The Development of e-navigation

D. Patraiko, FNI
The Nautical Institute, London, UK

ABSTRACT: E-navigation is, at the moment, a catchall phrase for a concept of bringing existing and new technology together to improve safety of navigation, commercial efficiency and security. The challenge for the industry working through the IMO will be to produce a unified strategy for this integration and then (and only then) to develop specific systems to meet the needs. This is no small feat! Chart data and systems need to be brought to an agreeable standard; position fixing systems need to be of high integrity; and communication systems need to be establishing that meet the needs of e-navigation with agreed technology, protocols and payment plans. This all needs to be achieved with an acceptable cost/benefit balance.

1 INTRODUCTION

The concept of e-navigation is to integrate existing and new navigational tools in an all-embracing system that will contribute to enhanced navigational safety and commercial efficiency.

The International Association of Lighthouse Authorities (IALA) has defined E-Navigation as "*the harmonized collection, integration, exchange and presentation of maritime information aboard and ashore by electronic means to enhance berth-to-berth navigation and related services, safety and security at sea, and the protection of the marine environment*."

In December 2005, Japan, Marshall Islands, Netherlands, Norway, Singapore, UK and USA submitted a paper (MSC 81/23/10) to the IMO Maritime Safety Committee (MSC) on the development of an e-navigation strategy and, in which, it was proposed to add a new item on e-navigation to the work programmes of the NAV and COMSAR Sub-committees. The paper goes on to propose that the aim should be to develop a strategic vision for the utilization of existing and new navigational tools, in particular electronic tools, in a holistic and systematic manner. e-navigation, the paper argued, would help reduce navigational accidents, errors and failures by developing standards for an accurate and cost effective system that would make a major contribution to the IMO's agenda of safe, secure and efficient shipping on clean oceans. MSC 81 agreed that the two Sub-Committees should consider the issues with the aim of developing a 'strategic vision' within their associated work programmes for taking this issue forward to report to MSC 85 in 2008. It is towards creating this 'strategic vision' by 2008 that the industry and international bodies like IALA and IHO are now focused.

2 SECRETARY GENERAL'S VIEW

Following this meeting of the MSC, on 22 May 2006, Efthimios Mitropoulos, Secretary-General of the IMO addressed the issue of e-navigation in his keynote address at the quadrennial IALA conference in Shanghai. The following is an extract from this address and which clearly illustrates the concepts and ambitions for e-navigation:

"*There is no doubt that we are now entering a crucial stage in the development of what has become known by the "catch-all" designation of "e-navigation". Many of the building blocks are in place, but what is still in an embryonic state is the global strategic vision needed to ensure that the new generation of navigational tools, available to us now and in the near future, can be drawn together in a holistic and systematic manner or, in other words, into an all-embracing system. If we get this right, we have the opportunity to secure not only a greater level of safety and accident prevention but, at the*

same time, deliver substantial operating efficiencies with consequent commercial benefits.

Although it is difficult, at this stage, to be precise about the full extent of the changes that might be necessary to realize fully a vision of e-navigation, it does, nevertheless, seem reasonable to assume that they will be extensive and fundamental. In the digital world, anything seems to be possible and nothing is sacred. As well as IALA's world of aids to navigation, the whole gamut of shipboard navigational tools is on the brink of revolution and the impact of this is likely to be felt in working methods and practices, personnel training, communications and the shoreside infrastructure. It is also very likely that, as the overall strategy for e-navigation becomes clearer, there will be implications for the international regulatory framework, and I can assure you that IMO stands ready to address this issue and deal with it effectively when the time comes. The recent reaction of MSC to relevant proposals bears testimony to this.

There seem to be clear advantages in the development of e navigation that will contribute to enhanced navigational safety (with all the positive repercussions this will have on maritime safety overall and environmental protection) while simu-ltaneously reducing the burden on the navigator and I am sure that all relevant factors will be meticulously examined before we move onto endorsing the proposed system. This may take some time but, as I observed at MSC two weeks ago, even the longest walk starts with a first step.

3 PROGRESS

Subsequently, in July 2006, e-navigation was added to the 52nd session of the IMO Safety of Navigation Sub-Committee (NAV 52) work programme and initial discussions undertaken. The main outcome of these preliminary discussions was the decision to establish a Correspondence Group, co-coordinated by the UK, and instructed to report back to NAV 53 (July 07).

The Correspondence Group were issued terms of reference to consider, provide comments and make recommendations on the following:

- the definition and scope of the concept of e-navigation in terms of its purpose, components and limitations to produce a system architecture;
- the identification of the key issues and priorities that will have to be addressed in a strategic vision and a policy framework on e-navigation;
- the identification of both benefits of and obstacles that may arise in the further development of such a strategic vision and policy framework;
- the identification of the roles of the Organization, its Member States, other bodies and industry in the further development of such a strategic vision and policy framework;
- the formulation of a work programme for the further development of such a strategic vision and policy framework, including an outline migration plan and recommendations on the roles of the NAV and COMSAR Sub-Committees and the input of other parties concerned.

There are many groups and organisations nationally and internationally who are providing input to the IMO e-navigation CG. One of these working at an international level is the newly formed IALA e-navigation Committee. Launched during the Shanghai Conference mentioned earlier, IALA formed an e-navigation committee with a four-year work programme. IALA will use this dedicated committee of international delegates, practioners and technical experts to build on its expertise in the fields of aids to navigation and VTS to contribute significantly to the concept of e-navigation through the IMO.

4 WORK OF IALA

While the work of the IALA e-navigation committee is on going, to date the committee has agreed that e-navigation is a concept that incorporates systems and services and that it identifies at least three significant outcomes of e-navigation, notably:

a. Onboard navigation systems will be developed that benefit from the integration of own ship sensors, supporting information, a standard user interface, and a comprehensive system for managing guard zones and alerts. Core elements of such a system will include high integrity electronic positioning, electronic navigational charts (ENCs) and system functionality with analysis reducing human error, actively engaging the mariner in the process of navigation while preventing distraction and overburdening.

b. The management of vessel traffic and related services from ashore will be enhanced through better provision, coordination, and exchange of comprehensive data in formats that will be more easily understood and utilised by shore-based operators in support of vessel safety and efficiency.

c. E-navigation will thus provide an infrastructure designed to enable authorised seamless information transfer onboard ship, between ships, between ship and shore and between shore authorities and other parties with many attendant benefits, including a reduction of single person error.

IALA further states that the key goals for e-navigation should be:

- To improve the safety of marine navigation for all vessels and protection of the environment,
- To improve the efficiency of marine navigation and vessel traffic services,
- To provide opportunities for improving the efficiency of transport and logistics,
- To improve the monitoring of and communication with sea-borne transport therefore enabling competent authorities to provide enhanced security and other allied services,
- To support SAR services and incident management, and
- To provide improved tools to facilitate optimum support and to engage mariners and shore based users whilst maintaining high levels of attention without causing distraction or undue burden.

Given that e-navigation is a concept, that concept is a path or a strategy under which systems are brought together in a harmonised fashion. However many believe that for the full effectiveness of e-navigation is to be realised core elements have to be in place such as complete Electronic Navigation Chart (ENC) coverage of navigational areas; a robust electronic positioning system (with redundancy) needs to be in place; and an infrastructure of communications needs to be agreed.

5 WORK OF THE NAUTICAL INSTITUTE

The Nautical Institute endorses the concept of e-navigation and the need to bring together a disparate collection of electronic systems, together with traditional skills, to improve the safety and efficiency of shipping. Although the ultimate goal of shipping is to move cargo from point A to B in order to support the world economy and societies needs, the shipboard component of e-navigation is critical to the whole system success. Following years of research and consultation with mariners The Nautical Institute has proposed that an S-Mode may be able to play a pivotal role within the concept of e-navigation for improving the safety of navigation.

5.1 *S-Mode*

It is recognised that there is a vital need to embrace new technology and for manufacturers to be able to innovate with the expectation that if they get it right, they will be rewarded with sales of their products. Recent innovations include the Chart Radar; New Technology (NT) non-pulse Radar; ECDIS; just to name a few. Significant innovations from the past have included electronic position fixing systems, the gyrocompass and even the chronometer in its day, to name but a few. Standardisation of navigation equipment on the bridge however would simplify training and ensure that pilots and mariners could instantly be familiar with the operation of such equipment when joining a vessel and therefore be better placed to concentrate on making good decisions. The question therefore is how to balance these two objectives!

The concept of S-Mode builds on the concept of a ‘default setting’ by being a ‘default mode’. This mode is made possible by the increasing use of Multi-Function Displays (MFD) where Radar, charts, electronic position systems etc are inputs that can be arranged or re-arranged in any form on a display.

S-Mode would require all navigation displays, regardless of manufacture, to have a clearly identified button, that when pressed brings the display into a standard format with a standard menu/control system, standard interface (i.e. keyboard/joystick etc..) and basic features. For example there may have to be tactical display, for near time decisions (collision, and hazard avoidance) and another display for planning. At the press of a button the tactical display might revert to a 12 mile range Radar view with targets showing relative vectors and perhaps hazardous depth contours shown (from vector chart data, such as used on a Chart Radar). This view would be standardised and familiar to all pilots and mariners, and then could be manipulated through a standard menu system for a limited, although adequate, functionality. The advantage to this would be that:

- Training for S-Mode could be standardised throughout the world
- Any mariner or pilot would be comfortable to revert to S-Mode and be competent in using the systems layout and functionality, regardless of manufacturer.
- Masters or companies could impose S-Mode only uses by crews until such time that they have proven they are competent to use further functionality that may have been provided by individual manufactures.

- S-mode could also be used at times when the bridge team is made up of multiple persons who need to share a common display for decision making.

With the performance of S-Mode secured and strictly governed by the IMO, manufacturers would be able to develop further functionality that they could market to shipowners as 'value added feature'. If, in time, these innovative features proved to be popular and effective, they could then be brought into 'S-Mode' in a controlled way by the IMO.

At a basic level, some ships might opt to only have S-Mode functionality installed, but there may be other vessels which by the nature of their trade or quality of their training can take advantage of new and innovative features that would be developed by the industry.

This is a fledgling idea and the Nautical Institute is currently working with various organizations and stakeholders to further explore the possibility of developing S-Mode.

Ultimately, whether S-Mode is accepted or not, vessels navigation systems need to be designed to work both independently and jointly with shore service to improve the operators ability to focus on the most critical aspects of safe navigation, limiting distractions and reducing single person errors. The application of technology for this goal will only be a single component, and must be equally supported by the establishment of 'best procedures' for use and effective training for both the operation of such equipment and the procedures.

6 CONCLUSION

E-Navigation is a concept that incorporates systems and services and will generally bring the integration of electronic systems and information within a strategic plan governed by the IMO.

There are many stakeholders that will be affected by e-navigation and who will have to be involved in its development. These include but are not limited to mariners, pilots, port authorities, port services, coastal states, manufacturers, data providers, ship-owners, and of course, the IMO.

The current plan is for all these groups to work through the IMO in order to create a strategic plan for the development and implementation of e-navigation by the time that MSC 85 meets in 2008.

Existing technology and the ability to integrate systems today provide an almost limitless scope for what e-navigation might consist of, and therefore it is absolutely critical that at this stage of development the concept is lead by user needs, or in terms of current IMO parlance, e-navigation becomes 'Goal Based'.