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THE SHIP'S NAVIGATION SYSTEM FOR THE XXI CENTURY

Summary. This paper discusses the necessity of further fast development of the new ship's navigation system for XXI century. The main issues constituting the subject of this paper have been presented.

SYSTEM NAWIGACJI OKRĘTU W XXI WIEKU

Streszczenie: W artykule przedstawiono konieczność dalszego szybkiego rozwoju nowego systemu nawigacji okrętu XXI wieku. Przedstawiono główne problemy dotyczące tematu artykułu.

1. INTRODUCTION

The term "maritime navigation" has three following meanings:

- a. process of planning, recording and controlling the movement of craft from one place to another,
- b. process of ensuring the safe and efficient operation of the ships at sea,
- c. process of realization of all the ships' navigational activities at sea.

It should be stressed that more and more frequently all the ships' activities at sea are being divided into two main groups; these are:

- a. ships' navigational activities, and
- b. ships' non-navigational activities, called also as the "ships' special activities".

2. FACTORS INFLUENCING DEVELOPMENT OF THE SHIP'S NAVIGATION SYSTEM

All the factors influencing and being influenced by the development of the ship's navigation system can be divided into the following groups:

- a. factors enabling and favoring the development of ship's navigation system,
- b. factors whose adverse influence can be reduced by the development of ship's navigation system,
- c. factors being indifferent to the development of the ship's navigation system,
- d. factors forcing the further fast development of ship's navigation system,
- e. factors restraining the development of the ship's navigation system.

To the factors that enable and favor the development of ship's navigation system belong mainly these that are resulting from the scientific and technological progress. As the most important of these factors are being considered the following:

- a. very accurate global navigation satellite systems,
- b. very reliable and effective global radio communication and information systems,
- c. global remote sensing systems,
- d. subregional, regional and global monitoring systems,
- e. subregional and regional Geographic Information Systems constituting of the component systems of the radio communication and information systems.

Besides the above systems belonging to the positioning and information-technologies' systems, it should be also mentioned two very important technologies for development of the ship's navigation systems; these are:

- a. advanced automation technologies,
- b. remote-control engineering technologies.

To the environmental factors whose adverse influence can be reduced belong mainly in the environmental hazards such as:

- a. collisions,
- b. grounding,
- c. hazards resulting from the adverse-weather conditions' and other ship's external hazards.

To the human factors whose adverse influence can be reduced, belongs mainly to the deficiency of human reliability. It should be stressed that one of the main objective of the ship's navigation system is increasing the efficiency of the control of ship's navigation process. This objective is being just achieved by decreasing the influence of human-reliability's deficiency upon the control of ship's navigation process.

To the factors that remain indifferent to the development of the ship's navigation system belong the material objects and, their features and characteristics. Therefore, to these factors belong the ships and their characteristics, such as the maneuvering ones, etc.

To the factors enforcing the further fast development of the ship's navigation system belong the operational factors. The main of these factors are the following:

- a. the permanent increase of the amount, kinds, classes and type of the ships,
- b. the permanent increase of the amount and intensity of human activities,
- c. the necessity to ensure the reasonable level of risk for persons and property at sea, as well as the reasonable level of protection of the maritime environment from pollution.

3. CHANGES IN THE SHIPS OPERATIONAL ENVIRONMENT ENFORCING DEVELOPMENT

After the 11th September 2001, i.e. after the outbreak of the global war on world terrorism, almost nothing is the same as it was before. Even the meaning of the term "maritime safety" has been changed. Now, the expression "maritime safety" means not only the safety of lives, and property at sea, and safety of marine environment from pollution, but also the antiterrorist security of all human activities at sea, but mainly the antiterrorist security of the shipping, i.e. ships and port facilities.

However now, the ships must be not only protected from the terrorists' activities, but also the ships have become the important elements of the international maritime antiterrorist security system. The main objective of this system is not only the protection of maritime assets, mainly ships and port facilities from terrorist activities, but also prevention from the spreading of terrorism using for this aim the ships and their cargoes (illegal passing the borders, smuggling the means and tools of the terrorist activities, etc.).

The above situation results in the necessity to adapt the ships to their new, additional tasks regarding the protection of shipping from terrorist activities, as well as prevention from spreading terrorism using to this aim the ships and transported goods. Therefore, the above situation results in the necessity of adaptation the ships navigation systems to the new ships tasks regarding the maritime antiterrorist security.

The second very important change in the ships operational environment is the permanently growing dependence of the ships maritime activities on the coastal navigational supervising and assisting systems.

However now, the fast growing role of the coastal navigational supervising and assisting systems is caused also by the necessity to protect the shipping from the terrorist threats and preventing the spreading of terrorist activities by using to this aim the ships and transported goods. The above resulted in having been implemented the Automatic Identification System (AIS) and in implementing now the Long Range Identification and Tracking (LRIT) System.

The above situation resulted in being established now the regional Vessel Traffic Monitoring and Information Systems (VTMIS) for European Union's maritime areas.

The third main change in the ships operational environment resulting from the development of the very sophisticated shipborne systems that are very efficient and useful in the solution partial ships tasks (ECDIS, GMDSS, etc.). However, these systems are not sufficiently correlated with each other and with other shipborne systems (radars, ARPA, etc.). Therefore, the above, very often results in ships' accidents caused by the reliability deficiencies of the operators of these systems (officers of the navigational watch and captains). Also the growing dependence of all the ships upon the coastal navigational supervising and assisting system caused that the ship's management is more and more distressed by the great amount of these systems. This means that the ship's management is less and less effective because it is not able to cope with all the demands of the today's ships operational environment of the shipping industry. Therefore, the above situation resulted in the idea of the development of an E-Navigation Strategy (2006).

4. DESIRABLE CHARACTERISTICS OF THE SHIP'S NAVIGATION SYSTEM

The urgent necessity not only of the further perfection of the ship's navigation system but also the urgent necessity of carrying out some very important changes in this system, results mainly from the changes in ships operational environment. These changes and their consequences have been discussed above.

The most pressing necessity of carrying out the important changes in ship's navigation system results mainly from the absolute necessity to adapt the ships to their new function, i.e. to the function of ensuring the maritime antiterrorist security of the whole shipping industry.

However, as it was stated above, the ships are not only the objects that must be secured but the ships have become also the very important elements of the whole international maritime security system. The necessity of adaptation of the ships to the new requirements regards not only the ships participating in the shipping industry but all the ships.

In fig. 1 there are shown the components of the ship's operation system for the XXI century.

As it is shown, the ship's navigation system of the ships of the XXI century will be, according to the authors' opinion, the integrated system that will enable the realization of the three very close connected and correlated functions; there are:

- a. ship's navigation function,
- b. ship's radio communication function and
- c. ship's information function.

Below, there are given some general remarks regarding the ship's navigation system for the ship of XXI century. Such system, as is shown in fig. 1 is proposed to be named "the Ship's E-Navigation, Radiocommunication and Information System". The proposed name means that the system should realize all three functions being already mentioned.

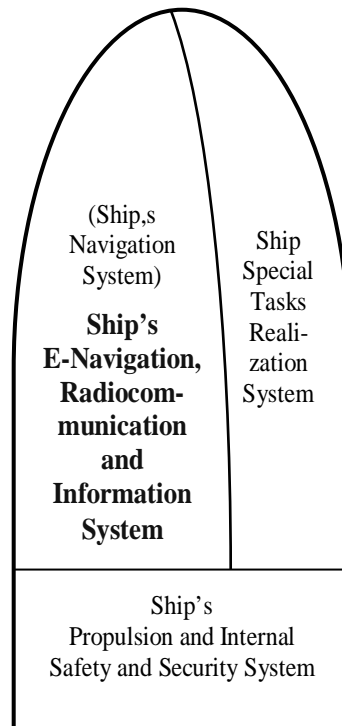


Fig. 1. The main functions and adequate component systems constituting the ship operation system of ships of XXI century

Rys. 1. Podstawowe funkcje i odpowiednie systemy składowe tworzące system operacyjny okrętu XXI wieku

The term *E-Navigation* used in this name does not mean that this system should meet with all the requirements resulted from the E-Navigation strategy. However, this name means that this system should and must be adapted to today's new requirements. The existing shipborne navigation system must not only be considerably improved but the new shipborne navigational systems must be much better adapted to the new requirements of the ships operational environment.

The second function of the proposed ship's navigation system, i.e. the radiocommunication function. This function is not new. It is also today performed by the "command and radiocommunication system". However, this function must be considerably extended and must realize the additional tasks belonging to the sphere of tasks that might be realized by the new kinds of information and radionavigation technologies.

The third function "information" is the new one. However, many tasks of the proposed new function have been realized already by the existing ship's navigation system. However, the new information function should comprise all the tasks regarding the getting, processing, storing, updating, transmitting and displaying the information. This function, and the proper subsystem, must deal not only with the traditional navigational information, i.e. with geographic and operational, but also with information considered as the "ships traffic information" and "security information".

According to the authors, the ship's E-Navigation, Radiocommunication and Information System should possess the following operational characteristics:

- gathering, storing, up-dating, providing and displaying the whole navigational information (geographic and operational),
- receiving, and exchanging all the information regarding the vessel traffic and security information with the proper coastal facilities,
- automatically planning and correcting ship's route,
- automatically receiving all the environmental information from all ship's sensors, processing it with the navigational information, and displaying it,

- e. monitoring the ships process and all its parameters, evaluating all the external hazards, preparing the proper solution and assisting its realization,
- f. preparing the proposals regarding actions when distress signals have been received,
- g. ensuring the reliable operational, as well as the management and every day's radiocommunications,
- h. automatically recording all the necessary data regarding the ship's navigation process, including the keeping the ship's log.

The whole above process should be performed with applying the expert-knowledge technologies. The above requirement applies also to all three basic functions realized by the Ship's E-Navigation, Radiocommunication and Information System.

5. CONCLUSIONS

The today's ship's navigation system should and must be considerably improved in order so that it could comply with the today's requirements. The authors' opinion is that the ship's navigation system of XXI century might be similar to the discussed Ship's E-Navigation, Radiocommunication and Information System.

The authors are convinced that the today's development's stage of technologies constitute not any impediments of development of such system. Even the results of cost benefits evaluation will not constitute the main obstacles for development of such system.

However, the authors are aware that the highest obstruction of development of the ship's navigation system for XXI century will constitute the legal and operational conditions expressed themselves in existing international conventions, resolutions, standards, etc.

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