ARQ(Automatic Repetition Request) and FEC(Forward Error Correction) error control methods, which can quickly and reliably realize telex communication between berth and shore, berth and berth, and berth and land telex users via shore r1].NBDP system is composed of ship and shore SSB radio stations equipped with NBDP terminal equipment. NBDP berth is mainly composed of NBDP terminal equipment and SSB equipment (see Figure 3 above). Central Processing Unit, CPU), memory, keyboard, display and interface circuit constitute a special microprocessor, which is called NBDP terminal. All functions of NBDP are handled and controlled through it.

2.2 NBDP System Structure:

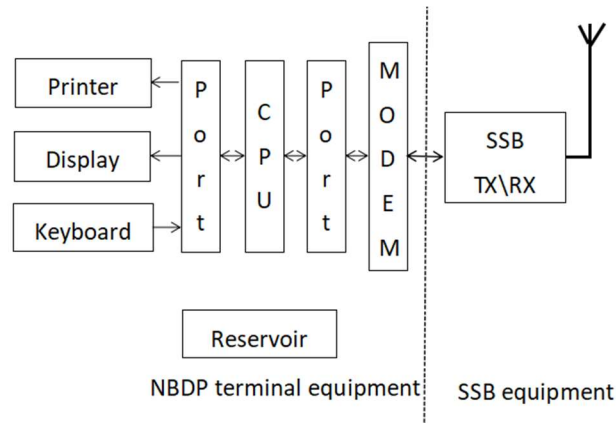


Figure 1. General composition of 1:NBDP equipment

2.3 Introduction of Hardware Equipment Panel of System Composition

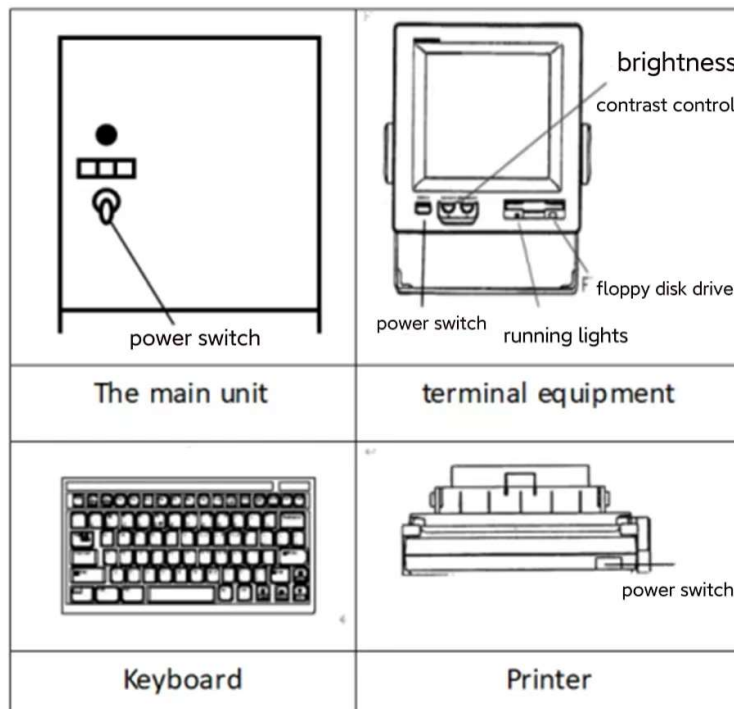


Figure 2. This section describes the device panel of the system

Initialize the system operation (complete basic functions such as creating, printing telex information, editing, controlling sending and receiving).

2.4 Switch on and Off and Main Buttons:

Table 1. The system consists of the button switch function of the device

Set	functional key	Use way
Main unit	POWER	Main unit power switch
terminal device	POWER	Display power switch
	BRIGHT	Display brightness adjustment knob
	CONTRAST	Display contrast adjustment knob
printer	POWER	Printer power switch
keyboard	[F1]	Show the File menu
	[F2]	Show Edit menu
	[F3]	Show the Operate menu
	[F4]	Show Window menu
	[F5]	Show Station menu
	[F6]	Show the System menu
	[F7]	WRU instruction
	[F8]	HR instruction
	[F9]	Over instruction
	[F10]	Break instruction

2.5 Functions of Each Button in the Menu:

Table 2. Summary of the menu

menuitem		function declaration
File	File menu	Create, open, save and print telex information; Format floppy disk
Edit	Edit menu	Editing function
Operate	Operation menu	Control sending and receiving
Window	Window Menu	Display the corresponding data in the window
Station	Coastal radio information menu	Coastal radio data storage, timing operation settings, user channel settings, different ID code input
System	system menu	Contains tests, and system settings
WRU	(Who Are You?)	Inquiry response code
HR	(Here Is)	Transmit response code
Over		Change the direction of information flow
Break		Disconnect the line and end the communication

Two main working modes of ARQ and FEC are simulated.

2.6 ARQ Mode Workflow

The ARQ technology used in NBDP system is wait to send ARQ. This type of ARQ means that the sender stops sending after sending a code group and waits for the response signal from the receiver. If the receiver's answer is that it has received correctly (ACK), the sender will send the next code

group; If the receiver's answer is negative acknowledgement (NAK), the sender will resend the code block until the code group is received correctly. In this way, the transmission of the whole message is completed. ARQ mode is only used for communication between two radio stations, that is, communication between a shipway and a shore station or between two SHIPWAYS. The whole workflow of ARQ mode includes selective calling and phasing program, mutual identification program, communication program, re phasing program and ending communication program.

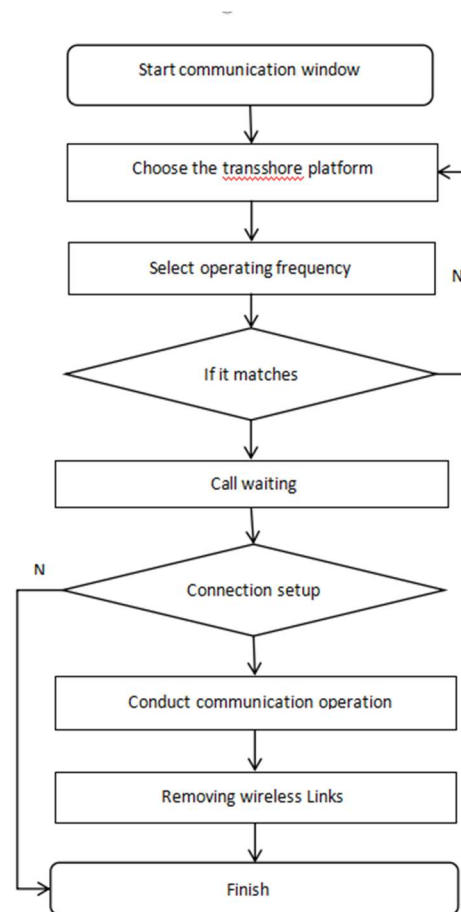


Figure 3. ARQ Summary of the menu

2.7 FEC Mode Workflow

In NBDP system, FEC means that the transmitter sends each code block twice. In other words, there is a delay of 280ms between the two transmitting bits. The receiving end compares and selects the results of the two reception, makes a correct and wrong judgment, and then outputs the correct and wrong results (marked with "*") to the external device.

FEC mode has two forms:

- (1) CFEC (collective FEC) is usually used for broadcasting from one station to multiple stations, such as broadcasting of communication report, weather, navigation warning, etc.
- (2) Selective sfec (selective FEC) is used to broadcast information from one station to one station or from one station to a group of stations. The status of information transmission and receiving remains unchanged. It is often used when the ship radio station can not turn on the transmitter, but a certain radio station still needs to send messages to the slipway.

The work flow of FEC mode includes three steps: phase determination procedure, communication procedure and ending communication procedure. However, in sfec, due to the discrimination of selective identification code, there is a selective calling procedure.[3].

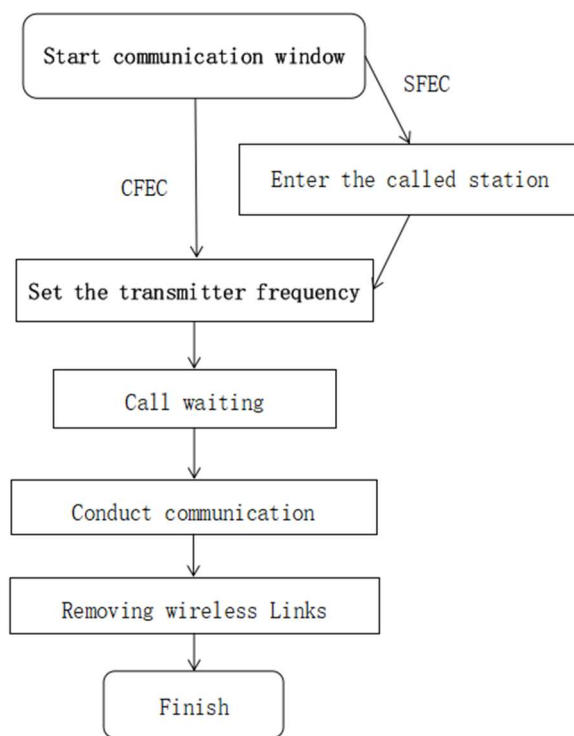


Figure 4. FEC Summary of the menu

With the improvement of ship modernization and management level, higher requirements are put forward for ship communication. In order to reduce the false alarm probability, reduce unnecessary life and property losses, give full play to the role of GMDSS and improve its reliability, it is necessary to pay attention to the training of GMDSS equipment operation skills. The theoretical knowledge training of NBDP can be taught by relevant training institutions or maritime colleges and universities. However, the training of operation skills is difficult, and the investment cost of real machine equipment is high, and the price of complete set of GMDSS equipment is expensive. Therefore, the development of GMDSS simulation training system such as narrow band direct printing telegram has direct practical significance. The person applying for GMDSS general operator qualification certificate shall pass the theoretical examination and assessment of maritime radio communication (including communication equipment and communication business), communication English, operation and maintenance of GMDSS equipment, communication English listening and conversation, etc. Communication English teaching is mainly aimed at the students majoring in driving and communication as well as the current seafarers in short-term training. Students at school have a good English foundation. But the basic knowledge of radio is limited, so it is difficult for them to understand the working principle of the whole system; Although the current crew has more work experience, but the basic knowledge of English is poor. As a professional English, communication English is different from navigation English and marine engineering English. GMDSS Communication English mainly enables students to understand the basic concepts, working methods, basic functions, system composition, operation procedures and corresponding conventions and regulations of the whole GMDSS system, and enables students to have certain English writing ability.[4].

3. Perfect Method of Simulator Design

In order to transmit a telex to the destination quickly and accurately, and the communication cost should be as low as possible, experienced radio operators should consider the following factors comprehensively, Try to select those coastal stations with high transmission power, multiple channels

and wide band. If the transmitting power of the selected shore station is high, the receiving effect of ship radio station will be better, So as to improve the communication quality. However, if the selected shore station has many channel bands, the channel can be established more reliably and timely. This is because the communication service uses short wave band, which mainly includes 4MHz, 6mhz, 8MHz, 12Mhz, 16mhz, 22mhz and other bands, and the transmitted signal is transmitted by sky wave, Which band is used for communication depends on the distance between the shipway and the shore station and the radio wave propagation conditions.2. Select the shore station with lower cost. Don't keep in touch with too many coastal stations at the same time, so as not to receive possible calls back.[3] The design of the simulator is perfect, It is of great significance to the practical teaching of maritime students and seafarers trained in the society. At present, the design of the simulator mainly solves the following problems: replacing and updating the old narrow band direct printing telegraph simulator in school or society, so as to solve the problem that the existing simulator is quite different from the marine simulator; Solve the problem of region limitation of the original simulator.(for example, the teaching practice during the period when the epidemic situation or other reasons cannot be returned to school can not be carried out normally, and it can only be carried out after returning to school. Based on this system, such problems can be better solved.); Solve the problem that the contact can not be used at any time and in multiple periods. for example, students can't digest and understand well after class, and they can't connect with each other more, which limits their use time, This system can solve this problem better.

4. Idealized Future of Design of Narrowband Direct Printing Telegraph Simulator

Radio communication plays an important role in ensuring the safety of life and property at sea, which can ensure the smooth communication of ships in emergency. At present, the information exchanged between ship and shore is not only limited to ship reports and some telegrams requesting instructions and reports, but also includes massive data information of images, pictures, voice and various ship parameters. The simulator is closely related to the development of the times. The improvement of ship modernization and management level puts forward higher requirements for ship communication. With the development of the times, the country pays more attention to the training of seafarers, and the simulator is gradually developed.

The narrow band direct printing telegraph simulator can simulate different actual maritime scenes, and through repeated practice to achieve the purpose of reasonable, correct and timely selection of equipment to complete various types of maritime communication, and can set different scenarios randomly by the teacher side, so as to enhance the students' ability to cope with emergencies. In the context of the global epidemic, Students can't achieve distance practical teaching through this system during their school stay, and realize "zero delay" in education and teaching. With the progress of science and technology, especially cloud computing, many technical capabilities become resources that can be easily obtained like hydropower and coal, so the difference in technical ability will be smaller and smaller, What can make you stand out at this time is whether your product can impress users and meet their needs. As a product with strong interaction with users, the system also meets this trend. Therefore, in the future, the enterprises that can do a good job in this system must be able to define the system value, not only to obtain commercial value, There is also a need for breakthroughs in the dimensions of user experience, humanistic care, ecological prosperity, and the promotion of positive values. It is good to provide users with valuable information and emotional connections. The system with humanistic care must have the ability to effectively cooperate with people and machines, which is also the normal of the system for a long time in the future. These multi-dimensional values will become more and more important and become the core competitiveness of the system.

So far, the application based on Internet has penetrated into various fields of society, such as finance, telecommunication, aerospace, e-commerce, e-government and military. A system from the beginning of a simple password, to now we can use fingerprint or facial recognition to improve user

security, However, the open and dynamic nature of the system itself is increasingly leading to various security problems, and the development of its application is increasingly restricted. Therefore, many manufacturers, including Microsoft, begin to attach importance to and gradually establish a secure and trusted operating system. It is believed that the security and practicability of the system will be greatly improved in the future.

More simple and easy to operate: the system is more convenient to use, not limited by time and space, can be remotely controlled, simulate different scenarios, and increase the adaptability of students.

5. Discussion and Innovation

Through investigation, it is found that the assistance of narrow band direct printing telegraph simulator is of great significance to the training of maritime talents. Through this equipment, we can simulate different actual maritime scenes, and through repeated practice, we can achieve the purpose of selecting equipment reasonably, correctly and timely to complete various types of maritime communication, In addition, different scenarios can be set randomly by the teacher to achieve the purpose of strengthening students' adaptability. Universities and training institutions can make full use of a small number of real equipment to improve the students' intuitive sense of the equipment. At the same time, combined with a large number of training of virtual simulation network training system, students' proficiency in equipment operation can be established.

Although this study also has some limitations, it can overcome the limitations of time and frequency. In view of the limitations of the original simulator in LAN, the next step is to optimize the wide area of simulator training courses and bring more benefits to the trainees as much as possible.

Strengthen the function of ground communication system: introduction of ground communication system due to the rapid development of satellite communication, recently, radio communication between ship and coastal radio station has become more and more unimportant and less used. The SSB and NBDP between the ship and the shore are basically tested and inspected, and the daily communication is basically not used. However, according to the requirements of GMDSS, these radio equipment are still within the scope of specification requirements. Another kind of communication equipment in GMDSS ground communication system is DSC (digital selective calling) equipment. It is the terminal for distress alarm and has selective call function. That is, distress alarm, distress confirmation and distress broadcast, With the functions of selective calling, on duty listening and ship inquiry, the communication in MF / HF / VHF band has entered a new stage. Thus, the history of the ship in distress and unable to call the police in time and the nearby ships without knowledge can not be rescued in time in Titanic.[5].

6. Conclusion

This paper studies and analyzes the wide application of narrow band direct printing telegraph simulator in navigation training machine. It is proved that the narrow band direct printing telegraph simulator has many advantages when applied to maritime training institutions. The simulator can not only meet the requirements of navigation majors for mastering navigation communication equipment, It can also simulate and change the corresponding environment according to individual needs, and has the function of simultaneous assessment and monitoring at both ends of teacher-student education. However, due to the narrow band direct printing telegraph simulator design and application in the navigation field, as well as the simulator development, operation and compilation are all in the forefront of research at this stage. Therefore, this paper only analyzes the popularity and application of narrowband direct printing telegraph simulator in maritime training institutions. In the future, the narrow band direct printing telegraph simulator will continue to improve and update with the progress of China's shipping industry and the improvement of the needs of maritime training institutions for training and teaching purposes.

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