

# TRAINING COMPLEX AIS FOR TRAINING OF THE SHIP SPECIALISTS

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One of the important components for inculcation of steady practical skills to the ship specialists on a teaching level is the training preparation. Its efficiency, in turn, is determined by a condition and level of development of the training equipment, its capabilities on creation of integrated medium, with a high accuracy imitating real situation and permitting not only to decide practical problems, but also directly to observe and to fix the errors in a learning process. In the report the training complex AIS (Automatic Identification System), which operate on marine radio communication chair, is considered.

In the last decade in a world there was a considerable qualitative leap in development of information technologies (IT), communication engineering and telecommunications, infrastructure of communication and, as a consequent, market of communication services. Both conventional systems and types of communication, and in principle new equipment have received development: personal systems of a mobile satellite communications, system of a cellular communication, communications system on the basis of broadband technologies, IP - telephony etc.

The communication is the basis of construction and operation, the main component of management systems (MS) of any physical nature and any level of complexity (GMDSS, NAVTEX, AMVER, VTS etc.). As far as the communications system, engineering and the technology of communication is perfect, in many respects depends also condition of the management system, its capacity to execute the assigned functions with demanded efficiency. Quite often system frameworks of communication determine in the issue system frameworks of control. So, with development and intrusion of technologies, founded on application of wide-band signals, it was possible considerably to increase speed and reliability of delivery of the information in MS. The development of satellite systems of communication has allowed on the in essence new basis to organize delivery of the maritime safety information (MSI) and system of monitoring of ships. The development of systems of a cellular communication, their integration with mobile satellite systems of personal radio communication is opened the large outlooks in creation of a solid zone of cover. The development of radio-relay systems, fiber-optic

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links of communication has resulted in creation of the principal new infrastructure of terrestrial points and communications networks. The unification of capabilities of a communication engineering and computer technologies has allowed to receive a series of the new solutions, such as IP - telephony, off-wire subscriber lines, local area networks of a transmission of information etc.

The increase of intensity of the world navigation, creation of high-performance expensive ships, increase of their sizes and speeds is determined the paths of development of means of offshore navigation, which one, first of all, should provide the high safety of navigation. One of mainstreams in perfecting means of offshore navigation is connected to a broad intrusion of automatic systems, founded on complex using of communication, computer facilities and ship navigation systems within the framework of development of a direction of electronic navigation (E-navigation).

The appearance of global navigational satellite systems, including with a differential mode, systems of electronic cartography, development of systems of automatic digital radio communication have opened a perspective an intrusion of new navigational and information technologies for navigation and for increase of safety of navigation.

The main source of navigational data both for ships, and for shore services, is the radar. However under certain conditions it has a number of lacks:

- short range of detection, specially of small targets;
- delay in identification of manoeuvre of the target;
- strong influencing of a sea clutter and atmospheric phenomena;
- limitation in target detection behind impediments etc.

One of ways of their overcoming is usage of an Automatic Identification System (AIS). This system is a new mean for increase safety of navigation and quality of offshore navigation. However it at all does not substitute existing means of offshore navigation. Moreover, inept its usage can result it in pernicious consequences. In the Resolution IMO MSC 74 (69) is apart pointed out, that the watch officer always should mean, that on other ships AIS can be on any causes is switched - off. In this case such of ships become invisible if to rely only on AIS information. There is also number of problems with usage of the AIS information of marine pirates.

AIS is the equipment for automatic exchange by the most important navigation data between ships and coast centers with usage of a VHF of radio communication with a time division of channels (TDMA). It means, that all AIS stations work on one frequency, however each station transmits the information in a strictly retracted time period - so-called slot. The general synchronization of all stations implements by the GLONASS/GPS receiver

The automatic identification system is the combination of working AIS stations, established on ships, coast centers, navigational objects. The AIS stations interchange the data among themselves on two VHF channels with a time division of signals. The fault of the internal GLONASS/GPS receiver does not result in failure of AIS station. In

this case the reserve way of synchronization of AIS station concerning other AIS stations (indirect synchronization UTC and synchronization by a method of “semaphore”) envisaged. Except for two TDMA channels the AIS station simultaneously works on a DSC channel 70. The ship AIS station receives and processes the inquiries of a coast DSC station. The base AIS station can transmit on a DSC channel the data about AIS regions, request navigational data.

In each region the numbers of a VHF channels the administration sets. Outside of regions the AIS stations use the channels 87B (161,975 MHz) and 88B (162,025 MHz). AIS can work in frequency band 25 kHz, and also in frequency band 12,5 kHz on low power. The radius of action thus is reduced.

The frequency modulation with minimum frequency deviation FM/GMSK (Gaussian Minimum Shift Keying) is applied to transmission in TDMA channels. The given type of modulation is optimal from the point of view of reduction of held frequency band at a preset speed of data transfer of 9600 bits per second.

The ship equipment AIS is partitioned on two classes: the class A and class B. The equipment of the class A meets the requirements, shown to ships, for which the installation AIS is mandatory by the Rule 19 chapters V of the Convention SOLAS. All other convention ships (for example, pleasure yachts, the small fishing boats) can have the equipment AIS of the class B. Intervals of transmissions AIS of the class B is more, than for the class A. The AIS stations are set also on aircraft used at search and rescue operations, and on navigational objects. The listed types of stations relate to a mobile stations.

The fixed AIS stations are set on a coast and work, as a rule, in vessel traffic systems (VTS). For extension a cover zone will use stations of simplex repeaters.

The successful activity of a ship's AIS, implementation by it of all functions in many respects depends on a training level of staff: the knowledge of a system designated purpose, fundamentals of its operation, solved problems, skills, to enter and to correct values of performance parameters. Thus the special importance gains the factor of an error, as its detection directly on a workstation of the AIS operator is impossible, and the consequences can be very seriously. So, the errors in navigational data can result in incorrect perception of coordinates of a vessel, its course and speed. The errors or the inaccuracy in the voyage information can distort an anticipated arrival time, type of cargo. Errors or the inaccuracy of the static information result in an incorrect estimation of overall dimensions and draught of a vessel, its name and call sign etc. All transferred factors in the issue reduce safety of navigation and result in necessity of additional actions as on the ships, and on the coast stations.

In Odessa national maritime academy on the basis of GMDSS training center for the first time on Ukraine the training complex AIS is organized. Its structure is:

- ship equipment AIS MT-1 “Transas”;
- ship equipment AIS KTM-201 “Izumi”;

- electronic cartographical system - programmatic complex Navi Sailor 3000;
- electronic cartographical system - programmatic complex Fleet Manager IZB;
- program modules AISpos and AISer.

The basic problem solved with the help of a training complex AIS, is the training of highly qualified staff from a navigation personnel and radio officers of ships, capable to organize competent exploitation of the ship equipment AIS.

The main peculiarity of the built training complex is practical usage of two ship complete AIS, linked with completes of electronic cards (ECDIS), permitting operatively to register and to analyze errors of a different level, ensuring a capability of activity in an real air with the real navigational targets. The complex enables in real-time mode to observe the actions and errors of the student during input static, dynamic and voyage data. It is very important from the methodical point of view, since considerably increase visualization of training, and due to a feedback the capability of repeatability of assigned situation is provided.

The communication between workstations implements with a radio channel in a VHF band. A structure of one workstation is:

- ship transponder AIS of the "A" class in a structure of the mainframe, supply unit, an operator's terminal (MDT-2011) and GPS antenna;
- programmatic complex Fleet Manager IZB with the database of ships and programmatic modules AISpos and AISer.

The coupling of the AIS transponder with a programmatic complex is provided with the help of standard outports of the device and COM-ports of the computer.

The operator's terminal MDT-2011 conforms the requirements of the standard of IEC 61993-2, represents the minimum keyboard and indicator. It allows:

- to reflect MMSI, call signs, name and coordinates of interacting ships;
- to reflect mean and instantaneous heading, speed, angular rate of turn;
- to enter and to reflect the reports on safety;
- to enter the initial data and data of a voyage of the vessel;
- to reflect the characteristics of a positioning system (source of obtaining of coordinates, quantity of satellites, tag of availability of differential correction);
- to reflect the characteristics of the transceiver (channel, passband, radiated power);
- to establish a work channel;
- to reflect lists of the reports of the alarm system, inquiries from means of distant communication, system reports, list of the silence periods;
- to make of set-up;
- to give a sound signalling.

The programmatic complex Fleet Manager IZB is intended for:

- registration of ship positions both equipped AIS, and transmitted under the data of radar wiring;

- granting of the information about ships and their positions in a graphic form on an electronic card and as text;
- granting of the information about parameters of motion of ships (velocity vector, route);
- granting of help information from the database;
- granting of navigational data;
- solution of different measuring and information problems with usage of electronic cards.

The complex consists of a server and client part. In a structure of the server the database of ships operates under the control of a InterBase and set of the specialized programs executing an entry in the database the information of ships, which one goes on AIS, DSC, INMARSAT channels. Operator interacts with a system through a client workstation.

The information going from AIS is processed by the interface module AISpos. Apart from data processing AIS this program controls an amount of information, storable in the database of positions, and, if necessary, removes of the most aged report about a position. Before deleting of the aged reports, there is a backup copy of base of the data, which can be utilize in case of recovery of a system. The module reflects the reports on new ships in the database, about connection and disconnection with AIS in a real time, allows for total of the processed targets, including active, how much targets are lost, update rate of the database etc. The main window of the program represents the panel of bookmarks, with the help of which are possible to control a current condition and set-up of a system.

The interface module AISer represents the terminal of mobile station AIS and represents as hooked up transponders with the indicating MMSI, coordinates, number of the escorted targets, and observed targets with the indicating of their name, MMSI, class AIS, coordinates, accuracy of reading of coordinates, distance, bearing, course, speed. With the help of options of the main menu it is possible to form and to transmit commands to the inquiry of the information, safety report, telegram. Under condition of coupling it is possible to control main parameters and condition of the transceiver, static and voyage information, to inject a window of the alarming system and inquiries of a long-range communication. The relevant role in a structure of the interface module AISer is executed by an option "Diagnostic". With its help it is possible to set the dynamic programs of movement of a vessel, on which one the given module established, setting thus different coordinates, course, speed and series of additional parameters.

Doubtless advantage of a considered complex is the capability of joint utilization of program modules permitting to process AIS data, to control an amount of information storable in the database of positions, creation, dispatch and obtaining of the reports, creation of the programs of a simulation from external sensors etc.

However today navigational complex AIS-ECDIS with the equipment GMDSS functionally is not connected. At the same time their affiliation at a hardware level under

the scheme GMDSS-AIS-ECDIS will allow considerably to increase an effectiveness and to simplify a procedure of organization of radio communication.

For implementation of such problem on chair of maritime radiocommunication the device of remote access (DRA) and programmatic complex permitting to control by the controller of a digital selective call (DSC) was designed. DRA allows to control the conforming controller from the personal computer, on which the programmatic envelope ECDIS is established. The hardware of the device represents the double-directional interface intended for transformation of formats of commands and the data of the DSC controller in semantic codes, sent in the PC through COM-port, and as for return operation of transformation of control commands of the PC in codes of controllers.

Such affiliation of radio communication systems and navigating will allow to execute a forming/reception of the information circulating in DSC channels, using the data cards of the AIS-ECDIS targets, and imaged in a current time scale on the navigational display. It will allow the operator, were in unified information space, with the help of context menus conforming to selected object, to form / receive indispensable formats of calls. The considerable part of the format of a call, including digital identifiers, coordinates, time will be imaged automatically, that will allow to avoid their manual input and considerably will speed up a procedure of preparation of a call.

The creation of a unified ship integrated system of radio communication and navigating on the basis of GMDSS-AIS-ECDIS will allow:

- to unify procedures of control of equipment of radio communication on the basis of unified information space, the fundamentals which one is made with a specialized programmatic complex ECDIS;
- to free the operator from necessity of interplay with two information subsystems - AIS and GMDSS;
- to simplify, considerably to speed up and to control a correctness of actions of the operator at problem solving of communication in a DSC system.

The experience of a exploitation of a training complex AIS, the tests equipment, combined working with the GMDSS equipment have allowed to determine reference directions of its modernization and development:

- to provide communication between workstations on a wiring channel without radiation in a air;
- to ensure transmission of the images reshaped within the framework of a system of electronic cards Fleet Manager IZB, on remote display devices;
- to supply coupling a system of imaging of the real information about ships with the DSC controller (GMDSS-AIS-ECDIS) for operating transmission of calls to address imaged objects.

## THE LITERATURE

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