INTERNATIONAL MARITIME ORGANIZATION
4 ALBERT EMBANKMENT
LONDON SE1 7SR

Telephone: 020 7735 7611
Fax: 020 7587 3210
Telex: 23588 IMOLDN G

IMO

E

Ref. T2/4.01

MSC/Circ.1091
6 June 2003

ISSUES TO BE CONSIDERED WHEN INTRODUCING NEW TECHNOLOGY ON BOARD SHIP

1 The Maritime Safety Committee, at its seventy-seventh session (28 May to 6 June 2003), recalled that, in the context of large passenger ship safety, the STW Sub-Committee at its thirty-fourth session (24 to 28 February 2003) had considered the training issues related to the use of new navigational technologies, equipment operation and management and the use of information and data provided to mariners during routine ship operations and during emergencies.

2 The Committee also noted the outcome of an international conference on "Integrated Bridge and Navigation Systems (IBS/INS)" which had brought together the relevant expertise including: seafarers, shipowners and managers, equipment manufacturers, regulators, and trainers to discuss various user-centred issues, including the identification of training needs associated with the introduction of new technology on board.

3 The Committee considered that it would be beneficial if parties concerned were provided with advice on issues to be considered when new technologies are introduced on board ships and, to this effect, approved this circular, inviting Member Governments to bring the advice at annex to the attention of all concerned.

***

ANNEX

ISSUES TO BE CONSIDERED WHEN INTRODUCING NEW TECHNOLOGY ON BOARD SHIP

Introduction

1 The introduction of new technology on board merchant ships has been increasing at an accelerated rate. The effectiveness of crews to use the technology safely and to best effect requires familiarity with the equipment and training as recognised in the STCW Convention. There are a number of aspects to be considered with respect to how seafarers interact with the technology and also some issues to be considered when assessing the training needs for the seafarers who use such technology.

Issues to consider for the training of seafarers

Standardization

2 Although performance standards exist, many bridge systems, engineering consoles and cargo systems vary greatly in their user interface (layout of controls, displays and symbology) and functionality beyond what is required as a minimum (added features requiring extra controls, menu options or customised symbology). The result of non-standardized controls and displays is an increase in the amount of training needed to make a seafarer familiar with, and effective in, the use of the equipment.

3 Increased training to facilitate the use of these systems however is not always achievable, such as when a pilot boards a ship or a seafarer joins a ship just prior to departure, or possible to provide, such as multiple systems in training centres. There are clear dangers for seafarers which find that the systems they are required to use at sea are very different from those on which they have received training ashore.

4 One solution is to familiarise seafarers with equipment by training them using simulators (either desk top or full mission) prior to them joining their ships. This is made far more efficient where manufacturers provide assistance in developing the training tools.

5 The solution is a common interface with standard symbology for common operations and where systems are capable of being customised into non-standard displays, the standard display should be able to be reverted to through a single and obvious control feature.

Challenges in training for technology

6 There are many challenges encountered when assessing the training needs for seafarers in using technology-based systems on board, some are cultural and others are practical, but these issues need to be addressed if seafarers are to be able to utilize technology-based systems on board to make good decisions.

7 In many cases, crews of new ships or ships retrofitted with new equipment may be trained ashore in accordance with a manufacturer's recommendation or model course criteria, but those

initial crews may be required to train their reliefs, *in situ,* in the proper use of the equipment. This procedure is often known as cascade training. This leads to a situation where the initial crew might receive 3-5 days of specialist training for a system, but are required to pass this knowledge on to other watchkeepers during a brief turn-round period in port. Additional aids, such as Computer Based Training (CBT) modules, used either aboard or prior to joining a ship, can improve the situation. Technical manuals can however be poor training tools.

8 One issue of note for trainers is the realization that many young watchkeepers have a culture of using information technology (home computers, Internet, video games etc.) and that during times of stress revert to electronic displays for their primary decision support systems. Inexperienced seafarers may seek more data and information in stressful situations, often confusing themselves further. Problems can also develop when novice navigators are trained on desktop simulators which do not have the advantage of a simulated "window" for visual observation. This may reinforce the habit of constant reliance on a digital display for situational awareness during actual operations.

9 Care must be exercised to ensure that training on new technology centres on selection of the most appropriate technology and using it effectively to assist the decision-making process. Examples include officers who are very proficient in operating Integrated Navigation Systems who continue to use the system for decision support when other means are more appropriate, such as in close quarters situations, or where various pilotage techniques are more appropriate.

10 The information supplied by navigation systems such as ECDIS and AIS can add value and improve operations when used by well-trained officers who understand how to manage and prioritise the information, however the same information provided to an officer without these skills can lead to information overload and poor decision-making.

Taking the human element into account when introducing new technology

11 Research has shown that automation has qualitative consequences for human work and safety and does not simply replace human work with machine work. Automation changes the task it was meant to support; it creates new error pathways, shifts the consequence of error further into the future and may delay opportunities for error detection and recovery. Automation creates new kinds of knowledge demands. Watchkeepers must have a working knowledge of the functions of the automation in different situations, and know how to co-ordinate their activities with the automated system's activities. This manifests itself in situations whereby officers do not understand weaknesses or limitations of systems they rely on. Training in this respect will become more important as systems become more integrated and sophisticated.

12 It has been shown that operators will monitor less effectively when automation is installed, and even more so if the automation has been operating acceptably for a long period. There is also evidence that the more robust a system is in its design to prevent human intervention, the more difficult it is to know about and thus control what is going on inside its boundaries. Under these circumstances, the human operator has no means of checking the accuracy or fidelity of instrument readouts and thus may well ignore relevant information and revert to heuristic decision-making.

13 It has been observed that sophisticated systems used by well-trained seafarers with a good level of underpinning knowledge use the systems to make better decisions. However, the same level of sophistication made available to seafarers with poorer understanding of the basic principles of navigation and collision avoidance often creates a more hazardous environment for decision-making.

Information technology aboard ships has increased the level of information, thus increasing the task of managing the information. The information on the bridge of a ship can include information pertaining to navigation, collision avoidance, communication, cargo, engineering, ship management, ship safety and security. It is also not uncommon for in excess of 200 alarms to be installed on a ship's bridge. For a single watchkeeping officer to monitor this level of information properly, training in information management is essential. Information overload is a real hazard.

Summary

14 The introduction of new technology on board merchant ships has the potential to improve the efficiency and effectiveness of watchkeeping and to improve the safety of operations. However, it must be recognized that this technology brings with it the inherent training requirements needed to be able to physically operate the new systems and also the training needed to allow seafarers to use the systems to make better decisions. Standardization of designs is necessary to create an environment where seafarers and pilots, working within the natural constraints of their trades, can operate the systems safely and effectively.

15 Training for the use of such systems should take into account the special human element issues associated with the human machine interface, the recognition that automation changes a task it was meant to support and that operators will monitor less effectively when automation is installed.

_____