IALA GUIDELINE

1096

ANTICIPATED USER e-NAVIGATION REQUIREMENTS FROM BERTH TO BERTH, FOR AtoN AUTHORITIES

Edition 1.0

May 2013

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DOCUMENT REVISION

Revisions to this IALA Document are to be noted in the table prior to the issue of a revised document.

Date	Page / Section Revised	Requirement for Revision

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1. SCOPE AND PURPOSE

The purpose of this document is to provide guidance for AtoN authorities on user requirements and applications of e-Navigation from berth to berth. This document has been written prior to the release of the IMO e-Navigation implementation plan.

e-Navigation is currently defined as: 'the harmonised collection, integration, exchange, presentation and analysis of maritime information onboard and ashore by electronic means to enhance berth to berth navigation and related services, for safety and security at sea and protection of the marine environment'.

e-Navigation is intended to benefit all mariners and associated marine stakeholders. Shipborne carriage requirements and navigational support infrastructure requirements will need to be such as to ensure a consistent international level of service.

User requirements are for simplified navigation and communication support systems and reduce the risk of human error. Information must be reliable, and displayed in a clear and consistent manner. Therefore, visible and aural AtoN will remain an important element of passage planning and implementation.

Systems should be capable of automatically using the most appropriate data available and alert the user to any data integrity issues as they arise. Automated exchange and synchronisation of data can provide the basis for a risk analysis model that will inform and support safe decision making and reduce human error.

The core dataset at the heart of e-Navigation should be controlled by a National Competent Authority. However, the user interface needs to be sufficiently open to encourage innovative applications and commercial competition. Control of user functionality and presentation needs to be balanced against the need to take advantage of rapidly developing technology and user needs.

A key factor of e-Navigation is the human element. Therefore, applications should distinguish between the different levels of user knowledge and experience and present appropriate levels of functionality and assistance to the user.

2. GENERAL REQUIREMENTS

Among other requirements, e-Navigation requires:

- the provision of better integration of ship and shore-based systems with greater standardisation of interfaces;
- enhanced navigation system resilience;
- more standardised and automated reporting facilities;
- automated supporting tools and alert/alarm management;
- improved reliability, better indication of reliability and greater quality assurance;
- improved target detection;
- more effective use of area limits (e.g. guard zones, restricted areas, danger zones);
- reduction of administrative burden;
- better data collection for marine domain awareness and more automated updating of essential information.

Integration and exchange of data between shore and ship can provide a simplified clear shared dataset that will enhance operational understanding and reduce the risk of human error.

A Maritime Service Portfolio (MSP) defines and describes the set of operational and technical services or products and their level of service provided by a National Competent Authority (and other stakeholders) in a given sea

area, waterway, or port, as appropriate. Thus, the MSP concept should allow for a selectable and scalable service based on the type of user and phase of the voyage compatible with onboard systems carried by vessels in the area covered by the service.

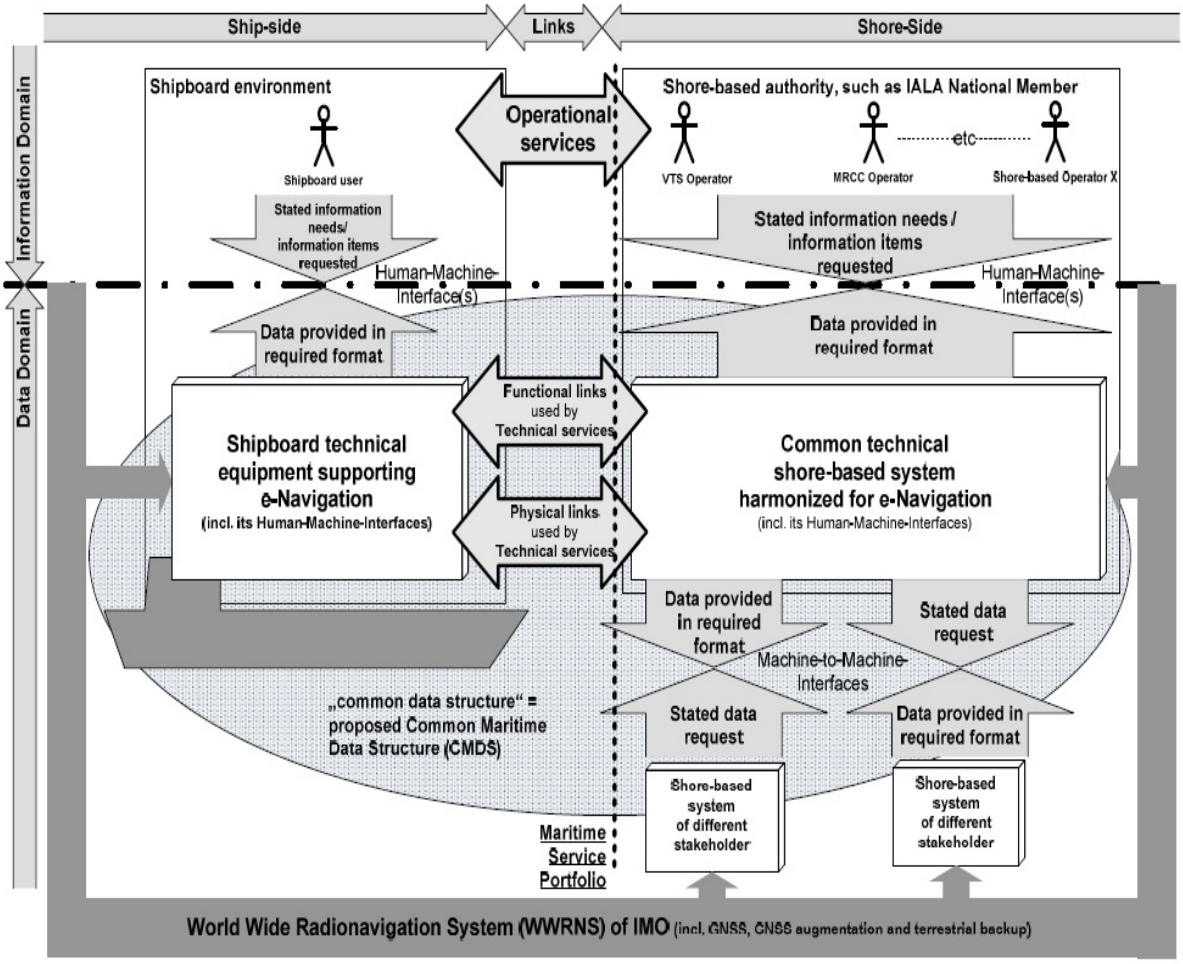

Figure 1 Example of an schematic representation of e-Navigation information workflow

2.1. DATA REQUIREMENTS

Users of shipboard and shore based information systems and associated decision support tools demands for the utilization of:

- data mining techniques;
- risk assessment models (real time or not) identification and mitigation;
- enhanced alarm and alert management;
- integrity enhancement, both system components and data quality and monitoring;
- means to engage the user in different processes;
- automatic event recording and electronic log books.

2.2. SOURCE

Data must only be sourced from authorised sources and subjected to validation before incorporation in the dataset.

2.3. PROVISION AND MANAGEMENT

The data must be maintained and managed by the data provider within agreed procedures and parameters depending on the type and purpose of the data.

Data provision and MSP content will differ for different users and areas. It is envisaged that a wide range of data providers will be involved.

2.4. FORMAT

Data format must be in accordance with existing standards and specifications, approved by competent agencies.

2.5. SECURITY / PROTECTION

Some data, depending on its purpose, may be subject to additional protection measures, including the use of encrypted data.

2.6. INTEGRITY AND RELIABILITY

Each data source will require validation for reliability and integrity before onward dissemination to the user. Data validation processes should also be performed on reception.

Automatic data synchronisation should then provide identical reliable data for all users including static and dynamic data. Such data requirements may include:

- traffic density;
- hydrographic data;
- CCTV and imagery data;
- METOC data;
- vessel information (Position, Course/Speed, Voyage Plan, Cargo, etc.);
- port information;
- VTS Data;
- Maritime Safety Information (MSI);
- domain awareness;
- charts and publications;
- communications channels;
- Position Navigation & Timing (PNT) data.

3. COMMUNICATION AND NAVIGATION REQUIREMENTS FOR MSP

COMSAR 15 and NAV 57 identified 5 different areas in which MSP may be developed. These are:

1 Harbour operations.

2 Operations in coastal and confined or restricted waters.

3 Transocean voyages.

4 Offshore operations.

5 Operations in Arctic, Antarctic and remote areas.

The future e-Navigation system with automatic selection of data and channels should not require any user intervention to identify the stage of the voyage or optimum operating mode.

Reliable communications at an appropriate bandwidth are critical to e-Navigation. The level of communications required will depend on the type and area of operations and will be set out in a MSP.

Communications requirements and capability will differ in each of these areas.

3.1. HARBOUR OPERATIONS

Harbour operations will require the highest level of communications in terms of reliability, accuracy, integrity, availability, bandwidth and variety of means.

It is envisaged that in harbour areas considerable volumes of data will automatically be synchronised between ship and shore; this data may include:

- tidal and current data;
- chart updates;
- pilotage plan;
- DGNSS corrections;
- AtoN status;
- port security information;
- traffic reports;
- administrative information.

Potential communications channels include:

- VHF (voice, AIS, DSC, data);
- GSM / 3G / 4G;
- WiMax;
- proprietary local systems (may be various bands and protocols);
- Satellite;
- HF / LF systems (such as eLoran);
- WiFi;
- national broadcasting services (e.g. information, time signals).

Any compatible system or mix of systems may be used provided they meet the reliability and integrity criteria and compatibility with onboard systems.

3.2. COASTAL, CONFINED & RESTRICTED WATERS

Operations in coastal, confined and restricted waters will require a high level of communications. In the transition area from harbour to coastal the mix of systems will be greater but the system used should be capable of switching to the most suitable means without loss of data and must be compatible with onboard systems.

Potential communications channels include:

- VHF (voice, AIS, DSC, data);
- GSM / 3G / 4G (near coastal only);
- satellite;

- HF / LF systems (such as eLoran);
- proprietary regional systems (may be various bands and protocols);
- WiMax;
- national broadcasting services (e.g. information, time signals).

3.3. TRANSOCEAN VOYAGES

Transocean voyages will require longer range communications systems but will also have reduced data needs.

Potential communications channels include:

- satellite;
- LF systems (such as eLoran);
- MF;
- VHF (voice, AIS, DSC, data);
- national broadcasting services (e.g. information, time signals).

3.4. OFFSHORE OPERATIONS

Among the communications required for the respective GMDSS area, offshore operations are likely to need specific communication channels and may also require channels for large volumes of data.

For this operation, it is envisaged that the communication channels that are likely to be used at the three previous stages of voyage could also be applicable, depending on the location and the type of operation.

3.5. ARCTIC, ANTARCTIC AND REMOTE AREAS

The potential communication channels will depend on the regions and the proximity to shore infrastructures. Therefore, the following channels may be deployed:

- GSM / 3G / 4G;
- WiMax;
- proprietary local systems (may be various bands and protocols);
- satellite;
- HF / LF systems (such as eLoran);
- MF;
- VHF (voice, AIS, DSC, data);
- WiFi
- national broadcasting services (e.g. information, time signals)

4. AIDS TO NAVIGATION REQUIREMENTS

Aids to Navigation (AtoN) will be one of the key data sources for the e-Navigation dataset.

AtoN elements may include:

- radio navigation systems (GNSS / Terrestrial backup):
  - GNSS for providing time reference for synchronized lights;

- e-Racons as terrestrial RADAR ranging mode;
- AIS ranging mode;
- eLoran.

- DGNSS beacons:
  - for provision of GNSS corrections.
- lighthouses, buoys and beacons:
  - visual marks;
  - racons.
- AIS data:
  - real, virtual and synthetic AtoN.
- database matching (imagery, bathymetric, radar, CCTV, etc.).

5. TRAINING

Training will be critical to successful implementation of e-Navigation. Training should be structured in such a way that all types of users experience the same approach to the use and interpretation of the shared data.

6. ACRONYMS

AIS	Automatic Identification System
AtoN	Aid(s) to Navigation
CCTV	Closed Circuit Television
COMSAR	Sub-Committee on Communications and Search and Rescue (IMO)
DGNSS	Differential Global Navigation Satellite System
DSC	Digital Selective Calling
GNSS	Global Navigation Satellite System
GSM	General Service Mobile
HF	High Frequency (3 – 30 mHz)
kHz	kilohertz
LF	Low Frequency (30 kHz–300 kHz)
METOC	Meteorological
MHz	megahertz
MSI	Maritime Safety Information
MSP	Maritime Service Portfolio
NAV	Sub-Committee on Safety-of-Navigation (IMO)
PNT	Position Navigation & Timing
VHF	Very High Frequency (30 MHz to 300 MHz)
VTS	Vessel Traffic Services

WiFi	local area wireless computer networking
WiMax	Worldwide Interoperability for Microwave Access
3G	3rd Generation (of mobile telecommunications technology)
4G	4th Generation (of mobile telecommunications technology)