INTERNATIONAL MARITIME ORGANIZATION

IMO

E

SUB-COMMITTEE ON STANDARDS OF TRAINING AND WATCHKEEPING
33rd session
Agenda item 16

STW 33/INF.2
17 October 2001
ENGLISH ONLY

ANY OTHER BUSINESS

Information technology and the training needs of seafarers

Submitted by
The International Federation of Shipmasters' Associations (IFSMA)

SUMMARY

Executive summary:	The Nautical Briefing on Information Technology and the Training Needs of Seafarers, compiled by the Nautical Institute and attached hereto, is submitted for wider dissemination..
Action to be taken:	Paragraph 3
Related documents:	MSC 74/INF.16, MSC 74/24, paragraph 7.19

1 The Maritime Safety Committee MSC, at its seventy-fourth session, had noted the information provided by IFSMA (MSC 74/INF.16) on information technology and the training needs of seafarers and welcomed IFSMA's offer to make this information available to the Sub-Committee.

2 The Nautical Briefing examines the needs and cost benefits of computer training, levels and types of training and the responsibilities of Maritime Administrations, shipowners and managers and seafarers. Electronic copies of the Briefing are available at: <http://www.nautinst.org/ITTraining>

Action requested of the Sub-Committee

3 The Sub-Committee is invited to consider the above information and to take action as appropriate.

***

NAUTICAL Briefing

INFORMATION TECHNOLOGY AND THE TRAINING NEEDS OF SEAFARERS

Sponsored by:

Trinity House

Compiled by David J Patraiko, BSc, MBA, MNI
Project Manager The Nautical Institute

Supplement to Seaways March 2001
Sponsored by Trinity House

FOREWORD

By: Captain E.M. Scott RD** FNI RNR Shipmaster
President of The Nautical Institute

When The Nautical Institute carried out an international survey into the use of information technology at sea recently, the results showed the wide number of applications and a disturbing statistic that seafarers responding believed they had inadequate training.

It is The Nautical Institute Council's belief that to use computer based systems effectively and efficiently, professional mariners of all ranks should be familiar with this technology and certainly be competent using it for their respective required tasks.

I am therefore pleased that The Nautical Institute has taken the initiative to present this nautical briefing to its members and the industry. This continues the Institute's work in this field starting in 1988 with Captain Coles's monograph "Computers at Sea", the Institute's conference "Improving Shipping Company Performance through Information Technology" in 1998, Mr Ramsey's nautical briefing "Internet for the Seafarer" in 1999 and the first annual computer based training conference "CBT@Sea" last October.

On behalf of The Nautical Institute's Council, I would like to thank Trinity House for their generous sponsorship which has enabled this briefing to be written, and to all the maritime and IT professionals that participated in its development.

Introduction

In 1998 when The Nautical Institute carried out its survey into the use of computers aboard ships[1], it became evident that there were few shipping industry standards for the use of computers and that most of the computers had been initially put on board to use single applications such as maintaining crew lists, performing stability calculations and report writing.

The critical function of a stand-alone computer could be affected by hardware or software failure or the inability of the operator to be able to use it. As network systems are developed for ever more complex tasks, such as inventory management, stock control and communications, not only does failure of the system prevent the rendering of planned maintenance, it effectively inhibits the process of that task. As systems become more complicated they also become more critical to operations.

This briefing examines the question: what skills do seafarers need now and in the future to manage their computer systems effectively? It then goes on to discuss some of the techniques which can be used, both on board and ashore, to deliver competence in this relatively new area of management activity.

Merchant vessels plying the waterways of the world are becoming increasingly complex in terms of the ships themselves, the regulatory environment in which they operate, and the commercial pressures to accomplish more with fewer people yet in a safer manner. To assist shipmanagers and seafarers to

▲ *Navigation station.*

manage this complexity many operations now, both ashore and afloat, rely on the use of computers.

It is hard to estimate how many ships have computers on board because the number changes daily and because so many seafarers today carry their own computers with them, but it is safe to say that the vast majority of ships over 1,000 dwt have at least one stand alone computer on board. Computers are used for communications, administration, navigation and to control and monitor engineering systems. The infrastructure on board can range from a single handheld computer to a complete networked system with many terminals linked by fiberoptics and forming part of a Wide Area Network (WAN) connecting land-based offices and a fleet of vessels in a seamless virtual community.

With the implementation of computer systems on board comes the demand for seafarers to use, manipulate and often maintain them. The success of these systems will depend on the operator interacting efficiently with them, requiring a certain level of skill. It is important to understand, however, that training a seafarer in the use of IT is not an effective goal. Ultimately, as is later explained in the section on STCW, the final objective is for a seafarer to be 'fit for purpose' and able to carry out tasks required by their position. It is often misunderstood just how integral information processing is to many of these onboard tasks, and this is what this briefing seeks to highlight.

Scope

In preparing this briefing, a common question asked by non-seafarers was: why are seafarers different? If a shipping company doesn't have a policy for training its shore staff in the use of computers, why should it treat sea staff any differently? Leaving aside the obvious riposte of the need to train both staffs, the answer is of course that seafarers work in a more isolated environment where resources are limited and communication is costly.

Most computer users have at some point experienced a problem. The first reaction from a shore-side user is often to contact a friend or colleague. Perhaps someone within the same room or office, just down the hall, the IT department, an IT consultant or just the nearest teenager. Support is usually no more than a local telephone call away.

At sea however, if a knowledgeable colleague or other technical resources are not available on board, the vessel's problems have to be solved through time-consuming research, frustrating trial and error or through costly communication to shoreside support staff.

The scope of this briefing will be largely confined to shipboard computer systems (often inextricably linked to company wide networks). It does not, however, cover electronic devices within specialist systems, or embedded chips, that operate without the need for human intervention. It will additionally focus on Windows® based operating platforms (shown to be used by the vast majority of on board applications).

For this briefing, a computer is defined as "an electronic device for storing and processing data according to instructions given to it in a variable program". Under this definition many electronic devices on board a vessel would qualify and crew may therefore require training to use them, but as these are specialist systems or may have embedded chips that perform their operations without the need for intervention, they are not considered in this briefing.

This Briefing will examine basic generic Windows based computer applications commonly used throughout the world's merchant fleet.

Background

In 1998, following many comments from seafarers concerning IT issues on board ships, The Nautical Institute initiated a survey of its members to determine the extent to which computers were being used on board, how they were being used, what they were being used for and problems and benefits derived by their presence[1].

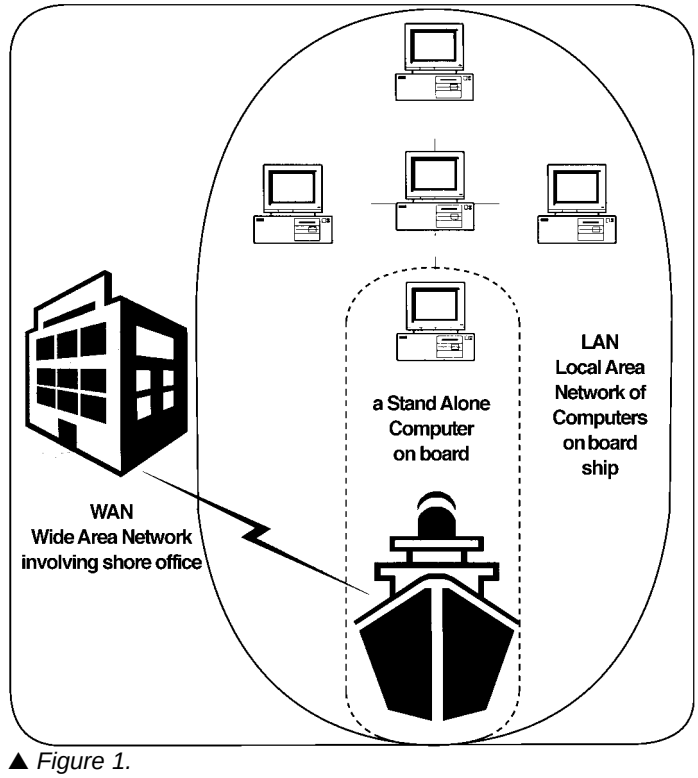
One of the most striking statistics was that 83% of the responding seafarers had no IT training at all, and claimed to be self-educated. Although this is not bad in itself (for many people self-training can be quite satisfactory) it does represent the potential for inefficiencies (to be expanded on later). It can also be a serious distraction to crew burdened with operational matters and may contribute unnecessarily to fatigue. In contrast, of those seafarers who responded, 73% requested further IT training by instructors, 9% requested training using media such as video or CD-Rom, and only 21% thought self-training was still the best method. These results were a driving force behind the publication of this briefing.

What's on board?

The surveys conducted by The Nautical Institute and an independent survey conducted for Inmarsat during the same period[2] both concluded that the vast majority of vessels carry computers on board. In The Nautical Institute's survey, less than 1% of ships did not have computers on board and the Inmarsat survey indicated 5%. These figures are further supported by reports made by the Institute's network of pilots, surveyors, shipmanagers and others that visit ships on a regular basis. These figures clearly show that computers on ships are a reality.

In terms of configuration and infrastructure, both surveys indicated that over 70% of vessels had stand-alone computers on board (single computers not connected to other computers), while over 30% of vessels used networks (computers connected in groups, usually through a central computer or server, see figure 1). This latter category is growing rapidly as many companies are well into their third, fourth or even fifth generation of on board computer systems with sophisticated software applications relying on file sharing.

An operating system is the program that manages all the application programs in a computer. Research indicates that, as in shore side operations, the vast majority of shipboard computers use Microsoft Windows® (e.g. Windows 3.11, Windows 95, Windows 98, Windows NT workstation, Windows NT Server, Windows 2000) as an operating system although the use of Novell NetWare and Unix systems may be gaining popularity for networks. At the time of writing it is estimated that the majority of stand-alone computers are operating Windows 95, and the majority of Local Area Networks (LAN's) are running Windows NT. There are many versions of Windows, and it is being upgraded on a regular basis, but for the purpose of this briefing it shall be assumed that a Windows style interface is the standard to train to and is expected to remain so for the near future.



▲ *Figure 1.*

The Nautical Institute

Application programs found on board ships today are even more numerous and would run into the thousands, if itemised. It is not uncommon for some shipping companies to run hundreds of applications within a fleet from redundant programs such as different versions of wordprocessors and communication packages, making fleet communication and file sharing all the more difficult.

Applications can, however, be categorised into basic groups such as standard applications like word processors, spreadsheets, databases, presentation programs, browsers, and communication or messaging programs that handle e-mails and faxes and bespoke programs (these programs, often based on a standard application, that are customised for a specific operational task). Examples of these include inventory systems based on a database such as Microsoft SQL, or an engine performance program based on a Lotus 123 spreadsheet. A more common bespoke application is an ISM Safety Management System Manual based on a word processor, or draught surveying software and oil and chemical cargo calculation based on spreadsheets. In addition to the increasing use of the Internet at sea and ashore by seafarers[3], current trends, however, are to use browsers and browser technology to standardise the interface between the user and the computer [4]. Applications, either standard or bespoke, using this type of protocol will become very important in the future as users expect to navigate their applications using hyper-links and "forward/back" step keys.

Good bespoke software uses standard menus and buttons etc so that it is just as easy to use as a wordprocessor, once the user has learnt standard windows operations of menus such as "file>Print etc. This "common interface" is one of the great advantages of the almost universal domination of Windows.

The training implications for these applications are that, once basic knowledge is acquired, to use and manipulate operating systems and standard applications, bespoke applications based on these programs are easier to use and users therefore require less training.

Common applications found on board vessels include management software to handle crew records, financial accounting, payroll, stock and inventory control, and purchasing and invoice requirements. The implementation of the ISM Code has also been responsible for accelerating the use of computers on board. Many companies rely on computer technology to manage their ship board SMS system, including maintaining accurate records both on board the vessel and throughout a fleet, in order to provide the necessary audit trail.

Further uses of windows based applications are commonly found in vessel performance monitoring, stress and stability calculations, and navigation. Leading integrated bridge manufacturers are designing their systems to use Windows NT operating systems and the look and feel of a Windows-type interface with a trackball-pointing device is now being widely adopted for interactive displays found in radars, ECDIS and engine monitoring stations.

The need for training

The value of having officers who are competent in the use of computers is to be found in their ability to support shipboard management and use systems effectively. Seafarers not trained in the use of on board systems using or based on computer technology are at risk of violating regulations such as the STCW 95 Convention, by not being fully competent to perform a required task (such as navigation), or violating the ISM Code by not identifying training for systems such as cargo or propulsion which impact on a vessel's safety or environmental responsibilities.

The commercial argument can be as simple as 'time is money', wasted time onboard due to the inefficient or ineffective use of computer applications also wastes time and costs money. At sea, on a long voyage this may be negligible, but some time is more valuable than others. Delays in port due to a seafarer's inability to access or process computer-based records can delay a vessel and even one lost hour can make quite a financial difference. Inadvertently losing files, "crashing" a system or mismanaging a backup can not only result in lost time on board and costly satellite calls, but might require a technician to visit a ship. These are all real examples of problems encountered with IT systems at sea given to The Nautical Institute by seafaring members.

▲ *Stewards store room.*

Commercial incentives to train

There are major commercial benefits to be gained from having computer-literate seafarers on board a vessel with computers, they include; the ability to manage commercial risks, the use of computers as an effective management tool, more efficient fault diagnosis and improved morale and self-confidence. From a business perspective, it becomes difficult to justify the investment of on board computer systems if there is not the skill onboard to operate them.

It is clear that many shipowners and operators are planning for a future increasingly centred around the operation of the "IT office at sea". By implication, employers will be seeking to retrain or employ new officers and crew who have a capability to use such equipment, programs and services[5].

Managing commercial risks

Accident investigators and insurers are now developing a growing awareness as to the effect that poorly operated IT applications can play in casualties and incidents. It has been suggested, particularly in cases involving cargo contamination (liquid), the miscalculation of stability and stress, and the failure of cargo lashings (inside and independent of containers) that a fundamental inability to effectively use computer-based applications has contributed to commercial losses.

Ships and shipboard systems are becoming more complex, and computer applications are being used to push operational limits ever further. Computer processing to monitor and control these applications are therefore relied on to a greater extent. Many tankers use IT applications exclusively to calculate stability and stress and to monitor and manipulate loading and discharge operations. Sophisticated programs have also been developed to assess lashing requirements for container vessels with larger and heavier stacks. To effectively use and operate these systems seafarers are required to have both an understanding of computers in general and specific training in the particular application. Failure to train for these systems can lead to commercial loss and may result in claims for negligence.

Another source of IT related commercial risk is in the maintenance and operation of the on board system itself. Proper training can reduce risks associated with using standard applications, bespoke applications or administrative applications such as MS Explorer, or the Registry Editor. The management (or mismanagement) of backups, virus protection, privileges and security operations can also pose risks with considerable commercial consequences.

Computers as management tools

Computers are used in business and on board ship to assist with management tasks. One method for this to happen is to design

specific bespoke software that crews interact with in a pre-established process. An example of this might be a program which allows the entering of names and dates into a payroll program, that then calculates wages, prints the desired cheque and logs the transaction. This is the most common use of a computer, it is effective and requires minimal training due to the lack of decision-making tasks for the operator.

For a ship's officer to voluntarily use the functions of a computer to assist him in solving a problem or to streamline an operation requires a more theoretical level of training. An example of this might be a chief engineer who logs events or readings in a spreadsheet in order to plot performance anomalies that might otherwise go undetected, a medical officer who, rather than just typing the medical inventory as a standard text document, uses date fields for expiration dates, in order to sort by dates to reveal when a drug has expired or needs replacing.

▲ *Master's office.*

The seemingly simple art of using a word processor is not always what it seems. Most self-taught seafarers can produce letters and reports, but how efficiently and professionally? A common problem is that most self-taught people do not know what facilities are available and tend to use a computer as an electronic typewriter. Huge amounts of time have been needlessly wasted because users were not aware that pages and bullet points can be automatically numbered, standard letters or forms can be saved as templates or realising the potential of mail merge for correspondence. In today's world where masters are expected to be business managers with no secretarial support, the ability to use a word processor efficiently can save a great deal of time and money.

Many companies are now seeking ways of increasing commercial advantage and are finding that computers used on board as a management tool, have more than justified training programmes particularly when related to the ability to create and edit complicated documents, such as shipyard specifications, especially when used in conjunction with e-mail communication.

Fault diagnosis

When using computers it is inevitable that something at sometime will go wrong, this may be very minor or possibly a major fault. How these problems are dealt with can have clear economic ramifications. A seafarer trained to the level adequate with his tasks and responsibilities (discussed later) will have the ability to a) recognise a minor fault and correct it, b) recognise a fault beyond his ability and know where and how to get assistance, and c) be far more effective while working with others to correct the problem. In this latter activity, the trained seafarer will be able to communicate or discuss a problem or fault using appropriate technical terms and have an understanding of the process proposed for the solution of the problem and work effectively using his skills to complement a knowledge-based technical support system or shore-based technical assistance.

Basic knowledge and skills will, for example, assist a seafarer to use diagnostic tools, isolate a problem, reboot computers, re-install applications or replace a terminal or server.

Morale and self-confidence

The effect of self-confidence on seafarers in their ability to use computers onboard cannot be underestimated. A seafarer not confident in their ability to manage a computer will, at best, be confined to using it in the most minimal way possible and, at worse, be frightened to use it and become frustrated and fatigued. This is most often seen in senior officers who may, due to personal or cultural traits, be reluctant to seek advice especially from junior personnel who might be more familiar with the equipment. Failure to train officers or crew to use the technology required will have an adverse effect on morale which can, in turn, further reduce productivity.

There has also been some evidence that the use of and training for IT systems by seafarers offers additional job satisfaction and career enrichment needed to recruit and retain high quality crews.

Regulatory considerations

Commercial arguments for training aside, is there a legal or regulatory requirement for training seafarers to use computers? Computer literacy is not directly addressed in the IMO's STCW95 Convention or ISM Code, but there are ramifications that need to be addressed. Voluntary codes of good management such the ISO standard, or the ISMA Code also need to be interpreted as training for competence which is implicit in quality management.

International Safety Management (ISM)

The Nautical Institute has asked Captain John Corse, FNI, Director of Ferriby Marine to examine the ISM Code in relation to the need for IT training for seafarers. He writes:

"With every year that passes there is an ever increasing trend towards the fitting of more electronic equipment on board ships. The electronic component of much of this equipment is designed to further the automation of ship-board functions in order to reduce the size of crews which means that it must be reliable and easily understood. Great advances in reliability have certainly been obvious in recent times but especially where there is integration of these functions and the sharing of information between different pieces of equipment, the complexity of this electronic wizardry has meant that it is all too often anything but simple to understand.

For example on the navigating bridge the Officer of the Watch has to contend with GPS, ARPA, ECDIS charts, GMDSS, Loading / Stress and Stability computerized programmes, Integrated Navigation Systems and in the Engine Room there are sophisticated engine control and machinery scanning systems, data loggers and planned maintenance systems to grasp.

The degree of sophistication varies greatly from company to company and ship to ship and may be part of the reason why there is not a global or even concerted approach to this problem of ensuring that personnel are properly instructed in the use of such apparatus. Whilst there are currently no figures available to show how many accidents are related to the lack of training or comprehension of this ever growing list of equipment, there have been some significant examples such as the "Royal Majesty"[6].

The introduction of the International Safety Management Code high-lights areas of concern regarding the lack of IT training. Whilst the ISM Code does not specifically refer to computers and IT equipment, it never the less draws attention to aspects of safe operation which have to be complied with irrespective of how the information, measurement or result is obtained. At the very beginning of the Preamble to the Code, it states very clearly, "The purpose of the Code is to provide an international standard for the safe management and operation of ships and for pollution prevention". Whatever methods of operation are utilized to achieve those ends, "safety" must be paramount. However, it is all too common to find that ships have been fitted either originally or as a retro-fit with equipment for which the seaman has not received any training whatsoever. Or he has been instructed by a fellow officer who has only limited knowledge, some of which may in fact be incorrect. Or members of the crew originally appointed to the vessel were given some instruction but it was not passed on to subsequent crew members.

The Nautical Institute

*In 1.4.2 the Code states that every company should develop and implement a Safety Management System (SMS) which contains **instructions** and procedures to ensure safe operation of ships and protect the environment in compliance with relevant international and flag state legislation. This is further supported by clause 3.3 which requires that adequate resources and shore based support are provided to enable the designated person(s) to carry out their function.*

Again in clauses 6.3 and 6.5 which deal specifically with familiarization and training respectively, it is stressed that unless people are properly trained and conversant with the equipment they have to operate, they will fail to do their job properly, damage the equipment and possibly put the vessel and crew in danger. In clause 7 it is necessary to develop appropriate plans for shipboard operations and in clause 10 it requires that adequate maintenance be carried out and that it is fully recorded with special regard to critical functions. Both of these requirements tend these days to be controlled electronically as is the documentation referred to in clause 12.

In the early sixties following the Andea Doria/Stockholm collision it was determined that those who operated radar should be properly trained in evaluating the information it provided to the watch-keeper. Since then legislation to ensure adequate training for the correct use of ARPA and GMDSS has followed but there are so many other items that confront the seaman of today.

In conducting ISM assessments and audits in many parts of the world, I often come across a marked disregard or understanding of the need to ensure that all personnel who have to operate computers and other electronic equipment are given the necessary training and familiarization to ensure a reasonable degree of competency. This has resulted in a non-conformance being raised but with frequent changes of personnel on board ships it recurs all too often. This is principally a management problem and one that is growing ever larger by the year. Do we have to wait for an accident with serious loss of life before the problem is properly resolved?"

STCW Convention

Mr. Ian Giddings, FNI Training and Education Manager for The Nautical Institute, looks at IT training requirements inherent in IMO's STCW95 Convention:

"The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995 and the Seafarers' Training, Certification and Watchkeeping Code make no specific mention of information technology training. These two documents focus upon the competencies together with the associated knowledge and understanding which a seafarer is required to demonstrate.

It is possible to achieve these and to carry out one's duties on board without the need for information technology. However in this day and age this is rarely the case and so the seafarers do require training in information technology to be fully competent particularly at management level.

In the standard of competence for Masters and Chief Mates there is the function of controlling the operation of the ship and care for the persons on board at the management level. Within this function there is the specific competence "organize and manage the crew", which requires a knowledge of personnel management, organization and training on board ship. Today's vessel owners supply computer programmes to monitor and record such activities thus the seafarers require training in their general operation, if it is a Windows-based programme say or in their specific operation if it is a specially designed programme. Of course much of this could be eliminated if the programmes were made intuitive but that rarely happens.

This then percolates throughout the system with various competencies carrying an implication that information technology may be used in this area. Consequently there is a need to have a level of competence in information technology. Can one really envisage, on a modern well-equipped vessel, the Master doing correspondence without it or the Chief Engineer handling stores without it? Information technology may not be written into STCW in black and white but it is there and if it is there the people need training."

Analysing the need for training

Training Needs Analysis (TNA) is a formal term often used for determining the need for training. In essence, the task is to define the competence level for a specific task, determine the present skill level of the seafarer, asses any gaps and to apply one or a combination of training methods to create a training strategy and implement a training programme. Firstly the needs are defined, next the existing skills levels are established, and finally any gaps between them are addressed by training.

Before the need for training can be addressed it is first necessary to answer the question: Who wants the seafarers to be trained? For the purpose of this briefing, three perspectives will be considered, that of the ship owner/manager, the seafarer and the trainer/administration.

Shipmanagers should want to ensure that their seafarers are trained to an adequate level to use the equipment on board the ships in their fleets and are able to accomplish the required tasks efficiently, safely and in a successful commercial manner. The shipmanager's task is the easiest of the groups to identify because they know exactly what equipment and applications will be used on board and are thus able to address further training needs in advance of implementing new systems.

The seafarer will need to address his own situation as well. The professional seafarer will assess his own level of skill with reference to the type of ship on which he is expecting to serve. Once on board, if the seafarer feels his level of competence in the use of on board IT does not permit efficient operations, his needs should be discussed with the training officer, master or company representative. This is not only justified by professional ethics, but can be construed to comply with voluntary management practices (ISMA, ISO, TQM) as well as requirements such as those contained in the ISM Code. Personal IT skills will also be needed by a seafarer if they decide to change careers, and should be addressed by them as part of their Continuous Professional Development (CPD) and educational strategy. Personal use of computers on board by all ranks, will also be driven by the rapid development of economical facilities for crew e-mail.[7]

Training providers have a duty to train students to a level required by government policy or the needs of the market, and **flag administrations** have a duty to assure that its seafarers are adequately trained to the competency levels required by international regulations (STCW) and again, fit for market demands. If seafarers are being trained for a career in international shipping, they should be competent to handle tasks required of them for their level of certification.

The Nautical Institute, in collaboration with many maritime professionals, has proposed three generic levels of IT competency for seafarers serving in today's international merchant fleet. It must be stressed that the following are suggested levels of training and that The Nautical Institute is not promoting any further mandatory training, testing or certification. It should also be noted that when training seafarers for non specific employment, a broad and general approach to the scope of training should be given, while if a seafarer is being trained by his employer, the scope of training should be more specific and in relation to the tasks and equipment they will use.

Level 1: 'Familiarisation'

All seafarers of any rank, holding any level of STCW certification, should have the skills necessary to operate computers or programs in a Windows environment at the simplest level. The primary justification for this is that many ships and shipping companies are using computers for safety and induction training. Further justification comes from the fact that, as discussed earlier, most ships are now equipped with computers running (or emulating) a Windows environment and that increasing levels of technology on board for operations and communications are likely in the future. This familiarisation level will add to a foundation of a modern technically competent labour force needed for the shipping industry.

This first level of competency might therefore include the ability to:

- Use a pointing device such as a mouse, trackball or touchpad
- Ability to use a keyboard
- Access and explore pull down menus
- Ability to click icons or buttons to activate a procedure or access information
- Use the task bar
- Use 'Get Help' function

Level 2: 'Basic'

The *Basic* level, should be the minimum level for watchkeepers or department heads. Seafarers of these ranks are often required to produce basic letters and reports, interact with stock control and planned maintenance programs, safety management systems (SMS) and use computer-based equipment such as navigational aids and engine room control systems.

The *Basic* level of competency might therefore include the ability to:

- Meet the *Familiarisation* level of competency
- Log-on and log-off
- 'Save', 'Save As', 'Open', and 'Close' files within an application
- Input text into a text editor
- Create letters and reports using wordprocessing software
- Choose a printer and control print functions for layout
- Enter data into spreadsheet and database applications
- Use a browser

{note that the term *Basic* is used for this level to coincide with similar *Basic* standards used in various national vocational qualifications (NVQ's) and Microsoft training standards}

▲ *Cargo office.*

Level 3: 'Supervisory'

The third level of competency should be the minimum level for ship board officers (senior or junior) responsible for system administration. The training involved for this level would be to prepare officers to understand the network concept, manage day-to-day system maintenance, and have the ability to apply the system as an effective management tool.

The third level of competency might therefore include the ability to:

- Meet the *Basic* level of competency
- Understand the structure of on board terminals and networks
- Use MS Explorer® or equivalent
- Use messaging applications such as e-mail, telex and PC fax
- Use diagnostic tools to troubleshoot such as virus check, 'scandisk', defragment' and the ability to monitor memory usage
- Install and uninstall hardware and programs

Types of training

There are various types of training and no one type will suit all applications or all seafarers. The important thing is to assess the need for training at a required level of competence and to match a programme of training to meet this need. The following section will look at some different options for imparting computer skills, their strengths and weaknesses. Advice concerning IT training resources is given in the the text box.

Where to look for training resources

There are many sources of information technology (IT) training available throughout the world. By far the largest of these are the companies who offer, under licence, training packages for a range of specific applications such as MS Windows, Word and Excel. These courses are normally delivered at the training company's well-equipped site but can often also be delivered at other locations. An example of this type of provision is New Horizons (www.newhorizon.com) who offer a variety of courses at various locations throughout the world whilst maintaining a common standard. Many of these and similar courses can also be found through the web at a variety of training related sites such as www.blueU.com, www.courseLeader.com, www.worldoftraining.com and www.microsoft.com.

Another source of training and information about training are the further and higher education establishments around the world who offer IT courses ranging from short courses on specific areas or applications through to the longer courses which may cover a range of IT subjects and lead to recognised higher qualifications. These can also be offered in a variety of delivery methods such as instructor-led short courses or open learning.

There are also the many self-tuition packages and publications such as the Teach Yourself tutorials on CD-Rom from Focus Essential (www.focusmm.co.uk) or books such as those in the Windows for Dummies series (www.dummies.com) and others.

Many of these training centres are now offering the European Computer Driving Licence, a European-wide qualification that enables people to demonstrate their competence in computer skills. The syllabus is designed to cover the key concepts of computing, its practical applications and their use in the workplace and society in general. Further details of this may be obtained from the British Computer Society (www.bcs.org.uk) or the centres themselves. The Marine Society (www.marine-society.org.uk) also has courses available through the National Extension College with discounts for seafarers.

Another good starting point for seeking information on IT training may be the IT department of your company and the IT supplier for your company. Because of their in depth knowledge of your company, they may be able to offer or advise on the specific training required for the applications commonly fitted to the computers and systems within the company.

Finally another starting point in the search for efficient and effective IT training will be the Institute's NauticalCampus website at www.nauticalcampus.org.

Instructor-led training

Instructor-led training is popular and can be very effective if, like all training it is planned well. Research indicates that for computer applications instructor-led training also has limitations.

Instruction carried out on board needs to be carefully planned. Onboard training while a vessel is in port runs the risk of disrupting a crew who are trying to turn a vessel around in a short time and contending with the myriad of tasks such as cargo transfer duties, crew changes, port administration to name a few. Attempting to train in such an environment, if not managed properly can be very ineffective due to distractions. Training at sea may be more effective due to reduced distractions, but may be prohibitive in terms of cost and scheduling feasibility.

If an opportunity does, however present itself for instruction at sea, the advantages are that the actual equipment and software that the seafarer will be required to operate can be used and, that the instruction will be in the real environment using actual scenarios, that the cost of travel (for the seafarers) is removed, and that assessment of competence is more accurate. The

The Nautical Institute

seafarer will also stand a better chance of knowledge retention in this environment.

Where it is possible to consult the crew themselves, and offer a choice of training options, the crew benefit from increased retention and a feeling of greater participation in the decision making process.

Instructor-lead training ashore brings the benefit that job distractions are limited, and greater attention can be given by the seafarer to the task at hand, however there are costs incurred for travel, subsistence and often wages. It is also a recognised fact that this type of training suffers from lack of retention. It is estimated that after a month's time only 30% of knowledge is retained. If this time period coincides with a seafarers time on leave (or holiday) the retention can be even less.

A further consideration with instructor-led training is the ratio of students to instructor. In a purpose built computer training laboratory, where each student has his own terminal and the instructor's terminal is projected for all to see, class sizes approaching or exceeding twenty are thought to lose effectiveness. On board ship, or ashore where an instructor is leading multiple students sharing a terminal, more than two students to a terminal is, again, thought to be ineffective.

Video-based training

Video-based training is another option that can be used on board for standard or bespoke applications. Advantages with this method are that the training modules can be customised for specific applications and that the lessons can be shared with an audience. The disadvantage is that videos need to be updated in line with software changes.

Although video-based training has been use effectively on board ship for general training, using video for computer training does have limitations. It is not interactive and it can be difficult to translate what is learned whilst watching a video to skills when sitting down in front of a computer at a later time. If this medium is used it should be used in conjunction with a workbook that provides reference and allows for note-taking.

Computer based training

On board computer-based training can be very effective and cost efficient and should be looked at as an important option. Computer Based Training (CBT) is actually a very broad concept and perhaps the name is a little misleading. To be pedantic, CBT can be used for many things, education, training, reference, review and assessment. It can take many forms including CD-Rom or be Internet-based. It can use simulation or virtual reality and can be interfaced by using the traditional mouse and keypad, touch-screen or voice command.

With minimal introduction, CBT can be used to teach the most basic skills such as keyboard and mouse usage, right through to the most advanced levels. CBT should, however, be well-designed and interactive[8].

Advantages of using (well-designed) CBT for IT training onboard include

- Seafarers can work at their own pace and in their own time,
- Being computer-based, a seafarer can switch between training and trial modes,
- Progress can be assessed and recorded,
- Areas of weakness can be targeted,
- Training material can be kept up-dated using downloads or Internet-Based Training (IBT) packages.

Many modern standard applications come with CBT pre-installed in the form of tutorials and help wizards. CBT can also be customised to represent specific bespoke systems as well as fleet-specific processes. These can also be developed into troubleshooting aids for fleet-specific systems.

CBT alone is not, however, a panacea and should be implemented as part of a holistic training programme, possibly incorporating one or more of the other techniques discussed.

Books and paper-based systems

The use of manuals for training and on board reference is probably the most common method. Unfortunately poor quality software books and manuals are easy to produce and sell. The effect is further weakend by the fact that most people tend not to read the manual before attempting to operate software packages, and they generally make poor reference material when something goes wrong. The reasons for this can be debated, but include the lack of ability to interact and simulate the actual program.

Manuals may not be as flashy as other options, but there are some excellent examples. They do not require power, are available on demand and can be read in the comfort of a lounge or cabin. Good manuals should be indexed, logically laid out, written in plain language and illustrated as much as possible.

Reducing the need for training

This report has looked at the need for training, and examined, generically, the level of training required for various ship board tasks. An assessment of specific required training would be based on the tasks required to be preformed by the seafarer. Logically, if the tasks are reduced or simplified, the need for training will be reduced. In this section we will look at how to reduce the tasks and limit training while maintaining or even increasing the effectiveness of on board systems.

To reduce the skill level of a specific task there are two options, remove the task or simplify the task. This applies to on board computer systems in that a ship using intuitive applications and remote or automated administration will require less-specific training.

Software vendors, to indicate that operation of their application is easy to use, and therefore does not require training or requires minimal training often use the term "intuitive". The concept of intuition is an interesting one, intuition can be defined as the ability to perceive and understand things instinctively. When applied to ship board applications, software needs to be intuitive to the seafarer not the developer[9].

Attention should also be given to the entire system when assessing training needs of those on board. A system that uses very intuitive applications may have an operating system such as Windows NT which, if a problem arises, is not intuitive (to the average seafarer at least).

▲ *Coaster's bridge.*

Systems intuitive to seafarers also reflect tasks that they are already familiar with. Software, such as a program designed to assist the master in administering personnel, for example, will be far more effective if it is based on a system he is already familiar with both in the use of forms and processes. Designing software that is familiar to seafarers is not always practical or desirable (particularly when developing new systems or standardising systems throughout a fleet) but the issue should be addressed when assessing the training implications.

Intuitiveness is also a reflection of the capacity of the program and how close it follows existing skills. For example, a program used for celestial navigation calculations, which closely follows

standard calculations that a watch officer is used to, would not need the level of training that such an officer might need to use a GMDSS terminal which could include communication theory not normally used by him. It is also important to understand the difference between computer skill and management skills. When implementing a new computer-based stock control or planned maintenance system onboard where such systems haven't existed before, the training emphasis may need to be on the management task rather than on IT. Software companies who provide management systems point out that problems with computer based management systems are often not IT or computer based, but are rooted in the lack of management theory or culture supportive of a management task such as stock control[10]. The process of communication is also an issue that may have to be addressed in a company training policy. The potential for improved flows between the ship and the office and vice versa implies the need for a better understanding of each other's role in this increasingly interactive environment[11]. Excess quantities of non-essential e-mails facilitated by the "copy to" function have been commonly sited as a major source of inefficiency within a fleet.

Interaction or communication between applications needs to be addressed when assessing the need for training. Many ships now have systems that require applications to communicate with each other, such as a database application that generates letters or reports using a wordprocessor and then sends them to a messaging application which then transmits the reports via satellite. If these applications have been designed to interface automatically so as not to involve the seafarer they will reduce the training implications (as long as nothing goes wrong). However, a system that does require intervention, such as a messaging application that requires a seafarer to understand the hierarchical system of drives and folders in order to attach specific files, does require a certain level of skill.

The most difficult IT task a seafarer must attend to is usually on board system administration[12]. Whether the vessel has a single stand-alone computer or a fully integrated network, high level administration tasks or troubleshooting represents a skill level which few seafarers currently possess. One problem in this area is that the skills are needed so infrequently, that even if a seafarer were trained, in say network administration, he might soon forget the knowledge through lack of practice. This has lead in some fleets for a case being made for a separate trade as Computer Operator, who would look after electronics, communication and navigation equipment along with computer operations[13].

Many shipping companies have spent much time addressing this issue of system welfare. One company has achieved some success by attaching a start-up CD to the side of the computer, and in the case something goes seriously wrong, the machine can be rebooted, all the applications can be reinstalled afresh from the CD and other files can be reinstalled from the daily backup.

Many companies are using remote maintenance, such as 'Norton PC Anywhere from Symantec'. If the on board system is connected to a communications link, such as cellular or satellite phone, it is possible for a shore-side technician to dial up and log-on to the on board system and manipulate it as if he were on board himself. This can be used both in times of trouble and for routine maintenance. It has saved many companies time and money, and reduces the advanced level of training otherwise required of on board personnel.

Redundancy has been used by many shipping applications, particularly with Dynamic Positioning (DP) applications where double or triple redundancy is required for critical systems[14]. Redundancy can be used in other non-safety critical systems to reduce the need for high level skills. Having twin servers in a network will allow one to fail without rendering a system dysfunctional, and having a spare stand-alone terminal with applications already installed can save time and skills as well.

Conclusion

Seafarers need to be trained to operate computer systems on board ships to a level appropriate to the tasks they will be expected to carry out today and in the future. The training can be carried out ashore or on board, taking advantage of a multitude of media. However, the training must be planned and implemented in accordance with the objectives of the seafarer, the shipmanagement company, the training organisation or flag state administration. In assessing the need for, and level of training, a shipmanager must take into consideration the complexity of onboard systems, the intuitiveness of the systems and the consequences of failure. International regulations and management codes require seafarers to be competent in tasks requiring IT skills and many companies have found that computer-literate seafarers are not only commercially beneficial but can add a competitive edge.

References

1. Patraiko D (1998), *The Nautical Institute Survey into the Use of Computers at Sea*, Seminar Proceedings – Improving Shipping Company Performance through Information Technology, 1999 The Nautical Institute, London UK
2. *Shipmanagement Software Systems (SMA) Market Research,* (1998) Inmarsat
3. Ramsey, D (1999), *Internet for the Seafarer,* Nautical Briefing, The Nautical Institute, UK
4. Elder J, (1998) *The Future – 64kbits and Internet Technologies*, 2nd International Conference on IT Strategies is Shipping, (18-19 March 1998, Amsterdam), London, LSM
5. Muirhead P, (1998), METHAR Project Report, EC Transport 4th Framework 6.4.3
6. US NTSB Report: NTSB Number MAR-97/01 (1997) (http://www.ntsb.gov/publictn/1997/mar9701.htm)
7. *Communications for Crew,* Digital Ship (December 2000), Digital Ship Ltd, London, UK
8. *Issues to be considered when integrating computer based technologies into the training and assessment of seafarers,* November 2000, Results from The Nautical Institute's CBT@Sea 2000 Conference (submission to IMO: STW 32/INF.7), The Nautical Institute, UK
9. Lyras D (1998), *Critical Issues of Computerisation for Ship Operators,* Seminar Proceedings – Improving Shipping Company Performance through Information Technology, 1999 The Nautical Institute, London UK
10. Macleod M (2000), *Using Shipboard Computer Based Maintenance Systems,* The Nautical Institute on Command – A practical guide, The Nautical Institute, UK
11. Muirhead P, (1998), *Can Training Keep Pace?*, 2nd International Conference on IT Strategies is Shipping, (18-19 March 1998, Amsterdam), London, LSM
12. Patraiko D (2000), *Managing Information Technology at Sea,* The Nautical Institute on Command – A practical guide, The Nautical Institute, UK
13. Padmanabhan N (1999), *Ship Operations and Fleet Support,* Computers and Ships, The Institute of Marine Engineers, UK
14. Bray D (1999), *Dynamic Positioning Operator Training,* The Nautical Institute, UK

NOTE FROM NI

This briefing has been prepared as part of the Institute's continued effort towards keeping members appraised of relevant developments in the use of Information Technology.

The Nautical Institute will continue to update its members with current information through its journal *Seaways*, and of course through it's web site **<www.nautinst.org>**.

Published by The Nautical Institute, 202 Lambeth Road, London SE1 7LQ. Tel: +20 7928 1351 Fax: +20 7401 2817 Email: pubs@nautinst.org
Copies are freely available as a pdf file from web http://www.nautinst.org/ITTraining