INTERNATIONAL HYDROGRAPHIC ORGANIZATION

ORGANISATION HYDROGRAPHIQUE INTERNATIONALE

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16 March 2005

MARINE e-NAVIGATION

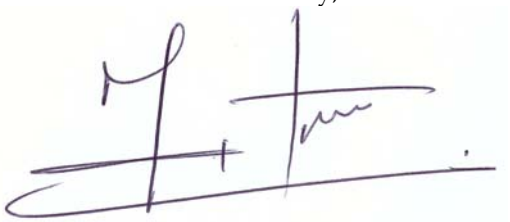
Dear Hydrographer,

The IHB recently received the enclosed paper "MARINE e-NAVIGATION" written by Brian Wadsworth of the UK Department of Transport which is forwarded for your information.

The orientation paper includes "accurate, comprehensive and up-to-date electronic navigational charts ("ENC"s), to a common format, covering the entire geographic 'span' of a vessel's operation;" as a key element in any such e-Navigation system. This is of course already a goal of the IHO.

The IHB intends to be present at the June meeting in the UK and would welcome any comments that Member States might have. Given the wide ranging effect that any such system would have Member States might wish to discuss this matter with other national maritime organisations, e.g. Maritime Safety Agency, Lighthouse Authority etc. This document will also be referred to the next WEND meeting as Document WEND9-Inf4.

On behalf of the Directing Committee
Yours sincerely,



Vice Admiral Alexandros MARATOS
President

Encl. MARINE e-NAVIGATION: An orientation paper by Brian Wadsworth

Department for Transport

BRIAN WADSWORTH
DIRECTOR

LOGISTICS AND MARITIME TRANSPORT
Zone 2/25a (2nd Floor)
Great Minster House
LONDON SW1P 4DR

Tel: + 44 (0) 20 7944 2750
Fax: + 44 (0) 20 7944 2759
email: brian.wadsworth
@dft.gsi.gov.uk

To colleagues as attached list

10th March 2005

MARINE e-NAVIGATION

I enclose a copy of a paper which I have written about marine e-Navigation, with the benefit of advice from a number of colleagues interested in this subject.

I should like to seek your support for the proposition that we should invite the IMO, enlisting the active participation of IALA and the IHO, to set in hand work towards the agreement of a global framework and strategy for the development and realisation of an integrated, electronic navigation system for the marine sector. The aim of this work would be:-

- to secure a global consensus supporting a set of definitions and outcome-based standards for e-Navigation;
- to identify the key issues and requirements which need to be addressed in order to realise the desired outcomes;
- to develop the components of a co-ordinated project plan which would address those issues and requirements;
- to agree and assign responsibilities for delivery across the various institutions involved, their members and stakeholders, and
- to set milestones, initiate actions and manage the delivery of the project plan.

I hope that the paper is self-explanatory. It is written in non-technical language. While the key technologies needed to facilitate e-Navigation are available today, or are already being developed, I believe that there is a pressing need to articulate and generate wide support for a clear strategic vision, which recognises the potential benefits of an integrated e-Navigation system and can generate political support and momentum behind it. Unless we put that vision

in place, the diverse strands of technological development necessary to deliver e-Navigation are less likely to cohere and coalesce on a path which will lead us in the right direction.

It has to be recognised that this path is neither short nor straightforward. There are institutional issues, as e-Navigation requires closer collaboration between maritime safety, navigational and hydrographic agencies at international, regional and national levels. There are practical issues - the patchy coverage of Electronic Navigational Charts is one obvious example. Many detailed technical issues lie behind the development of integrated bridge and shore-based navigational displays using secure, standardised protocols (though I see the role of the various agencies and stakeholders focussing on the agreement of output or goal-based standards, rather than the design of hardware and software, which is well within the capability of specialist equipment suppliers, given a clear set of performance parameters to work to).

Therefore a strategic commitment to e-Navigation has to be seen in a medium to longer-term context. But that is all the more reason to start now. The longer we delay, the greater the risk that technology will run ahead of the agreement of standards - and that way lies confusion and missed opportunity.

As a first step towards soliciting wider support for an e-Navigation strategy, I should like to invite you and your colleagues to a meeting in London in the margins of IMO Council in June. We have booked a room at Trinity House on the evening of 23rd June for this purpose and would be pleased to offer dinner there after the meeting. I envisage quite an informal occasion, with one or two speakers making relatively brief interventions to start us off, with a view to inviting contributions from everyone present. At this stage I am being selective in inviting representatives from a number of key maritime administrations, plus the principal institutions involved, so that we can have a manageable discussion and gauge initial reactions. For that reason, I should be grateful if you would have a word with me beforehand if you feel you would like to discuss the issues raised here with colleagues in other administrations or institutions. (I would not wish anyone to feel aggrieved at not having been included on our original consultation list.)

If - as I hope - the meeting on 23rd June indicates support for taking this further, I would then propose to make a similar approach to a wider range of maritime administrations. Our aim would be to canvass support for a draft paper and resolution which could be submitted for the IMO Assembly meeting in London in November this year.

Subsequently, and subject again to obtaining the necessary level of support, we would widen the net of consultation to include key stakeholders (such as the shipping and ports industries) through their international representative bodies. At this stage there could be some external publicity, and perhaps a more public event in London in the autumn, before Assembly.

Of course, we are also keen to listen to any concerns or reservations which colleagues may have and ready to adjust our plans to take account of them. I believe that we have an exciting opportunity here, to initiate a programme of work to improve maritime safety and security in a way which will be perceived by all major stakeholders as supportive and constructive, emphasising safety facilitation and incident prevention and with scope to achieve substantial operating efficiencies in the longer term.

I hope you will agree, and in any event that you and your colleagues who have an interest in this area will be able to attend our meeting in London on 23rd June. Please let me know. It would be helpful to have the names of those likely to attend.

Do not hesitate to contact me by e-mail or telephone if there are issues you would like to discuss meanwhile.

BRIAN WADSWORTH

MARINE E-NAVIGATION

Letter and paper sent to:

Richard Day, Transport Canada
Rr Admiral Tom Gilmour, US Coastguard
Bruce Carlton, US Maritime Administration
Clive Davidson, Australian Maritime Safety Authority
Russell Kilvington, NZ Maritime Safety Authority
Sec General, IALA
Yasuo Ohba, Maritime Bureau, Japan
Noriyoshi Yamagami, Embassy of Japan, London, UK
Mary Seet-Cheng, Maritime & Port Authority of Singapore
Matthew Lee, MPA of Singapore, London
Alexey Klyavin, Deputy Director, Ministry of Transport, Russia
Igor Ponomarev, Perm Rep of IMO, London, UK
Jorgen Hammer Hansen, Danish Maritime Authority
Jan Olof Selen, National Maritime Administration, Sweden
Klaus Grensemann, Ministry for Work, Germany
Leif Asbjorn Nygaard, Ministry of Trade and Industry, Norway
Raimo Kurki, Ministry of Transport and Communications, Finland
Kees Poldermann, Ministry of Transport, Public Works and Water Management, The Netherlands
Vice Admiral Alexandros Maratos, International Hydrographic Bureau, Principality of Monaco
Andreas Chrysostomou, Department of Merchant Shipping, Cyprus
Capt David Bruce, Perm Rep of IMO of Republic of the Marshall Islands, London, UK
Capt T F Heinan, Dep Commissioner of Maritime Affairs, Republic of the Marshall Islands, USA
Efthimios Mitropoulos, Sec Gen IMO, London, UK
Rr Admiral Jeremy de Halpert, Dep Master, Corporation of Trinity House, London, UK
Dr David Wynford Williams, UK Hydrographic Office, Somerset, UK

Isabel Stone
PA – Brian Wadsworth
Director, Logistics and Maritime Transport
Department for Transport
London SW1P 4DR
UK

MARINE eNAVIGATION: AN ORIENTATION PAPER

Summary

1. This paper argues that we have an important window of opportunity to make marine navigation easier and to reduce navigational errors, with their attendant toll of accidents, loss of life, injury and environmental damage. Electronic navigational technologies are already available, being developed or are capable of development, which can be integrated to provide an accurate, secure and highly cost-effective e-Navigation system, with potentially global coverage. The same technologies are scalable for use by larger and smaller vessels.

2. Delivering e-Navigation will require close co-operation between national and regional institutions, led at international level by the IMO, IALA and IHO. The key steps we need to take are:-

- to create and promulgate a compelling, medium-term vision for the adoption of e-Navigation, which has commitment from all key stakeholders; and

- to develop a viable action plan to deliver that vision, identifying the various work streams which need to be completed, defining desired outputs and assigning responsibilities.

3. Making a commitment to agree a vision for and create a migration plan to e-Navigation would be a strong signal of the commitment of Governments and regulatory authorities to a positive agenda for the growth and development of the global shipping industry, whilst achieving key safety and environmental goals.

Context

4. There are three 'lines of defence' against shipping accidents and ship-source marine pollution:

- prevention of incidents and accidents,

- mitigation of incidents and accidents through emergency intervention, and

- consequence management (eg. oil spill clean-up).

It hardly needs stating that *prevention* is always to be preferred.

5. While some marine accidents result from technical failures of one kind or another (eg. structural, engine or steering failure), many are caused by navigational errors. Of course, navigational errors have diverse causes. But they have a common defining feature: failure to maintain a safe course.

6. Every year, considerable sums of money are expended by ship owners and operators, on top of very substantial resources deployed by regulators (flag and coastal states, individually or collectively) in support of our shared objectives of "safer ships and cleaner seas". It follows from what has been said in the previous paragraphs that one of our highest priorities in allocating these resources should be to reduce navigational errors - from whatever cause.

7. Today we face a critical window of opportunity to improve navigational safety in coastal and international waters, with important opportunities for synergy between safety and security. The technology to enable us to do this exists today in various 'formats', though there is a need for some

further development and standardisation. The constraints on progress are largely structural and attitudinal.

Making Safe Navigation Easier and Cheaper

8. No one can *force* a ship's crew to navigate safely. But the clearer and more accurate the information provided, the more likely it is to happen.

9. Compare the range of navigational tools offered today on the bridge of a large merchant ship, with those available to the private motorist (at one extreme) or the commercial airline pilot (at another). Consider for example the range of information available, how it is obtained and how presented to those responsible for taking decisions. Vast resources have been invested in creating integrated and prioritised information displays in civil aircraft cockpits, and even more in military aircraft, where split-second decision making can make the difference between life and death. Private automobiles are increasingly marketed with integrated colour map displays and voice announcements to guide the driver through unfamiliar territory. These devices are often multilingual and capable of navigating over very wide geographical areas, managing a huge complexity of mapping data within a compact device.

10. Yet on the bridges of merchant ships one still sees a diverse range of technologies and equipment 'generations'. Display data is typically neither integrated nor prioritised. Value added data management is limited or nonexistent. And displays may require interpretation by experienced professionals in order to make sense of the information presented.

11. The marine navigation 'picture' must also be viewed from the land. Many coastal states today maintain extensive 'legacy' networks of traditional navigational aids, such as lights, buoys and radar transmitters. Around the coast of the U.K. and Ireland alone, the cost of maintaining these networks amounts to £70m (c. $125m) annually, although much has been invested in modernisation and automation, reducing operating and maintenance costs.

12. Helpful though they are as aids to safe navigation, the utility of these aids is limited by a range of factors, such as visibility in diverse sea and weather conditions. Moreover these aids are strictly 'passive'. They do not facilitate any oversight from the shore of navigational decision-making. Apart from harbour pilotage, today such intervention is facilitiated (through substantial additional resource investment) only at a handful of sensitive and intensively trafficked locations, such as the Dover Straits. In most locations, intensive radar and visual surveillance is impractical and shore to ship communication is thus of limited utility in supporting safe navigation.

The Opportunity

13. AIS, developed as a comprehensive electronic navigation ("e-navigation") tool, integrated into a clear and effective visual display on ship (ECDIS) and on shore, has the potential both to improve navigational precision and security and to reduce costs.

e-Navigation

What is it?

The transmission, manipulation and display of navigational information in electronic formats,

Why is it needed?

to minimise navigational errors, incidents and accidents,

to improve security
and to reduce costs for shipping and coastal states,

<u>How</u> will it be delivered?

using satellite positioning signals,
underpinned by fail-safe supplementary positioning signals (eg. Loran C), displayed in an intelligible and comprehensively integrated format (ECDIS)
on board ship and replicated on shore
with shore-based intervention capability.

14. e-Navigation aims to replicate, in the field of marine navigation, standards of safety and accuracy associated with air navigation; to deliver intelligibility and ease of use on a par with the best contemporary consumer navigation systems (eg in-car satnav); to enhance maritime security; and to save money too. Achieving this vision will require forward thinking, wide (eventually global) acceptance of common goals and standards, a determination to focus the development of technology in pursuit of those goals and the will to share a common agenda across the range of institutions (at national, regional and international levels) which are currently concerned with maritime safety and security.

15. It is often observed that successful change programmes require a "burning deck": a real sense of urgency, often driven by fear of the consequences of failing to change or adapt. The consequences of failing to deliver e-Navigation in a planned and coherent way could indeed be painful. Technology is developing rapidly and diversely and as equipment costs fall, the market may be flooded with new navigation systems of varying quality, performance and utility - potentially using proprietary and incompatible architectures and protocols. One can envisage scenarios in which navigational safety might actually *worsen*. (A further risk in this respect is the pressures which are already mounting in some developed countries to disinvest in traditional AtoN.) At best, an historic opportunity to bring clarity and consistency to technology development could be lost.

An Integrated Structural Framework for e-Navigation

16. It is not hard to describe the essential structural components of a safe and comprehensive e-navigation system:

- accurate, comprehensive and up-to-date electronic navigational charts ("ENC"s), to a common format, covering the entire geographical 'span' of a vessel's operation;
- accurate and reliable electronic positioning signals, with 'fail-safe' performance (probably provided through multiple redundancy, eg. GPS, Galileo, differential transmitters, Loran C and defaulting receivers);
- information on vessel route, bearing, manoeuvring parameters and other status items (hydrological data, ship identification data, passenger details, cargo type, security status etc), in electronic format;
- transmission of positional and navigational information ship to shore, shore to ship and ship to ship;
- clear, integrated display of the above information on board ship and ashore;
- information prioritisation and alert capability in risk situations (collision, grounding etc), on ship and ashore.

17. All of this capability is (or can potentially be) provided by contemporary technologies. The issues which require to be addressed in order to realise the potential focus on standardisation and development. For example:

- there is a need to increase the production and coverage of ENCs with standard formats and interfaces, accelerate distribution and promote commercially viable models for ENC production and updating;

- there is a need to agree common standards for the performance of bridge e-Navigation systems (which information needs to be captured and how, how displayed, how shared with other vessels and shore-based navigation control centres);

- there is a need to develop protocols whereby such systems offer visibility and utility to professional and authorised users, whilst preventing unauthorised access to, dissemination of or intervention in safety or security-critical, real time data transmissions;

- there is a need to develop a shared understanding of the potential benefits and mechanics of shore oversight, leading to the design and implementation of shore-based marine e-Navigation centres covering coastal and, potentially, international waters. (e-Navigation makes this approach technically and economically feasible - for example, there is no reason why the whole East Atlantic coastline from Gibraltar Straits to the North Cape could not be overseen by perhaps three e-Navigation centres - one in the Biscay area, another in the Dover Straits and a third in the Baltic approaches, providing overlap and redundancy in case of local systems failure);

- there is a need to reach a shared understanding of the future role of the different types of 'legacy' navaids in different locations and situations, with a view to developing an orderly and safe migration plan for e-Navigation.

18. Reference to shore-based e-Navigation centres is not intended to imply external intervention and control of the navigation process to the degree accepted in air navigation. The issues are different as between the sectors, and different solutions are appropriate. In the marine environment, locations where such intervention is warranted on a routine basis would be exceptional, defined by exceptional risks, whether from traffic congestion, physical hazards, environmental sensitivity etc (examples *might* include Dover, Malacca, Torres, etc.) In the vast majority of situations, the benefits of shore-based oversight would derive from a capability to lend remote assistance on an exceptions basis, to vessels whose position or course gives rise to concerns. The potential for long-range observation would also convey important security benefits, as is already well appreciated.

Making it Happen

19. A single international institution must take 'lead ownership' of the vision for e-Navigation. This institution must have the ability to integrate and manage the essential contributions of key stakeholders, in such a way as to promote constructive development and standardisation. The logical choice of lead institution is the International Maritime Organisation.

20. This role would build upon the considerable work already done by IMO in the development of AIS and ECDIS and its involvement in regional developments and trials, notably the Marine Electronic Highway project in the Malacca Straits. AIS and ECDIS clearly point the way towards the development of e-Navigation, although they require further development and, especially in the case of ECDIS, expanded take-up in order to progress towards the delivery of e-Navigation as a practical reality.

21. IMO will need to work in close alliance with IALA (whose members have done much constructive groundwork in this field) and IHO. There will be a substantial, wider stakeholder

management role involving the professional community, including navigation practitioners, ship owners, the ports industry and equipment designers and suppliers. Security and enforcement agencies will also have a part to play.

22. Ultimately, e-Navigation can only be made to work as an international - indeed, global - system. That is why it is right that IMO should take the lead. But there is also much being done at national and regional level, and value in developing it.

23. For example, the USCG and certain European countries are trialling Loran C as a potential 'fail-safe' backup to satellite positioning systems. These trials have the potential to inform and facilitate progress at international level. Experience with early AIS networks will also be extremely valuable, and potentially provides a 'launch pad' from which the e-Navigation centre networks of the future could be developed through regional co-operation, subject to international protocols and standards. Discussions are developing on long-range AIS, of particular interest to security authorities. This paper has already mentioned the Marine Electronic Highway project in the Malacca Straits: the development of an interactive electronic navigation regime for the Inner Route of the Great Barrier Reef in Australia is another noteworthy example of a regional contribution to e-Navigation. Canada has also been active in this field.

24. We must continue to use bilateral and multilateral channels to strengthen regional collaboration between coastal states and we must also work to align our domestic institutional and other stakeholders in support of the e-Navigation vision.

Conclusion and Next Steps

25. This is not a technical paper. e-Navigation is not *primarily* a set of technical issues. Of course, there are a great many questions, large and small, which flow from a decision to embrace the e-Navigation vision. Some will not have easy answers. Delivering fully viable systems with global coverage will undoubtedly take years (though the process could expand from regional coverage of the world's major shipping lanes). But if we do not make a start, soon, the agenda may be overtaken and eventually submerged by uncontrolled technological development and stakeholder confusion.

26. We are highly fortunate to have this window of opportunity to develop an efficient, considered and safe migration plan to e-Navigation. The benefits, whether for "safer ships and cleaner seas", for national and global security or simply in terms of building a more versatile and cost-effective system by comparison with traditional navaids, are compelling.

27. With a view to assembling a powerful alliance of interests behind the e-Navigation vision and giving impetus to the cross-institutional agenda sharing which will be essential to its delivery, the Government of the United Kingdom would like to host an informal, international meeting in London, in the margins of IMO Council at Trinity House on Tuesday, 21st June 2005. We sincerely hope that this meeting will be well attended by senior representatives from countries with an active interest in e-Navigation and from the three key international organisations involved (IMO, IALA and IHO). We shall circulate details in the coming weeks and look forward to extending a very warm welcome to you here in London.

Brian Wadsworth
Director, Logistics and Maritime Transport
U.K. Department for Transport

21st February 2005