CIRM Workshop

Guidelines on the use of non-type approved electronic equipment on the bridge

Liguria, Italy
Tuesday 12th April 2016
09:00-12:30

Richard Doherty, CIRM

Contents

1.   Overview

1.1   The workshop "Guidelines on the use of non-type approved electronic equipment on the bridge" was held during the CIRM Annual Conference 2016 in Liguria, Italy, on Tuesday 12th April.

1.2   Approximately 100 individuals participated in the workshop, representing more than fifty CIRM member companies and a number of external organisations; including, but not limited to, the International Hydrographic Organization (IHO), the International Chamber of Shipping (ICS), the International Association of Classification Societies (IACS),   the International Association of Independent Tanker Owners (INTERTANKO), the International Maritime Pilots' Association (IMPA), and Technical Committee 80 of the International Electrotechnical Commission (IEC).

1.3   The workshop was chaired by Dr Thomas Allan *BSc. DSc. CEng FRINA*. Dr Allan is a former Director of the UK Maritime & Coastguard Agency and UK Permanent Representative to the UN Agency for maritime affairs the International Maritime Organization (IMO), where he chaired the Maritime Safety Committee. The workshop secretary role was performed by Richard Doherty, Deputy Secretary-General of CIRM.

2.   Background and purpose

2.1   During ship operations, mariners may find benefit in using electronic equipment for which no IMO Performance Standards exist, in addition to using type approved navigation and communication systems. Examples of such equipment include smartphones, tablets, Portable Pilot Units (PPUs) and berthing aids.

2.2　There are generic SOLAS requirements related to the use of such equipment, but previous discussions within CIRM (including the panel discussion during the CIRM Annual Conference 2015) have indicated that those requirements may not be universally understood, or uniformly enforced. Furthermore, the extent to which such equipment may be used on the bridge in support of operations seems unclear, and may not be adequately addressed by the current requirements.

2.3　The CIRM Technical Steering Committee has suggested that industry could benefit from the development of clear guidelines governing the use of non-type approved equipment on the bridge, particularly when we consider that there are e-navigation products and services in development that will likely provide value-added information that is not available in the equipment covered by SOLAS

2.4　The purpose of the workshop was therefore to consider the use of non-type approved electronic equipment in depth, taking into account the views of a range of stakeholders, and ultimately to determine if there is a need for CIRM develop guidelines on the use of such equipment and, if so, to consider the content of the guidelines.

3.　Format of the workshop

3.1　The workshop comprised two separate parts:

　　.1　During Part One, four speakers each gave a presentation outlining their views on the use of non-type approved electronic equipment on the bridge. These speakers represented some of the different stakeholders involved; namely, the equipment manufacturer, the shipping company, the Flag State administration, and the Protection & Indemnity (P&I) insurer.

　　.2　Part Two was devoted to a 1.5-hour panel discussion, during which the four speakers from the previous session formed a panel under the moderation of the workshop Chairman, for further discussion of the matters under consideration at the workshop.

4.　Chairman's Introduction

4.1　The Chairman opened the workshop at 09:00 and welcomed the attendees, encouraging their participation in the discussion. He identified a number of specific aspects that would be considered, including:

- The sorts of non-type approved electronic equipment that might be used on board, and what the benefits are for users;
- The existing requirements covering the use of such equipment, the interpretation of those requirements, and where the gaps might be;
- How use of such equipment is handled in other industries;
- If there are gaps in the current rules, whether there is a need for guidelines to be developed;
- If there is a need for guidelines, what should the scope and content of the guidelines be.

4.2　The Chairman explained that the true value of this workshop was in the discussion. It appears that there is a lack of clarity over this topic both inside and outside of CIRM, and the workshop had been arranged in order

that we might tackle the subject in depth. The Chairman noted that if the workshop concluded that the existing requirements were sufficient and there was no need for the development of additional guidelines, then that would be a valid conclusion.

5.   Part One - Stakeholder perspectives

5.1   During this session four speakers, representing different stakeholders, each gave a presentation outlining their view on the use of non-type approved electronic equipment on the bridge.

Manufacturer's perspective
Anders Rydlinger, Product Director Navigation (Transas Marine Ltd.)

5.2   This presentation, on behalf of a leading manufacturer of electronic navigation equipment, began by considering "**where we are today**", looking at technology trends (increasingly connected ships, Internet of Things, big data, mobile apps, etc.), customer needs and trends (moving from paper-based to electronic systems, increased automation, reduction of workload, etc.), and risk aspects (safety of navigation, cyber security, etc.). It was asked - how can manufacturers utilize new technologies to build new products and services meeting customer needs in a new way?

5.3   Consideration was given to the **regulatory regime** in place today covering the products and data needed for safe navigation, including SOLAS, IMO Performance Standards, IEC test standards, Type Approval, Class requirements, Flag and Port State requirements, and Operational requirements. The "pros" and "cons" of this regime were also considered – whilst ensuring safety and standardization, the regime also adds time and cost to development, and may reduce flexibility and/or clarity.

5.4   With respect to the **move from paper-based to electronic systems**, reference was made to development of Maritime Service Portfolios (MSPs) within IMO and the development of data products based on the IHO's S-100 model. With respect to **machine-to-machine information sharing,** reference was made to those type approved systems complying with SOLAS (e.g. Radar/ARPA for anti-collision, ECDIS for voyage planning/route monitoring/anti-grounding) and those that follow industry standards but are not type approved (e.g. e-Navigation displays/tablets for displaying e-Nav data not available in type approved systems). A distinction was made between "**mission critical" information** related to safety (which should only be available in type approved systems) and **"non-mission critical" information** not related to safety (which could be available in non-type approved systems).

5.5   Regarding the **use of non-type approved equipment on today's ships**, it was remarked that this practice does occur and that typically it involves stand-alone systems. It was asked if integrating/interconnecting such equipment with other systems (in a safe way) could bring extra benefits, in respect of better sharing of data and information.

5.6   The presenter also considered **what we can learn from other industries**, noting that, for example, when leaving port a ship's master still uses paper-based checklists, whereas prior to take-off the captain of an airliner completes the necessary procedures on a tablet, connected to the LAN, and uploads the information directly into the plane's navigation systems.

5.7   In considering the "**way forward**", it was suggested users would benefit if manufacturers could utilize new technologies to bring new solutions to market in a short amount of time and to low cost, particularly if new systems were easy to update; but that the current regime of rules and regulations may impose barriers on this model of rapid development. The presenter concluded by asking the workshop if we need to review the certification process, how we might design an open but safe on-board architecture, and ultimately if we need to develop guidelines.

Shipowner's / Operator's perspective
John Murray, Marine Director (International Chamber of Shipping)

5.8   This presentation by the International Chamber of Shipping (ICS), the principal international trade association for the shipping industry representing shipowners and operators in all sectors and trades, began with a statement that ICS members consider that **equipment carried for use on board which has safety/environmental protection functions must be type approved**, while recognising that portable electronic equipment may be useful in fulfilling certain tasks performed on the bridge, providing complementary information to that provided by the mandatory approved equipment.

5.9   The ICS position recognises that information (safety-critical, important, supporting) may be difficult to ring fence in all systems and on all ships and that as much as it is **important to address the need for separation between types of information**, noting that the management of this requirement needs to be considered holistically. Fundamentally we must avoid the situation where we have non-type approved equipment on the ship using non-type approved data; approval of some form is essential.

5.10   Regarding the **use of non-type approved equipment on today's ships**, it was recognised that this does occur, with reference to Commercial off the Shelf (COTS) desktop computers (for nautical publications, nav planning, etc.), Portable Pilot Units (PPUs), berthing aids, etc. Apps on iPads are commonly used, yet ICS members have not reported any problems as a result of such usage. PPU usage is a concern; these devices provide decision-making information but are not type approved.

5.11   ICS believe **the existing rules are clear**, with reference to SOLAS Regulations V/19 & 20 (mandatory equipment), V/18.7 (additional equipment), V/17.3 (electromagnetic compatibility), I/5 & V/3 (exemption), the ISM Code, and Flag State rules. SOLAS does not prevent carriage of non-approved equipment; it should just not compromise the functionality of SOLAS-approved systems. The extent to which equipment can be used is up to the Flag. ICS do not see gaps in the rules, but rather **opportunities for guidance**; perhaps guidelines could clarify the difference between the "static/fixed/non-critical" information that may be made available in non-type approved systems, and the "dynamic/critical" information that must only be available in type approved systems.

5.12   With regard to **e-navigation**, type approved systems will have priority in supporting harmonised dynamic and interactive services, whilst there will be opportunities for non-type approved equipment in the presentation of static and fixed information/services. Some of the proposed MSPs, such as meteorological services and nautical publications, will likely be assisted through additional methods of display. The concept of an "Electronic Folio for Ships" was considered – a repository of electronic documentation to replace existing paper-based documents. Consideration was given to the associated **risks** - factoring in COTS products, application quality and integrity, inappropriate use, and integration and connectivity – and a need for safeguards was expressed, with reference to those in place in the aviation industry.

5.13 Regarding **what the proposed guidelines would cover**, a concept map was presented, suggesting a range of factors that could be addressed in the guidelines. It was stated that ICS would see guidelines as an interim measure, providing temporary guidance in the current regulatory environment until a longer-term solution could be implemented.

5.14 In **conclusion** ICS reiterated that non-type approved equipment is in use on board; that the existing regulations are clear; that there must be a distinction between critical and non-critical information; that e-navigation presents opportunities for use of non-type approved equipment; and that guidelines could be useful as an interim measure. Finally, ICS believe it is critical that a market is not created for sub-standard equipment.

Administration's perspective
Ringo Lakeman, Senior Policy Advisor (Netherlands Ministry of Infrastructure and the Environment)

5.15 Representing the Netherlands Flag State administration, Mr Lakeman began by referencing the **existing legislation** that is in place to regulate the use of non-type approved equipment, noting that the 2002 amendments to SOLAS Chapter V introduced flexibility and paved the way for new technologies but perhaps introduced some challenges for implementation, relating to ambiguity and interpretation. Relevant clauses of SOLAS V include 15.2, 15.3, 15.7, 17 on electromagnetic compatibility (EMC) for all electronic equipment on or in vicinity of the bridge, 18.6, and 18.7. Regarding regulation V/17, it was commented that technically this means that *all* electronic equipment on the bridge must be EMC tested – so where do we draw the line (e.g. coffee machine)?

5.16 **Categories of shipboard equipment** were presented – Type approved equipment to fulfil IMO carriage requirements conforming to IMO performance standards; Non-type approved equipment performing essential functions for which there are no performance standards (e.g. computers running stability programs); and Non-type approved equipment performing functions for which performance standards do exist but for which the manufacturer has no interest in applying for type approval (e.g. specialist echosounders).

5.17 Consideration was given to **user needs**. The OOW/Pilot faces an increase in the number and complexity of tasks, and has a resulting need for better efficiency and convenient/continuous access to essential information.

5.18 **What types of non-type approved equipment do Flag States encounter onboard?** Examples include specialist echosounders on dredgers, smartphones/tablets for private use (not normally used for navigation), tablets with apps for IMDG requirements, QR code scanners on inspectors' smartphones, COTS PCs/laptops for nautical publications or stability programs, fishfinders and VMS on fishing vessels.

5.19 **How do Flag states deal with this equipment?** It must be EMC tested (i.e. IEC 60945), any interfaces must conform to IEC 61162 series, equipment must have redundancy, document control procedures must be in place and licenses must be valid, data must be protected and secure, power supply arrangements must be sufficient, and training/familiarization procedures must be in place.

5.20 In relation to the **available practical instruments**, there are many are in place. Reference was made to MSC.1/Circ.891, MSC.1/Circ.982, MSC.1/Circ.1091, MSC-MEPC.2/Circ.2, IACS Recommendation No.95, and Flag State instructions (issued by MCA, AMSA, etc.).

5.21   Discussing current developments, **e-navigation** caters for the development of new technologies/solutions but will not introduce additional carriage requirements, resulting in an increase of non-type approved equipment in use on the navigation bridge controlled by internationally-agreed standards. Considering if this will become an enforcement issue, it was felt to be unlikely.

5.22   In concluding by looking at **what is needed going forwards**, a number of questions were posed. Is provision of essential navigation information and services duly covered by SOLAS Chapter V? Are information/services required for operational management covered by IMO/IACS/Flag State instruments? Do we need more harmonisation/clarification? It was suggested that there may well be gaps to be address through development of a guideline, and that a critical first step would be to perform a risk analysis. If it transpires that guidelines are required, this should be brought to IMO.

Insurer's perspective
Karl Lumbers, Independent Marine Adviser

5.23   This presentation was given by an expert in Protection & Indemnity (P&I) insurance, who noted up front that P&I insurers are aware that there **is increased use of non-type approved portable hardware around the ship**, including on the bridge. It was noted that tablets/smartphones are perfect for handling electronic information and checklists, and that an increasing number of apps are being made available for maritime use. Further it was reported that equipment failures onboard do cause insurance claims.

5.24   This was followed by an **overview of P&I insurance**, which is third-party liability insurance that does not cover damage to own property. The P&I industry is primarily mutual in nature and handled by clubs, owned by the shipowner and organised to support the shipowner. P&I has a comprehensive set of rules, with the basic principle being that owners of similar ethos/quality share their risks. P&I clubs rely on other bodies for technical standardisation. Information was given on how P&I policies are policed.

5.25   There are **five main categories of P&I insurance** claim – Collision, Property, Cargo, Personal injury, and Oil pollution. The majority of claims are caused by people rather than equipment. There are a number of **factors influencing claims today**, including rapid promotion of officers lacking experience, poor market conditions, higher levels of automation and system complexity, increased use of third party managers, etc.

5.26   P&I insurers **expect information used onboard to be fully up to date and correct** (including Port and Harbour information, Medical Advice, Weather warnings, VTS information, MSI, etc.) but there is a question as to who will be responsible if something happens and the information is found to be incorrect? Insurers have concerns about usability, reliability and fixability of information/systems, and there was an acknowledgment that P&I insurers may not know enough about the issues to be able to effectively reduce such concerns/risks.

5.27   **Risk** is of course a key concept in the insurance industry and can be expressed by the general formula "risk= frequency x consequence". Risk is assessed using a risk matrix that considers consequences, severity and likelihood. If it is determined that incidents arising from the use of non-type approved electronic equipment on the bridge is an identified risk, then insurers will need to start considering Responsibility and Accountability, looking at who is liable for something that happens as a result of, for example, failure of equipment or software. Determining responsibility and accountability for non-type approved equipment could prove difficult.

5.28   With respect to the **development of guidelines**, this is probably a good idea, but caution was urged as there are already too many rules. It must be clear who the guidelines are aimed at, and what will be in them.

5.29   In conclusion, this matter may raise **more questions than answers**. Traditionally insurers are more reactive than proactive, with underwriters preferring factual records to anecdotal accounts. It is impossible to consider all factors when assessing premiums. Underwriters will always want to clearly identify the risk before committing – so what are the facts?

6.   Part Two - Panel discussion

6.1   For this session, which began at 11:00, the four speakers from Part One formed a panel under the moderation of the workshop Chairman, for further discussion of the matters under consideration at the workshop. Comments and questions were taken from the floor, either addressed to a specific member of the panel or to the panel as a whole.

6.2   This section of the report provides a summary of the main threads of the panel discussion.

Fig 1: (From left-to-right) Dr Thomas Allan, Mr Ringo Lakeman, Mr Karl Lumbers, Mr John Murray, Mr Anders Rydlinger.

Differentiating types of systems and information

6.3   In noting that some of the presentations had explored the difference between critical systems/information and non-critical systems/information, it was observed that the practice of differentiating types of systems and information is common in other industries, such as aviation, and that systems/information may be categorised (for example, as "critical", "essential", and "casual"), where the category of system dictates the requirements that apply to it. It was suggested that such differentiation could be useful in the maritime industry and could help with the matter of use of non-type approved equipment. It was suggested that if guidelines were to be developed on use of non-type approved equipment, introducing differentiation of systems and information to those guidelines might be useful.

6.4   It was remarked that differentiating different types of information is difficult in practice, particularly with the introduction of e-navigation which erodes the "firewalls" that have traditionally been in place to separate the different types of information provided on the ship. The representative of the International Chamber of Shipping (ICS) reiterated the point made in his presentation, that the guidelines could help being clarity here, but should be seen as an interim solution only.

6.5   Regarding ECDIS, an opinion was stated that it is now overloaded with functionality making it complex to use for the operator, and that we could move away from this situation by moving some of the non-critical information into other systems, unburdening the ECDIS; however, this would require "smart" integration and would need to be thought through properly. This concept was supported with reference to IMO carriage requirements, which state minimum requirements only and do not prevent a ship having additional equipment in place if it helps the crew to perform tasks in a better way, but of course this should not result in less-regulated systems being used for mission-critical purposes.

6.6   It was remarked that in the context of system differentiation, we need to consider the less critical systems that may have an effect on critical systems, and the example was given of the possible interference to electronic bridge systems caused by LED lights (a matter recently raised by France at ITU and IMO), which also calls the existing Electromagnetic Compatibility (EMC) requirements into question.

General use of non-type approved electronic equipment onboard

6.7   There was some discussion on the types of non-approved equipment used on board, with many comments supporting the fact that smartphones and tablets are widely used on bridges, as well as unofficial electronic charts, systems like the Portable Pilot Unit (PPU), and Dynamic Under Keel Clearance (DUKC) solutions. There was general agreement that such systems and information can be very useful to the navigator.

6.8   Concern was expressed by some over PPU usage, where decision-making navigation information is provided through a non-type approved system. In response, the Secretary-General of the International Maritime Pilots' Association (IMPA) made a statement on use of PPUs by pilots, explaining that their members like to use PPUs during pilotage because of their concerns about the quality of the data provided onboard and because PPUs are a very useful tool for the pilot; explaining further that IMPA are aware of the unregulated status of PPUs, and that they have previously authored guidelines on the design and use of PPUs with the technical input of CIRM; and finally stating IMPA's concern that having an IMO performance standard for PPUs would be to the detriment of their value as a port-specific tool providing unique data.

6.9   Regarding the use of portable phones on the bridge, it was asked if there is a potential interference risk. The ICS representative responded to this point explaining that an ICS Bridge Procedures Guide had recently been published, which includes guidance for the use of phones on ships, which does help the situation.

Testing of such equipment

6.10   There was a comment from the floor stating that in reality it is difficult to make the distinction between different types of equipment and testing requirements, because IMO already distinguishes between mandatory and non-mandatory equipment through its carriage requirements, and our industry already has the IEC 60945 general requirements testing standard that applies to all electronic equipment used on the bridge.

6.11   It was further remarked that IEC 60945 has two main purposes – firstly, it ensures that the equipment's own functionality will work properly, and secondly, it ensures that the equipment does not detrimentally disturb the functionality of other equipment in the same environment. It was asked if there would be value in

only applying part of the requirements of IEC 60945 to additional equipment used on the bridge – i.e. to ensure that it does not interfere with other equipment.

6.12   In response, it was suggested that a new standard could be developed as a lighter-weight alternative to IEC 60945 which would present interference requirements for additional equipment used on the bridge; or that the proposed guidelines could include a section identifying which of the IEC 60945 requirements apply to non-type approved equipment.

6.13   In response to these suggestions there was broad agreement that testing equipment to the full requirements of IEC 60945 is expensive and that explains why there is a lot of equipment on board not tested at all; and that if there was a less expensive alternative to the full IEC 60945, then it might be used more. It was agreed that as long as equipment – such as an iPad – does not disturb the functionality of other bridge systems, then it should be fine to use.

6.14   It was observed that there are a significant number of different EMC standards in force all having different requirements. The example of searchlights was given, which have different standards and criteria applying, all of which are less stringent than IEC 60945, meaning that these lights can potentially cause interference with bridge equipment. It was stated that the core problem here is that there is no universal rule for application of standards.

6.15   The representative from the International Association of Classification Societies (IACS) explained that this area is difficult to police, as Class sees ships at port, not at sea where these sorts of issues might arise; further noting that many of the items under discussion will need to comply with the EU EMC Directive, meaning that parts of the IEC 60945 standard would be met anyway.

Testing of portable electronic devices in the aviation industry

6.16   Further reference was made to the aviation industry, where iOS, Android, and Microsoft devices have been approved to not interfere with the flight deck equipment on an aircraft. It was stated that surely this provides assurance that such equipment does not interfere with critical systems – and it was asked why we need to re-type approve for marine, instead of just accepting the findings of the aviation industry?

6.17   In further discussion of the aviation industry it was reported that aircraft pilots are permitted to install their own personal apps on iPads also used during navigation because the critical software and data on the iPad is encrypted and secured against interference.

6.18   A key outcome of this discussion was that tablets and smartphones used in an aircraft cockpit are type approved to operate safely in that environment.

User awareness and information quality

6.19   It was suggested that as the sort of non-type approved equipment under discussion is made for the consumer market, it is not practical to try and regulate it for the marine market, but that there is a need to raise awareness amongst users of this equipment so that they understand how it can be used. In the following

discussion it was agreed that this could be achieved through risk assessment, looking at the risks of using such non-type approved equipment and the information it provides during navigation.

6.20   This discussion prompted a question from the floor, and it was asked what happens if a Master uses iPad-derived information to navigate the ship? The representative from the Flag State administration suggested that it would require investigation, but that ultimately it comes back to the awareness of the user of the device – the Master must make himself aware of the consequences of using such equipment, and this should be part of any risk analysis.

6.21   The representative from IACS explained that they have experience with non-type approved equipment being used for navigation, and that when IACS pointed out that the equipment was not approved, the response was not to replace the equipment, but to enquire how the equipment could be approved; the point being that if ships are using this equipment, they are doing so for a reason, and we should allow them to know how they might use it.

6.22   An opinion was expressed that because a navigator should use all means available, this suggests that the navigator has an obligation to use information coming from all of the equipment on board, regardless of its type approval status. However, the representative from ICS advised against this interpretation because it implies that a navigator could be at fault if they did not use non-type approved equipment available on board, and this could be seen as another stick with which to beat the shipowner/crew.

6.23   There was some further discussion on data and information quality. It was remarked that problems can arise when smaller companies develop "nice-to-have" equipment/tools without having the associated quality management procedures in place; but that the introduction of the S-100 data exchange framework through e-navigation will ensure that harmonised quality data is provided to ships as an additional source of information for decision making.

6.24   There was general agreement that the ultimate aim is to increase a ship's situational awareness through provision of quality information from all relevant sources; that the navigator must understand where the information comes from, including which information is essential and which is not; and that a risk assessment could be a useful tool for raising the awareness amongst users of non-approved equipment. The proposed guidelines could cover these aspects.

Other areas of discussion

6.25   Regarding training, it was agreed that ships' crews already face a huge training burden and that any guidelines should not add to this. It was further agreed that "education" is more fundamental than "training" – understanding what a system does for you, not just how to use it; and that this ties in to raising awareness amongst users. It was also agreed that de-skilling is a real issue in an era of technological innovation.

6.26   It was remarked by one manufacturer that there cannot be any reduction in the level of the current type approval regime because some small companies cannot afford it, and that instead we should maintain the current level of safety whilst adding guidelines to bring clarity regarding the use of non-type approved equipment.

6.27   It was noted that the proposed guidelines would take years to develop and would be in force for a certain number of years, but all the while technology is developing and changing – so how do we future proof the guidelines? In response it was suggested that the guidelines should be generic and not prescriptive, and that they could be goal-based. However, some scepticism was expressed on behalf of manufacturers over the practicality of meeting goal-based requirements when they have a lack of detail.

6.28   It was also stated that at times the discussion had focused too much on safety – there are already robust information and systems in place supporting the safety of navigation; what we are talking about is supplementary information coming from non-type approved systems that will address other needs on the bridge (for example, better performance, automated reporting, etc.) We should consider how these sorts of systems and information can safely interface with the type approved systems.

Close of panel discussion

6.29   The session was closed by the Chair at 12:30.

7.   Conclusions

The following section is a compilation of the agreements reached during the workshop, compiled by the workshop chairman and secretary.

7.1   Areas of agreement

- Non-type approved electronic equipment is widely used on board ships' bridges today, and includes tablets, smartphones, PPUs, and Commercial Off-the-Shelf (COTS) computers;

- Such equipment will continue to be used and can be of considerable value – but it must be controlled;

- There are requirements and instruments in place governing use of non-type approved equipment, including SOLAS regulations, Class recommendations, and Flag State instructions;

- There are however gaps in the current requirements and a lack of clarity in interpretation;

- There appears to be a lack of awareness amongst users about the different sorts of equipment on board and its associated data, and how/if such data can be used in decision making;

- There is a difference between critical safety-related information and other non-critical supplementary information, and possibly a need to differentiate different types of equipment (e.g. critical or non-critical / mandatory or non-mandatory, etc.);

- It is essential that additional non-type approved electronic equipment does not interfere with other bridge systems;

- E-navigation will have an impact in this area, as it involves increasing system integration and presents the possibility for much more information to be delivered to the user through additional equipment;

- Lessons could be learned from the aviation industry, where peripheral electronic devices are widely used by navigators;

- Guidelines on use of non-type approved electronic equipment would be useful to bring clarity, at least as an interim measure ahead of a longer-term solution, and there was no opposition from any workshop participants to the principle of developing guidelines.

7.2   Further groundwork needed

- Identification of the existing rules/requirements that currently apply to use of non-type approved electronic equipment, followed by identification of where gaps might lie;

- Further consideration of who the guidelines are aimed at;

- Further consideration on how to future-proof the guidelines.

7.3   Considerations for "Guidelines on use of non-type approved electronic equipment on the bridge"

- The guidelines should aim to raise awareness amongst the users of non-type approved equipment, so that users understand where the information they are using is coming from, which information is essential, and which is not;

- In support of raising awareness amongst users that not all systems and information are equal, the guidelines could differentiate systems and information, for example by categorising them based on criticality (e.g. "critical", "essential", and "casual") or carriage status (e.g. "mandatory" and "non-mandatory");

- The guidelines could consider the consequences for the mariner of using information that has come from a non-type approved system in decision-making, and this could be accompanied by a larger risk assessment on the use of non-type approved equipment;

- The guidelines could consider interoperability of non-approved equipment with mandatory bridge systems, with a focus on how to safely interface these systems;

- The guidelines could also consider the compatibility of non-approved equipment with other bridge systems, for example by identifying which parts of the general electromagnetic compatibility requirement (IEC 60945) applies to non-approved equipment.