WWNWS
Meeting 2
Agenda Item 3

WWNWS2/3/5/1A & WWNWS2/3/5/4A
7 July 2010

REPORT TO THE WWNWS SC : E-NAVIGATION AND MODERNIZATION OF GMDSS

By François Lacroze, Rapporteur for e-navigation and the GMDSS review.

Related documents IMO documents and among:
- MSC 85/26/Add.1, Annex 20 : Strategy for the development and implementation of e-navigation
- COMSAR 13/14 (report to MSC)
- MSC 86/23/4
- NAV 55/11/4 (from UK, approach to developing and mapping e-navigation user needs, taking MSI as an example)
- NAV 55/21 (report to MSC) and NAV 55/21 Add.1 for annexes 13 (draft Guidance on the application of AIS binary messages) and 14 (presentation and display of AIS Application-Specific Messages information).
- COMSAR 14 (March 2010) : preliminary documents and report to MSC)
- MSC 87 (May 2010) : preliminary documents and the report
- NAV 56 (end of July 2010) : preliminary documents.

The related documents have been selected for their interest for the WWNWS SC. They are succintly presented and focused in regards with the goal of WWNWS SC : the broadcast of navigational warnings, with obviously an extension to the broadcast of meteorological warnings. They are presented in a chonological way for e-navigation and or modernization of GMDSS*, as following :

- for e-navigation : MSC 85 (December 2008), NAV 55 (July 209), COMSAR 14 (March 2010), MSC 87 (May 2010) and NAV 56 (end of July 2010) for preliminary documents
- for modernization of GMDSS : COMSAR 13 (January 2009), COMSAR 14, MSC 87 and NAV 56 (end of July 2010) for preliminary documents

To note that document MSC 86/23/4 (February 2009), no more presented, proposed a coordinated approach to the implementation of the e-navigation strategy. It included a proposal for a joint plan of work for the COMSAR, NAV and STW SCs for the period 2009-2012

* MSC has designated NAV SC as coordinator of the issue of E-nav and COMSAR SC for the modernization of GMDSS (see document COMSAR 14/4).

A) E-NAVIGATION

E-navigation is a real huge challenge for the maritime World and could be summed up as following : how to bring up the safety level of merchant shipping trafic to a level comparable to the level of the civilian commercial air travel commercial
E-navigation will be certainly built from existing systems and equipments which need evolution, mainly in regards with the evolution of the information tecnology (IT) and with the developpment of the World-Wide Radio Navigation System (WWRNS).

Summary of part A : E-navigation:
1- Strategy for the development and implementation of e-navigation – Main items
2- Some remarks upon the three last main items of the strategy
3- MSI and e-navigation

1) Strategy for the development and implementation of e-navigation

In December 2008, MSC 85 approved the Strategy for the development and implementation of e-navigation. The document MSC 85/26/Add.1, Annex 20 can be considered as a temporary guidance document for e-navigation because the Strategy had been finalized in co-operation with the COMSAR and NAV SCs over a period of two years (2006 to 2008) and was sufficiently developed and detailed for implementation. Relevant input had also been provided by the industry and other relevant organizations, e.g., IALA and IHO.

Just a quick look on this document MSC 85/26/Add.1, Annex 20 defines e-navigation as following :
– 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 marine environment.`
– E-navigation is intended to meet present and future user needs through harmonization of marine navigation systems and supporting shore services

The main items of this documents can be listed as following :
- *- The need for e-navigation*
- *Vision of e-navigation*
- *Core objectives of the e-navigation*
- *Main broad benefits of e-navigation*
- *Basic requirements for the implementation and operation of e-navigation*
- *Potential ship and shore-based users of e-navigation and their high-level needs*
- *Key strategic elements* of which *architecture*
- *Communications technology and information systems*
- *Equipment standardization*.

2) Some remarks upon the fourth last main items of the annex 20 of document MSC 85/26/Add.1

a) Potential ship and shore-based users of e-navigation and their high-level needs
A significant number of potential ship and shore-based users of e-navigation have been identified and listed in annex 20 of document MSC 85/26/Add.1.

a1- Shipborme users : SOLAS vessels and non SOLAS vessels, leisure ships etc. see table below

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

a2- Shore-based users : to note that MSI providers are not explicitly named as Shore-based users, listed as following (to ask for adding explicitly MSI providers ?) :

- National administrations
- Coastal administrations
- AtoN organizations
- Meteorological organizations
- Hydrographic Offices/Agencies
- National, regional and local governments and administration

a3- High-level needs of the users.
The needs of a typical SOLAS ship and a generic shore authority have been used as the basis for the identification of the high-level user needs. These needs have been updated at NAV 55.

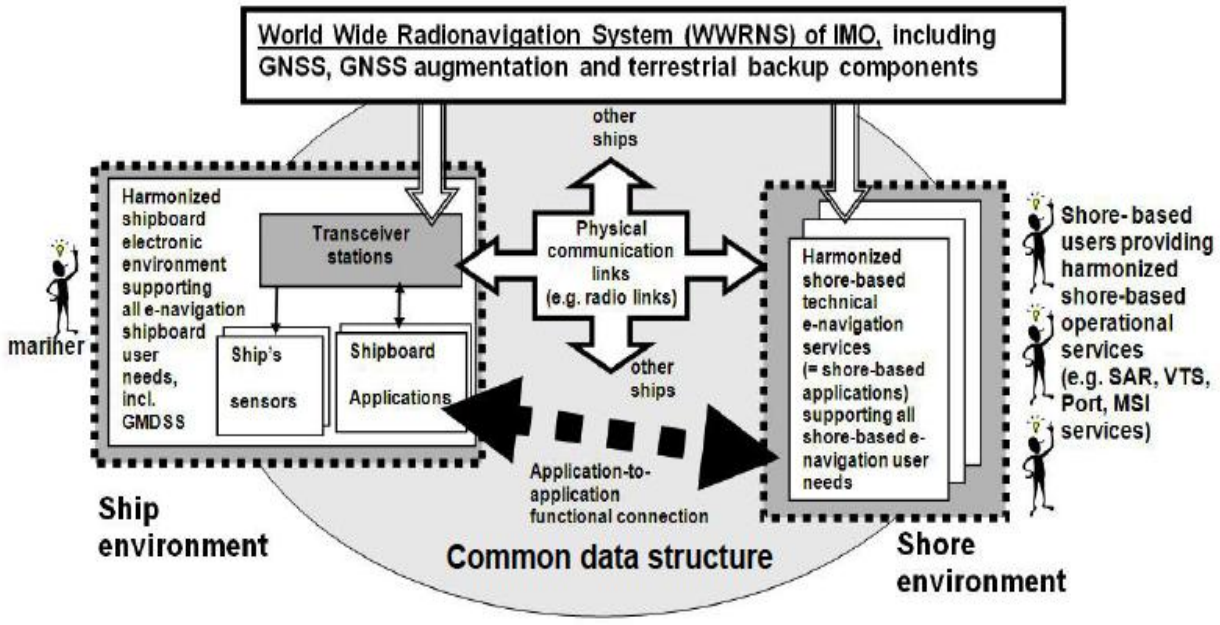
The improved application of MSI onboard vessels has been clearly identified as a user need by mariners : they expressed to sort and display MSI received by SafetyNET and NAXTEX.
Some elements extracted from document NAV 55/11/4 will be presented further (point 3 b) in order to study more deeeply the question. Extract report NAV 55 (NAV 55/WP5)

User Need	Justification	Relation to IMO Strategy (Section 8.2)	Priority in terms of work required	Issues to Consider
Marine Safety Information (MSI) Mariners expressed a desire to sort and display MSI, such as NAVTEX, SafetyNET more effectively.	On most ships, NAVTEX information is displayed on a separate screen or printed on a scroll of paper. The Latitude and Longitude of the MSI must then be mentally compared to that of the vessel by the watchkeeper to calculate risk. Notification of a new and dangerous wreck carries the same weight as a buoy that has drifted off station, which may be hundreds of miles away from the ship's intended voyage. This is a very time-consuming and distracting task, and susceptible to human error. Mariners considered that presenting such safety information on the ship's navigation display would be far more effective and a clear benefit of e-navigation.	• Effective communication • Human Centred Presentation needs • Human Machine Interface • Analysis	Work with relevant stakeholders to address technical requirements for presenting MSI on navigation displays. Take note of Methodology for developing e-navigation user needs using a task-based approach (NAV 55/11/4).	Possible re-formatting of NAVTEX data and continuing with transmitting data on same frequencies Transition from old to new format. Task-oriented presentation based on INS-tasks MSC.252(83).

WWNWS to note that the first paragraph of the proposed *Issue to consider* is under his responsibility : *Possible re-formatting of NAVTEX data..* SEE POINT 3 b) BELOW

b) Architecture (key strategic elements)

The Correspondence Group on e-navigation proposed to NAV 56 the following conceptual representation of the e-navigation environment.



This figure is an abstract representation of the e-navigation environment. The figure shows a great dependency on the World-Wide Radio Navigation System (WWRNS), which provides position and timing information. The bold arrow in figure represents the data exchange between the shore-based applications and the "ship's environment" (with sensors and applications connected to transceiver station, INS and IBS) and vice versa.The GMDSS functions, of which RNW function, have been included in the ship environment, with a direct link to the transceiver station and a link to the WWRNS.

c) Communications technology and information systems : Communications technology and information systems will have to be identified to meet user needs. This work may involve the enhancement of existing systems or the development of new systems. Any impacts affecting existing systems will need to be identified and addressed, based on technical standards and protocols for data structure, technology, and bandwidth and frequency allocations.

d) Equipment standardization. : This part of the work will follow the development of performance standards and will involve users and manufacturers.

3) MSI and e-navigation

WWNWS SC to bear in mind with the 2 following extracts :

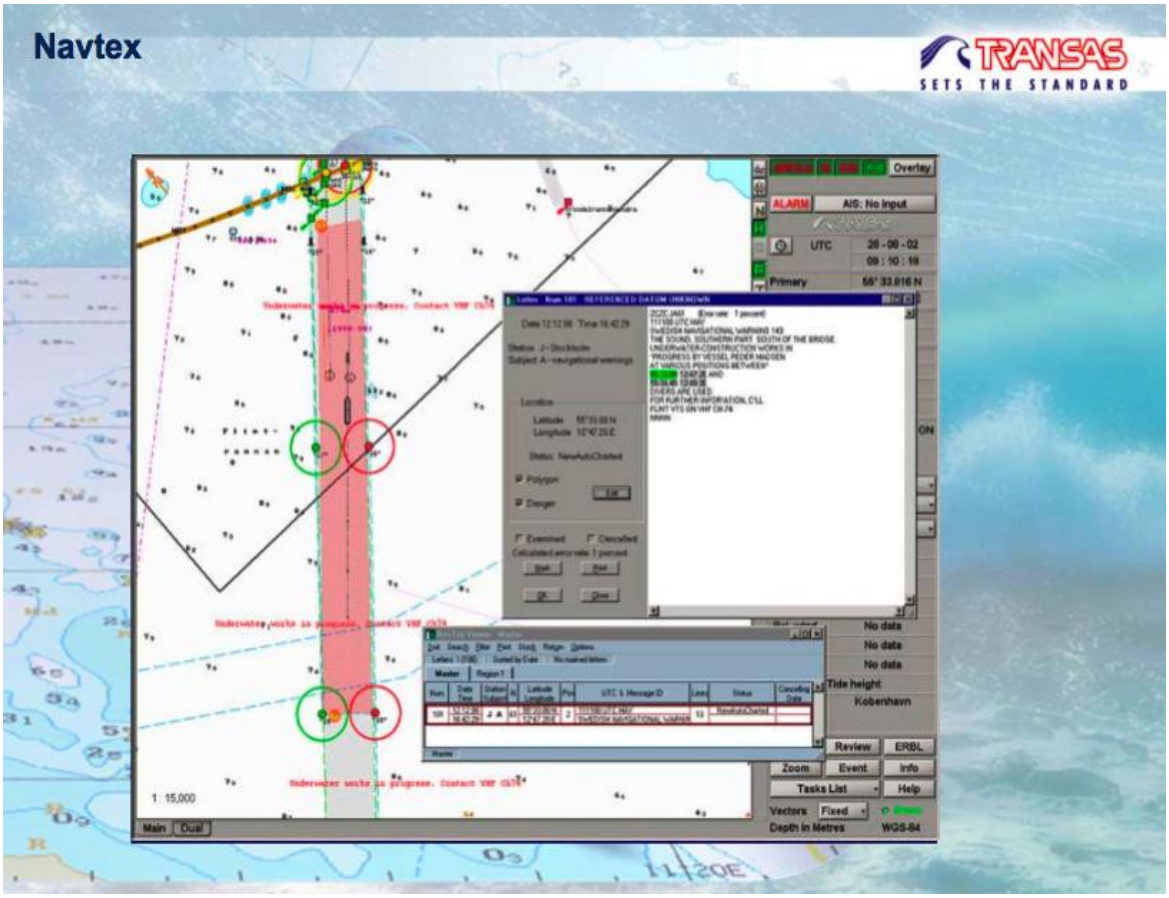
A good start to the development of e-Navigation would be to focus on a single function. For the inter-sessional meeting mentioned above, Marine Safety Information (MSI) is proposed. This offers a good example of a ship/shore structure, has scope that is clearly defined, contains elements of collection, exchange, integration, presentation and analysis…. [Strategy & Operations working group (WG1) of the IALA e-Navigation committee (March 2008)]

The improved application of MSI on board vessels had been clearly identified as a user need by mariners, and work on this issue under the agenda of e-navigation should continue." [Report NAV 55 (July 2009)]

Summary of point 3 :

- Examples of integrated MSI in ECDIS
- presentation of preliminary set of MSI user requirements (from document NAV 55/11/4)
- Summary of the discussion between SHOM and ECDIS manufacturers about integration of navigational on ECDIS
- action of IHO EUWG for the display of navigational warnings on ECDIS

a) Examples of integrated MSI in ECDIS



b) Preliminary set of MSI user requirements

The following elements are extracted from document NAV 55/11/4.

The improved application of MSI onboard vessels has been clearly identified as a user need by mariners : they expressed to sort and display MSI received by SafetyNET and NAXTEX.

The following tables summarize the user requirements, first on shore, and second on ship .

Reference	User Requirement	Current solution	Strengths and weaknesses of current solution	Potential improvements from e-Navigation
ON-SHORE				
Collection				
MSI_REQ_1	The MSI SP shall enable appropriate data originators to provide reports, in accordance with international standards	MSI SPs make available contact details and relevant instructions for data originators Information received from variety of third parties via published means of contact (e-mail, fax, phone, paper, etc)	Single point of contact and well coordinated/structured. Duties are well specified in IMO resolution A.706(17) , as amended Inconsistency in format of incoming data	Greater level of automation in receipt and formatting of input data
Analysis				
MSI_REQ_4	The MSI SP shall assess and validate incoming reports to identify MSI	Manual subjective process, using charts and other relevant information	Potential for inconsistencies in working practices	Increased use of standardized decision support tools
Presentation				
MSI_REQ_5	The MSI SP shall format all MSI in a form suitable for subsequent integration and presentation on board all vessels	Guidelines published for different types of warning	Format used dictates presentation to end user. Potential for inconsistencies in working practices	Separation of data format from presentation offers flexibility in on-board presentation, which will require a published standard
Exchange				
MSI_REQ_6	The MSI SP shall make available MSI relevant to their scope of responsibility	MSI SPs pass information to other MSI SPs that is out of their scope of responsibility (i.e. NAVAREA, NAVTEX service area, etc.) MSI SPs monitor the on-air output of other MSI SPs	MSI SP relationships are well established Exchange of information is unstructured And *ad hoc*	Establish efficient and robust exchange mechanism providing information in known format
MSI_REQ_10	MSI shall be available to all users to whom each item of MSI applies – in both location and time	Variety of different broadcast methods and schedules In-force bulletin used for MSI no longer being broadcast	Repeated transmissions necessary to ensure that users receive the broadcast	Improved availability of all valid MSI, regardless of date of issue
MSI_REQ_11	MSI shall be available to all types of vessel, including both SOLAS and non-SOLAS vessels	Different technologies used for ocean and coastal MSI. Coastal NAVTEX service and RT more suitable for non-SOLAS vessels. Often rely on posters and notices for communication of MSI to non-SOLAS vessels	Needs of non-SOLAS users not well catered for	Provide MSI in a standardized form that can be used to develop solutions for all sectors of the market, removing the dependency on specific equipment

Reference	User requirement	Current solution	Strengths and weaknesses of current solution	Potential improvements from e-Navigation
ON-SHIP				
Collection				
MSI_REQ_12	The user shall acquire all MSI appropriate to operational requirements	Messages are currently received by multiple systems (NAVTEX, SafetyNET, voice, etc.) and manually logged	Risk of single person error, and lack of traceability in assessment of MSI by the user	The system should display all MSI relevant to voyage planning and/or voyage execution and save a record of all MSI received
Integration				
MSI_REQ_15	MSI alarms shall be integrated with the vessel's navigation alarm system	No integration with other onboard navigation alarm systems. No electronic/computerized treatment of MSI	Solely dependent on the MSI information collector presenting MSI to any concerned people	Enables consistency of presentation of alarms to user
Exchange				
MSI_REQ_16	Users shall be enabled to exchange MSI between vessels	Currently achieved by VHF transmission	No automatic procedure/system allowing the user to broadcast MSI	More effective exchange of MSI between vessels
Presentation				
MSI_REQ_17	All relevant MSI shall be presented in a user friendly manner and in conjunction with other related navigational information	Presently not integrated in terms of location and format onboard ships	Lack of integration into the navigation system doesn't guarantee the proper treatment of the MSI	MSI information should appear like any other navigational or safety information readily available on the navigational system
MSI_REQ_18	An alarm shall be presented to the user for any MSI when it represents a threat to the safe navigation of the vessel	Currently, the only alarm that is presented occurs at the moment of receipt (EGC)	Risk that MSI is not taken into account at the moment it is needed even if it has been previously acquired	System should be able to alert the user in due time and location when any MSI becomes relevant to the safe navigation of its ship
Analysis				
MSI_REQ_24	The criticality of each item of MSI shall be analysed	Continual process of assessment, undertaken manually today	The user analysis is the sole agreed way to perform a practical and knowledgeable evaluation of MSI criticality	Should still depend primarily upon human analysis
MSI_REQ_25	The analysis of MSI shall not be at risk of single person error	MSI is solely acquired, analysed and recorded by the watchkeeper at the time of receipt	At the moment it is at risk of a single person error	e-Navigation should provide a phased MSI alarm system to assist risk avoidance

In fact, for the mariner, the need is not for all MSI but for the navigational warnings. The mariner asks for displaying on ECDIS (or ECS) the navigational warnings at the position which are indicated by the text of the warning receipted on the Navtex and SafetyNET receivers.

The tables identify strengths in today's solution (institutionally, operationally, technically, etc.) and also identify weaknesses and potential means of improvement.

WWNWS SC has to consider these strengths, weaknesses and potential means of improvement mainly for the format of navigational warnings (named after RNW for simplification), as indicated in the tables : « Inconsistency in format of incoming data of the RNW », and need for « Greater level of automation in receipt and formatting of input data »

So, WWNWS SC is directly implicated by the user requirements upon navigational warnings integration in ECDIS
WWNWS should contribute to the answer to the following questions :
- is there really a need for improve the format of RNW, as defined in the IHO/IMO/WMO MSI Manual (MSC.1/Circ.1310)
- if a new format is needed (and WWNWS SC obliged to change the format, until where to go with the display on ECDIS (or ECS) the RNW ? :
    - just to display a sort of reference at the relevant position, with when clicking on, the display of the text received on Navtex or SafetyNET receiver ?
    - or to go very far, in order to display graphical integration navigational warnings, in sort similar to the possibilities of integration of AIS data in ECDIS (document NAV 55/14) ?

So the task/job of WWNWS SC is to define clearly what he can do and where he doesn't want to go.

c) Summary of the discussion between SHOM and ECDIS manufacturers about integration of navigational warnings on ECDIS

Some ECDIS manufacturers are developing several options, including the capacity to receive and read the NAVTEX messages on the ECDIS and thus to give a geographical position on the map of the ECDIS. What are the characteristics of this option and what is the process used to display an icon on the map corresponding to the location concerned by the message?
Here below is the summary of discussions between SHOM and MARIS, discussions initiated by the chairman of EUWG (see para d) below).

The module used to read the message extracts the position when readable (99% of the cases) since sometimes there are wrongly formatted positions linked polluting the serial communication and problem of the NAVTEX received when sending data. This is linked to the quality of the installation (if there is a ground loop on the bridge, this can cause serial communication problem).

Furthermore, the parser used to identify the positions in the NAVTEX messages can accept several numerical formats (for example if "." or "," are used to write numbers) and it can be easily extended to accept more formats. So it appears that to identify a numerical position in a message is simple, well-known and often used today.

Otherwise, it is possible to give a geometrical figure in the case of a NAVTEX message including several geographical positions. Nowadays there are three possibilities. If there is only one point, then there will be one isolated message icon on the chart on the ECDIS. If there are two points in the same message, then these two points on the map will be linked by a segment. If there are three or more points in the same message, the points are linked by segments and the area defined by the polyline is closed.

Finally, the options proposed by the different companies working on it (Maris, Sodena, Transas, …) must be compared. Such a comparison would permit to select the more secure way to display the RSM on ECDIS in order to establish future norms to display these messages on ECDIS (according to GIS technologies and in the perspective of S-100), and for WWNWS SC to know if the format of RNW needs to be improved.

d) action of IHO EUWG for the display of navigational warnings (RNW) on ECDIS

Information gathered from the chairman of EUWG, Yves Le Franc from SHOM

EUWG was created by CHRIS (now HSSC) at the end of 2008, to :
- develop and propose a pragmatic approach to overcome any current shortcomings in the updating mechanisms for Temporary and Preliminary notices in ENCs
- review and revise the updating mechanisms as contained in S-52 Appendix 1 «*Guidance on Updating the ENC »*
Regard to the first item, EUWG has developed a guidance for encoding T & P ENC updates which now published in S-65 "ENC Production Guidance ».

EUWG also reported to HSSC 1 (Singapore – October 2009) that numerous NMs (especially temporary NMs) are subsequent to RNWs and relay them. These NMs should be encoded as ENC updates to provide EDCIS with the NM information. This has a significant cost for HO. Furthermore, there is a need to include the RNW into the ECDIS for example in an overlay (CPRNW10 Report and IMO NAV 55/WP.5 refer). Then the quite same information would be provided to the ECDIS with two different electronic means. It should be interesting to study with WWNWS how to harmonize the two services in the spirit of the e-navigation. HSSC Committee noted the need for this harmonization.
Now, EUWG is working on the review of S-52 Appendix 1 published in 1996 and which is an over-arching description of the updating model. This conceptual document was design to launch ENC services when no thing exited. The intention of EUWG is to renew the model to describe thinks as they are currently.

S-52, Appendix 1 mentions RNW (navigational warnings) as to be introduced in ECDIS manually through a keyboard with the remark that RNW providers should endeavour to ease this task for the mariner by adding whatever additional information might be appropriate to facilitate manual input. Another part of the document evokes the IHO project to use SafetyNET to include promulgation of electronic chart corrections (Note : in the revised international SafetyNET manual, MSC.1/Circ.1364, May 2010, the section *Chart correction services* expected for the corrections to ENCs was deleted).

EUWG has started to explore the state of the art in this matter. So, some ECDIS manufacturers already offers to possibility to display on ECDIS screen the RNW information.

The chairman of EUWG would like to suggest to the WWNWS SC to go forward the following way and principles :
- to give RNW on ECDIS must be simple for every stakeholders. It implies that limited efforts must be provided by the different actors. For example, it should be possible to modify the format (re-formatting) of the messages if necessary for an effective and reliable reading by the ECDIS software.
- these possible evolutions must stay compatible with the Navtex and SafetyNET systems which continue to broadcast information in a text form also readable directly by mariner, without supplementary costs for HOs and without supplementary time of assessment.
- if possible, the management of RNW on ECDIS should reduce the need/time/price to encode subsequent T ENC updates (a number of T notices relay navigational warnings).

To conduct this study, the first step should be to define the exploitation of the RNW by ECDIS (display on screen, management of the data) with the co-operation of some IHO WG, such as DIPWG and TSMAD, IEC, maritime administrations, ECDIS manufacturers, etc.
Secondly, if they are necessary, the eventual evolutions or modifications of the format of RNW (according to S-53) for displaying on ECDIS, and eventual modifications to the rules for the management of the data, should have to be defined under the direction of WWNWS-SC.

A survey of the solutions of some ECDIS developers seems necessary to know what industrials propose to obtain RNW on the screen of their ECDIS and what it is possible to do. This concerns the display of the messages, their format, management, storage and their future in the ECDIS (cancellation, activation, re-activation, compatibility of the Navtex and SafetyNET messages with the software of ECDIS).
Obviously it will be important to know and to respect the norms on the ECDIS-working and on their screens (IHO/IMO/IEC).

B) Modernization of GMDSS

The GMDSS was designed over 25 years ago. There has not been a full review since its implementation in 1999 and technology has developed significantly in that time. The current system is seen to be relatively sound, but it is known that there are areas where improvement could be brought about, e.g., managing the cessation of international telex.
But on the other side, by instance, if Navtex is an old (archaic ?) technology, it works well and it is cheap for the mariner (a lot of non SOLAS vessels have got a Navtex receiver).

Among the items to be considered, you can find :

- evolution of GMDSS, even if these examples have no real interest for WWNWS : cessation of Inmarsat E and of Inmarsat B
- current technologies like AIS, and new or emerging technologies that are over the horizon, and their integration
- new developments, mainly by non-GMDSS communication providers
- the emerging e-navigation
- the enhanced use of allocated spectrum
- etc.

So, IMO has been undertaking a scoping exercise to establish the need for a review of the elements and procedures of the GMDSS
In March 2010, the COMSAR SC noted that « the first phase of this Scoping exercise to establish the need for a review of the elements and procedures of the GMDSS should be directed towards establishing the need for review of the GMDSS and defining what issues should be included »(COMSAR 14/17).

WWNWS SC cannot really be an actor of the evolution of Information technology (IT) and of the communications technologies BUT he has to be an auditor, the most possible reactive in order to note and to act if necessary.

To follow the evolution of Information technology (IT) and of the communications technologies is not really easy. Among the items/points to follow, the WWNWS SC is fully concerned by :
- managing the cessation of international telex
- Iridium as replacement of Navtex in Arctic areas ?
- regional satellite system for MSI?
- new technology such as the maritime mesh network technology, which can be developed by using existing spectrum efficient radio systems, can be used in many shipping lanes opportunelly to provide a means to disseminate information
- broadcast of MSI by AIS : only local MSI ? local and coastal ? open sea ?
- the fact to consider the needs for BOTH SOLAS and Non-SOLAS vessels
- the repartition of the spectrum/frequencies bands, particularly, the utilization of the 495-505 kHz band for the broadcasts of safety and security information to and from ships and ports
- etc.

As did and does the IHO for the occupation/repartition of the spectrum/frequencies bands, the WWNWS SC must be a reactive auditor for items relative to MSI .

Here below are some considerations upon AIS and some extracts from IMO documents for some more thoughts

SOME CONSIDERATION UPON AIS AND SOME EXTRACTS FROM IMO DOCUMENTS

1) AIS

AIS is a good example of integration of new technology in GMDSS. Its use for the broadcast of MSI is more and more considered by national maritime administrations and nothing in the IMO regulation forbids such broadcast :
- A 705 (MSI) and A 706 (WWNWS) : Administrations may also provide maritime safety information by other means (than SafetyNET, NAVTEX and HF NBDP).
- A 706 : Local warnings are broadcast by means other than NAVTEX or SafetyNET

Two new IMO SN circulars are very interesting :

Circular SN.1/Circ.289 (2 June 2010) which provides an overview of the purpose and scope of AIS Application-Specific Messages, and provides guidance on their use.
In particular, there are new binary messages such as Area notice. This message provides dynamic information concerning a specified geographic area, polyline or positions. It should be only used to convey pertinent time-critical navigation safety information to mariners or authorities, and not as a means to convey information already provided by current official nautical charts or publications.

Circular SN.1/Circ.290 (2 June 2010), Guidance for the presentation and display of AIS Application-Specific Messages information, gives elements which could be used as reference for the broadcast of MSI, with moreover the possibility of a graphical representation on ECDIS or ECS.

2**) COMSAR 14/4** : outcome of the fifth meeting of the Joint IMO/ITU Experts Group on Maritime radiocommunication matter (23 – 25 June 2009)

Issues under study under WRC-11 Agenda item 1.10 : Broadcasts of safety and security information to and from ships and ports;

During a brain storming, it was noted :
- the four different areas of carriage requirements (Sea areas A1 to A4) might be reduced
- that over the years GMDSS had become the distress and safety system for non-SOLAS ships as well, and that this should be taken into account;
- new developments, mainly by non-GMDSS communication providers, as well as the use of mobile phones and (regional) satellite systems should be considered

Position of OMI about the spectrum
The frequencies for MSI within Appendix to the Radio Regulations need to be retained, recognizing their essential role in the promulgation of MSI in Sea Area A4.
IMO supports the future use of the band 415 kHz-526.5 kHz for safety and security related systems, recognizing that this band is allocated on a world-wide basis for the use by the maritime community.

3) COMSAR 14/7/2 from IMSO : Scoping exercise to establish the need for a review of the elements and procedures of the GMDSS.

This document comments on COMSAR 14/4, paragraphs 6 to 8 and annex 3.
To note the following question to take into account when considering the need for a review of the elements and procedures of the GMDSS :
the further evolution of MSI broadcast systems to provide faster data transfer than is currently available via Inmarsat-C, able to operate via the most modern communication satellites and offering the possibility to transmit graphical meteorological products and navigational (electronic) chart corrections to ships at sea.