Today's Maritime Navigation and Its Changes

J. Urbański, W. Morgaś & Z. Kopacz
Polish Naval Academy of Gdynia, Poland

ABSTRACT: In this paper, there are presented the main reasons and results of changes in maritime navigation. The following issues are discussed: substance of maritime navigation; the main reasons of changes in maritime navigation; integration of the ship's navigation process and its results; the growing necessity of supervising all the human activities performed at sea; steady increase of the amount and differentiation of the human activities at sea and; the main results from the changes in maritime navigation. This paper should be considered as further précising and developing the authors' considerations and conclusions presented in the earlier papers.

1 SUBSTANCE OF MARITIME NAVIGATION

The main meaning of the term "maritime navigation" is the following: "maritime navigation is the process of safe and efficient conduct the ship at sea". The term "ship at sea" should be understood as" surface, hovering, and underwater; manned and unmanned; autonomous and remote-controlled ship, vessel, vehicle, craft, etc." The ship's navigation process consist of the series of navigational works, deeds, procedures, etc. being performed in the sequence, recurrently and accordingly to the navigational dangers and threats occurring in the ship's surrounding, automatically or personally from the bridge of own ship, or from the remote place. The maritime navigation is also the profession and kind of applied maritime science.

The process of maritime navigation and its component subprocesses have been presented in the earlier authors papers [Kopacz Z., Morgaś W., Urbański J., 2003].

2 THE MAIN REASONS OF THE CHANGES IN MARITIME NAVIGATION

There are a lot of reasons of changes in maritime navigation. The most important of them can be expressed as follows:

a) fast growing amount and kinds of human activities at sea, especially so called the non-navigational activities performed in underwater environment and even in shallow waters;
b) fast technological and scientific progress expressing itself mainly in creation and wide applying the following:
   - very accurate and reliable global positioning systems,
   - very efficient and reliable telecommunication equipment and systems,
   - maritime Geographic Information Systems (GIS) and voyage management systems (VMS),
   - remote sensing equipment and systems, but especially, hydroacoustic ones, and different kinds of surveillance technologies,
   - technologies offered by the control and remote control engineering, and others;
c) steady emerging of the new kinds of dangers and threats, but especially:
   - global threat of terrorist attacks,
   - growing danger of environmental pollution,
   - harmful and unlawful exploitation of sea resources, etc.;
d) steady desire and demand of enhancement of the operational and economical efficiency of all kinds of human activities performed at sea.

3 INTEGRATION OF THE SHIP'S NAVIGATION PROCESS AND ITS RESULTS

Integration is the process of making the whole (system, process, etc.) more perfect and efficient by adding or bringing together the component parts

(elements, subprocesses, etc.). The integration of the ship's navigation process consists in making this process more efficient operationally and economically by merging and incorporating into the ship's navigation process the activities that before were not considered as navigational ones, i.e. activities that belonged before to the other ship's processes. In Figure 1, there is shown the substance of integration of the ship's navigation process into ship's operation control process [Kopacz Z., Morgaś W. and Urbański J., 2004].

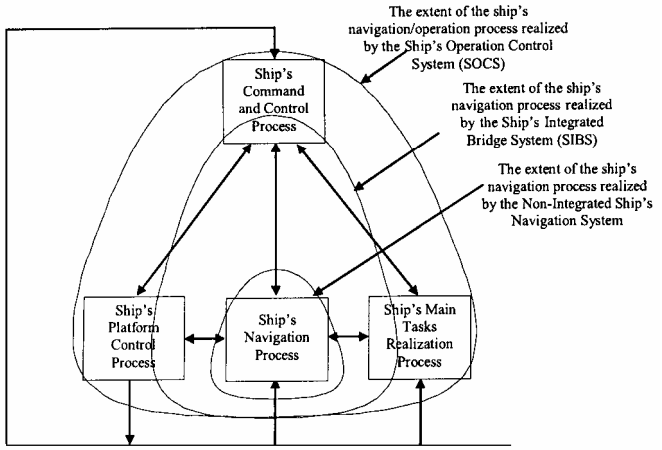

Fig. 1. The extent of ship's navigation/operation processes for three levels of ship's integration

The final objective of integration of ship's navigation process is transforming it into the ship's operation control process and complete elimination of all other ship's processes constituting the ship's operation process.

4 THE GROWING NECESSITY OF SUPERVISING ALL HUMAN ACTIVITIES AT SEA

Fast growing necessity of supervising more and more human activities at sea results mainly from the following reasons:

a) growing necessity of monitoring and assisting the ships traffic in congested and confined areas,
b) necessity to diminish or even eliminate the threat of huge environmental pollution by tankers and other ships transporting the dangerous goods (crude oil, liquefied gases, etc.),
c) necessity of prevention of all terrorist activities and attacks on the whole maritime infrastructure and on all the maritime industries.

Today's scientific and technological progress renders all the possibilities to create and operate very reliable and effective systems supervising all kinds of human activities at sea. The supervising the human activities at sea is and will be realized by the following system:

a) ships traffic monitoring and assisting systems; these are: Ships Reporting Systems (SRS), Vessel Traffic Systems (VTS); Automatic Information Systems (AIS), and others,
b) European Union's Vessel Traffic, Monitoring and Information System (demanded by the Directive of the European Parliament and of the Council of 2002),
c) Long Range Identification and Tracking System (LRIT), and others.

The process of permanent, and accelerated increase of supervising all the human activities at sea results in growing dependence of ship's navigation process upon the more and more coastal supervising systems.

5 INCREASE AND DIFFERENTIATION OF HUMAN ACTIVITIES AT SEA

In the not distant past all human activities at sea could have been considered as navigational activities, called also as the standard activities. The main objective of these activities is safe and efficient transport of goods and people at sea. However now, the non-navigational activities at sea are prevailing. The share of this part of activities is steadily increased, especially, the underwater activities. The not-navigational, i.e. special activities are not related to the sea-transport industry. These activities comprise the sea exploration, sea exploitation, naval warfare and different kinds of protection activities, as well as other not transporting activities.

The precondition of realization of any kind of human activity at sea is ensuring the navigational safety. This kind of safety, i.e. state of being safe from the collisions, groundings as well as damages and losses resulting from the very unfavorable weather conditions, and terrorist activities, is being achieved by:

a) creating, maintaining and operating the Ship's Navigation Safety System. This system must provide all users of sea with the standard navigational information, i.e. information which meet the requirements imposed by the International Convention for "Safety of Life at Sea (SOLAS 74) and other relevant international requirements [Kopacz Z., Morgaś W. and Urbański J., 2001 and 2002],
b) performing the ship's navigation process in conformity with the requirements established by the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW 78/95) called the standard ship's navigation process.

The realization of special, i.e. non-navigational kinds of human activities, at sea, besides ensuring the navigational safety, demands also, additionally, ensuring the possibilities of realization of these activities as well as sufficient affectivity of the realization process. For the realization of the above requirements there is needed:

a) additional special navigational information, proper for each kind of realized activities,
b) adapting the standard ships' navigation process to realization of special, i.e. non-navigational ship's tasks.

The special navigational information is being achieved from the dedicated special information sources (Hydrographic Offices, etc.) and from the own, i.e. organic sources (Additional Military Layers for ECDIS-N systems, specialized hydroacoustic sensors, etc.).

Adaptation of the standard ship's navigation process to realization of special human activities at sea, i.e. to special ship's tasks, comprises, mainly, planning the necessary ship's handlings and maneuverings while realization of special ship's tasks, as well as ways of their realization (e.g. maneuverings and handlings while mine laying, mine fighting, etc).

In Figure 2, there is shown the ship's navigation process while realization of special activities at sea.

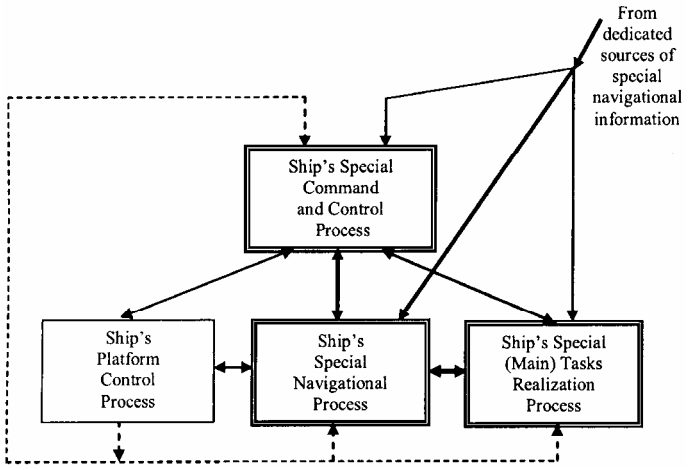

Fig. 2. Ship's navigation process adapted to realization of special ship's tasks

The above considerations and statesment allow to conclude the following:

a) ship's navigation process of majority of ships, vehicles and craft, i.e. of ships realizing the special, i.e. non-navigational activities, must ensure not only the safe and efficient conduct them at sea but also the possibility and high efficiency of realization of non-navigational ships tasks,
b) the above allow to conclude that there have come into being two kinds of ship's navigation process, i.e. the standard ship's navigation process performed by ships realizing the standard, i.e. navigational activities (activities related to transport at sea), and special ship's navigation process that contains also in itself the standard ship's navigation process, and that is performed by the ships realizing the non-navigational activities (tasks) at sea,
c) maritime navigation, but more precisely, more and more navigational procedures are becoming the integral part of special human activities performed at sea.

6 MAIN RESULTS OF CHANGES IN MARITIME NAVIGATION

The above considerations allow to draw the following conclusions:

a) the ship's navigation process is being transformed stepwise into the ship's operation process,
b) the fast growing amount and kinds of special, i.e. non-navigational, human activities at sea resulted in coming into being the special ship's navigation process. This process must not only realize the tasks of standard ship's navigation process, i.e. ensuring the safe and efficient conduct the ships at sea, but special ship's navigation process must also ensure the possibility of realization of ships special tasks as well as sufficient efficiency of their realization,
c) the procedures of maritime navigation in greater and greater degree are becoming the integral part of all non-navigational human activities performed at sea,
d) the growing necessity of supervising all the human activities realized at sea results in growing dependency of the ship's navigation process upon more and more coastal supervising and navigation assistance systems,
e) despite the huge scientific and technological progress implemented into maritime navigation, the ship's navigation process did not become neither simpler nor easier. The reasons are the following:
   - the amount of dangers and threats at sea do not decrease. It is contrary. The amount and kinds of dangers and threats at sea including the terrorist threats, are steadily increasing,
   - the ship's navigation process in more and more degree is being depended upon coastal supervising and navigation assistance systems whose amount steadily increases,
   - integration of ship's navigation process results in situation that ship's navigation process in greater and greater degree includes also the ship's operation activities that before belonged to the other ship's processes, e.g. to the

ship's platform control process and others (cf. Figure 1.),

f) because the navigational safety is not only the main component of the maritime safety and security being necessary for realization of all human activities at sea, but it is also the precondition of realization of each kind of these activities, maritime navigation is becoming the science that in greater and greater degree integrates all the other maritime sciences in effort to ensure the sufficient level of maritime safety and security for realization of human activities at sea,

g) because the satellite positioning system constitute the very important element of navigational infrastructure not only of maritime navigation but also of all the other kinds of navigation, i.e. air, land and space navigation, and because of wide applying the informatics' achievement in all kinds of navigation, e.g. geographic information systems (GIS), voyage management systems (VMS) and other similar systems, the differences between the different kinds of navigation are steadily disappearing. However, it seems that the differences between different kinds of navigation, resulted from the different kinds of geographical environment and, therefore, from different navigational and operational features of vessels, vehicles and craft, as well as different kinds of human activities performed in these environments, will not disappear in the foreseeable future.

7 CONCLUSIONS

In this paper, the most important reasons and results of changes in maritime navigation have been presented and discussed. The authors' belief is that their attempt to show these reasons and results may be interested and useful mainly for these who are interested how the maritime navigation may develop and change in the nearest future. This paper constitutes also an attempt to identify and specify the most important reasons and results of today's changes in maritime navigation.

REFERENCES

Kopacz Z., Morgaś W. and Urbański J., (2001). The Maritime Safety System; Its components and elements. *The Journal of Navigation,* **2**, 199-211.

Kopacz Z., Morgaś W. and Urbański J., (2001). The specification of the ship's navigation process. *Annual of Navigation,* **3**, 91-109.

Kopacz Z., Morgaś W. and Urbański J (2002). The maritime navigation; Its environment and its safety system. *Annual of Navigation,* **4**, 45-57.

Kopacz Z., Morgaś W. and Urbański, J (2002). Identification and specification of the Maritime Safety System. Archives of Transport, **14**, issue 3, 43-69.

Kopacz, Z., Morgaś, W. and UrbaŃski, J. (2003). The ship's navigation function, ship's navigation process and ship's navigational information. *The Journal of Navigation,* **1**, 101-109.

Kopacz, Z., Morgaś, W. and Urbański, J. (2003). Navigational infrastructure, its state, its establishing and its changes. *Annual of navigation,* **6,** 49-64.

Kopacz, Z., Morgaś, W. and Urbański, J. (2004). Navigation: the profession, the branch of study and field of applied science. *European Journal of Navigation,* **1**, 6-9.

Kopacz Z., Morgaś W. and Urbański J., (2004). The changes in navigation and competences of navigators. *The Journal of Navigation,* **1**, 73-83.

Kopacz Z., Morgaś W. and Urbański J., (2004). Information of maritime navigation, its kinds, components and users. *European Journal of Navigation,* **3**, 53-60.

Kopacz Z., Morgaś W. and Urbański J., (2004). Maritime navigation environment's information and its providing by the Maritime Safety System. *Annual of Navigation,* **8**, 21-44.

Kopacz Z., Morgaś W. and Urbański J., (2005). The substance of today's maritime navigation. *European Journal of Navigation,* **1**, 64-72.