

Introducing the e-navigation revolution

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E-navigation is *'the collection, integration and display 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'*: definition from the International Association of Marine Aids to Navigation Lighthouse Authorities (IALA).

This is an ambitious concept – nothing less than that existing and new navigational tools can be integrated in an all-embracing system that will make a uniquely important contribution to enhanced navigational safety and commercial efficiency.

David Patraiko chairs the IALA E-navigation Operators Working Group, and represents The Nautical Institute on the IMO E-navigation Correspondence Group. In this article he outlines the background to what is an important and complex development. And as he writes, it is vital that seafarers give their views at this stage, to help shape the way e-navigation grows and to make sure it works for them.

In December 2005, Japan, the Marshall Islands, Netherlands, Norway, Singapore, UK and USA submitted a paper (MSC 81/23/10) to the IMO Maritime Safety Committee on the development on an e-navigation strategy. This was proposed to add a new item on e-navigation to the work programmes of the NAV (Safety of Navigation) and COMSAR (Radio Communications and Search and Rescue) Sub-committees. The paper went on to propose that the aim should be to develop a strategic vision for the utilisation 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 subcommittees should consider the issues with the aim of developing a 'strategic vision' within their associated work programmes to progress this issue and reporting to MSC 85 in 2008. It is towards creating this strategic vision by 2008 that the industry, and international bodies like IALA and the International Hydrographic Organisation (IHO), are now focused.

Following this meeting of the MSC, on 22 May 2006, Efthimios Mitropoulos, Secretary-General of the IMO (and Honorary IFSMA Member) addressed the issue of e-navigation in his keynote address to the quadrennial IALA conference in Shanghai.

Making progress

Subsequently in July 2006, e-navigation was added to the NAV 52 work programme and initial discussions were undertaken. The main outcome of these preliminary discussions was the decision to establish a Correspondence Group, coordinated by the UK, and instructed to report back to NAV 53 (July 2007).

The group was issued terms of reference to consider and asked to provide comments and make recommendations on the following:

- 1. The definition and scope of the concept of e-navigation in terms of its purpose, components and limitations and to produce a system architecture;
- 2. 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;
- 3. The identification of both benefits of and obstacles that may arise in the further development of such a strategic vision and policy framework;
- 4. The identification of the roles of the IMO, its member states, other bodies and industry in the further development of such a strategic vision and policy framework;
- 5. 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 at an international level which are coordinating and providing input to the IMO. One of these is the newly formed IALA E-Navigation Committee, launched during the Shanghai conference mentioned earlier and with a four-year work programme. IALA will use this dedicated committee of international delegates, representing practitioners 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.

In September 2006, the IALA committee met for the first time. After discussing the wide range of options and benefits that could become part of e-navigation, it agreed that its primary value was to join the ship's bridge team and VTS team to create a unified navigation team that would achieve safer navigation through shared tactical information. For full implementation and effectiveness of such a system, it would need to be mandatory for SOLAS vessels and scaleable to all users.

The committee was united in the belief that before any primary benefits or value added services could be realised, an architecture comprising three fundamental elements must first be put in place.

- World electronic navigation chart (ENC) coverage of navigational areas;
- A robust electronic positioning system (with redundancy); and
- An agreed infrastructure of communications to link ship and shore.

Considering the human element issues, the following need to be taken into account while developing an e-navigation strategy:

- Man/machine interface (balance between standardisation and leaving room for innovation and development);
- Modes of information display/portrayal;
- Appropriate communication of situation awareness;

- Onboard e-navigation system equipment should be designed to engage the bridge team and maintain high levels of attention and motivation without causing distraction.

Building on this concept the Australian Maritime Safety Authority (AMSA) held an e-navigation workshop in November 2006 and produced an architectural diagram to complement the work of IALA and contribute to the IMO CG.

The architecture clearly shows that communication between the ship and shore navigation teams is at the core of e-navigation, that there can be a wide range of inputs into such a system but two very clear outputs; safe navigation and improved efficiencies of operation.

At a meeting last December to explore the e-navigation concept it was stated that ‘although the official concept of e-navigation is still in its infancy and only loosely defined, it was also recognised that the amount of energy and interest shown by the maritime community offers an opportunity to make a positive impact on the way vessels are navigated in the future’.

There is now available some cutting edge technology such as the bridge systems developed by L-3 Marine, the Kelvin Hughes ‘new technology’ radar, and e- Loran. Lloyd’s e-Register have views about how alarms could be better managed and there has been heated debate about how important alarm management is, there is also a necessity for any future systems to be of ‘high integrity’ if they are going to be relied upon.

Sailing mariners often and passionately remind us to keep things simple, make best use of standardisation and to put a high priority on training.

S-mode: feedback needed

Armed with this advice, efforts continue to work with all stakeholders in the industry to represent the professional views of mariners, towards developing a future navigation system to improve safety and efficiency.

These discussions bring us back to a recurring theme from the series of integrated bridge systems (IBS) conferences held in 2002 and 2003. There the debate often centred on the need and advantages of standardised controls and presentation, and the advantages and need for the manufacturers to drive innovation. One outcome from these conferences was the desire for an IMO approved default setting that could be triggered by a single button. Although the mariner/display interface is only one aspect of e-navigation, it is an important one.

This general concept has now evolved into what could be called the ‘S-mode’ of operation and I would invite IFSMA Members to provide some feedback on the idea before the concept is developed further.

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-magnetron radar; and ECDIS, to name just a few. Significant innovations from the past have included electronic position fixing systems, the gyro compass and even the chronometer in its day. Standardisation of navigation displays on the bridge would simplify training and ensure that pilots and mariners could be instantly 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 (MFDs) 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 manufacturer, to have a clearly identified button that, when pressed, brings the display into a standard format with a standard menu/control system, standard interface (keyboard/ joystick etc) and basic features. For example, there may have to be a tactical display for near-time decisions (collision, and hazard avoidance) and a complementary display for voyage 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 reverting to S-mode and be competent in using the system's layout and functionality, regardless of manufacturer.
- Masters or companies could impose S-mode only use 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 a '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: however 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.

Conclusion

E-navigation is, at the moment, a catchall phrase for a concept of bringing existing and new technologies together to improve safety of navigation, commercial efficiency and security. The challenge for the industry, working through 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 agreed standard; position fixing systems need to be of high integrity; communication systems need to be established 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.

To my mind, implementing technology is like a three-legged stool: if any one or more legs is inadequate, the whole system fails. Here, one leg is the technology itself, another is the procedure for how to use the technology (gained through testing and experience) and the final

one is training, both in the operation of the technology itself but most importantly in using the technology with agreed procedures to make good decisions.

The concept of e-navigation, as outlined in this article, is a worthwhile and essential goal that we should embrace. However we should be aware that 'electronic navigation' is with us already and flourishing, led by commercial developments. Systems already exist that have high levels of integration both onboard and via communication links to shore, and this will continue to develop regardless of the work of the IMO. E-navigation, however, gives us a chance to bring this development within a strategic vision.

The Secretary General of the IMO has stressed the need for 'those who actually practice navigation' to be involved in the development of e-navigation, IFSMA members are invited to participate in this essential task.

This is a fledgling idea and I seek feedback from all IFSMA Members. If it is seen to be worthwhile, the functionality of S-mode will have to be established, and we will need to work with various stakeholders to develop this. Feedback on the initiative, either as a concept or with specific suggestions for format, should be sent to IFSMA or the author at djp@nautinst.org.