Impact of E-Navigation on ECDIS Development as a Decision Support System

Utjecaj E-navigacije na razvoj ECDIS-a kao sustava podrške odlučivanja

Miroslav Bistrović
University of Rijeka
Faculty of Maritime Studies, Rijeka
e-mail: mbistrov@hi.t-com.hr

Domagoj Komorčec
University of Rijeka
Faculty of Maritime Studies, Rijeka
e-mail: domagoj.komorcec@uljanik.hr

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Summary

Density of sea traffic and an increasing number of ships requires the application of new technologies in vessel traffic monitoring in order to find new solutions for existing problems. The solution is identified through application of e-navigation concept by connecting maritime institutions on shore with ships and vessels for better information sharing and integration. The implementation of e-navigation requires adaptation of existing navigation and communication systems to this new concept. The aim of this paper is to present the ECDIS development possibility through requirements of e-navigation, based on end-user needs. Given the large number of devices and systems used in navigation, ECDIS adaptation to e-navigation requirements makes sense only through a thorough understanding of user's needs. By integrating all available information, organizing them into a database, and presenting them in a specific fashion, a suitable platform for decision-making in everyday ship navigation is created. Since the application of ECDIS onboard has become obligatory and ship's primary navigational device, the adaptation to e -navigation requirements would mean also becoming a central decision support system onboard.

KEY WORDS
ECDIS
e-navigation
safety at sea

Sažetak

Gustoća prometa na moru i povećanje broja brodova zahtijeva primjenu novih tehnologija u nadzoru plovidbe brodova kako bi se pronašla nova rješenja za postojeće probleme. Rješenje je prepoznato kroz primjenu koncepta e-navigacije povezujući pomorske institucije na kopnu s brodovima i plovnim objektima u svrhu bolje integracije i razmjene informacija. Primjena e-navigacije kao preduvjet traži prilagodbu postojećih navigacijsko-komunikacijskih sustava ovom novom konceptu. Cilj ovog rada je prikazati mogućnost razvoja ECDIS-a kroz prilagodbu sustava zahtjevima e-navigacije temeljenih na korisničkim potrebama. S obzirom na veliki broj uređaja i sustava kojima se koristi u navigaciji, prilagodba ECDIS-a zahtjevima e-navigacije ima smisla jedino kroz potpuno razumijevanje korisničkih potreba. Integriranjem dostupnih informacija, njihovom organizacijom u baze podataka i prezentacijom informacija na određeni način stvorila se pogodna platforma za donošenje odluka u svakodnevnoj brodskoj navigaciji. Kako je ECDIS obveznim uvođenjem u uporabu postao primarni navigacijski uređaj na brodu, prilagodbom zahtjevima e-navigacije postao bi i središnji sustav za podršku odlučivanju u navigaciji broda.

KLJUČNE RIJEČI
ECDIS
e-navigacija
sigurnost plovidbe

INTRODUCTION / *Uvod*

Although ECDIS has existed on the market for many years and has been accepted by both ship owners and end users-seafarers, thru mandatory introduction by the IMO, it has become the primary navigational system on board. The system itself is designed as a device that integrates a variety of navigation data and presents them as useful information on electronic map ENC. The emergence of system with such complexity and a wide range of possibilities, while keeping all other navigation devices and systems on board, has contributed to the greater safety of navigation, better control of ship navigation and easier voyage berth to berth planning. E-navigation definition by IMO can be summarized as: "harmonized collection,

integration, exchange, presentation and analysis of maritime information onboard and ashore using electronic technology with the aim of improving the navigation of the ship berth to berth and support services for safety at sea and protection of marine environment". Such formation of definition suggests that in addition to administrative bodies, commercial and governmental institutions, the core of e-navigation consists of electronic and information technology which provides the ability to manage information. Out of the development of E-navigation and a request for a higher degree of integration and an exchange of information, there emerges a need for ECDIS system adaption to the concept of e-navigation. For this reason, it is necessary to analyze the needs and requirements which should be fulfilled for ECDIS to be successfully applied as a central part of e-navigation concept on board. If thru rejection of the paper charts and the introduction of e-navigation attention of bridge officer is directed to ECDIS, it is necessary to revise the architectural and organizational structure of ECDIS and to adapt the system to new applications and user needs.

With a brief legislation review, we will concentrate on the technological segment of e-navigation and its interrelationship with the ECDIS system from which a suitable platform for decision support system is created. A new system architecture model is proposed in which ECDIS system is more centralized, thus emphasizing its role in navigation even more. But at the same time, the system will be more user-oriented allowing it the configuration i.e. system set up according to the needs and desires. Specific functions, presentations of information and ways of managing information need to be standardized, which would facilitate user transition from one type of equipment to another or from a vessel to a vessel.

It should be noted that although a large number of entities within e-navigation concept performs various tasks, they all share the information related to the safety of navigation. The information exchanged may relate to the ship itself and its status, conditions at sea, administrative notices, weather reports and so on. By creating a database and selecting the appropriate presentation model, timely and reliable information in ship-maritime environment becomes the basis for proper decision-making in navigation and maritime traffic and transport management. The consequence of such an approach to the management and control of maritime traffic is reflected in an increased safety and reduced human errors, caused by wrong judgment. The management of information received from ship's sensors and from communication with other ships and administration on shore, assumes the existence of a central user interface that should be developed from ECDIS system.

USER NEEDS AND REQUIREMENTS APPLICABLE TO ECDIS SYSTEM DERIVED FROM E-NAVIGATION CONCEPT / *Potrebe korisnika i zahtjevi koji se primijenjuju na ECDIS sustav koji proizlazi iz pojma e-navigacije*

For a successful e-navigation implementation, it is necessary to establish basic technological concepts which will be the foundation of practical e-navigation implementation. According to the research[1] conducted by Polish Maritime Academy, Gdynia, Maritime University Gdynia and Maritime University Szczecin, basic e-navigation elements as a basis for further system development should be:

- ENC charts – for a successful application, it is necessary to achieve 100% coverage of the whole globe
- Robust EPFS (Electronic Positioning Fixing System) – under the electronic system for determining position, a terrestrial hyperbolic navigation system (Loran C) as an auxiliary system and satellite navigation systems like GPS, GLONASS or Galileo as the main source of data on the position should be considered
- Communication infrastructure for communication between shore and ships should be established

Although this division includes the proposed core of e-navigation, for complete functionality of e-navigation concept in all desired domains, it is necessary to add the following segments:

- AIS – as a basic system used for vessel identification and vessel track and information monitoring
- ARPA Radar – basic system for object detection and collision avoidance

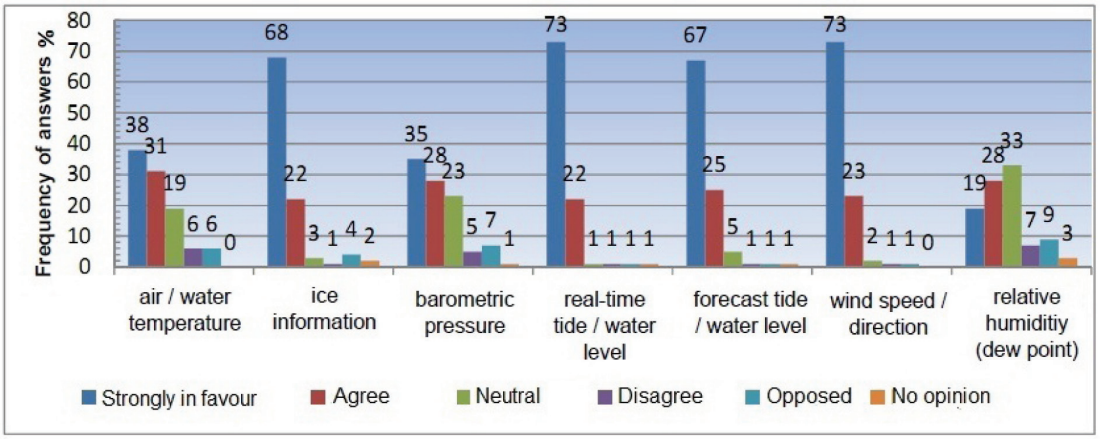
In this division, it is important to notice the need for inclusion of mentioned elements and their integration into a logical whole. As a logical solution, ECDIS system has been imposed, by which ENC charts have been already successfully integrated with satellite positioning system GNSS, ARPA radar and AIS system. The system further allows the integration of various types of navigation equipment. In the context of ECDIS systems, EPFS has been observed, just as GNSS sensor that forwards the ship's position information to the system where this information is used to show the ship to the ENC chart, together with other available information.

What should be pointed out as potentially problematic segment of e-navigation are ENC charts that do not yet have 100% global coverage, but a possibly greater disadvantage is deficiency of existing S-57 hydrographic standard (currently used for data presentation on nautical ENC charts) for application in e -navigation. Given that the main principle of e-navigation is information integration and exchange, the S-57 standard does not meet all the requirements that needs to be achieved by the introduction of e-navigation, that is this deficiency is mainly incapability of proper support for S-57 charts and MIO (Marine Information Overlay) information. For better compatibility and meeting the needs of e-navigation concept for ENC charts, IHO has developed a new standard S-100 as a universal hydrographic data model, which will allow usage of images from the charts, classification of seabed, high density bathymetry, 3D data, dynamical ECDIS, online update etc.

USER NEEDS DETERMINATION FOR E-NAVIGATION IMPLEMENTATION / *Određivanje potreba korisnika za implementaciju e-navigacije*

Canadian Coast Guard [2] has conducted a research for determining user requirements and needs for implementation of e-navigation by means of questionnaire in which participating mariners (65%) and land users and support (35%) expressed their opinions. Questionnaire was prepared in accordance with the template developed by IMO for international research in the field of e-navigation in three main categories: maritime communications, user interface and technical / operational improvements.

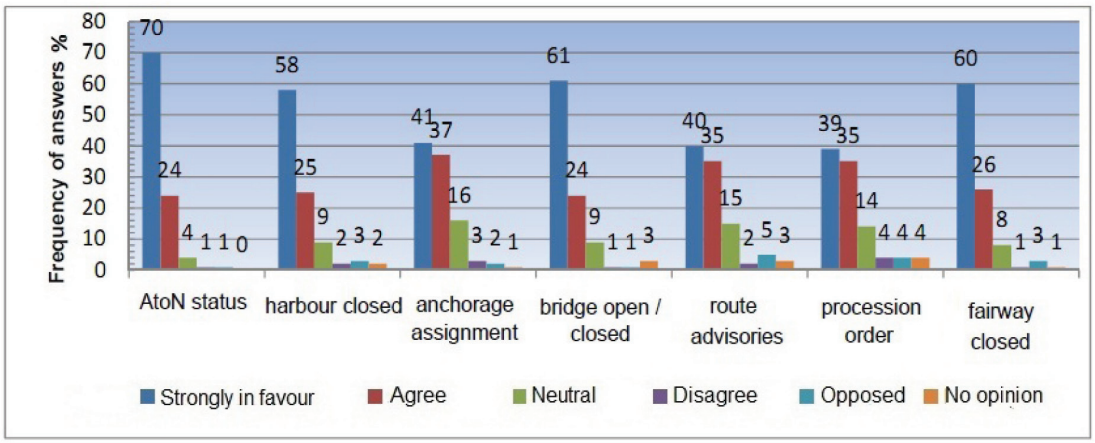
Chart 1 Results of the questionnaire about the importance of meteorological and hydrological information
Karta 1. Rezultati upitnika o važnosti metoroloških i hidroloških informacija



Source: Findings of Canadian E–Navigation User Needs Survey, May–October 2009

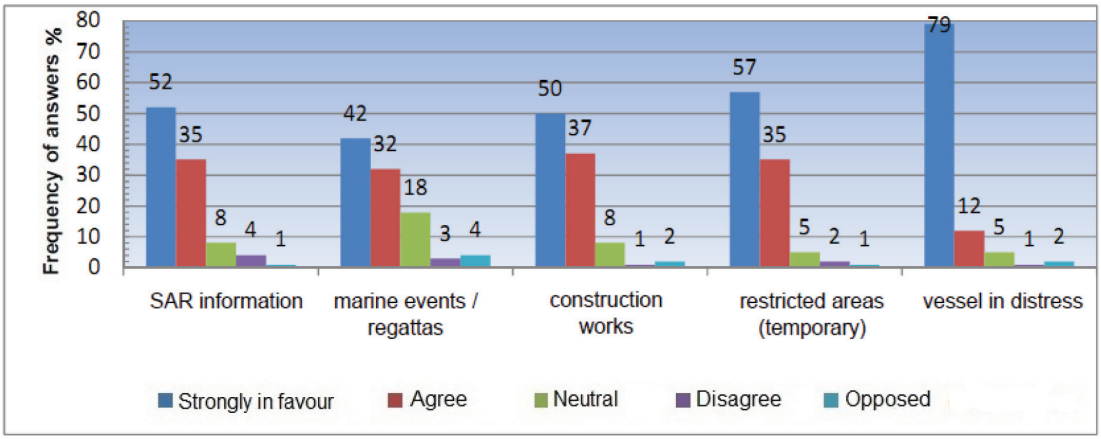
In this paper, we will concentrate not as much on maritime communications because ECDIS is the only system, as a central system for presentation of different information that can meet user needs and requirements for e-navigation through the integration of all such information. Information relating to meteorological phenomena and sea conditions are highlighted as particularly important by participants, especially if these information are displayed in real time. Information about the status of ports, waterways, moorings, anchorages, bridges, routes, etc. are considered important for a safe navigation, as well as information relating to the situation in specified maritime zones or areas, and SAR information. Availability and accessibility of this information provides excellent support for real time decision making, thus increasing the safety of vessels navigation while at the same time reducing a human error. If practical application of these requirements in ECDIS system is

Chart 2 Results of the questionnaire about the importance of traffic information
Karta 2. Rezultati upitnika o važnosti informacije o prometu



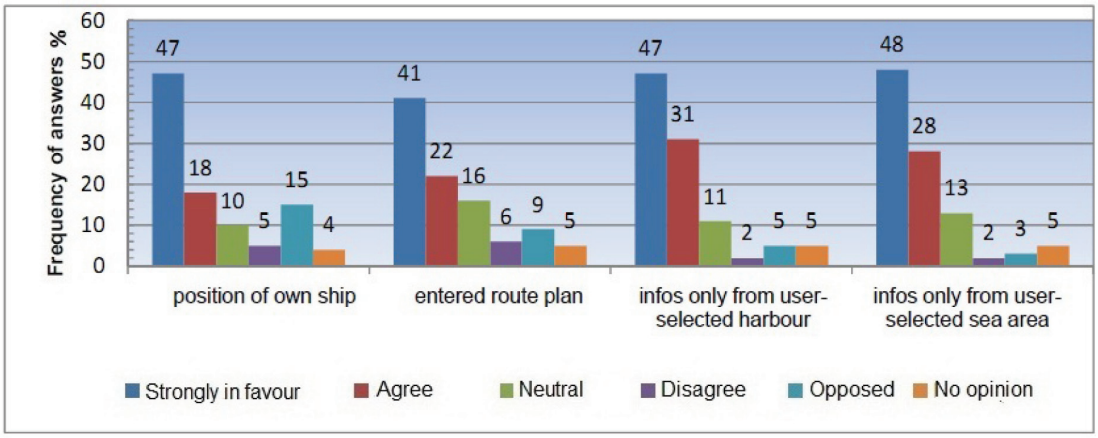
Source: Findings of Canadian E–Navigation User Needs Survey, May–October 2009

Chart 3 Results of the questionnaire about the importance of information about the area / zone
Karta 3. Rezultati upitnika o važnosti informacija o prostoru / zoni



Source: Findings of Canadian E–Navigation User Needs Survey, May–October 2009

Chart 4 Results of the questionnaire about the importance of filtering information
Karta 4. Rezultati upitnika o važnosti filtriranja informacija



Source: Findings of Canadian E–Navigation User Needs Survey, May–October 2009

achieved on a logical, unambiguous and user friendly way, the improvements related to the safety of navigation, better control over ship's navigation planning and right decision making in an emergency situation will be significantly increased.

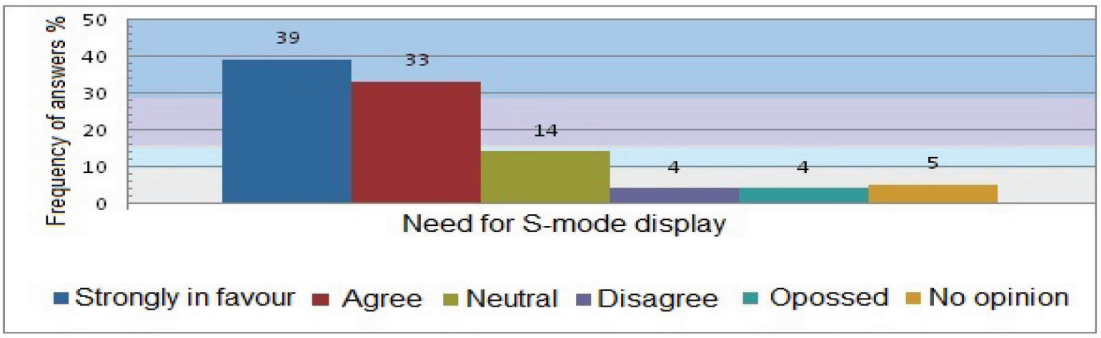
Such a large amount of information also includes additional burden for deck officers on the bridge with information which are, for him in a given time, not so important. For this reason, particular attention should be paid to designing optimal model for using available information through the possibility of selection and prioritization of important information over less important. Research also has shown that information which users consider particularly important are subject to frequent changes, meaning that they have a dynamic characteristic which highlights the importance of time factor for information availability. If all information are constantly available in the system, then the officer on the bridge could decide for him what information are needed in a particular situation and could respond appropriately. The selection of required information would be conducted by means of additional presentation layers on ECDIS system which would represent different types of navigational data in real time. Also there is a clear need for simple data filtering switching off and restoring the system to standard navigational mode of operation.

NEED FOR S-MODE DISPLAY INTRODUCTION / *Potrebe za uvođenjem S-Mode ekrana*

S–Mode display [2] is highlighted by the participants, as particularly interesting segment of the system, but here are also evident the biggest problems which need to be solved in future. Emphasis on the design of minimal function of S-Mode display needs definitely to be put on the needs and requirements of end users, that is those users who will be using it in their daily work and have most benefit from the system. The obvious problem that arises is standardization of S–Mode display and logical definition of minimum functions and information that should be displayed on the screen, in order for it to fulfill its primary purpose. Definitely, the trap should be avoided to load S-Mode display with too many different information without taking into account the real needs of deck officers on the vessel. Also the minimum information that should be presented on display must meet the sufficient conditions for a safe navigation of ship and create basis for making right decisions in navigation. Every deck officer will not consider all available information to be of same priority that is, what may be very important piece of information to one person, another one can consider it to be of secondary priority. Participants also noted that the introduction of S-Mode screen can lead to a reduction in the quality of deck officers training for relying too much on a simplified form of information presentation. Defining the minimum amount of needed information in the S-Mode display can lead to the restriction of further development and application of new technologies, which should be also taken into consideration. For this reason, planning and developing S-Mode display should be done with extra attention.

What has been pointed out as a positive aspect of the introduction of S-Mode display certainly is introduction

Chart 5 Results of the questionnaire for need of S-Mode Display
Karta 5. Rezultati upitnika za upotrebu S-Mode ekrana



Source: Findings of Canadian E–Navigation User Needs Survey, May–October 2009

of a certain standardization which will be helpful in vessel navigation and vessel traffic control and surveillance. Also development of S-mode display will be a good starting point for training in e-navigation concept and its further development and application, facilitating easier transfer between equipment from different manufacturer.

INFORMATION TYPES WITHIN E-NAVIGATION / *Tipovi informacija unutar e-navigacije*

Information access, availability and timeliness are the basic parameters of e-navigation concept. Such approach to system organization gives priority to end users' requirements, taking into account their real needs in correlation to a presumed need. According to the characteristics and data source circulating within the system information can be divided into:

- Ship's sensor information – speed, course, position, wind, depth, ROT, rudder angle indication…
- VTS traffic information – traffic density, traffic corridors, SAR information, port information, route exchange, AtoN status, logistic information
- Weather and atmospheric information – weather reports, current reports, ice reports, wind reports, tide and waves reports
- Collision and grounding avoidance information – ARPA objects, AIS information, optimal route display, vessel characteristics, protected zones and areas, archeological sites

Each piece of information by itself represent s only one of the variables whose practical value will be shown only through integration with other external or internal information. All this integrated information will form a set of mutually dependent and time-variable data which will allow new possibilities of presentation and use of relevant information for the purposes of navigating the ship and communicating with other subjects within the concept of e-navigation.

STANDARDS AND ARCHITECTURE OF ECDIS SYSTEM / *Standardi i građa ECDIS sustava*

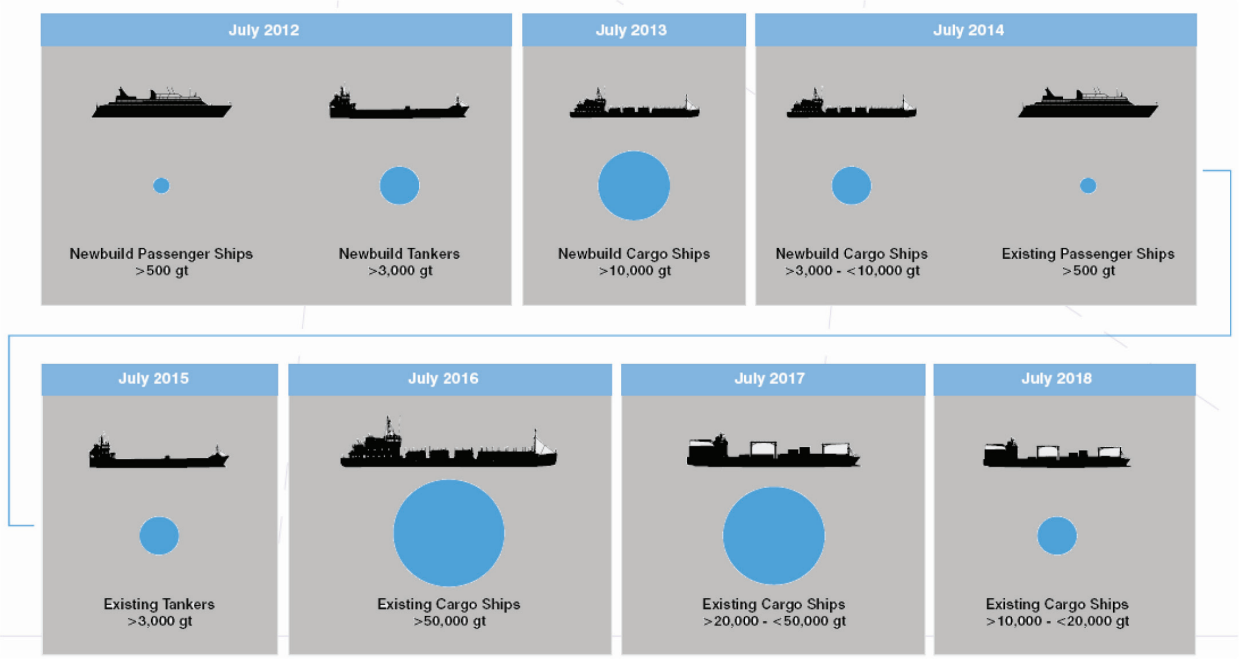
STANDARDS FOR ECDIS TRAINING AND TECHNICAL HARDWARE / *Standardi za ECDS obuku i tehnička podrška*

According to SOLAS convention, all passenger and merchant ships in international voyages under the proposed schedule will need to have ECDIS system installed, rule for passenger ships is valid from 1 July 2014, while all cargo ships need to have ECDIS installed as soon from 1 July 2018.

Mandatory dates for ECDIS system implementation - SOLAS Amendment MSC 282 (86), [16]:

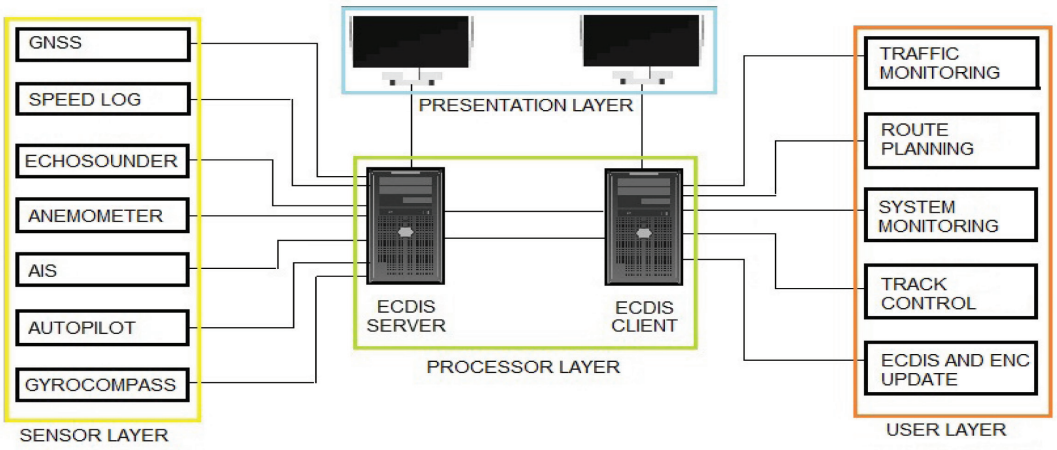
1. July 2012: All new passenger vessels over 500gt and new tankers over 3,000gt
1. July 2013: All new cargo vessels over 10,000gt
1. July 2014: All new cargo vessels over 3,000gt and existing passenger vessels over 500gt
1. July 2015: Existing tankers over 3,000gt
1. July 2016: Existing cargo vessels over 50,000gt
1. July 2017: Existing cargo vessels 20,000gt and under 50,000gt
1. July 2018: Existing cargo vessels 10,000gt and under 20,000gt

Consequently STCW has also issued an instruction, which entered into force on 1 January 2012, which defines the guidelines for the implementation of training related to ECDIS systems. It included and defined the programs curriculum which all deck officers have to master. Upon successful completion of this program, in order to be recognized as an ECDIS trained users officers need to be able to:



Source: http://www.martek-marine.com/ProductsSystems/ECDIS.aspx

Figure 1 ECDIS Implementation Schedule - July 2012 to July 2018
Slika1. ECDIS raspored implementacije-srpanj 2012 do srpnja 2018



Source: Authors / Izvor: Autori

Figure 2 A typical configurations of ECDIS system
Slika 2. Tipična konfiguracija ECDIS sustava

- Use ECDIS for safe navigation,
- Monitor navigational information on ECDIS in a way that contributes to safe navigation
- Use ECDIS and other navigational tools and devices as a decision support in navigation
- Plan and conduct coastal navigation and determine ship's position

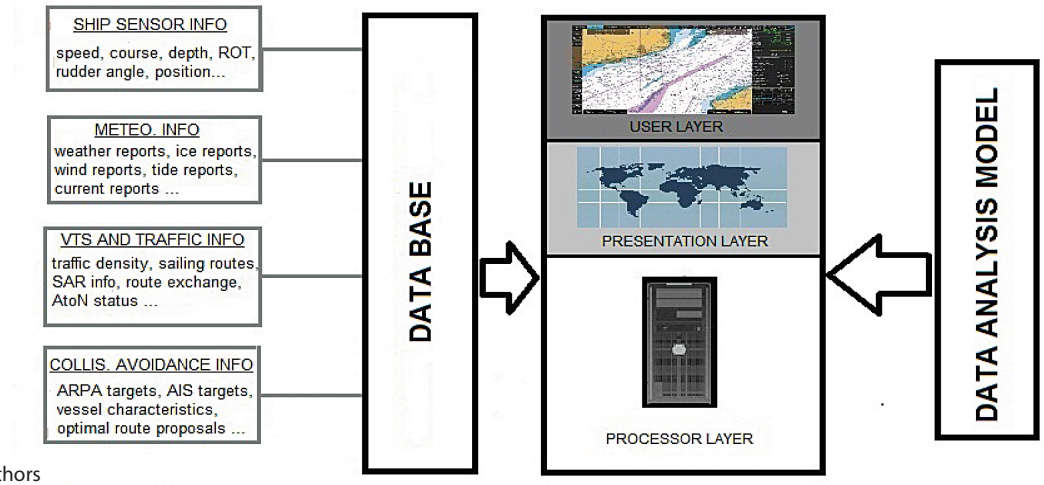
By means of this instruction, there has been defined necessary skills and competencies that deck officers must receive during their ECDIS training and skill demonstration upon finishing required curriculum and criteria for performance evaluation of participants. This standardization of training is important in terms of balancing education requirements for deck officers at the international level. Training is carried out through two modules of which the first is general overview in which participants learn about the ECDIS technology through theoretical and practical training, while the second part considers the type of training for specific equipment and is carried out on the same equipment that officers will use on their ships. IMO also regulates minimum requirements that ECDIS systems must satisfy in order to be approved by the IMO through its IMO resolution MSC.232 (82) applying for systems installed after January 1. 2009. This are requirements as follows:

- Possibility of ENC usage in standard S-57 format (with transition to newer S-100 format)
- Charts presentation to color and symbols specifications format S–52
- Support for basic navigational functions (VRM, EBL, route planning, route monitoring)
- Support for information received from other navigational systems and devices
- Alarm management and generation facilities with warning and malfunction visual indication
- Separate power supply
- Back up support

Although the program and learning outcomes for deck officers ECDIS training are well known as its technical characteristics are defined and known, because of different systems manufacturers training should always be accompanied by specific training that relates to a particular equipment or individual equipment manufacturers.

ECDIS AND E-NAVIGATION AS A DECISION SUPPORT SYSTEM / *ECDIS i e-navigacija kao sustav podrške odlučivanju*

Although ECDIS is a powerful navigation system with its complex software and slightly less complex hardware in typical configuration it is always integrated with other navigation



Source: Authors

Figure 3 ECDIS system model as a decision support system
Slika 3. ECDIS model sustava kao sustav podrške odlučivanju

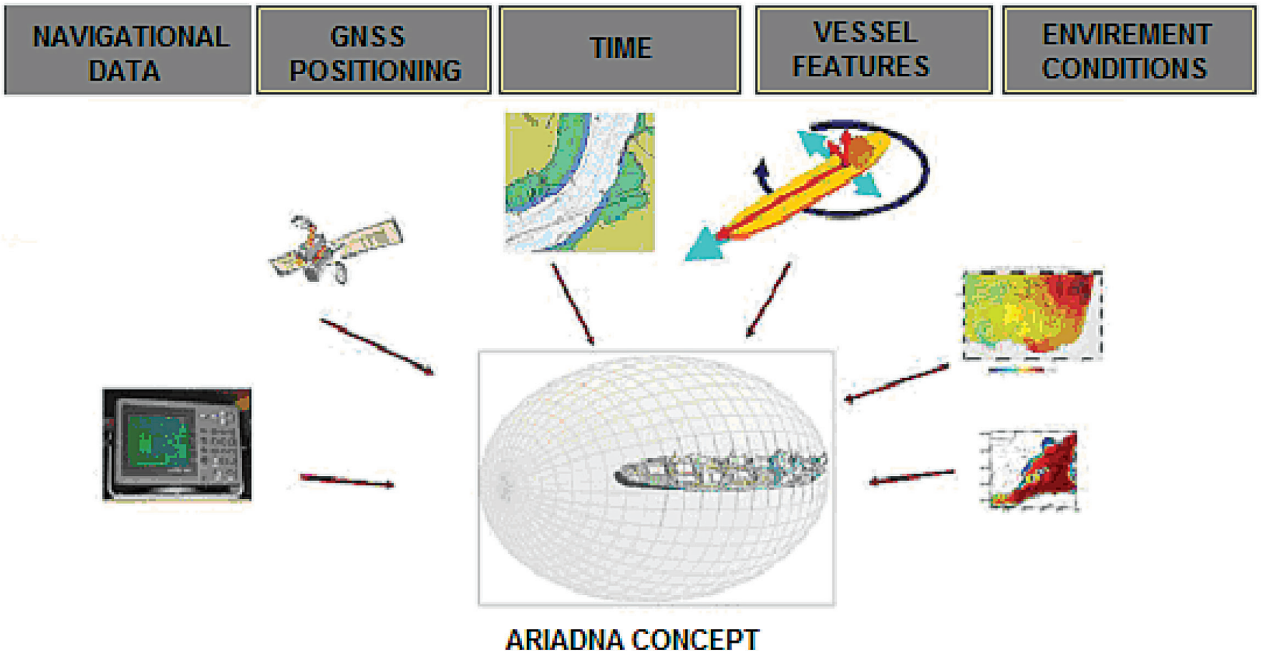
systems and devices on bridge. The usual configuration of ECDIS systems on newer ships consists of the main and auxiliary processor module (Figure 1), input from ship's sensors, software support, ENC charts and display screen for collected and presented information (and UPS as an uninterruptible power supply for the entire system).

Processor layer usually consists of computer adapted for marine usage, which serves as a storage location for ENC charts, and using input - output module receives information from the ship's sensors and presents them on display screen. Both processing modules can independently perform complete function of ECDIS system in case of failure of either one of them. In case of simultaneous operation together, they operate on server - client basis and at any given time the status of server processing module can be switched from one module to another processing module. The part of the sensor layer can be any navigation device or system such as GNSS, echo sounder, anemometer, AIS, speed log etc, which provides information on different parameters or for example autopilot, which in this case acts as an actuator.

All these data coming from the ship's sensors are processed in the processing module. They primarily serve as a source of useful information giving thus a significant contribution to the safety of navigation. But the whole system should be seen as a tool that is subject to certain deviations and errors which can have different characteristics, and therefore must not be ignored, since correct decision making process depends on its reliability.

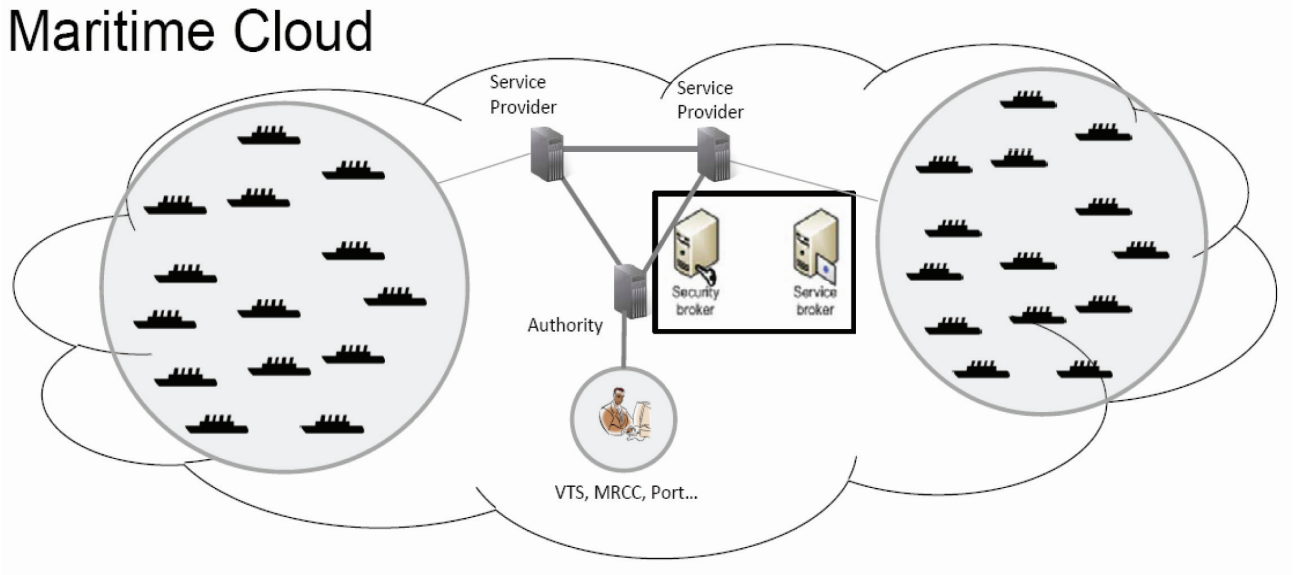
If we take into account the available information that system provides, and interacts with it in the right way, then it is possible to use ECDIS as a decision support system in all phases of ship voyage, starting from basic reading of available information, up to the automatic track control of ship on any given route. The basic principles of e-navigation are sharing, analysing, collecting and storing of data and we can say that the information and the possibilities of its use are the key to a successful application of e-navigation in practice. The combination of various data obtained from several mutually independent sources, selecting and implementing appropriate model that is algorithm, and presentation power can make ECDIS system suitable for decision support making. Each decision support system consists of certain data organized into a database, a suitable description model for data analysis using data from database and user interface which helps the user to monitor and control system. This organizational structure creates excellent base for decision making in any probable situation. From the perspective of maritime environment, ships decision support systems model can be presented as in Figure 2. that is a model which uses ECDIS resources to perform desired functions.

In addition to the data from ship's environment (primarily information from ship's sensors) ECDIS in his databases uses also static data, which from time aspect is not an optimal solution. Taking into account the time as an important factor that affects the whole range of different parameters, from an external environment of a ship, a possibility appears to create real-time information that will provide a significant impact on deck officers operations in navigation. A large quantity of data acquired by the system will not only serve as mere data accumulation, but the aim is to integrate all available data in meaningful real time information which will be the basis for taking appropriate action in different navigational situations. By gathering all available information in the ship's environment, available from external and internal sources, integrating them into database and new types of useful data, analysis and presentation of these data as new useful information opens the possibility for creation of decision support systems based on e-navigation concept. This approach seeks to provide mariner with quality information, instead of piling up a whole range of data which is sometimes of secondary importance, in order to make proper reaction in potentially dangerous situations.



Source: www.ariadna-fp7.eu

Figure 4 Concept of Ariadna system
Slika 4. Koncept sustava Ariadna



Source: http://www.sjofartsverket.se/en/MonaLisa/MONALISA-20/

Figure 5 Maritime cloud data distribution

Slika 5. Raspored podataka pomorskog oblaka

An example of such management method of navigational information has already been successfully implemented in project "Maritime Volumetric Navigation System - ARIADNA". It is a system that uses navigation data, GNSS data, characteristics of the vessel, sea conditions, meteorological data, volume data and integrates all of these information with the "fourth dimension" in this case time. Although primarily designed as a system for inland navigation, it can be used anywhere where the density of traffic is high and there is a potential high risk of collision. Using this data and placing them in an appropriate analytical model, the system calculates volumetric envelope of the vessel which is represented as a 3D safety zone in real time. Vessels dimensional layer changes depending on variations in vessels speed and position, current depth of the sea, weather conditions, tides, currents, waves, traffic density, parameters of other vessels and current navigational situation at sea. Layer provides enough space and enough time to take an appropriate action for object avoidance at sea as well ashore, and given that the vessel's volume varies in response to external and internal changes in current parameters of the vessel and changes in vessels environment, the system provides an excellent ship's maneuverability at all times.

Another good example for E-navigation implementation is MONALISA project which seeks to introduce improvements in information exchange relevant for safe navigation. System is designed as a navigational user interface in which deck officer on watch at the arrival to his shift logs in the system via smartcard. The system identifies officers using a database containing all relevant information about the officer, his qualifications, competences and skills, thus ensuring that the qualifications of the person in charge who operates vessel remains at a high level of proficiency. Deck officer during his shift communicates by satellite or terrestrial link with the coastal services sharing mutual information relating mainly to the selection of optimal routes for the safe navigation of the vessel and any other relevant information that can benefit to the mariner in his every day navigation.

ECDIS SYSTEM ADAPTATION TO E-NAVIGATION REQUIREMENTS / *ECDIS sustav adaptacije na zahtjeve e-navigacije*

The presentation requires a significant adjustment to E-navigation concept, since it will be a central user interface for data exchange and communication between vessels and shore institutions. ECDIS support presentation of data through three basic data layers (basic, standard and full layer) allows user option to choose different data layers according to users' preferences ranging from the basic to the presentation of all available data and information. The integration of information that the system receives from the external sources includes the creation of additional layers of data, which will be used to access meteorological, situational, navigational and other information, such as information that system receives such as MSI, information from VTS and port authorities, information from logistical support, display of volume zones, 3D presentation and more. Current capabilities which ECDIS supports are needed for advanced features, required to meet the needs of E-navigation. They are limited with S-57 data presentation model. The proposed model to be used for overcoming these limitations is S-100 hydrographic data model, with advanced display capabilities, usage and data exchange.

The use of S-100 data presentation model allows the user to keep all layer functions that exist in classical ECDIS configuration, with the support of the functions that would be serving E-navigation for example:

- Control over integrated navigational system and vessels central alarm system
- Control over vessel traffic and current situation at sea
- Monitoring of navigational, meteorological, and hydrographical sensor information
- Route creating and berth to berth route planning
- Communication with port authorities, logistical support, SAR authorities, other vessels, service providers etc.
- Real time data exchange between users (vessels, coastal institutions etc.)

- Automatic reports generation regarding vessel and vessels systems status
- Online update of ENC charts and other upgradable navigational systems
- Internet access and internet services access

Significant progress needs to be made in terms of linking ECDIS system with internet support and communication with support from coastal institutions and other vessels in the area. Since the need to transmit large data packets in both communication directions must comply with the requirement for the bit rate over 1 Mbps and to cover a range greater than 25nm for a successful use in maritime industry. The obvious advantage of terrestrial communication systems in reference to satellite systems is still the price which is for satellite systems still significantly higher, compared to common terrestrial communication system. In this segment, the integration of ECDIS system with communications systems, either terrestrial or satellite, It is still necessary to conduct further research to find the most acceptable or optimal solutions for communication and information exchange.

One proposed concept emerges from "Maritime Cloud", a type of communication strategy to be used by e-navigation. This strategy [19] will encompass standards, technical infrastructure and governance that facilitate secure interoperable information exchange between all participants in maritime environment thru available communication means. Basic idea is that thru new applications of existing technological solutions a reliable, secure and available means of communications will be provided thus bypassing communication limitations that E-navigation has to solve to be successfully implemented.

CONCLUSION / *Zaključak*

With the mandatory introduction of ECDIS, E-navigation is also being developed as a concept for storage, exchange and integration of information between vessels and shore. Given that information is the main value of e-navigation concept and the basis for making the right decisions in everyday navigation, it is understood that ECDIS will be a central system that would enable such an integration and information sharing. This approach to ECDIS architecture, focuses the attention of deck officers fully on ECDIS as a prime source of navigation data and information onboard vessel allowing offices to make an appropriate action in each situation. Gathered information will be presented in a way to best describe the current situation on vessel surroundings taking into account other subjects with which the vessel is in interaction or has tendency to interact. However, it should be noted that a number of predefined and standardized information must always be visible or easily accessible with one click, bearing in mind that such information is sufficient to give insight into the current situation at sea. The minimum information which deck officer will be loaded with, for now is still a big problem because there is no consensus on what information is crucial and how do declare priority among them. For solving this problem, it is also necessary to keep in mind the specific needs of end users, taking into account the potential situations that may occur during different navigational situations.

Integrating information by using ECDIS which user receives from the support from the mainland, other vessels and those obtained from their ship's sensors into useful information and its presentation, preconditions are created for proper decision making in the daily voyage of the vessel. Such integration of information opens up new possibilities for the use of ECDIS system for example volumetric navigation system is one of the possible ways of using ECDIS as decision support system. Given the fact that the e-navigation concept tries to encompass all users and participants in maritime transport it is easy to reach the conclusion that some standardization would be required and, in addition to the equipment, also in training for users of ECDIS. The adaptation of ECDIS system to the requirements and needs of e-navigation is resulting in a direct impact on the increased maritime traffic safety that will be revealed through the avoidance of maritime accidents, avoidance of vessels strandings, prevention of environmental incidents and ease of information exchange between vessels, SAR services and the support from mainland.

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