TRANSNAV the International Journal on Marine Navigation and Safety of Sea Transportation
http://www.transnav.eu
Volume 14
Number 3
September 2020
DOI: 10.12716/1001.14.03.03

# The Need to Update the Navigation Curriculum as a Consequence of Adoption the e-Navigation Model

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ABSTRACT: Nowadays the World Transporting System are closely interrelated with the use of integrated navigation model. There is an important need for development and implementation of the new e-navigation system to meet the requirements for increasing level of safety and environment protection, efficient navigation and control of ship's track in all phases of the passage.

## 1 INTRODUCTION

Nowadays the World Transporting System are closely interrelated with the use of integrated navigation model. There is an important need for development and implementation of the new e-navigation system to meet the requirements for increasing level of safety and environment protection, efficient navigation and control of ship's track in all phases of the passage.

## 2 THE PHILOSOPHY OF THE INTEGRATED NAVIGATION MODEL [4]

The current trends in navigation are connected with the computer-based navigation systems. Navigation solution is concerned with the fundamental question of determination coordinates and how much reliance upon all data obtained from the navigation systems must be placed, to keep the ship safety on her track.

A navigator has to ensure safe navigation by avoiding all hazards during the passage between two selected positions. Due to dense traffic in constraint waters the requirements for higher margin of safety in navigation has increased.

The existing navigational model of conducting the ship is based on processing of information flow on the navigation bridge and in consequence continuously decision making due to find right control vector (course and speed) free from risk. Thus, there is a sense of use Integrated Navigation System in processing navigational and positional data on the bridges of large ships.

Moreover, there is a great need to use a global navigation high accuracy system that can guarantee a very rapid production of navigational position information in connection with analysis, based on filtering methods. In addition, correlation of propagation model of information could be forecasted in this decision making navigation model.

Introduction of filtering methods to navigation has given some advantages as:
- It can easily cope with different intermittent data.
- The different sensors are independently modelled.
- Real time algorithm is provided.
- Possible working in different coordinates systems.

There is a need for educating the navigators into a correct appraisal of visual display and use new method of presenting information.

The visual display are arranged as graphical display of DR position and fixes, on ECDIS map displays on electronic charts.

Fully automated navigation has not been achieved yet on the bridges of merchant fleet. Integrated navigation technics cannot overlook the human role. A navigator plays still a decisive role and even the most sophisticated technics are the tools in his hands. The training of the navigator in effective use of this tools is the most important aim. An improvement of navigational technics and methods such as errors treatment, increasing reliability and so on, will increase the effectiveness of safe navigation.

Navigation in such cases requires continuous monitoring to avoid navigational dangers. Thus arises requirements to improve smooth interfacing or correlation between collision – avoiding systems and navigational systems. Navigator divides his decision – making tasks between traditional navigation and integrated navigation.

Still there is a trend to stress on the navigating officer that optical guidance is of fundamental importance while approaching congested waters and areas difficult to navigation.

## 3 THE INTEGRATED NAVIGATION IN MONITORING THE SHIP'S PASSAGE [3]

It is recognized that Integrated Navigation System can meet a large variety of navigational requirements, particularly in accuracy of position, coverage and others operational characteristics which leads to elimination of number of radio navigation systems operated on board.

Integrated Navigation besides other benefits, also provide continuous position fixing. Using GPS in the differential mode of operation in conjunction with low cost receivers, could provide the high accuracy of position fixing parameters in the world shipping.

The Satellite System will offer the improvement of the capability which exceeds benefits of many existing ground based electronic navigational aids and systems.

The Satellite System will also provide communication links as well as position reporting systems which could provide exact location of a ship in VTS's. Introduction of the Global Satellite Systems improved the ships operation costs in ocean navigation: reduction of time of sailing, reduction of fuel consumption, reduction of purchasing, maintenance and crew cost.

Integrated Navigation System of a high accuracy, continuously available, will fulfil the operational needs of maritime users. Such system, besides the improvements of operation costs, will also improve the safety at sea and efficiency of marine operations in the following ways:

- More accurate passage planning and execution of the voyage in all phases of the passage.
- Reducing number of electronic position fixing systems on board.
- More accurate course and speed information which improves trackeeping.
- Reducing risk of collisions.
- Reducing of strandings.
- Standardization of shipboard equipment.

## 4 DEVELOPMENT OF THE E-NAVIGATION NEW MODEL

In December 2008 Marine Safety Committee (MSC 85) the International Maritime Organization approved the E-navigation to developed in 2012 an implementation plan.

E-navigation is the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the maritime environment. [5]

### 4.1 *Vision of E-navigation*

A vision of navigation is embedded in the following general expectations for the on board, ashore and communication elements:

- On board. Navigation system that benefit from the integration of own ship sensors, supporting and a comprehensive system for managing guard zones and alerts.
- Ashore. The managements of vessels traffic and related services from shore enhanced through better provisions coordination, and exchange of comprehengive data in formats that will be more easily understand and utilized by shore-based operators in support of vessel safety and efficiency.
- Communication. An infrastructure providing authorized seamless information transfer on board ship, between ships, between ships and shore and between shore authorities and other parties with many related benefits.

### 4.2 *Core objectives of the E-navigation [5]*

The core objectives of the E-navigation concept are to:

- Facilitate safe and secure navigation of vessels having regard to hydrographic, meteorological and navigational information and risk.
- Facilitate vessel traffic observation and management from shore/coastal facilities, where appropriate.
- Facilitate communications, including data exchange, among ship to ship, ship to shore, shore to ship, shore to shore and other users.
- Provide opportunities for improving the efficiency of transport and logistic.
- Support the effective operation of contingency response, and search and rescue services.

- Demonstrate defined levels of accuracy, integrity and continuity appropriate to a safety-critical system.
- Integrate and present information on board and shore through a human-machine interface which maximizes navigational safety benefits and minimizes any risks of confusion or misinterpretation on the part of the users.
- Integrate and present information on board and shore to manage the workload of the users, while also motivating and engaging the user and supporting decision-making.
- Incorporate training and familiarization requirements for the users throughout the development and implementation process.
- Facilitate global coverage, consistent standards and arrangements, and mutual compatibility and interoperability of equipment, system, symbology and operational procedures, so as to avoid potential conflicts between users.
- Support scalability, to facilitate use by all potential maritime users.

### 4.3 *Benefits of E-navigation [5]*

The main benefits of E-navigation are expected to be:
- Improved safety of navigation.
- A reduction in human error.
- Improved coverage of electronic navigation charts.
- Introduction of standardised equipment.
- Enhanced navigation system to improved reliability and integrity.
- Better integration of ship and shore-based system.
- Better protection of the environment.
- Reduce risk of collision and grounding.
- Higher efficiency and reduce costs.
- Global standardisation and type of equipment.
- Automated and standardised reporting procedure.
- Improved bridge efficiency.
- Integration of systems that meets all user requirements.
- Improve human resource management by enhancing the experience and status of the bridge team.

The key strategy elements for E-navigations based on user needs include: Architecture, Human Element, Conventions and Standards, Position fixing, Communication Technology ENCS, Equipment and Standardization and Scalability.

A significant number of ship and shore-based users of E-navigation have been identified. The tables in Appendix 1 provide examples of E-navigation users classified into 20 shipborne users and 34 shore-based users.

The basic idea of the E-navigation solution is to avoid failure and degradation of bridge resource management.

The E-navigation strategy has been developed on shipborne user and shore-based users to avoid system failure. Presented Shore-based systems for distribute information on board the ship will help to avoid system failure in navigation.

The main tool to reducing system failure are in difficult to navigation areas presented in five blocks. [1]

I block

1 Local Port Service
2 Traffic Organization Service
3 VTS Information Service

II block

4 Pilotage Service
5 Tug Service
6 Vessel Shore Reporting

III block

7 Nautical Short Service
8 Nautical Publication Service
9 Maritime Assistance Service

IV block

10 Meteorological Information Service
11 Ice Navigation Service
12 Hydrographical and Environmental Information Service

V block

13 Maritime Safety Information Service
14 Tele-Medical assistance Service
15 Search and Rescue Service.

## 5 SUMMARY

Operational criteria of E-navigation Systems worked out by the IMO Sub-Committee of Safety of Navigation creates new way of analysing the E-navigation Systems and has its influence on methods of teaching the navigation subject. An Appendix 1 provide examples of E-navigation users.

Moreover, through the adoption of the E-navigation model there is an obligation to up-dating the syllabuses by every Maritime Training Institution to meet the requirements of training deck officers. In figure 1 there is given block-scheme. There are three levels of training personnel in scope of the new model.

The first level refers to preparatory courses for officers for examinations to obtain certificates.

The second level is connected with the students training, graduates from Marine Academies.

The last, highest level concerned to the advanced electronic navigation courses or lectures training.

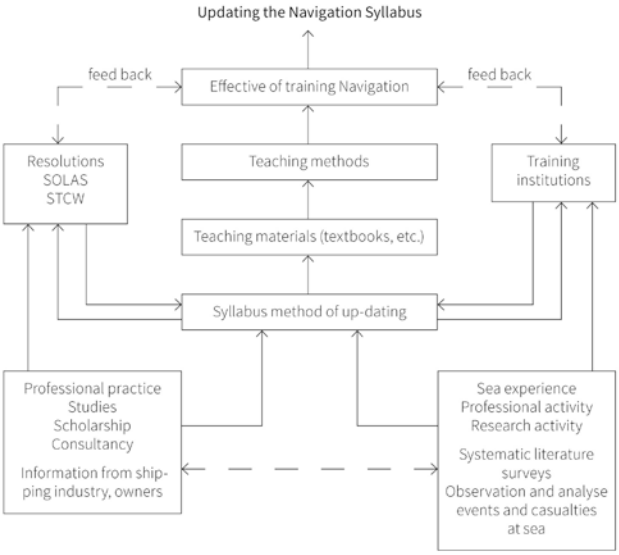


Figure 1. Block-scheme representing up dating the Navigation subject

Every syllabus of navigation must contain the fundamental basic knowledge on the organization of the system currently in use. It is important to know that E-navigation is not a static concept and it will change in times as user requirements and also as technology will develop in the world shipping.

## APPENDIX 1

The tables below provide examples of E-navigation users classified into: shipborne users and shore-based users.

Potential E-navigation users

1 Shipborne users

- Generic SOLAS ships
- Commercial tourism craft
- High-speed craft
- Mobile VTS assets
- Pilot vessels
- Coastguard vessels
- SAR vessels
- Law enforcement vessels (police, customs, border control, immigration, fisheries inspection)
- Nautical assistance vessels (tugs, salvage vessels, tenders, fire fighting, etc.)
- Counter pollution vessels
- Military vessels
- Fishing vessels
- Leisure craft
- Ferries
- Dredgers
- AtoN service vessels
- Ice patrol/breakers
- Offshore energy vessels (rigs, supply vessels, lay barges, survey vessels, construction vessels, cable layers, guard ships, production storage vessels)
- Hydrographic survey vessels
- Oceanographic research vessels\

2 Shore-based users

- Ship owners and operators, safety managers
- VTM organizations
- VTS centres
- Pilot organizations
- Coastguard organizations
- Law enforcement organizations
- National administrations
- Coastal administrations
- Port authorities
- Security organizations
- Port State control authorities
- Incident managers
- Counter pollution organizations
- Military organizations
- Fairway maintenance organizations
- AtoN organizations
- Meteorological organizations
- Hydrographic Offices/Agencies
- Ship owners and operators, logistic managers
- News organizations
- Coastal managements authorities
- Marine accident investigators
- Health and safety organizations
- Insurance and financial organizations
- National, regional and local governments and administration
- Port authorities (strategic)
- Ministries
- Marine environment managers
- Fisheries management
- Tourism agencies (logistic)
- Energy providers
- Ocean research institutes
- Training organizations
- Equipment and system manufacturers and maintainers

## BIBLIOGRAPHY

[1] Baldauf M. et al., Improving and Assessing the Impact of e-Navigation application, https://www.sciencedirect.com.
[2] IMO adepts e-navigation, Seaways, February 2009/14.
[3] Jurdziński M., Changing the Model of Maritime Navigation, The TransNav, The International Journal on Marine Navigation and Safety of Sea Transportation Vol. 12, Number 1, March 2018.
[4] Jurdziński M., Nawigacja Morska, AM Gdynia 2014.
[5] MSC 85/26/Add. 1. Annex 20..