IALA e-Navigation Seminar
London, UK
2nd– 4th July, 2007

Draft Seminar Report

Executive Summary

The IALA e-Navigation Seminar was held from 2nd to 4th July, 2007 at Trinity House, Tower Hill, London, UK. Eighty two delegates, including representatives from twenty three countries, attended the seminar.

The seminar was characterised by a series of presentations on the concept of e-navigation. Information on the individual components of e-navigation was presented. The seminar also explored legal aspects and training issues relating to e-navigation.

The program provided an excellent opportunity for delegates to discuss various aspects of this new international initiative.

The seminar identified 13 conclusions and 9 recommendations.

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Introduction

A seminar on e-navigation was held at Trinity House, Tower Hill, London from 2nd – 4th July, 2007. The seminar was attended by 82 delegates, including representatives from 23 countries.

The three (3) day event witnessed high level representation from various national administrations and the maritime community.

Session 1 - Opening of the seminar

Rear Admiral J de Halpert opened the Seminar at 1000 hrs. He welcomed the IMO Secretary General and everyone present, to Trinity House. He said he was delighted that Trinity House was hosting the event, particularly as Trinity House had been in the business of navigational safety for 493 years. The seminar was all about the future of navigation, he added. He observed that it was at the IALA Council meeting in Kuala Lumpur, in 2003, that IALA was introduced to the Marine Electronic Highway and its potential. This led to the UK initiative on e-navigation, followed by a submission to IMO MSC. The IALA seminar was a key waypoint in the e-navigation voyage. He wished the seminar every success.

Rear Admiral J de Halpert then invited Mr T Kruuse, the IALA Secretary General, to welcome the delegates. The text of the address delivered by Mr T Kruuse is at Annex 1.

After his address, Mr T Kruuse invited the IMO Secretary General, Mr E Mitropoulos, who, with the aid of a PowerPoint Presentation, delivered the keynote address. The text of his address is at Annex 2.

In response to a question from the floor, the Secretary Generals of IMO and IALA clarified the situation regarding the expected cost of e-navigation and how it would be compatible with SOLAS Ch V. Mr T Kruuse stated that the e-navigation system must not increase costs for the shipowner. Rather, for similar costs, the system must improve safety of navigation.

In response to another question from the floor, both Secretary Generals confirmed that IMO, IALA and ITU were working together to achieve a satisfactory outcome with respect to the issue of potential interference to AIS channels from VHF data transmissions.

Session 2 – The concept of e-Navigation

Chairperson – Bill Cairns, FRIN, USCG

Marine e-Navigation: The Next Big Prize (Brian Wadsworth, Dept of Transport, UK)

Mr B Wadsworth said that steady progress had been achieved in maritime safety by a succession of technological innovations and regulatory measures. Safe navigation was the foundation of safety at sea and the opportunity was now within reach, to integrate earlier generations of navigational aids, bringing critical safety information together in a form readily intelligible to the PC-literate navigator of today. The demand was clearly there and the time had come to deliver. Achieving a true generation change in bridge and shore equipment would be the key to success.

His presentation detailed the origins of the concept of e-navigation and the way it has been developed to date. B Wadsworth expressed concerns at the delay in the provision of ENCs and described a UKHO initiative to speed-up the production of ENCs.

IALA and the e-Navigation Vision (Bill Cairns, FRIN, USCG)

B Cairns outlined the early work of the IALA e-Navigation Committee and its vision for the future. He then stated how IALA saw e-Navigation as a concept.

B Cairns stated that in the IALA definition for e-navigation, the key goals of e-navigation and existing impediments to the implementation of e-navigation had been addressed. He stated that the IALA definition was:

> *"E-Navigation is the harmonized collection, integration, exchange and presentation 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"*

His presentation also described the structure of the IALA e-NAV Committee and the role of this Committee within the IMO Correspondence Group on e-navigation. He focussed on IALA's role regarding the provision of information on aids to navigation and VTS to ship operators (and the provision of information from ships to shore) in the context of e-navigation, including radionavigation and the associated communications links.

Finally, he outlined the plan for future work in the Committee. These included developing the e-navigation concept, common shore-based system architecture and the e-navigation service.

Components of e-Navigation - their role (Nick Ward, Trinity House, UK)

Dr N Ward described the various components of e-navigation, including positioning and timing systems, communications and identification systems, information and display systems and the inter dependencies between them. The role of each sub-system was described and the manner in which they could be integrated was also outlined.

The role of VTS, the MEH and LRIT in e-Navigation (Mike Sollosi, USCG)

Mr M Sollosi started by explaining the traditional role of VTS and its functions. He then outlined the various levels of service offered by VTS, and the different categories involved. M Sollosi stated that modern marine transportation had placed demands on ships and shore based authorities, which extend far beyond their radar horizons. E-navigation could provide

opportunities to link ship and shore in ways that could be mutually beneficial. The merging of Marine Electronic Highways and LRIT with traditional vessel traffic services and marine information systems could contribute to the safety, security and efficiency of the global marine transportation system.

M Sollosi explained the potential role of VTS as a communications node in the berth to berth tracking of vessels worldwide and proposed opportunities to expand and improve on service delivery to the mariner. M Sollosi also introduced and described the concept of Vessel Traffic Management (VTM).

Discussion

Admiral Maratos, President of IHO, expressed surprise at what was stated in the presentation by B Wadsworth about ENC developments. Firstly, he said that he could not comment on the "new product" of the UKHO, since it has not yet been presented to IHO, its committees, or the appropriate organs of IHO. But, he wanted to stress that the IHO was the competent authority to provide ENCs to be used with ECDIS under the mandatory carriage requirements, as regulated in SOLAS V and under e-navigation developments. He also commented on other issues in the presentation, and what had been accomplished by IHO during the past ten years. Particularly:

1. It had been recognized by many parties that, after a slow start for obvious reasons, the production of ENCs had been accelerated.

2. Different technical and financial issues associated with the production and delivery of ENCs have been discussed within the appropriate bodies of IHO, in order to improve procedures noting that even today, paper charts are not technically perfect.

3. The IHO has reported on different occasions, to different IMO bodies, that at the time of mandatory ECDIS carriage requirements, IHO will have in place good coverage of consistent quality ENCs.

4. In May 2007, during its main conference, IHO had passed two unanimous resolutions related to ENCs; these would be presented to NAV53 in July 2007. With these resolutions, IHO has committed to having in place good coverage of ENCs by 2010, when mandatory carriage requirements will possibly be implemented. Also, considering the DNV Report on the ENC coverage, which acknowledges that even today there is a good coverage of ENCs, the IHO supports the IMO considerations of mandatory carriage requirements which will further accelerate the production of ENCs.

Taking into account the UKHO proposal, a question was raised from the floor regarding the standards to use for electronic charts. What was required and what was not? The situation becomes very confusing for mariners. In response, Brian Wadsworth reminded the seminar that the UKHO proposal was based on agreement between producers of official charts. The format used could be displayed on ECDIS and the collection of charts was accessible to everyone.

In response to a question regarding human element and the high level of training that is required (as there are always more sophisticated techniques available) in relation to the evolution of VTS, the presenters explained that the IALA Strategy Group was carefully considering this question, as it was considered essential for e-navigation. They added that VTS operators have to be trained to

a higher standard, because of the growing level of sophistication reached by those systems and services.

One participant raised a question about the use and function of traditional means of navigation such as visual aids to navigation or voice communications, when looking at the future. He asked if e-navigation was aimed at diminishing the use of such aids. The response was that e-navigation was primarily aimed at improving decision making capability. The question of reducing infrastructure such as visual aids was not the aim of the development of e-navigation.

Commenting on e-navigation, one participant expressed the view that e-navigation was a system and could not be assimilated into a single display. Different functions needed different displays. It was also pointed out that e-navigation included an increasing use and dissemination of information through different systems, with the risk of divulging sensitive information. In response, one presenter explained that, indeed, obligations to provide information are evolving; such information is necessary to improve safety, security and traffic management; it also means that we should accept that such information is less and less private.

Session 3 – User requirements

Chairperson – Mike Sollosi, USCG

The Mariner's Perspective (S Krishnamurthi, Vice President, Nautical Institute)

Capt Krishnamurthi stated that as a Vice President of The Nautical Institute, he was pleased that his Institute had committed the resources of its membership and knowledge base to support the concept of e-navigation.

He congratulated IMO and IALA for embracing the concept of e-navigation as a means of harmonising, collecting, integrating, exchanging and presenting maritime information onboard and ashore by electronic means in order to enhance berth to berth navigation.

Capt Krishnamurthi stated that the convoluted and uncoordinated use and presentation of such information often reduced the effectiveness of bridge teams and could result in distractions that could impede the ability to make good decisions. Unfortunately, ships personnel were not consulted when ships were designed or when deciding on the equipment they were to use. This meant that the equipment was not placed in the optimum location.

In relation to e-navigation, he outlined a typical 'wish list' of a shipmaster:

1) agreed passage plan between ship/shore

2) model of shared ship/shore risk analysis

3) presentation of AtoN and current status

4) current navigational warnings

5) reliable confirmation of position

6) real depth of water under keel

7) what are other vessels doing, and

8) A digital recording of the route followed.

Whilst it is easy to train mariners, it is important perhaps to understand that trainers themselves need an overhaul from time to time, he added.

Key areas to address from his point of view were the harmonised integration and presentation of such information on the bridge of a ship. It was critical that navigation systems be designed with procedures and training in mind, so that mariners and pilots could at all times feel confident in their ability to use these systems, to make good decisions. Another absolutely critical aspect of e-navigation should be the holistic look at 'alarm-management' not only for the navigation systems, but for the entire bridge, as any bridge alarm can be a distraction to the navigation process.

The Shipowner's Perspective (Peter Hinchliffe, International Chamber of Shipping)

Mr P Hinchliffe stated that ICS was the principle international shipowner representative organisation. It was an 'association of associations', with 36 national shipowner associations in the membership. This cross-sector, cross-trade membership, of 75% of the world's tonnage, gave ICS a unique insight into the needs of shipowners internationally.

The presentation supported the concept of e-navigation with regard to the potential benefits and noted some concerns held by shipowners on potential shortcomings.

Mr Hinchliffe stated that e-navigation gave the maritime community an ideal opportunity to standardise equipment. It must deliver clear benefits to seafarers, avoid premature carriage requirements and it must be user defined, not technology driven. Although parallels with aviation are often used, it is important to remember that e-navigation in the maritime world has several major differences.

Mr Hinchliffe stated that ICS fully supported e-navigation and the work being carried out by IALA and IMO. However, it was important that it be user driven and traditional method of navigation ought not to be forgotten.

Shore Authorities Perspective (Keijo Kostiainen, Finnish Maritime Administration)

Mr K Kostiainen said that traffic volume in the Baltic was increasing very rapidly. This was especially due to increasing oil transportation from Russia. Also, the passenger traffic between Helsinki and Tallinn was high. These two traffic routes intersected in the middle of the Gulf of Finland, which posed a very special risk.

He stated that the coast around Finland was shallow and there was a dense archipelago. Traffic was spread amongst many ports, which meant that traffic flows were light, but the overall number of ships was large. The sea bottom was hard and rocky, therefore dredging was costly. And a ship running aground could easily lead to serious damage. The fairways to the ports were long and narrow with lots of bends. So, they needed many aids to navigation. Besides darkness, fog, rain, snow and ice had their impact on the safety of navigation.

Mr K Kostiainen stated that for shore authorities, e-navigation offered several tools for enhancing the safety and efficiency of navigation, as well as for the protection of the marine environment. The system in use was called PORTNET, which consists of a single window where all the information was received, collated and then distributed to the relevant authorities. e-navigation would enable the current ship reporting system to cover the whole Baltic Sea.

Mr Kostiainen concluded by saying that Finland expected real time and accurate information from e-navigation, together with good communications. e-Navigation needed to be cost effective and user friendly.

Port / harbour Perspective (Peter Struijs, CCO, Port of Rotterdam)

Peter Struijs commenced his presentation by outlining the two key objectives of the Port of Rotterdam, which were to promote the effective, safe and efficient handling of shipping and to develop, construct, manage and commercially operate the port of Rotterdam.

He stated that a Port Manager was essential for the development of e-navigation and although the Harbour Master was not part of the Executive Board, the Port Manager and Harbour Master needed each other. Peter Struijs talked about the current status of the Port of Rotterdam and what was envisaged for its future development. He outlined the Port of Rotterdam's investments in e-navigation by using enhanced VTS for vessel and port safety and efficiency, as well as enhanced vessel traffic planning and monitoring. Peter concluded his presentation by suggesting some issues that he felt could be addressed by IALA.

E-Navigation - the Challenges and Benefits (Duncan Glass and Sally Basker, Trinity House, UK)

The Challenges

Capt. D Glass started his part of the presentation by asking, *why is the maritime community doing this (e-navigation) and do we seriously think we can achieve it?*

He stated that more than 80% of all collisions and groundings involving SOLAS Convention Ships were caused by human error. Although the number of such incidents was not increasing, the consequence in terms of damage to the marine environment and cost to the industry was rising each year.

Capt Glass said that the time was right. The necessary technology was available. Mandatory carriage of ECDIS would occur. The display of AIS data, onboard and ashore was needed.

Capt. Glass stated that the three fundamental foundations upon which e-navigation could be built were: global broadband communications, radio navigation position fixing and timing of high accuracy, availability and integrity and global coverage of electronic navigational charts. He said that the user requirements were voyage planning, monitoring the voyage plan, position fixing, collision avoidance, manoeuvring and conning, two-way communication, recording navigational events and voyage reports. He concluded by saying that e-navigation would work if the maritime community mean it. E-navigation ought to assist in removing ambiguity, end information overload by intelligent presentation and present information that left no room for misinterpretation or wrong decision making.

The Benefits

The second half of this presentation dealt with the benefits of e-navigation and was presented by Dr. Sally Basker.

Dr Basker talked about the foundation pillars of e-navigation being communications, navigation and situational awareness or surveillance and how the lintel was the man/machine interface with its presentation display. Getting this interface right was an essential pre-requisite to realising e-

navigation benefits. She discussed the benefits, which could be classified at the highest level in terms of safety, security and protection of the marine environment and who the beneficiaries might be. Dr Basker said that e-navigation might be structured around a set of core, standardised services that are needed to satisfy global minimum operational performance requirements, together with regional or national augmentations or enhancements, depending on the local service provision environment.

Dr Basker concluded her presentation by saying the General Lighthouse Authorities have recently published their first radionavigation plan that is focused on e-navigation. She also said there is a need to ensure that whoever owns e-navigation, they must have the authority, responsibility, accountability and resources to make it happen.

Discussion

In response to a question from the floor on the inland waters of Finland and various European projects, K Kostiainen replied that with full AIS coverage in the Baltic Sea, it was not envisaged that LRIT would provide added benefits. He also stated that he was aware of the European projects being carried out and hoped that they could eventually be used to assist the decision making of VTSOs.

In response to a further question from the floor on guidance for shipowners on how navigators used their equipment, the presenters suggested that possibly a questionnaire may be a useful way to obtaining the information needed.

In another comment from the floor, it was suggested that there is a need to look at how manufacturers were working to resolve various problems. The seminar learnt that the Nautical Institute was working with CIRM to identify user needs. There was also a need to look at simulation as a way to solving problems, as well as develop training requirements. IEC and pilot bodies could be asked to assist.

END OF DAY

Day Two – Technical Aspects of e-Navigation

Key note presentation by Mr Koji Sekimizu, Director, Maritime Safety Division, IMO

In his keynote address, Mr K Sekimizu outlined the current status of discussion at IMO on the development of e-navigation, together with the need for a strategy for its development. He also detailed the IMO initiative on the development of Marine Electronic Highway (MEH), the importance of ENC and the responsibility of coastal States, as well as the role of IMO in promoting the concept of e-navigation.

Session 4 – Charting and Display Issues

Chairperson – Nick Ward, Trinity House, UK

Dr Nick Ward was Chairman for the session.

The IHO, ENCs and ECDIS (Stephen Shipman, IHO)

Mr S Shipman briefly reviewed the organisation and structure of the IHO, with particular reference to e-navigation. Following this, the presentation focused on IHO activities with respect to ECDIS and ENCs and finally reviewed the status of ENC production and availability. In particular, he pointed out the international obligations of coastal States and the recommendations to develop official electronic charts (ENCs). He also detailed the development of a comprehensive online catalogue of available official charts and reminded the seminar of the decision taken by the last IHO Conference regarding the coverage of ENCs by the year 2010.

The Generation and Display of High Quality Radar Signals – Opportunities for e-Navigation (Jens-Erik Lolck, Terma A/S)

Mr J Lolck described some techniques used to generate and present a highly resolved and highly graded radar image. Some of the factors determining the radar image quality were the transmitter frequency/ies and pulse shape, the radar antenna, the receiver dynamics, video digitisation, the automatic video processing, etc. The influence of each of these was discussed and examples were shown.

Today, the processed video can be distributed using off-the-shelf network technology (Ethernet IEEE 802.3) and displayed using PC-type hardware. In addition to presenting the video itself, historic information (radar trails) as well as various tools (EBL, VRM, re-centre and zoom) functionality are useful. On top of the video synthetic features such as tracks, coastlines etc. can be presented. The presentation concluded with a short description of a radar workstation display developed for ship-borne surveillance applications.

Service Orientated Architecture in Shore Based AIS Systems (Michael Birkmose, Gatehouse, A/S)

Mr M Birkmose described the service orientated approach to the design of shore based AIS systems. Gatehouse had adopted such an approach in order to promote standardization and reuse of existing components in shore based e-navigation systems.

Discussion

During the discussion a question was asked on the value of the information of raster charts for e-navigation purposes compared with the vector charts information. It was stated that, obviously, raster charts constitutes an improvement compared with paper charts but they are less performing that ENCs for which also all data are directly referenced in WGS 84. Raster charts which are derived from paper charts can be based on different standards or adapted from different standards. Regarding the question of shortfall of ENCs, the situation seems not as pessimistic as expressed by some participants and the ENC coverage on representative routes are now well underway as acknowledge by a recent DNV report.

It was also pointed out that the UKHO initiative is not an action against IHO but a support to many national hydrographic offices around the world which are not all IHO members and which have not necessarily the resources or the qualification to produce ENCs. UKHO has offered to help them to solve their problems and to make some coordination avoiding, for instance, duplication of ENCs by neighbouring countries.

Session 5 - Navigation and positioning systems

Chairperson – Stuart Ruttle, CIL

A Review of Satellite Navigation Systems and Future Developments (Terry Moore, University of Nottingham, UK)

T Moore explained the basic principles of satellite navigation systems, their current status as well as the modernisation and proposed developments of the systems for the next decade. It was stressed how important it was to be able to segregate the civil and military signals; future satellites systems would have this capability.

He stated that it was expected that by the year 2050, accurate positioning would be as widely accepted, and relied upon, as precise timing was today. The uses of GPS and the rapid growth of the market had far exceeded anyone's expectations. GPS was now a fundamental part of all our lives, whether we know it or not.

With such a reliance on GPS, it was perhaps not surprising that Europe, and other areas of the world, were considering additional, independent, systems to GPS. Galileo would be a European complement to GPS. The €3.5bn Galileo project became a reality with the launch of the first test spacecraft at the end of 2005. The system, which would be independent, but interoperable and compatible with GPS, was expected to be operational by about 2012. Over the same time frame GPS would also develop, and a modernised GPS service was expected to provide additional benefits. And over recent years, the world had seen the rapid re-emergence of the Russian system GLONASS, which hoped to get back to 18 satellites by the end of 2007.

Mention was made of EGNOS, which is up and running but still in the test phase. The major advantage of EGNOS was that there would be differential improvements as well as the provision of integrity warnings.

A meeting of the European Union Council of Ministers realized the concession-based model was heading nowhere. They agreed that Europe would pursue public funding for Galileo, which

hopefully would be in place by the autumn of 2007. A target date of 2012 was expected for full operational capability.

Global Navigation Satellite Systems – The Present Imperfect (David Last, Trinity House, UK)

D Last covered some of the limitations affecting GNSS including system failures, clock failures and solar activity in the form of flares. Jamming of GPS signals was another problem, with devices having this capability being freely available. Launching GALILEO would not stop jamming. Spoofing was another problem, on which subject the US Government had produced the Volpe report. Spoofing was an integrity problem. Civil receivers are bad at detecting spoofing, the detection of which needs another system with clever integration. D Last concluded by stating that a terrestrial back-up was the best defence.

Enhanced Loran: The Terrestrial System for the 21st Century (Sally Basker, Trinity House, UK)

Dr S Basker stated that the General Lighthouse Authorities (GLAs) of the United Kingdom and Ireland had long maintained that the widespread reliance on GPS and its known vulnerabilities meant that an alternative position fixing device was needed.

The emergence of e-navigation served to emphasise that a fail-safe backup was needed. In the recently published GLA Radio Navigation Plan - "2020 vision", it was stated that *"the deployment of a complementary, internationally standardised terrestrial radio navigation system provides the only way of maintaining our service levels until 2020 without undue increases in cost and/or risk"*. There is only one candidate: Enhanced Loran (eLoran). Proof of concept trials have already been successfully carried out.

eLoran is the latest in the long-standing and proven series of Loran systems, one that takes full advantage of 21st century technology. It is a positioning, navigation, and timing (PNT) service and trials have proved that it can meet the performance requirements for maritime harbour entrance and approach, aviation non-precision approach and telecommunications primary reference clocks among others.

Dr Basker said that the GLAs would continue to work with international partners to ensure that eLoran remained operational within Europe and the US in the short term as well as being involved in the development of eLoran standards. The GLA would also encourage the development of user equipment, encourage and support the realisation of the ERNP through an EC communication and the implementation of recommendations pertaining to Loran, as well as continuing to seek wider support from other user segments and public sector domains to share future costs on an equitable basis.

Marine Inertial Navigation Systems (Andy Norris, Consultant)

Prof A Norris stated that the General Lighthouse Authorities of the UK and Ireland commissioned an assessment of the impact that the integration of Global Navigation Satellite Systems (GNSS) with Inertial Navigation Systems (INS) would have on the Aids to Navigation (AtoN) services currently provided, and those to be provided in the future.

There is concern about the vulnerability of GNSS, and the provision of complementary and backup systems is seen to be of great importance. The integration of INS could provide an

independent and self-contained navigation system, for a limited time period, invulnerable to external intentional or unintentional interference, or the influences of changes in national policies.

The study included an analysis of the potential use of a combined GNSS-INS system in three of the four phases of a vessel's voyage: coastal, port approach and docking. The project consisted of a technology assessment, looking at the different inertial technologies that might be suitable for each phase. This was followed by a technology proving stage, evaluating suitable equipment using simulation and field trial to prove that the claimed performance could be achieved in practice. The final state of the project was to assess the effects of the availability of such systems on existing and planned aids to navigation services. INS may offer advantages to improve a ship's navigation. However, it cannot be considered as a primary back-up to GNSS. The main advantage is in allowing accurate navigation for a defined time after GNSS failure.

Prof. A Norris made a comment that e-Navigation should not be seen as a single piece of equipment on the bridge with its own display and controls. It is a system where different screens or windows can be displayed at monitors or workstations at various appropriate locations throughout a ship or shore facility. e-Navigation integrates the many separate navigation and marine information data and distributes its to individual locations where it can be further processed, as necessary, and displayed in a manner which meets the particular requirements of each user.

Discussion

In response to a concern from the floor about the jamming of GPS and Loran signals the presenters stated that having DGPS does not help, as if one signal is lost at the ship they are all lost. It is possible that a warning could be received but delay times vary depending on how quickly the ground stations can get the information to the end user. Regarding the jamming of Loran signals it would take an extremely powerful and very large jammer to do this. No trials have yet been conducted re the jamming of Loran transmitters.

In response to another question from the floor concerning eLoran user equipment the presenter explained that the aim is to standardise internationally and at different levels with the ultimate aim to present it to IMO. In the meantime their attention has been drawn to the equipment in a Paper, to be presented at the next NAV session.

Session 6 – Communications

Chairperson – David Last, Trinity House, UK

Prof. David Last opened the session by introducing the speakers for the session.

Maritime Communications (Kim Fisher, IEC, UK)

There are frequency bands available for maritime use over a range of spectrum from 100 kHz to 10 GHz, which allow the provision of communication to and from ships and between ships for local and world-wide needs.

Ships carry radio equipment mainly to conform to the carriage requirements of International Convention for the Safety of Life at Sea (SOLAS) in the Global Maritime Distress and Safety

System (GMDSS). The techniques used in the GMDSS are well established, but options are available to introduce new techniques for data communications and enhanced operating systems. An ITU World Radiocommunications Conference is due to be held in the autumn of 2007, which has a number of maritime spectrum issues on its agenda and will enable further flexibility of the use of the frequency bands to meet future needs.

Digital Aids to Navigation for e-Navigation (Ma Jianshe, China MSA)

Mr M Jianshe clearly demonstrated the connotation of digitisation of aids to navigation information, addressed its merits, and introduced its application in China, including aids to navigation information management system, aids to navigation remote monitor and control system, AIS base station network, broadcast of AIS information, etc.

He predicted the future development of e-navigation and digitisation of aids to navigation information, which is, by integrating different system information, to construct comprehensive navigation guarantee system for providing overall navigation information to port authorities and mariners and promoting e-navigation development.

No Boundaries – the Network Approach to e-Navigation (Arve Dimmen, Norwegian Coastal Administration)

Mr A Dimmen stated that the concept of e-navigation can be viewed upon in many different perspectives – one of these being the "network-centric approach". This approach outlines a notion that the boundaries between the ship-based information systems and the shore-based information system will be erased, and the content and timeliness of the information becomes more important than its origin and ownership.

This means that the ship becomes a node in a global network consisting of ships, coastal authority network, port state network etc. Once a ship reaches a designated point or area, it is instantly recognised in the network, it's mission and plans are exchanged, its required port state, flag state and coastal state information is received and sent. And more importantly, the required navigational support information is exchanged with the network. What type of information is this? We have already seen the beginning of "interactive" navigational support information – AIS, Virtual Aids to Navigation, DGNSS systems, traffic information, wave and current information etc.

There are two important conditions that have to be met:

> - integrity of the information must be ensured

> - the information exchanged is purely informational and must not in any way be interpreted in any other way by the ships Master

The boundaries between the ship and its surroundings will still exist – but just as the ship always has been an integral part of the ocean surrounding it, it will now be a part of the virtual ocean – the network and its waves of information.

Space Based Maritime Monitoring (Richard Kolacz, COMDEV, Canada)

AIS signal detection from space can be achieved with Low Earth Orbiting Satellites. The ability to extract useful and intelligent information is dependant upon the process used for AIS data de-collision. This presentation outlined the activities conducted to date to achieve an Advance

Capability AIS Space System and concluded that space based AIS system is feasible and can provide global AIS picture in a secure and controlled manner without the requirement for any additional shipboard equipment. Such system could be ready and be implemented by 2012.

Session 7 – Case Studies and training issues

Chairperson – David Last, Trinity House, UK

The Aviation Comparison (Norman Bonnor, RIN, UK)

Mr N Bonnor described the similarities and fundamental differences between the marine and aviation domains concentrating on navigational and collision-avoidance aspects. After introducing the ICAO CNS/ATM Project, the presentation explained the changes underway in commercial aviation that are dispensing with routeing over ground-based beacons and adopting area navigation (RNAV) combined with Required Navigation Performance (RNP). The Traffic Collision Avoidance System (TCAS) and Automatic Dependent Surveillance were briefly outlined together with the increasing use of GNSS for approach and landing guidance.

VTS, e-Navigation and Training (Terry Hughes, UK)

Can e-navigation compensate for the human factor problem which causes so many accidents/incidents in a VTS area? The presentation focused on the human element confronting new technology and the importance of man-machine interface, concluding on the fundamental role of training which should be mandatory, both ashore and on board, and should be performed by well trained trainers. Assessment of individual qualification should also be exercised on a continuous basis.

Discussion

During the discussion period, several questions were raised on the use of the frequency bands available for the maritime activity, in particular the VHF band. Attention was drawn to the threat that ITU was willing to consider sharing the channels used for maritime mobile communications. For instance, Channels 87 and 88, dedicated to AIS transmissions, are at stake and have to be protected. IALA had sent a liaison-note to ITU to reiterate the need to preserve the VHF channels and the necessity to protect them in the framework of the development of e-navigation.

However, it was pointed out that the bands used by maritime mobile communications are generally shared by other mobile users and ITU is of the opinion that the different users should learn to live together and to share the different frequency band available, including by using existing techniques for increasing volume of data communications.

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Day Three – Legal and Human Aspects

Session 8 – Regulatory and legal aspects

Chairperson – Gary Prosser, AMSA

The Mainer and the Judicial System (Mr Justice David Steel, Royal Courts of Justice)

Mr Justice David Steele talked about the mariner and the judicial system. The text of speech is reproduced at Annex 4.

E-Navigation, Liability and Legal Observation (Svend Eskildsen, RDANH, Denmark)

S Eskildsen reiterated the new IALA definition for e-navigation and stated that whilst e-navigation is not entirely different from what we already know, integrated systems are. Navigation systems are decision support systems and should support the navigator. Wrong decisions could be based on poor information or improper use of navigation systems. E-navigation can assist with surveillance, making the monitoring of vessels movements more efficient as well as helping with SAR and pollution operations. Certain considerations need to be born in mind, in particular standardisation of equipment and copyright issues.

E-Navigation and the Investigation of Marine Casualties (Dennis Bryant, Holland Knight, US)

D Bryant started by saying that in the olden days, investigation of marine casualties, such as collisions and groundings, relied heavily upon the experience of the investigating officer. Statements of witnesses, who were almost always interested parties, were incomplete and self-serving. In collision cases, statements of individuals on the two ships were generally contradictory. Navigation charts often were lacking in critical fixes and sometimes included material apparently inserted after the fact. The investigating officer was left to apply his or her experience to the facts that could be gleaned in order to determine what most probably occurred. Litigation was commonplace and often turned on the credibility of witnesses, rather than hard, cold facts. Even with the advent of electronic navigation, things did not change drastically as regards reconstruction of such marine casualties.

D Bryant provided an interesting overview on several case studies as appeared before the US judicial system. He went to say that we now have the global positioning system (GPS), the automatic identification system (AIS), the voyage data recorder (VDR), and other technologies that weren't even considered possible in 1923, or even in 1951. A marine casualty investigation is no longer considered complete unless and until all available information has been obtained from the various pieces of electronic navigation equipment that may have relevant data. As the IMO recommends: "Effective use should be made of all recorded data, including voyage data recorders (VDR), if fitted, in the investigation of a marine casualty or marine incident wherever it occurred."

After years of promotion and controversy, the IMO adopted performance standards for voyage data recorders (VDR). That was shortly followed by an amendment to the International Convention on the Safety of Life at Sea (SOLAS Convention) making carriage of VDR mandatory for most commercial vessel engaged on international voyages. As stated in the SOLAS regulation, the purpose of the VDR is to "assist in casualty investigations".

D Bryant concluded by saying that with the advent of electronic navigation – and particularly the recent availability of automatically transcribed records from those electronic navigation devices, marine casualty investigations have progressed far and fast. Details that were only guessed at 20 years ago are now laid bare for all to examine. The findings and recommendations of those investigations are now much more focused and on point. One should expect that enhancements to electronic navigation (both shoreside and afloat) will continue and that marine casualty investigators will find new ways to utilize those enhancements to improve the quality of their investigations

Legal Obstacles to e-Navigation (Nihan Unlu, Legal Affairs, IMO)

Ms N Unlu stated that e- navigation will be a way of providing accurate and clear navigational information to coastal States from vessels transiting their waters. However, introducing e-navigation beyond or within the jurisdiction of coastal States could raise legal questions. This presentation will focus on the legal obstacles to the application of e-navigation in both internal and territorial waters, exclusive economic zones and high seas.

There are already a great deal of many electronic navigational and communication technologies and services, with others being developed. IMO have adopted VTS, AIS, LRIT systems although the latter system is still in the development stage. The reason why SOLAS adopted the LRIT provisions is because the majority of States were of the view that the provisions were consistent with UNCLOS. E-navigation will contribute to safety of life at sea, safety and efficiency of navigation, protection of the marine environment and the security of the coastal state. The aim and establishment of e-navigation is to secure a greater level of safety and security, which will provide freedom of navigation.

Discussion

In response to a question from the floor about liability issues for the master and shipowner, the presenter stated that it will be up to the individual State as to how they deal with this issue. Unfortunately the mariner will still be held to account in many cases.

In response to another question from the floor as to whether or not service providers could utilise a user pays system, it was suggested that when entering port they could but it would be extremely difficult when it came to the high seas.

In response to a comment from the floor that certain Straits were not aligned with the way architects were now designing ships, which are becoming bigger and faster, that maybe someone will have to pay sometime, the presenter said that maybe the ICE PATROL system could be used as an example. This is an internationally agreed system inbuilt into SOLAS, whereby the US calculates the cost of providing the service and then sends the bill to particular countries requesting their share. It was suggested that perhaps e-navigation could be called a general service, as for lights etc, but VTS is not a general service. It is a very complex subject.

In response to another comment from the floor that as aircraft have triple redundancy systems, could not the same principle be applied to vessels, the presenter responded that of course that is possible. However, there is a danger that a big brother environment is being built up. On the other hand however, if a serious accident occurs, e-navigation records will help the investigation.

In response to a question from the floor concerning the liability issue of a master transmitting his passage plan to head office, the presenter replied that under US law if a shipowner was aware that the passage plan showed that a casualty may occur and the shipowner did not inform the Master so he/she could take remedial action, they may be liable.

In response to a final question from the floor regarding the insertion of AIS into the COLREGS, the presenter replied that AIS has already been mentioned in court but we must not forget that e-navigation technology is always constrained by the human element.

Session 9 – Conclusions of the seminar

Chairperson – Torsten Kruuse, IALA

Special presentation on Electronic Charting and e-Navigation: Challenges and Opportunities (Dr Lee Alexander, University of New Hampshire)

Dr L Alexander said that similar to the evolutionary process for living organisms, marine navigation systems are becoming increasingly complex and sophisticated. Both by design and function, shipboard and shore-based systems will no longer be individual components operating independently. Instead, the trend is toward system integration, fusion and synergy (i.e., e-navigation).

Dr Alexander discussed the challenges and opportunities involved in developing the "Electronic Chart-of-the-Future". Electronic charts are evolving from display of static, chart-related data to a decision-support system capable of providing real-time information. To do this, electronic chart data must incorporate both "Z and time" dimensions. Currently, we have the ability to conduct high-density hydrographic surveys capable of producing ENCs with decimetre contour intervals or depth areas. With real-time/forecast water depth information and port information services transmitted via a shore-based AIS communications broadcast, mariners will be able to precisely determine planned and actual under-keel clearance. Further, electronic charts will become a task-oriented composite display that enables the user to configure the display for the operational situation or task-at-hand.

Implications for e-Navigation as it relates to the provision and use of navigation-related information:

While there are numerous opportunities to display supplemental information on electronic chart-related displays, there are also significant challenges. We need to look beyond the provision of information that goes beyond that which is required for "safety-of-navigation." In particular, this includes efficiency of maritime navigation and marine environmental protection. However, for maritime community, this type of information is not readily available. Currently, many organizations continue to produce individual products/services on a sub-component basis. Hydrographic Offices grapple with trying to provide multiple chart products and services (e.g., paper, RNCs, ENCs), while Coast Guard/Maritime Safety agencies focus on improving AtoN and VTS. This "balkanization" and reluctance to change leads to a fragmented, sub-optimal "System", due the inability to provide maritime users information that is seamless, readily-available and at reasonable cost. In particular, government agencies must be willing to recognize that navigation-related information can no longer be considered separate products in terms of how produced, what and how used, and that being up-to-date is a critical factor.

Conclusions of the Seminar

1. There is widespread support for the concept of e-navigation, which is seen as an attainable goal. The global maritime community must continue to maintain momentum in the evolution of e-navigation.

2. The development of e-navigation must be driven by user requirements; it should be informed but not led by technology. The development of user requirements must be given the highest priority.

3. e-Navigation should not be pursued to reduce operational shore side personnel, crew numbers or their competencies.

4. Standardisation (i.e., data formats and communication standards) of navigation systems is very important, but this must not inhibit innovation.

5. The S-mode of operation should be supported

6. Independent and fully redundant position fixing and timing systems are vital for the implementation of e-navigation. Enhanced Loran (eLoran), a terrestrial radionavigation system, is an independent and dissimilar system to GNSS that is capable of meeting the positioning, navigational and timing requirements for e-navigation.

7. Marine Inertial Navigational Systems (INS) cannot be considered as a primary back up system to GNSS. It can assist in accurate navigation, but for a limited period of time. However, Marine INS can improve a ships operational efficiency, for example, by providing movement information to the ship's auto pilot and measuring squat and heel accurately.

8. Systems exist for increasing the volume of data communications with ships. But it is important to ensure that existing safety communication resources are adequately protected.

9. There is evidence of increasing coverage of the world's navigable waters by ENCs. By 2010, some 85 to 96 percent of the main shipping routes should be covered by ENCs. Therefore, it is anticipated that there will be adequate ENC coverage to support the e-navigation strategy.

10. A Vessel Traffic Management framework needs to be in place to accommodate the shore component of e-navigation.

11. Mandatory training, both ashore and afloat, as well as the on-going assessment of personnel, is critical to the success of e-navigation. It is equally important to ensure that trainers and training curricula are kept up-to-date.

12. In developing e-navigation technical standards, intellectual property rights must be respected; the creation of monopolistic situations must be avoided.

13. The development of e-navigation must give due regard to international law, including UNCLOS.

Recommendations of the Seminar

1. Working in close cooperation with international organisations like IMO and IHO, IALA must continue to play an active role in the evolution of the e-navigation concept.

2. IALA must take a pro-active role in the evolution of e-navigation in areas where it has the expertise - marine aids to navigation and VTS; high priority must be given to the users' requirements and the human element.

3. e-Navigation equipment manufacturers should consult extensively with shipmasters and shipowners to ensure that user requirements are understood and met.

4. IALA should support the development of the S-Mode of operation.

5. IALA should support / take the lead in the development of an international standard for eLORAN.

6. IALA should develop the VTM concept in the context of the expanding role of VTS and MEH.

7. Authorities should ensure that training of shore side operating personnel and shipboard personnel remains current with developments in e-navigation and is documented in accordance with existing conventions, guidelines and recommendations.

8. Authorities should ensure that simulation is used for proof of concept testing and training.

9. IALA should consider conducting a seminar on e-navigation in approximately two to three years time

Seminar Closing

In his closing remarks, Mr T Kruuse expressed his thanks to Trinity House for all their arrangements and cooperation. In particular he thanked Edgar King, Carla Zissler and the entire team.

Jeremy de Halpert congratulated the IALA Secretariat ,who he said had done outstanding work in putting together this high class seminar together. He also said that the seminar was very well reported in the international press.

T Kruuse congratulated all speakers for their excellent presentations and noted that the seminar had been a great success. He expressed his gratitude once again to Trinity House for co-hosting this event.

A CD-ROM containing electronic copies of all presentations, papers and the draft report was prepared and provided to delegates upon conclusion of the seminar.

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Annex 1: Address by the IALA Secretary General, Mr Torsten Kruuse

Opening words

Thank you, Deputy Master

IMO Secretary General Admiral Mitropoulos, Mr President, ladies and gentlemen, good morning.

On behalf of both IALA and Trinity House, I welcome you all to this e-navigation seminar.

It is pleasing to see so many distinguished people gathered here today. It is also encouraging to see a line-up of high profile speakers and an impressive seminar program.

This seminar is being held at a very important time in the evolution of e-navigation, and IALA is pleased to offer this event as yet another contribution to the development of this new concept of navigation.

The seminar also has historic significance, as it is being held to coincide with the 50th anniversary of the formation of IALA.

Brief History

IALA's origins can be traced back to 1889, when, a Conference on Maritime Works was organised by the French Lighthouse Authority. With the success of this first international meeting, it was decided that marine engineers from all over the world ought to meet regularly, to keep up to date with the rapid development in technology.

Conferences continued to be held until 1955, when it became evident that five years was too long a period between conferences.

Delegates were presented with a formal proposal to establish a permanent secretariat, whose responsibility would be to collect information on navigation and maritime matters.

Thus IALA was born, on 01 July 1957.

Today, IALA has over 200 members, including some 80 National Members and an equal number of Industrial Members.

During the years of its infancy, a large amount of work was undertaken. A stand-out achievement was the pioneering effort to harmonise the over 30 existing different buoyage systems.

Since then, IALA has led the way in the development of guidance on:

- VTS matters,
- the Differential GNSS (DGNSS) radiobeacon service,
- many aspects of aids to navigation engineering and management matters, and
- preservation of historic lighthouses

More recently, working closely with other international bodies like IMO, ITU and IEC, IALA has led the development of the operational and technical aspects of AIS.

e-Navigation

IALA is pleased to be part of the international efforts to develop the new concept of e-navigation.

As you know, e-navigation is a relatively new initiative, put before IMO in May 2006, by seven of its Member States.

But it may interest you to know that IALA was already working on an e-ANSI concept, from 2004 onwards.

You may ask, what is e-ANSI?
> e-ANSI is a concept that aims to provide real-time electronic information on the status of regional marine aids to navigation on a shipboard operational display.

Much work was done on this. Some Industrial Members of IALA organised demonstrations, thereby proving its feasibility to the IALA Council; relevant international organisations, particularly IHO, contributed to the development.

The aim was for IALA to prepare a recommendation on digital aids to navigation service for the twenty-first century.

In 2006 however, owing to international developments, IALA decided that a new IALA technical committee, called the IALA e-Navigation Committee, was needed to take forward the holistic concept of e-navigation including the work of the e-ANSI working group.

Seeing as one of the guiding principles of e-navigation is to join the bridge watch-keeping team with the shore-based VTS team to create maritime domain awareness *(that is, information on the presence and movement of surface craft in one's area of responsibility),* I can see that IALA is perfectly placed to contribute to the development in e-navigation.

The international maritime community, through IMO, aims to develop a strategic vision, to utilise existing and new technologies in a holistic and systematic manner.

I'd like to stress on a few points in this regard:

- Firstly, e-navigation is a not a brand new aid or tool that is being designed from scratch. Rather, the aim is to integrate mostly existing (and some new) technologies, in order to enhance navigational safety. Electronic navigation already exists, in the form of numerous manufacturers' integrated navigation and communication products. Therefore, I foresee a relatively shorter time frame for its introduction and implementation.

- Secondly, 'the e-navigation box' has to be a compelling product - something that the mariner and ship owner would want to have, rather than be made to carry. Then there will be true demand for it, and then industry will be able to offer innovative products. For

this, it is imperative that agreed international user requirements are developed. Only then can and should manufacturers work on building the new equipment.

> Of course, the design of onboard e-navigation equipment has to meet the user requirements. But the 'e-navigation box' should be an attractive alternative to the various navigation aids that SOLAS Chapter V requires a ship to carry. Also, the price of the e-navigation box should be less or equal to the price of the various navigational aids that SOLAS Chapter V requires as a carriage requirement.

- <u>Thirdly</u>, key elements need to be agreed – chart data and systems need to be brought to an agreed standard, fail-safe position fixing systems must be in place and communication systems need to be agreed.

- <u>Finally,</u> e-navigation must provide the mariner with information necessary to navigate safely from A to B. It must reduce the potential for human error by actively engaging the mariner in the navigation of the vessel, whilst preventing distractions and overburdening

However, a common mistake people make when trying to design something completely foolproof, is to underestimate the ingenuity of complete fools.

Increasing use of AIS
There is growing evidence of the use of AIS ashore. This offers shore authorities a wealth of near real-time ship data, which was, until now, unavailable.

Information on the presence, pattern and movement of shipping will provide maritime administrations with the ability to increase domain awareness and fulfil their statutory obligations.

AIS will be a key element of e-navigation. IALA has led the development of AIS so far and is perfectly placed to offer guidance on the use of AIS for e-navigation.

The future
A variety of shore administrations, at a local, regional and national level, are demonstrating an increasing need to interact with shipping. Therefore, I foresee a move towards more vessel traffic management initiatives – just like the management of air space.

The traditional role of a VTS is expanding beyond the radar horizon and beyond the limiting role currently prescribed. There is a global move towards more domain awareness. With the advent of Long Range Identification and Tracking (LRIT), the availability of AIS data and radar surveillance, the monitoring of, and interaction with, vessels has become a more widespread activity.

A prime example is the increasing level of piracy incidents in many parts of the world, which is a cause of deep concern to the maritime community.

I believe that e-navigation can be used to combat piracy. With e-navigation, it will be possible to have complete domain awareness in a given area. With enhanced AIS and radar surveillance. Authorities will be able to monitor, what is going on at sea.

With VTS extending to international waters, consideration could be given to establishing "Special Secure Shipping Lanes" in the most risky areas, with enhanced interaction through e-navigation, backed up by a ready response force.

IALA is prepared to play its role in the further development of e-navigation, and will continue to be, a dynamic and proactive organisation. IALA will continue to aim to foster the safe and efficient movement of vessels, in a manner that is inclusive, cooperative and one that has the best interests of the mariner.

Cooperating with other international organisations like IMO, IHO, ITU and our sister organisations, IALA will continue to contribute to the twin objectives of safety at sea and the protection of the marine environment.

I always remember that *'when technology becomes master, we will reach disaster faster.'*

I look forward to hearing the presenters and I wish the seminar every success. I now invite the IMO Secretary General to deliver his keynote address.

THANK YOU

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Annex 2: Key note address by the IMO Secretary General, Mr Efthimios Mitropoulos

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(As delivered)

IALA E-Navigation Seminar
Trinity House, London
2 July 2007

Keynote address by
Efthimios E. Mitropoulos,
Secretary-General, International Maritime Organization

Mr. Chairman and Deputy Master of Trinity House,
Secretary General of IALA,
IMO Council Chairman and NAV Sub-Committee Chairman,
Chairman of the EMSA Board,
President of the Royal Institute of Navigation,
Vice-President of the Nautical Institute,
Ladies and gentlemen,

As a former seafarer, harbourmaster and someone who has been involved in ships and shipping all my life, I know from first-hand experience that, almost above all else, the safety of navigation is the very essence of a reliable and effective maritime industry. That is why, in my present capacity, I always consider it a real pleasure and honour to assist meetings organized by IALA. For safe navigation is IALA's business, its *raison d'être* and the contribution it has made to its cause, in the 50 years since the Association was founded, is both **immense in size** and **broad in scope**.

Every day, millions of tonnes of cargo are safely delivered and thousands of seafarers go routinely about their working lives thanks to the coordinated efforts of IMO and, of course, IALA and its members. That you are able to treat the complex network of buoys, marks, signals and other aids to navigation that you have put in place all over the world with an unthinking confidence is a great testimony to your **vision, foresight, diligence** and **effectiveness**; not only that, your central role in the evolution of new technologies, such as Vessel Traffic Services and your continued contribution to IMO's regulatory work, in particular that of the NAV Sub-Committee, speak of an **admirable commitment to remain at the forefront of developments** – when your numerous initiatives do not shape it; not a rare case.

So let me begin this speech by thanking you for the opportunity to address you, once again, and by congratulating you whole-heartedly on your **50th anniversary**.

When I spoke at IALA's 16th Annual Conference, in Shanghai, last year, I observed that the **traditional hardware** designed to aid navigational safety – lights, buoys, channel markers and the like, in association with the corresponding shipborne navigational equipment – was being supplemented, and gradually superseded, by a new generation of information and communication-based tools, such as Vessel Traffic Services (VTS), the Automatic Identification System (AIS), the Global Positioning System (GPS), electronic charts, vessel reporting systems, satellite tracking and others.

This state of rapid technological development and change is occurring not just in the arena of electronics, but also, and perhaps even more crucially, in the **design** and **operation of ships** themselves. Ships are getting larger; ships are getting faster; and ships' crews are getting smaller – all of which make the need to support safe voyages and the task of providing appropriate and effective aids to navigation more challenging than ever before.

We are fast approaching a **watershed** in this respect. The imperative to evolve a radical new approach to the traditional art and science of navigation is growing. Most of the fundamental elements for such a change exist. The challenge now is how we combine **and** integrate them into systems that will have a significant beneficial effect far into the future.

IMO, IALA and other like-minded associations and institutes have recognized this and are now pro-actively and, indeed, aggressively driving the process forward. In IALA, you have established a special committee dedicated to the topic of e-navigation, as this new concept has come to be known. For its part, IMO, too, has firmly grasped the nettle. In May last year, the Maritime Safety Committee decided to include a high priority item on "Development of an e-navigation strategy" in the work programmes of the NAV and COMSAR Sub-Committees, with a target completion date of 2008. The NAV Sub-Committee was tasked with coordinating the work.

The overall aim is to develop a **strategic vision** for e-navigation, to **integrate existing and new navigational tools**, in particular electronic tools, in an all-embracing system that will contribute to enhanced navigational safety, while simultaneously reducing the burden on the navigator.

E-navigation, as currently envisaged, would incorporate new technologies in a structured way and ensure that their use is compliant with the various navigational and communication technologies and services that are already available, providing an overarching, accurate, secure and cost-effective system with the potential to ensure global coverage for ships of all sizes.

Since being charged with overseeing this effort, the NAV Sub-Committee has formed an intersessional correspondence, which is due to report to the Sub-Committee later this month. Although the proper time and place for a detailed analysis of that report is, of course, at that session, I think that, for the purpose of this seminar, it would be helpful to highlight one or two of its major conclusions here today.

Among other things, the group agreed to adopt the **definition of e-navigation** as initially put forward by IALA and incorporating recent amendments developed by IALA's E-navigation Committee – namely, that:

"E-navigation is the harmonized creation, collection, integration, exchange and presentation of maritime 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."

The group also attempted to identify the **core objectives of an integrated e-navigation system** and its conclusions in this regard were as follows:

"Using electronic data capture, communication, processing and presentation, to:

- facilitate safe and secure navigation of vessels having regard to hydrographic and navigational information and risks (e.g. coastline, seabed topography, fixed and floating structures, meteorological conditions and vessel movements);

- facilitate vessel traffic observation and management from shore/coastal facilities where appropriate, for example in harbours and approaches;

- facilitate ship-to-ship, ship-to-shore, shore-to-ship and shore-to-shore communications, including data exchange, as needed, to achieve the above points;

- provide opportunities for improving the efficiency of transport and logistics;

- facilitate the effective operation of distress assistance, search and rescue services and the storage and later use of data for the purposes of traffic and risk analysis and accident investigation;

- integrate and present information onboard and ashore in a format, which, when supported by appropriate training for users, maximizes navigational safety benefits and minimizes risks of confusion or misinterpretation; and

- facilitate global coverage, consistent standards and mutual compatibility and interoperability of equipment, fitment, systems, operational procedures and symbology, so as to avoid potential conflicts between vessels or between vessels and navigation/traffic management agencies."

Although it is not my intention to go, at this stage, into any further detail concerning the report of the NAV Sub-Committee's intersessional correspondence group, I consider this brief glimpse into its contents helpful to help set the scene for this seminar and focus on the issues that will be discussed in its context.

Personally, I am an enthusiast for the concept of e-navigation. I have no doubt that, if properly realized, it can have an extremely beneficial effect on maritime safety and security, on the safety of life at sea and, as a result, help protect the marine environment by reducing accidents and the consequent risk of spills and other environmental damage. This latter aspect is one that I do not think has been stressed sufficiently and I would like it to be paid appropriate attention, particularly in a year during which IMO is increasingly placing emphasis on its response to

current environmental challenges and is highlighting environmental issues in its chosen theme for World Maritime Day.

However, while not wishing to detract in any way from my overall support for the development of e-navigation, there are some caveats to which I should like to draw attention and which I think we would all do well to remember.

The key phrase, of course, is "if properly realized". It is all too easy to fall into the trap of assuming that **e-navigation will be a panacea**. It will not. Nor should e-navigation ever be viewed as an end in itself. Its role should be as part of a process that supplements and supports other critical elements of safe navigation, including watchkeeping skills; ensuring a good lookout and full observance of the Collision Regulations; good ship-handling and seamanship; and all the procedures and training that underpin these competencies. We will do a disservice to the cause of safety if we perceive e-navigation as a substitute for all these contributors to safe passage.

For the foreseeable future, the human element, with all its frailties, will remain the **key component** in any integrated and coordinated electronic navigation concept. Those of us, who are currently involved in the technical and regulatory evolution of e-navigation, must keep this in the forefront of our minds as we move the idea forward. The utmost care must be taken to avoid any kind of development that, on one hand, promises and delivers much that, without doubt, will be of great benefit but, on the other, actually harbours the hidden potential for confusion and complacency. The spectre of "technology-assisted collisions", or even "technology overload", looms over any advances in this field and all concerned are well advised to heed its presence.

To be properly effective, any integrated navigation system must be a decision-support-system. Yes, it should be able to relieve the officer of the watch from some of the burdens of watchkeeping while also being 'intelligent' enough to filter out some of the less crucial information; but, under no circumstances, should it ever draw the navigator into a false sense of security or induce over-reliance on the information presented. The system should never reduce the navigator to the role of mindless "equipment monitor". Instead, it should be designed to provide **optimum support and information** to enable appropriate and timely navigational and anti-collision decision-making, in accordance with good seamanship.

The bridge of a modern ship is already beginning to resemble an aircraft cockpit. However, whereas aeronautical navigation today relies almost completely on instrumentation and on direction from shore, this is not – at least, not yet – the case with maritime navigation. As the concept of e-navigation takes shape, using it to simplify the display of the local navigational environment to the mariner, with the addition of any relevant shore-derived navigational advice and assistance, becomes the paramount challenge.

Underpinning the concept of e-navigation is the realization that the piecemeal approach to the introduction of new technology is not appropriate in the context of vessel navigation. Simply adding more boxes and more information is not the answer and, in fact, it would likely be counter-productive. Integration, coordination and harmonization of bridge systems and other navigational tools in a way that genuinely assists the navigator is, and should remain, the prime objective.

No matter how sophisticated the technology becomes, there will remain an obligation for the officer of the watch to comply fully with the Collision Regulations; and '…maintain a proper look-out by…all available means…so as to make a full appraisal of the situation and of the risk of collision.' E-navigation systems should always assist the officer of the watch to undertake his or her duties with the confidence that reliable and timely information may be derived from them. And while they do, indeed, have the potential to offer assistance not just in the collection, integration, presentation and analysis of information, I think **the time is not yet ripe for final responsibility to be vested anywhere other than in the human element**.

E-navigation may also offer beneficial side effects, particularly, for example, in the reduction of fatigue. However, I would certainly argue against any move to **use e-navigation to pare down crew sizes still further**. The margins of safe manning are already considered tight – and the STW Sub-Committee is currently examining this issue, along with fatigue – and e-navigation should, therefore, be seen as an opportunity to achieve genuine improvement, rather than a chance to retain the *status quo* but with **less human resource input**.

I mentioned earlier that final responsibility for navigational decisions should remain, at least for the time being, with the human element. But exactly where that human will be located is becoming a moot point and the development of e-navigation will undoubtedly add fuel to that particular debate. We have seen over many years how various ships' routeing systems, including mandatory ship reporting systems and vessel traffic services, have served to shift the balance of navigational decision-making towards the shoreside. For, even if the final decisions about how to navigate in a given situation remains with the officer-of-the-watch, nevertheless the parameters within which such decisions are made are not so wide as once they were. There is, so to speak, less room for manoeuvre, and the advent of e-navigation will undoubtedly offer the technical potential for this trend to continue. Will shipping ever have the equivalent of air traffic controllers? I am not sure, although time will tell.

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Ladies and gentlemen, I know this e-navigation seminar is going to provide two days filled with a great deal of passionate debate, technical discussion and innovative thinking. I have every confidence that the process will serve to make a significant contribution towards the overall understanding of this most stimulating topic. IALA's participation in the work of IMO on this subject is vital, and will become more so as the concept takes shape and eventually nears fruition. I have no doubt that this seminar will help to inform and strengthen that participation and I wish you every success with it.

Let me conclude by saying just a few words about IALA in the wider context. As I mentioned at the outset, you are, this year, celebrating your 50th anniversary and I should like to reiterate my sincere congratulations. This is a most significant landmark, one that bears testimony to the fact that the right decision was taken when IALA was founded and the Association's success, since 1957, has enabled it to continue adapting and growing in response to changing times and new situations.

I have every faith that IALA is well equipped to meet the new challenges and new demands that will be made of it in the future, a confidence based on the leadership role you have taken in the

search to make the best possible use of the opportunities afforded by today's digital, information and communications technologies. These are exciting times in your particular discipline, and I know that the maritime world derives great confidence from knowing that IALA and its members are, as usual, at the cutting edge and at the forefront of the debate. At IMO, we value your contribution highly and are thankful of your co-operation and support not only in our regulatory work, including work on VTS, but also in the development of the international buoyage system, the global SAR plan and the Marine Electronic Highway concept in the Malacca and Singapore Straits; and in facing the chaotic situation the 2004 tsunami left behind in the Indian Ocean, to mention but a few. May we together continue serving the maritime community long – at least for another 50 years!

Ladies and gentlemen,

Thank you.

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2473 words
20.3 minutes
2 July 2007

Annex 3: Key note address by Mr Koji Sekimizu, Director, Maritime Safety Division, IMO,

Keynote presentation on the development of e-navigation
by
Mr. K. Sekimizu,
Director, Maritime Safety Division
IMO

Good morning distinguished participants, Ladies and Gentlemen,

It is indeed a pleasure for me to be present here today at this three-day IALA Seminar on e-navigation and to provide a keynote presentation relating to the technical aspects of e-navigation. I am particularly pleased to see so many participants, which underlines the interest this seminar has generated.

You will recall that yesterday morning at the opening session, the Secretary-General, Mr. E.E. Mitropoulos in his keynote address expressed his appreciation to IALA for organizing this most timely seminar to mark the 50th anniversary of this important organization with which IMO has been maintaining excellent co-operation and partnership. I also take this opportunity to convey special thanks to the President, Captain Liu Gongchen, and the Secretary-General Mr. Torsten Kruuse, of IALA, and their associates for their initiative in making this event possible. Since the Secretary-General of IMO, Mr. Mitropoulos, yesterday spoke about the concept of e-Navigation and various aspects of the human element involved in its future challenges and his expectation, and the Seminar today has been scheduled to cover charting and display issues, navigation and positioning systems, communications and training aspects, in my presentation today, I would like to highlight only the most recent developments at IMO on the discussion relating to the strategy for e-navigation at Committee and Sub-Committee meetings and other developments relating to the MEH Project and preparation of electronic navigational charts.

The development of a strategy for e-navigation under the Maritime Safety Committee started in May 2006. MSC 81 received a proposal put forward under the initiative of the United Kingdom supported by Japan, the Marshall Islands, the Netherlands, Norway, Singapore and the United States. MSC decided to include, in the work programmes of the NAV and COMSAR Sub-Committees, a high priority item on the development of an e-navigation strategy, with a target completion date of 2008. The NAV Sub-Committee was assigned as co-ordinator. MSC 81 further instructed NAV 52 to give preliminary consideration to the matter and also 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. MSC 85 to be held in December next year is expected to receive a report on the strategic vision for e-Navigation and develop the necessary policy directions for further progress of this important work.

There was an extensive debate on the issue during its preliminary consideration at NAV 52 in July 2006. The Sub-Committee fully supported the concept of e-navigation and agreed that work should be undertaken expeditiously towards developing a strategic vision or concept relating to e-navigation in a well defined and structured manner. It was also recognized, at NAV 52, that it would be essential, as a first step, to develop a clear definition and objectives for the concept of e-navigation. The Sub-Committee was of the opinion that **IMO should take the lead** in the development of the strategy for e-navigation, but it would also be important to invite other organizations, in particular IALA and IHO, to participate in its work and provide relevant input. There was general support that the issue of the human element, in general, and training and education requirements, in particular, would form a key issue in the development of an e-navigation strategy.

NAV 52 further agreed that, in order to progress the work, an intersessional Correspondence Group should be established and designated the United Kingdom as the co-ordinator. The report of the Correspondence Group was submitted to COMSAR 11 in February 2007 and identified a number of key elements in the work programme for e-navigation. Since the work of the Correspondence Group presented a framework of the current discussion at IMO, although it would lead to details, I would like to introduce the most important outcome here today.

As you heard yesterday from Mr. Wadsworth, the Correspondence Group was of the opinion that IMO should deliver four main products as an immediate goal:

- agreement on a core **system architecture** for e-navigation;

- the results of a **gap analysis**, with broad assessment of the nature and extent of gaps, including regulatory gaps, and actions needed to bridge them;

- **recommendations on overall project governance** for subsequent phases of e-navigation development; and

- **a responsibility map** for the gaps.

The core objectives of an integrated e-navigation system, using electronic capture, communication, processing and presentation of data, are also endorsed by the Correspondence Group. They are complex and comprehensive. The Secretary-General has already touched upon them in his remarks yesterday but I would also like to share some of the core objectives with you today. The e-navigation will:

- **facilitate** safe and secure navigation of vessels;

- **facilitate** vessel traffic observation and management from shore/coastal navigational facilities;

- **facilitate** ship to ship, ship to shore, shore to ship and shore to shore communications, including data exchange;

- **facilitate** the effective operation of distress assistance, search and rescue services and storage of data for the purposes of risk analysis and accident investigation;

- integrate and present information on ship and ashore which maximise navigational safety; and

- facilitate global coverage, so as to avoid potential conflicts between vessels and traffic management authorities.

The Correspondence Group further invited COMSAR 11 to identify the potential components of the e-navigation strategy and proposed system architecture that fall within the remit of the Sub-Committee. The COMSAR Sub-Committee was also invited to consider the communication and SAR aspects.

COMSAR 11, which met in February this year, agreed that the user requirements should be clearly defined by the NAV Sub-Committee before the COMSAR Sub-Committee could review the technical improvements that might be required if GMDSS equipment was to be utilized as a data communication network for e-navigation. The development of e-navigation should be user-driven and not technology driven. There should be equipment performance standards, including a standard mode of operation for shipboard equipment. Existing GMDSS infrastructure is supporting SAR services and communications; however, with respect to e-navigation, broadband communication on a global basis using satellite technology would be necessary. These are the main outcomes of COMSAR 11.

Turning to activities outside IMO, I am also aware that IALA has, since July last year, organized two meetings of IALA's e-navigation Committee at the IALA headquarters during September 2006 and at the MCA headquarters in Southampton during March 2007. The outcome of both meetings has been provided to the Correspondence Group of the NAV Sub-Committee. I wish to thank IALA and all the industry partners for their useful and constructive input towards our common task for developing a sustainable e-navigation strategy.

The final report of the Correspondence Group has been submitted to NAV 53. The central question of "exactly what is e-navigation" has been the subject of prolonged debate. The Group has decided to treat e-navigation neither as the physical installations, nor as the service provided, but treat it as a strategic framework for developing existing and future technological infrastructure onboard and ashore. The development of e-navigation is, therefore, an opportunity to optimise these developments, and maintain the focus of future developments on a holistic approach for safe navigation from berth to berth.

The report of the Correspondence Group will be discussed at NAV 53 by the Working group on e-navigation. It is expected that good progress will be made in developing a strategic vision and concept relating to e-navigation during the forthcoming session of the NAV Sub-Committee.

Distinguished participants,

According to my statistics notebook, the volume of world seaborne trade in 2004 was 27 thousand 500 billion ton-miles. Some forty years ago in the 1960s, the volume of seaborne trade was just 6 thousand billion ton-miles. Over these four decades, the activities of international shipping quadrupled.

When you look at the volume of the total world fleet, you can see the same pace of growth over the four decades. The capacity of the world fleet has grown from 200 million tonnes deadweight in the 1960s to 960 million tonnes deadweight. The latest estimates of the world

fleet, taking into account the present order books, indicate that we will soon break through the one billion tonne deadweight mark.

Furthermore, the number of ships in the world fleet has grown from some 42 thousand to 90 thousand from 1965 to 2004. These statistics would show the following:

.1   the world seaborne trade has quadrupled over the last four decades;

.2   this expansion was achieved by the expansion of the capacity of the world fleet and not by an increase of total mileage; and

.3   while the total number of ships has doubled over those four decades, the average size of ships has also doubled over the same period.

This can lead us to the following estimates:

.1   if the trend of expansion over the last four decades continues, the world shipborne trade in 2050 may have quadrupled; and

.2   by 2050, the number of ships may have doubled and the average size of ships may also have doubled in order to achieve the required world fleet capacity, only if the past trend continues.

International shipping carries more than 90% of the world trade. Without shipping, the world economy could not be sustained. Shipping does not in itself create trade but trade needs efficient shipping and any growth in world economy requires growth in international shipping. If the world economy continues at this pace of development, we will see a significant increase in the number of ships, which may cause a concern on congestion in narrow straits and choke points. For example, according to a study, the total traffic volumes going through the Straits of Malacca and Singapore were 4 billion tonnes deadweight and the number of ships passing through the Straits was 9 thousand in 2004. These figures are expected to increase by 50% in 2020.

The Marine Electronic Highway Project was proposed by IMO, taking into account these trends. In order to cope with the expected increase of volume of traffic and to maintain safe and uninterrupted navigation avoiding accidental marine pollution, a comprehensive system for navigation monitoring and assistance, employing the latest technological developments is being proposed. In such a system, navigational information and data are all processed by electronic means and devices. Obviously, the availability of Electronic Navigational Charts is the most fundamental and indispensable element of the system where position and details of ships, tide, current and necessary weather information are processed, taking the fullest advantage of GPS, radar, AIS and other communication means. In such a system, authorities of the littoral States and every ship which is connected to the system will share all information available about navigation through the Strait and information of all ships navigating in the Strait. This was certainly an ambitious idea generated among a small number of people in the late 1990s, who foresaw the benefits of such a future system and put a lot of effort into formulating its concept which is now called the Marine Electronic Highway System.

As IALA provided in its submission to the forthcoming 53rd session of the NAV Sub-Committee, in order to enjoy the real benefit of e-Navigation, the following three fundamental elements must first be put in place:

- worldwide coverage of Electronic Navigational Charts;

- a robust fail-save electronic positioning system with redundancy; and

- an agreed infrastructure of communication links between ships and shore.

Within its limited geographical scope, the MEH Project has taken into account all these three fundamental elements of e-Navigation and the IMO's 17 million-dollar project; the MEH Demonstration Project started its project activities this year with significant and substantial support from the Global Environment Facility (GEF), the World Bank and the offer to make hundreds of tankers available for the Demonstration provided by the shipping industry through INTERTANKO and ICS. Support and commitment to provide in-kind contribution by littoral States, Indonesia, Malaysia and Singapore, were significant and we also appreciate financial support provided by the Republic of Korea. I should not forget the consistent technical support provided by IHO with Hydrographic Offices of the three littoral States.

The MEH Demonstration project will develop Electronic Navigation Charts and establish AIS stations, current and tide measurement stations and a communication network to integrate all available information. I would like to take this opportunity to express IMO's appreciation to all involved in the preparation of the Project and, in particular, Captain Raja Datuk Malik Saripalazan of Malaysia, who was the Chairman of the first Project Steering Committee meeting in 2001.

During the Project Steering Committee which developed the master plan for the MEH Demonstration Project, various elements of e-Navigation were discussed. One of the core functions of the MEH system is to integrate information on position and identification of other ships in ECDIS and radar display through AIS systems. When we discussed this essential function of e-Navigation six years ago, we were not certain when we could expect that the AIS data as Aids to Navigation Information could be displayed on ECDIS and other onboard equipment. According to a submission from IALA to NAV 53, I understand that the 15th meeting of the IALA Policy Panel in April 2007 considered this issue. Since the MEH Demonstration Project expects that the demonstration of the prototype of MEH with several hundreds of tankers will actually take place in 2010, I sincerely hope that relevant standards for the display of the AIS data as Aids to Navigation Information on ECDIS can be implemented as soon as possible, so that equipment onboard participating ships will be fully upgraded to perform this function and the MEH Project Team can carry out a meaningful demonstration of the system - in essence, the core benefits of e-Navigation.

Coming back to the activities of the NAV Sub-Committee, the report of the Correspondence Group will be discussed at the 53rd session from 23rd to 27th of this month. It is expected that the Sub-Committee will make significant progress in identifying user requirements, development of system architecture and the basis for the initial gap analysis. MSC 83 in Copenhagen will then receive an interim report with a strategic plan and the Correspondence Group would be requested to continue its work next year. While the NAV Sub-Committee will make progress on the development of e-Navigation, the MEH Demonstration Project will proceed with:

- a bathymetry study of the Malacca Strait;

- the preparation of large scale Electronic Navigational Charts; and

- the preparation of the actual demonstration module in the fourth year of the project.

Developments of the MEH Demonstration Project will be reported to the NAV Sub-Committee at each session so that the development of e-Navigation at IMO and the MEH Project will proceed together providing contributions to each other.

Distinguished participants,

The concept of e-navigation has been under extensive discussion at IMO and the concept and strategic vision are taking clear shape now. It might be too early for the shipping industry to make sweeping assessments on the likely impact of its various requirements, however, e-navigation will integrate modern technology and shipboard functional requirements and, when the system architecture is put into practice, I am sure that we all appreciate the benefits of the e-navigation.

I once again appreciate the organizer for providing me with an opportunity to speak today and, on today's programme of the Seminar, I hope that you will benefit and gain as much insight as possible into the concept of e-navigation from the various presentations and discussions. I am confident that the seminar will also give you the opportunity to exchange views and share common experiences to the benefit of navigational safety, maritime security and environmental protection.

Thank you.

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Annex 4: Text of speech as delivered by Mr Justice David Steele, Royal Courts of Justice

I have been involved in shipping casualties involving loss of life and pollution for 40 years - starting with the loss of the Torrey Canyon in 1967 through to the investigation into the loss of the Gaul re-opened in 2003. But throughout that 35 year period, criminal prosecutions have remained rare. Indeed I can only think of a few in which I have been directly concerned. One was a manslaughter trial in Hong Kong arising out of a collision between two Macau hydrofoils: another was a manslaughter trial arising out of the capsize of a yacht in the mouth of the River Tyne; and a third a prosecution of Milford Haven Port Authority arising out of the stranding of the Sea Empress. Of course there were others in which I had more indirect involvement such as the Herald of Free Enterprise, the Exxon Valdez and others.

There can't be any doubt that public pressure for prosecutions in these classes of case, particularly where there has been heavy loss of life, has increased substantially over recent years. Even in the more sober jurisdictions, manifestations of this are to be found in for instance the Federal Oil Pollution Act, the Corporate Manslaughter Bill (a bill to which I will revert) and so on. In the wider community the trend is clearly moving towards the regular imposition of criminal sanctions against the mariner: see for instance the prosecution of the Russian Master of the Virgo in the Massachusetts courts in 2001, the prosecution of the OOW of the Dutch vessel Aquamarine at Lewes Crown Court in 2003 and the prosecution of the pilot of the Staten Island Ferry in the New York courts in 2004.

The more notorious cases such as the Erika, the Prestige and the Tasman Spirit reflect not so much concern that the incident did not justify the institution of criminal proceedings but that there had been unfair treatment of mariners as a result involving serious interference with even the most limited form of human rights.

This treatment often took the form of custodial detention together with:

- lengthy delays

- enormous demands for bail in order to force the involvement of employers.

- denial of access to legal advice

- detention of mariners not as defendants but as "material witnesses".

One of the features of maritime accidents is that a very large proportion of them are caused in whole or in part by the fault of the mariner. Of course there are cases where the loss of a ship and its crew is attributable to design features which experience later shows were defective: e.g. the Derbyshire. There are other cases the mariners are faced with emergencies not of their making but attributable to poor loading by stevedores (the Burtonia) or poor workmanship and maintenance by shore staff (the Gaul) or by unforeseeable engine or steering failure.

That said it is of course of concern that mariners are sometimes content to earn their living on vessels which are clearly below standard. I suppose that the Express Samina must be a striking example. One of the guide books to the Greek Islands had this remarkable entry:

"Now reaching the 35 year Greek ferry age limit and due for replacement, this dreadful boat is arguably the worst Greek ferry afloat. A large grime bucket with a reputation for running late, the vessel is the sister of the equally notorious Naias II…For most of the time she has shuddered along: not because of an excess of engine vibration but rather with the collective disgust of her passengers: she is definitely a boat to be avoided."

The serious casualty and loss of life that occurred in September 2000 was accordingly not a surprise and inevitably led to manslaughter charges given the allegations that the bridge had been deserted at the time of the collision with a charted and lit rock because an important football game was on the television. What was unacceptable was the delay in the trial which did not get underway until 2005 with the master being in custody throughout (of itself equivalent to a 10 year sentence under English procedures).

But more often than not more conventional negligent navigation or management is the immediate cause: e.g. the Herald of Free Enterprise and the Marchioness. If we are moving towards a position where causing death by a merely negligent act is to be a criminal offence then we can expect a substantial increase of prosecutions. I am afraid that I do not know to what extent such an offence is established throughout the world. But certainly Singapore has one: see The R.S.S. Courageous, H.C. of Singapore August 2004.   So also the US: see the Seafarer's Manslaughter Law (18 USC 1115) and the well known case of the Zim Mexico III

It must be recalled in this context that the UK government is pressing for the establishment of an offence of causing death by careless driving of a motor car. It is only a small and logical step to extend this to collisions (or indeed other incidents at sea). Quite apart from the concern that this policy will substantially increase the prison population I suspect most of us are agreed that mere want of care - giving rise to claim in damages - should not usually be treated a criminal offence let alone one deserving of a custodial sentence.

Of course different considerations arise where the negligence concerned arises out of reckless activity akin to criminal liability for dangerous driving. One phrase that is commonplace in this field is "gross negligence" - the ingredient of the English offence of manslaughter. As a side wind I suspect that the reluctance of juries to convict in motorcar manslaughter cases (which led to the creation of the offence of causing death by dangerous driving) was not merely a concern that "there by the grace of god" etc but the very name of the offence with its connotation of extermination and blood-shed.

It remains difficult to maintain any objective and standardised test of what is "gross": the prosecuting authorities of Spain may have a very different perception compared to those in say the Philippines. Since the underlying precondition of a prosecution in this field is the establishment of negligence (i.e. conduct failing short of that to be expected of a reasonably competent mariner) the mariner concerned is inevitably exposed in almost every case of loss of life to the vagaries of the local (and perhaps temporary) perception of what justifies a prosecution, it so often being a "given" that negligent activity is involved.

The problem is, I presume, exacerbated by the proliferation of one ship companies. Frustration on the part of littoral status in finding, let alone obtaining the cooperation of, somewhat obscure proprietary interests can lead to seafarers being used as bait.

Another problem in this field particularly arises in regard to pollution incidents. The interests of the ship-owner, the salvor, the insurer and the littoral state so often are in conflict. The mariner may find himself in command of a vessel which the littoral state views as a pariah and the salvors see as a great prize. The outcome can often be an abuse of power whereby the mariner is detained on the pretext of being answerable for criminal charges.

Another consideration that has to be borne in mind is the modern tendency to discount the possibility of an "accident." All casualties give rise to "victims" and are all attributable to "culprits". We live in short in a revenge society and, whether we approve or not, this is having an increasing impact on governmental thinking and is going to lead to greater incrimination of mariners.

Remember in this context that it is another feature of developments in the criminal law in common-law countries that moves are being made towards the creation of offences of corporate manslaughter. The Bill presently before the House of Lords reads as follows:

"An organisation to which this section applies is guilty of an offence of corporate manslaughter if the way in which any of the organisation's activities are managed or organised by its senior managers-

(a)   causes a person's death

(b)   amounts to a gross breach of the relevant duty of care
owed by the organisation to the deceased.

A breach of a duty of care by an organisation is a "gross" breach if the failure in question constitutes conduct falling far below what can reasonably be expected of the organisation in the circumstances."

The difficulty involved in assessing what is gross is recognised in the section which immediately follows:

In deciding that question the jury must consider whether the evidence shows that the organisation failed to comply with any relevant health and safety legislation or guidance, and if so-

(a)   how serious was the failure to comply

(b)   whether or not senior managers of the organisation -

(i)   knew or ought to have known, that the organisation was failing to comply with that legislation or guidance;

(ii)   were aware, or ought to have been aware, of the risk of death or serious harm posed by the failure to comply;

(iii)   sought to cause the organisation to profit from that failure.

I am not persuaded that that this will make the jury's task any easier

The approach of making "gross" fault a criminal offence is also sometimes criticised on the basis that a much better touchstone of criminal fault would be "recklessness" - indeed several conventions including MARPOL make use of that test for identifying pollution accidents for which the owners and/or master should be criminally responsible. An English lawyer would define a reckless activity as arising when the accused has foreseen that the particular kind of harm might result but has yet gone on to take the risk of it. For my part I regard this as an easier threshold to assess and less likely to lead to wrongful detention.

The government now asserts it seems a third way - namely that neither gross negligence nor recklessness is appropriate and that the right adjective is "serious": see the UK response to EU Framework Decision on ship source pollution March 2004. I confess that the distinctions are not only too subtle for me but merely emphasis the unhappy degree of flexibility in defining offences in this field.

One last comment. This seminar focuses on the implications of electronic navigational aids: electronic chart, GPS, anti-collision radar etc. One question that arises is whether this has implications as regards criminalisation of mariners. In one sense, the answer is obviously "no" save in the sense that these devices will hopefully reduce the instances of navigational error. But in another sense "yes". The standard of care to be expected of a mariner is that of reasonable competency in the relevant role: e.g. Officer of the watch. These standards do not remain still. They include the careful use of all navigational aids made available. And on that aspect the standard of care of a prudent owner must all move with the times so that ships are appropriately equipped.

There will be those of you who remember the startling policy decision of Ronald Vestey, Chairman of Blue Star Line, not to equip his ships with radar on the ground that it caused more collisions than it avoided. That would be an even more dangerous decision today.

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