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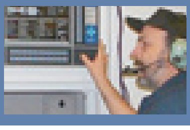

Alert!

The International Maritime Human Element Bulletin

Issue No. 15 September 2007

ISSN 1747-5015

Let's be clear about automation

"Ship systems are protected by strict design standards and tolerances, by redundancy - particularly for critical systems - and by feedback processes that will ultimately activate an alarm of some sort, or take corrective action. Their efficiency and reliability will be undermined if they are not correctly set up, regularly monitored or properly maintained; these are tasks that, for the most part, have to be undertaken by the ***human*** *element of any such system - that is, the* ***seafarer****."* (**Alert!** Issue 9)

It is the technological revolution that has changed the way in which people and systems interact with other people and/or systems. In the maritime industry, the human element of the human-machine/system interface is becoming an endangered species, partly because of the drive towards smaller crew numbers, but largely due to increasing automation.

Automation should make life easier for the seafarer and make operations safer, but if an automatic system is not 'fit for purpose' or is not correctly set up, regularly monitored or properly maintained, it can lead to an accident - as a number of accident investigation reports have already testified.

Automation can also be to the detriment of situational awareness and that instinctive feel for something not being quite right. Furthermore, automation can change the role of an operator into that of a monitor.

It can also bring with it a plethora of alarms, which can be distracting, can cause confusion and can be ignored by those who are not aware of their sources and implications - thereby negating their important purpose of communicating to the operator that a hazardous situation exists or that a system is overloading or about to fail. Equally, if the seafarer has not been trained to recognise and respond to that alarm appropriately, then an accident may result.

There are some who suggest that all accidents at sea are as a result of human error because, when seeking the root cause of an incident, it is invariably the human input to the design, manufacture or operation of a system that has been a contributory factor.

These causes can be as a result of faulty hardware or of software programming errors. But, they can also result from failures to follow a proper systems engineering approach to the design and build of a ship and its systems; from failing to meet the user needs and to follow the principles of human centred design; and failing to provide appropriate training and easy to understand operating and maintenance instructions for the operator.

The shipowner must therefore provide the shipyard with a clear and prescriptive specification of what he requires in terms of automation and alarms. He should take account of both the operation and maintenance of each system and give user and usability requirements equal emphasis with technical requirements. He should ensure that automated systems are specifically designed to keep the operator engaged, alert and competent to make good decisions.

He should ensure that the seafarer is properly trained in the operation of each automated system and that he/she can recognise and respond to any alarm and take the appropriate corrective action in the event of a system failure.

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We seek to represent the views of all sectors of the maritime industry – contributions for the Bulletin, letters to the editor and articles and papers for the website database are always welcome.

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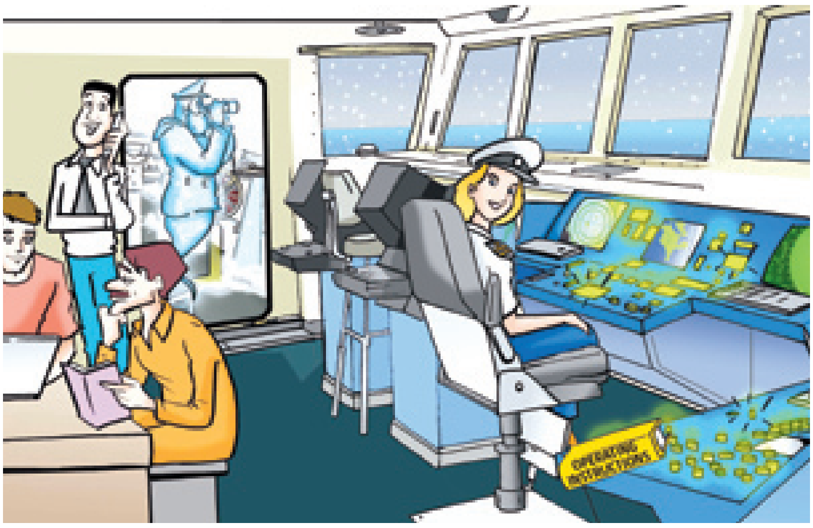


Making alarms more manageable

Brian Sherwood Jones, *Process Contracting Limited, UK*

The provision of brightly coloured and noisy alarms forms an important part of the safety assurance provided by Regulation, Classification and Safety Management. However, it is the appropriate response of the crew that enables safe operation, not the provision of the alarms.

Alarms and other loud distracting messages come from an increasing number of sources, in increasing numbers. These messages individually and collectively fail to meet the needs of safe and effective operation in a number of ways. The message originators (regulators, lawyers and designers) are keen to provide additional channels 'just in case', but are under no obligation to reduce false or distracting alarms. Providing logic to inhibit alarms or reduce their priority encounters the fear of liability.

There are well-understood changes to the design process that would reduce the number of channels, enable them to be inhibited, with appropriate set points and messages that are understood. This can be done, but it is not free. The ongoing management of alarm systems is also well-understood. There is established good practice that can be used to good effect; there are guides for the aviation, nuclear, marine and process control sectors.

Changing the regulatory process may prove more problematic. The ongoing revision of the IMO Code on Alarms and Indicators will test the ability of the regulatory community to meet the needs of the seafarer. A change in philosophy to 'alerts' has been adopted recently by IMO for navigation alarms, to enable better prioritisation of messages to users. This important development allows for greater prioritisation of alarm channels into alarms, warnings and cautions.

As regards engineering alarms, there is hope in the longer term from Condition Based Operation. This is an initiative to integrate online and offline information systems to provide stakeholders with the information they need to make effective decisions. Progress has been made on the technical front in terms of data exchange. Work still needs to be done on the real information needs and flows.

The design challenge is to provide alarms that switch attention without disrupting the primary task. It could be argued that many alarms are the result of inadequate overview displays. There is a long history of research that might help e.g. functional hierarchy, ecological, and other overview displays. Applying research into 'ambient' displays may provide information in a less disruptive way. Audio presentation could be improved more than a little. Research on directionality, sound characteristics and the use of speech could be used.

In the shorter term, it would help to provide the crew with familiarisation material on the noises that may be encountered.

Brian Sherwood Jones' presentation *Working with alarms on ships* can be downloaded from: www.he-alert.org/documents/published/he00650.pdf

What's new...

IMO MEPC 56 - Human Element working Group

The Joint MSC/MEPC Working Group on the Human Element met during the 56th session of the Marine Environment Protection Committee (MEPC), in July 2007.

The Committee approved, subject to approval by MSC 83, an MSC-MEPC circular on *Guidelines for operational implementation of the ISM Code by Companies*, intended to assist companies in the effective and efficient operational implementation of the ISM Code; and a further circular on *Guidelines on qualifications, training and experience necessary for undertaking the role of the designated person (DP) under the provisions of the International Safety Management (ISM) Code.*

It was agreed that there was a need to provide guidance to encourage companies and seafarers to document and record information on near misses and hazardous situations in order to understand the factors leading up to events that threaten safety and the marine environment. The format for reporting near misses will be considered by the next session of the group.

Perceptions of ship technology questionnaire

A research project investigating the impact of technology at sea is seeking the views and experiences of seafarers. The study, which is being coordinated by the University of Cardiff, will examine a number of issues including standards of computer literacy, training, alarms, email and internet access, as well as specific technology such as ECDIS, AIS, radar, and machinery space monitoring equipment.

Further information can be obtained from: www.technologyatsea.com

Alarm Systems: A Guide to Design, Management and Procurement (EEMUA 191)

The second edition of the Engineering Equipment & Materials Users' Association's publication *Alarm Systems: A Guide to Design, Management and Procurement* has been published. The Guide, developed by the users of alarm systems in industry gives comprehensive guidance on the design of alarm processing systems and their functionality, the operation of existing alarm systems and performance optimisation, together with the specification and purchase of new alarm systems.

Available from: www.eemua.org/p_instrumentation.htm

Alert!

The International Maritime Human Element Bulletin

Editor: David Squire, FNI

Published by the Nautical Institute, the world's leading international professional body for qualified mariners

www.nautinst.org
Membership info: sec@nautinst.org

Design & artwork production by:
Jacamar (UK) Ltd +44 (0)23 92410108

Printing by: Indigo Press +44 (0)23 8023 1196

Web site by & cartoons by: NewsLink Services (India Office) +91-9811649064

A chief engineer's perspective

Richard Thomas
Chief Engineer
BP Shipping

Automation has removed from the ship's engineer the continuous physical interaction necessary to control the ship's plant, such that we now need only to monitor the plant and perform maintenance. The greater control achievable by automation allows engines and systems to remain within close desired operating parameters, thus reducing the need for maintenance.

Consequently, engineers now rely on the automation, and have little experience in manually controlling the plant. Be it that either the automation or base plant give a fault, reverting to manual control is difficult at best.

Perhaps an important management consideration should be *how to manage without automation*, so that in an emergency we can quickly restore or keep the ship under its own power. This is only achievable if engineers new to a ship are given time to trace the various systems, and have the hands-on opportunity to start and operate critical equipment.

Automation on ships is generally reliable. In terms of its direct management, the monitoring system must be verified, and the only way to do this is to check each measuring point for accurate read-out, plus (if appropriate) alarm and emergency response. Furthermore, the automation must be verified by observing what is actually happening against what should be happening.

If I were to have a 'wish list' it would be to ensure that the ship is delivered with easy-to-understand operating instructions for all of the micro-processor controlled equipment.

I would have a selector switch that hides all non-critical alarms. In the event of a blackout or other major failure, the number of alarms produced is correctly enormous, but the visual display of alarms is too much, and hinders the engineer.

I would have all cabin alarms fitted with a 'soft' audible start, rather than the sudden heart stopping sound that they currently emit.

And, alarms covering areas of the ship directly looked after by the deck department would not sound on the engine console. Such alarms should feed a separate panel that will alert a selected navigation officer.

Automation is expensive; not only due to first cost, but also because frequently a maker's technician is required to attend on board to repair the system. It is of no surprise, therefore, that some owners try to have ships built with manned engine rooms - after all, the minimum manning certificate will normally allow for an engineer to be on each sea watch!

Automation, STCW and electronics officers

Captain Ricardo E Jiménez
Shipmaster

"The new ship here is fitted according to the reported increase of knowledge among mankind. Namely, she is cumbered end to end, with bells and trumpets and clock and wires, it has been told to me, can call voices out of the air of the waters to con the ship while her crew sleep. But sleep thou lightly. It has not yet been told to me that the Sea has ceased to be the Sea."

Rudyard Kipling (1865-1936)

A quotation that is still valid today - where the sea still has not ceased to be the sea and that despite automation and technology we have not reached a balance on human and machine intervention.

The idea of the automated process is to reduce operators - something convenient in this age of crew reductions and saving costs - assisting with physical and mental requirements of the work.

But we have to be careful: no instrument exists yet that will replace the officer of the watch in his duties despite the advancement in this field; and, what is more important is that not all automated processes are reliable with so many 'bells and trumpets and clock and wires' and sensors and data sensitive variables to control and monitor.

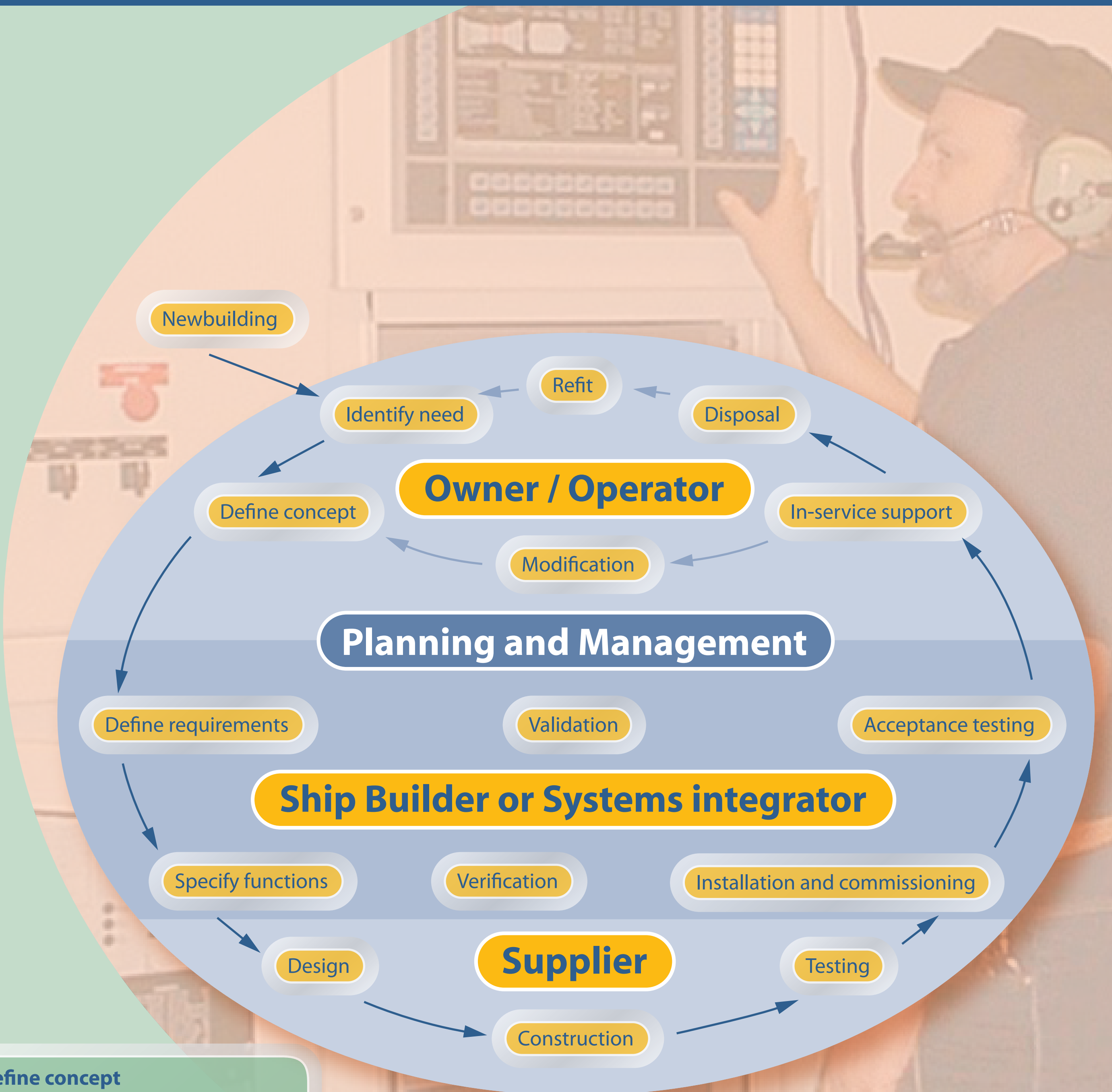
One of the problems faced onboard with automation, relates not to when the whole process is working correctly, but when due to incorrect information or calibration or failure, the results become unreliable and the automation process is in need of stopping - overloading other crew who need to complete the tasks manually - and then to be fixed by qualified engineers and electronics officers.

Yet, while the engineers are covered by the requirements of the STCW Code, electronics officers seem to have been overlooked. Such is the importance today of automation that many ship management companies and owners have started to check the possibility of getting electronics officers, with watchkeeping licenses, who are able to cover Safe Manning Certificate requirements, while others have opted to have one roving 'Electronics Officer' to travel from ship to ship, to solve problems, calibrate sensors, and replace parts, in an effort to avoid - or to reduce to a minimum - the need for an expensive third party shore technician.

Based on this importance we need to find ways to better cope with automation and its equipment when it fails, and to have the correct resources available to make it work as soon as possible - such as adding the electronics officer to the Safe Manning Certificate, establishing competences within the STCW Code etc.

Otherwise, automation just for the sake of saving costs is an accident waiting to happen...

Automation - Trust and Dependability



Define concept

Identify hazards and associated risks relating to the system; identify, clarify and record characteristics of stakeholders, tasks and organisational and physical environment in which it will operate; develop understanding of its users, boundaries, environment and applicable requirements sufficient to enable satisfactory performance of lifecycle activities

Inputs: System strategy - project scope – legislation - competitor systems

Outputs: Concept & scope description - hazard & risk management description - context of use - invitation to tender

Installation and Commissioning

Install and commission the validated system; establish human-system aspects of its support and implementation

Inputs: Validated system - context of use - requirements specification - installation plan - stakeholder representatives - training materials - support plans

Outputs: Installed system – Trained users

Identify need

Refine the need for a system

Inputs: Company strategy - crew, market & technology forecasts - replacement request - experience gained from existing systems - legislative requirements

Outputs: Business requirement - context(s) of use - system strategy - concept and scope description

Design

Draw on established state-of-the-art practice, experience and knowledge of the supplier and other stakeholders and on the results of the context of use analysis, to design the system to meet specified requirements; design the operation, maintenance, training, support and other procedures that ensure that it performs as required in use; develop integration testing approach and products

Inputs: Requirements specification - context of use - rules & regulations - standards & codes of practice – legislation - evaluation report

Outputs: Design documentation - integration & test specification - training needs of crew - support plans

Planning and Management

Specify how the required technical, quality, safety and human-centred activities integrate and fit into the whole system lifecycle

Inputs: Concept and scope description - terms and conditions of contract - requirements specification - context of use

Outputs: Project Plans - installation plan - validation plan

In-service support

Operate and maintain the system to keep the required dependability

Inputs: Installed system - operation & maintenance procedures - system manuals - support plans

Outputs: Operation & maintenance log - monitoring log

Validation

Validate that the system meets its requirements specification; ensure that it meets the requirements of the users, the tasks and the environment

Inputs: Validation plan - requirements specification - project plan - context of use – standards & legislation - user feedback

Outputs: Validated system - validation report - validation log

Define requirements

Define complete, correct and unambiguous set of functional and non-functional requirements for the system; establish requirements of the organisation and other stakeholders acquiring or utilising it, taking full account of needs, competencies and working environment of each relevant stakeholder

Inputs: Concept & scope description - hazard & risk management description - project scope - user representatives - industry/national/international standards

Outputs: Requirements specification - revised context of use

In order for the marine industry to gain full benefit from computer-based systems, such as ship automation, it is necessary for crews to place appropriate trust in the system and that the system is sufficiently dependable for the task. The International Standards Organization (ISO) has developed a total system, human-centred, risk-based, through-life approach to the specification, design, introduction and use of operationally effective and commercially efficient software intensive marine systems. This is presented in ISO 17894:2005 *General principles for the development and use of programmable electronic systems in marine applications*, which defines twenty principles and associated criteria for dependable marine systems. This new standard:

• Promotes a systems-oriented view of software intensive systems development;

• Gives user and usability requirements equal emphasis with technical requirements;

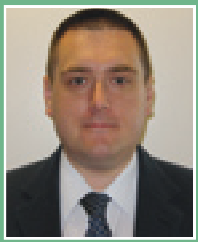
• Takes account of operation and maintenance;

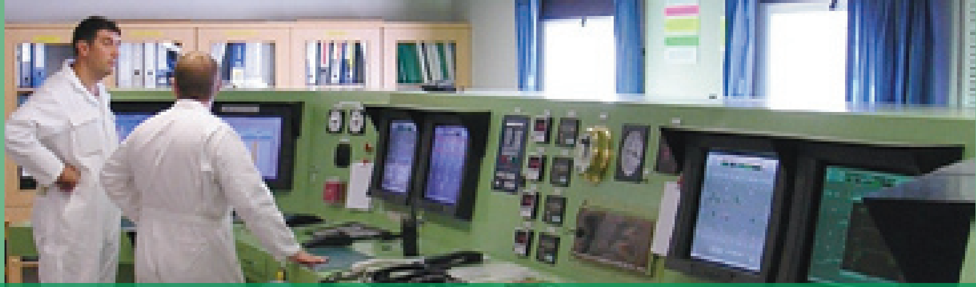
• Supports the assessment of innovative designs;

And

• Provides a set of dependability requirements that owners can request for all systems.

Here we present the guidance in ISO 17894 on the lifecycle stages and processes for the definition, development and operation of a dependable and usable computer-based system - from a human element perspective.





Staying cool in the LNG business

Alastair C Messer
Shell Shipping Technology
Shell International Trading and Shipping Company Ltd

Shipping Liquefied Natural Gas (LNG) is quite literally a matter of "staying cool". LNG 'boils off' at around –160°C at atmospheric pressure and so the cargo, carried in insulated tanks, has to be carefully managed during loading, transit and unloading. Boil off gas (methane) can be used as fuel during the voyage, causing interaction between cargo and machinery systems to an extent not found on other ship types.

The rapid increase in LNG ship construction, after a lean period in the 1980s and early 1990s, has led to significant changes in the way the LNG ships are purchased and operated. To be competitive, many shipyards offer standardised LNG ship designs instead of the custom-built ships of the past. As befits this production line approach, the shipyards tend to view automation systems as 'black boxes' to be bolted down, wired up and switched on.

Today, automation plays an increasingly vital role both at sea and alongside the terminal. The trend of the last ten years or so has been towards centralised operation and integrated automation systems to improve situational awareness and provide effective control of cargo and machinery systems. One effect of this change is that operators can become overloaded with information, especially in abnormal situations. Preventing this places certain demands and obligations on those involved in the development of automation systems.

At Shell International Trading and Shipping Company Limited (STASCO), we aim to make sure that the delivered ship satisfies the need of the operator, be that our own fleet or partners in a joint venture project. We actively seek to ensure that our requirements are clearly defined in advance of contract signing, and we take an active role throughout the development process to open up the 'black box' so that we can be satisfied that the systems meet our design criteria for safe and effective operation.

There are a great many rules, codes and standards that impact on system design but relatively few that address matters such as operability and integration at a functional level. We recognise that we need to be actively involved in the development process to get what we want, rather than rely on the shipyard and suppliers to make key decisions for us. This typically includes risk analyses and design workshops involving the cargo and machinery engineers who will ultimately use the systems.

The emergence of ISO 17894 is welcomed by STASCO as it provides a risk-based, user-centred and through-life framework for the development and use of automation systems. It guides us - in our specification process, to engage with shipyards and vendors and as a basis for our proactive involvement in system development - and it helps us to stay cool!

www.shell.com/shipping
For further information on ISO 17894,
see centrespread feature (pages 4/5)

Mitigating human error in the use of automated shipboard systems

Professor M Barnett, *Warsash Maritime Academy*

Although automation can be beneficial to operators of complex systems in terms of a reduction in workload or the release of people to perform other on-board duties, it can also be detrimental to system control if errors are introduced through its use.

Difficult or poor integration of new systems, and a move towards an increasingly passive monitoring role for seafarers working with some systems on the bridge and in the engine room can present an increased risk of inadvertent human error leading to accidents and incidents at sea.

Concern over these types of incident has led to research being undertaken on behalf of the UK Maritime and Coastguard Agency (MCA) to better understand the nature of human error in the use of automated shipboard systems, and to provide guidance for stakeholders, to minimise the risks posed by automation.

There are few documents dedicated to the mitigation of human error in automated shipboard systems. SOLAS Chapter V Regulation 15 is concerned with ergonomic principles and procedures, but only for ships bridges. It places significant responsibility on a range of stakeholders to ensure the safe and efficient use of bridge resources.

But, there is a need for further guidance for masters and officers of the watch about the practices necessary to achieve these aims. Such guidance would also be of benefit for the design and use of other automated shipboard systems in, for example, the engine room.

The study has identified a range of problems, which could result from inappropriate or incorrect specification, design, selection, installation and use of automated systems, and suggested some methods of mitigation.

Much of the guidance for mitigation is implied in the provisions and goals of the ISM Code. While no sections of the Code specifically mention automated shipboard systems, their use relates to sections including those on resources and personnel, emergency preparedness and maintenance of the ship and equipment.

This study concluded that, with regards to using training in mitigation, it would be artificial to consider errors related to automation separately from errors related to general maritime resource management (MRM). However, training developers should consider how effectively automation issues such as those identified by this research are incorporated into existing MRM courses, perhaps within the exercises or scenarios used.

It is hoped that the findings of this research will be considered by designers, shipbuilders, trainers, shore-based company management, ship-based management, and seafarers themselves, to assist in the safe, effective and efficient use of automation on board ships.

Further information on this project can be found at:
www.mcga.gov.uk/c4mca/min261.pdf

Meeting the needs of the operators

Richard Vie, *Vice President, Newbuilding & Technical Development, Carnival Corporation*

There is no doubt that automation has allowed us to reduce the manning on ships. However, while it is the economics that have driven this growth in automation, a lot of the processes could not be run without automation because they are inherently unstable such that you have to have automatic control feedback loops to keep them running - you have no choice but to fit these systems to the ships.

Some years ago, we were concerned that these systems were not meeting the needs of the operators. We never properly defined our requirements to the shipyard, resulting in them designing systems on the basis of what they *thought* the users' needs were. We were receiving complaints about information overload, too many alarms, alarm showers etc. There were concerns that if you had an alarm every thirty seconds people just acknowledged it and they did not look at the screen to see what was there; that some alarms were unnecessary; and that there were alarms and control functions that were needed but were not there.

We thought a lot about how we were going to address these issues for future ships, to give the people on onboard the tools that they needed to do their jobs effectively and safely.

You cannot give a commercial shipbuilder aspirational statements like those that appear in ISO 17894 (see page 4/5). The shipyard needs a prescriptive specification that either defines the performance or a requirement. You cannot give them a specification that simply says, for example *'a programmable electronic system will do no harm to the person or to the environment'* - it is meaningless to them.

We therefore needed to move towards a prescriptive specification that could be given to the shipbuilder; it caused us to be involved right at the start of the process, in identifying our need, defining the concept, defining the requirement and then passing this on to the supplier.

We enlisted the aid of BMT DSL, who have developed a systems engineering approach, which is split into phases, starting off with the user requirements and the system requirements and then building a functional and system hierarchy for the whole ship. We are about 50% of the way through the work at the moment because it is quite a long job to develop it.

Today, we have wonderful modern tools at our disposal which help us to be safer and better protected but the operator needs to apply engineering or nautical common sense before making a decision.

When I visit the ships, especially in the engineering department, I think they have a healthy scepticism for what the machinery systems tell them - probably more so than those on the bridge, who tend to take what they see on their Integrated Bridge System as gospel.

There is definitely scope here for improvement in the standards for ships' documentation, to ensure that all manuals are appropriate and in the same format - perhaps it is for the IMO to take the lead here.

It is difficult to get them to understand, for example that while the radar range ring may indicate that a ship is 2.7 miles away the number is driven by a computer, and that if I knew how to access the software, I could make it read '27' miles or even '.27' miles! I remind them that while it may be telling them that it is 2.7 miles, they should confirm that it is correct by looking out of the window and assessing the actual distance.

Those who are extracting the information from these systems need to ask the question 'does my engineering or my nautical common sense tell me that it is reasonable?' They should do a credibility check in their heads before they act - stop, think, decide what they are going to do, and then do it - rather than just press the button because that is what the system tells them to do.

People are safer now and better looked after, and that has got to be a good thing - but we must not lose that good human judgement.

The balance between the number of marine engineers on the ship and the number of electro-technical engineers is changing. Under the STCW Code, the electrical engineers are not included, yet their role on the ship is becoming more and more important with a move towards electric propulsions, electric drive systems, electric steering and electrically operated stabilisers - in the future, there may be less need for the traditional marine engineering skills.

There is certainly a need for the IMO to address the competencies of electro-technical officers (ETOs). Notwithstanding, we recruit and select our ETOs at a level that we believe we can train them to a standard that is appropriate for the safe operation of our ships.

However, if you take a ship's machinery automation system - it might be Unix or Windows based, on a network using propriety software packages bought from outside companies - we do not expect our ETOs to go into the software packages to check the code or alter any of the communications protocol or the underlying software. But, they need to have an understanding of what to do if the software fails, of what they can look for in the error messages, and to be able to restore the system.

The ISM Code requires all ships to have operating manuals, but there is not an industry agreed standard. Currently, the quality of some suppliers' manuals is poor - they are invariably non-specific to the ship and sometimes it is difficult to find a manual which applies to the actual model of the equipment that is fitted in the ship. We receive manuals at the last minute during build and some of them comprise only of the manufacturer's brochure. There is definitely scope here for improvement in the standards for ships' documentation, to ensure that all manuals are appropriate and in the same format - perhaps it is for the IMO to take the lead here.

Are we heading towards the totally automated ship? The answer, in my opinion, is 'no'. The up-front investment would be too great. A passenger ship is expensive but we only build three or four at a time so you cannot put the same kind of investment into automated systems as is done for an aeroplane - I simply do not think it is commercially viable.

That is not to say that we cannot make onboard systems better, but we are never going to put in the kind of investment that you would need to make a ship totally automated - it has got to be less expensive to put more people onboard.

Machinery breakdown
and subsequent fire onboard a container vessel

The 51931grt container ship had just left port when an engine room alarm sounded indicating that pressure in the steam system was low. On investigation, it was discovered that steam was escaping from the auxiliary boiler air intake.

An Exhaust Gas Economiser (EGE) was fitted in the funnel uptakes to generate steam from the waste heat contained in the main engine exhaust gases, using water circulated from the auxiliary boiler. The auxiliary boiler could be operated automatically, with local controls interfaced with the main machinery control system.

Feed quality water from storage tanks was transferred to the main feed tank by an automatic or manually controlled pump. The boiler control system sensed the level of water in the boiler and altered the position of the feed control valve accordingly, to maintain the correct level of water depending on steam demand. Sensors were fitted to turn off the burner flame if the water level fell too low and prevent the boiler from overheating.

A second feed water pump was started to boost the flow of water into the auxiliary boiler. This was intended to help replace the feed water that was being lost as steam through the crack into the furnace and maintain a constant supply to the EGE. The feed water transfer pump was also switched to automatic mode to ensure that a supply of feed water was available for the auxiliary boiler.

About 1½ hours after the steam system alarm had sounded, a rapid rise in the temperature of the EGE was noticed and the chief engineer realised that there was a fire inside the EGE casing.

Although the crew attempted to fight the fire with a water hose and a fire extinguisher, they were beaten back by the heat and smoke and the engine room was evacuated. The main engine room CO^2 gas smothering system was activated, but failed to discharge correctly. The fire was contained using water hoses to cool its boundaries and was finally extinguished, following advice received from the company head office.

The report concludes that the most likely cause of the fire was a malfunction of the auxiliary boiler control mechanism, which allowed the burner to keep firing with too little water in the boiler. This overheated the furnace, causing the distortion and cracking of a fire tube. As feed water was lost through the crack, the supply of water to the EGE failed, causing it to overheat. Soot deposits, which had accumulated within the EGE, then ignited.

The report also comments on a number of other human element issues with respect to firefighting techniques, maintenance and equipment checks and operating procedures; and language difficulties and poor communication resulting in a lack of leadership in controlling the machinery breakdown and fighting the fire.

Note: The purpose of this summary is to highlight some of the human element issues arising from this incident. Those who are involved in the management and operation of ships are strongly advised to read the whole report which can be downloaded from: www.maib.gov.uk/cms_resources/Maersk%20Doha-published.pdf

Reports & Studies

"The technology is great when it works" MARITIME TECHNOLOGY AND HUMAN INTEGRATION ON THE SHIP'S BRIDGE

Dr Margareta Lützhöft, *Master Mariner*

In this dissertation, Margareta Lützhöft suggests that technology alone cannot solve the problems that technology created. She contends that trying to fix 'human error' by incremental 'improvements' in technology or procedure tends to be largely ineffective due to the adaptive compensation by users. She argues that a systems view is necessary to make changes to a workplace. Her research illustrates the value problem-oriented ethnography can have when it comes to collecting information on what users 'mean' and 'really do' and what designers 'need' to make technology easier and safer to use.

Downloadable from: www.he-alert.org/documents/published/he00655.pdf

THE REPORT OF THE BP US REFINERIES INDEPENDENT SAFETY REVIEW PANEL

On March 23, 2005, the BP Texas City refinery experienced a catastrophic process accident. It was one of the most serious US workplace disasters of the past two decades, resulting in 15 deaths and more than 170 injuries. In the aftermath of the accident, BP formed an independent panel to conduct a thorough review of the company's corporate safety culture, safety management systems, and corporate safety oversight at its US refineries. This report presents the findings and recommendations of the Panel - some of which may be of interest to the maritime industry.

Downloadable from: www.bp.com/liveassets/bp_internet/globalbp/STAGING/global_assets/downloads/Baker_panel_report

A MASTER'S SOLITUDE

Captain Shahrokh Khodayari

An essay outlining some of the pressures that can be placed upon a modern shipmaster, leading to seclusion onboard, with particular reference to cultural differences, his position of authority, and work patterns and associated pressures.

Downloadable from: www.he-alert.org/documents/published/he00660.pdf

A MIXED CREW COMPLEMENT - A MARITIME SAFETY CHALLENGE AND ITS IMPACT ON MARITIME EDUCATION AND TRAINING

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The human factor/human element starts to have a key role in accidents and incidents during shipments at sea. Investigations show that poor communications increasingly are the root for many tragedies. A possible reason for communication constraints is the growing trend to employ multicultural crews. This thesis aims to document this new challenge in the maritime industry and to endeavour to show how Maritime Education and Training (MET) can address the problem.

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*This bulletin is distributed and promoted with the kind support of:
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