Feedback, please...

We are now well past the halfway stage in this three-year project, the aim of which is to raise the awareness of the Human Element in the maritime industry. Is Alert! achieving this aim? Are we striking the right balance with the mix of articles in each issue?

What do you think of the centrefeed features? Do you use the website (www.he-alert.org)? Of what use has it been to you? Have you downloaded any papers from the database? Have they proven useful to you in the conduct of your business? What human element issues would you like to see featured in future editions of Alert!?

If you have any thoughts on Alert!, please let the editor know, either by letter or by e-mail.

Your feedback is important to the future of the Alert! project.

Alert! is a forum for like-minded people to share ideas and solve problems on human element issues. The website - www.he-alert.org - provides a reference resource for study and information.

Contributions to the Bulletin and to the website database are always welcome, as are letters to the editor, which can now be uploaded and published on the website.

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A ship is comprised of a number of systems; each system has a specific purpose and it can either operate alone or form a component part of a larger system. A System is a combination of interacting elements (human and/or machine) organized to achieve one or more stated purposes.

The increasing reliance upon complex systems in merchant ship operations places certain demands and constraints on the human element, not least in terms of the competence of the user and of the organisational and physical environment in which he/she is required to operate.

The human element is a critical feature of all aspects of ship or system design and operation. User-input is essential to ensure that the operational parameters and the layout, crewing and procedures for the operation of shipboard systems are being optimised for the specific role or trade of the ship. Those who are involved in the design, build and updating of ships and their systems and in their operation need to be aware of the problems associated with onboard operations not only in terms of workplace design but also in respect to crew habitability and the education and training needs of the seafarer.

Human-Centred Design (HCD) focuses on making systems usable. It is the process of systematically applying human factors and ergonomics knowledge and techniques to minimize human error, enhance effectiveness and efficiency, improve human working conditions, and counteract possible adverse effects of use on the health, safety and performance of the mariner.

HCD - as a science - is a relatively new concept in ship design. The operational experience of the various users and the expert knowledge of a Human Factors specialist should be exploited by the designer to ensure that the number of design errors so often identified during the late stage of build, or even when the ship enters operational service, are minimized. The downstream effect will be a reduction in the number of costly 'change notices' during build, and in the number of slips, trips, falls, operating errors and other causes of accidents at sea, and an increase in crew satisfaction with their ship.

There are many stakeholders involved in the design of ships and their systems. Teamwork and communication at all levels, from concept to build, are essential to the success of any project.
A ‘good design’ is one that exceeds the owner’s expectations

Today’s naval architect needs to be a well-rounded engineer with an eye towards inspirational and innovative design, but with a deep understanding of principles, an experienced ‘feel’ for the strength, durability and safety of the floating structures he designs, and an understanding of the ‘ways of the sea’ and of the needs of the User.

A ‘good design’ is one that exceeds the owner’s expectations. Priorities will be that it meets his specification, is safe to operate, provides comfort and habitability for crew and passengers, meets environmental regulations and concerns, and complies with the relevant regulations of class, international and national authorities. Meeting the regulations is a question of diligence in assuring that all relevant rules are adhered to, and will produce a vessel with features that comply with an international consensus - but it may not necessarily be a good design.

Comfort and habitability is of increasing concern - the quality of life to a seafarer is one of the keys to a successful operation. There is no doubt that good ship motions, minimal noise and vibration, and well-planned ship accommodation are features of a good design.

The increasing use of safety case analysis and failure mode and effect analysis in ship design significantly enhances ship safety and is perhaps a better approach than the previous prescriptive and sometimes arbitrary safety rules - all provided that the naval architect does not become lost in a welter of analysis.

Probably the most difficult aspect, is that of providing the shipowner with a vessel that exceeds his expectations as regards specification. His requirements will include speed, deadweight and fuel consumption and also sea kindliness, maintainability, manoeuvrability, and reliability.

These are challenging times for today’s Naval Architect.

A longer article by Nigel Gee, can be downloaded from: www.he-alert.org (Ref: HE00365)

Usability in the maritime industry

The usability of systems is described in terms of the efficiency, effectiveness and satisfaction of users performing tasks with the system in a defined context of use. This goal-based view of system performance offers considerable benefits in the design and acceptance of the increasing range of marine computer-based systems.

Targets for usability are defined and met through Human-Centred Design which entails the following project activities:

- Understanding and specifying the context of use;
- Specifying the user and organizational requirements;
- Producing design solutions;
- Evaluating designs against requirements.

And, by observing the following principles:

- The active involvement of users and a clear understanding of user and task requirements;
- An appropriate allocation of function between users and technology;
- Iteration of design solutions;
- Multi-disciplinary design.

The maritime environment presents potential challenges to the existing range of methods and techniques. The inaccessibility of the working environment, the ‘make do’ attitude of the seafarer, the need for detail on seafarer culture and communication, and long operating life of marine systems requires all parties to work from a detailed context of use statement.

Furthermore, the high complexity of integrated systems, the uniqueness of each ship’s design and the dependence on (and lack of seafarer input to) prescriptive standards requires a detailed and carefully maintained specification of user requirements. From a process point of view the emphasis on contract, short design and build times, low profit margins and the number of equipment suppliers to each ship, requires management commitment to achieving usability.

Despite these challenges usability is starting to be used in the marine sector. However, work has so far emphasised new building and bridge operations and thus missed the easier targets of office and control systems, especially in retrofit.

For further information go to: www.usabilitynet.org
The foremost aim of international standardization is to facilitate the exchange of goods and services worldwide through elimination of technical barriers to trade, a precept of the World Trade Organization. Three bodies are responsible for developing International Standards:

- The International Organization for Standardization (ISO), responsible for all sectors excluding electro-technical. Its membership comprises of the National Standards Bodies of some 130 countries. Technical Committee 8 (TC8) deals specifically with Ships and Marine Technology.

- The International Electro-technical Committee (IEC), responsible for international standards for all electrical, electronic and related technologies.

- The International Telecommunication Union (ITU) responsible for developing internationally-agreed technical and operating standards for international telecommunication services.

The scope of the ISO Technical Committee 8 (TC8) is:

- Standardization of design, construction, structural elements, outfitting parts, equipment, methods and technology, and marine environmental matters, used in shipbuilding and the operation of ships, comprising sea-going ships, vessels for inland navigation, offshore structures, ship-to-shore interface and all other marine structures subject to IMO requirements.

TC8 is comprised of eleven subcommittees - two of which are devoted to our role with IMO Committees; five are for major subsystems in ships and shipbuilding, and others cover inland navigation vessels, computer applications, general requirements, and intermodal and short-sea shipping.

A principal role for TC8 is to serve as the linking instrument between the requirements/regulatory regime and the international maritime industry. (See Figure) Over 100 current items of work in ISO/TC8 relate directly to IMO. IMO has asked us to develop some standards, while some ISO standards bring about more specificity and clear guidance on compliance with IMO regulations, and some IMO circulars determine requirements from ISO standards.

We have focused on the Human Element in a number of standards, such as: Integrated bridges; life saving and fire protection; pilot and embarkation ladders; and navigation equipment. We are also looking at alarms and indicators - to bring some order to the system so that the watchstander has better information and is not overwhelmed with noise and flashing lights.

TC8 is proactive in working with all the relevant international stakeholders, both industry and government. The ISO/TC8 philosophy is: Timing and Timeliness - You have to "be there" when the need is stated and you must be "on time" for delivering the finished standard to meet the stakeholder needs! This is not a spectator sport - you have to be on the playing field, not in the stands or on the sidelines. Also, remember that if you as a stakeholder are not participating, then the chances are that your competitor is!

Further information on the work of TC8 can be found at: http://www.iso.org/iso/iso_technical_committee?commid=45776

Designing usable ships

The only real common concept seems to be safe. However, safe might not be given the same meaning by all users. Society would probably tend to view safe as no disasters while the crew would look at a safe ship as one that not only keeps floating but also is not inviting small personal accidents such as slips and falls.

So how do you build a ship that is - at the same time - cheap, safe, comfortable, easy to maintain, easy to operate and environmentally friendly?

Rules, regulations and recommendations issued by IMO, ILO and classification societies help to a certain extent, but they do not in themselves solve the problem. The professional knowledge and skill of the designers and builders of ships is of paramount importance in order for us to get ships that are really usable.

Simple things like making sure that surfaces, ladders and staircases do not invite slips, trips and falls; sufficiently lighted work areas; avoidance of noise and vibrations; layout of crews' accommodation; etc play a very important role in the design stage. There is a wealth of information available from other industries on human factors and ergonomics - why not use it?

Common sense should be used when designing a ship. This would and should certainly include consulting the people who are actually going to spend a lot of their time on board - the seafarers. And by this I do not only mean the master!

A full version of Jørgen Rasmussen's paper on Designing Usable Ships can be downloaded from www.he-alert.org (Ref: HE00360)
A human-centred approach to ship & system design

- **Identify need**
  - Owner / Operator
  - Build / buy / charter
  - Class
  - Flag
  - Ship Management
  - Crew Management
  - Crew nationally

- **Define concept**
  - Owner / Operator
  - Operational role
  - Operating pattern
  - Trading routes
  - Political & economic constraints
  - Cost
  - Fuel economy

- **Define requirements**
  - Operator / End Users
  - Class notation:
    - Type
    - Special features
    - Service restrictions

- **Specify functions**
  - Integrator
  - Specialist cargo
  - Electrical power
  - Machinery
  - Main structure
  - Navigation, communication & control
  - Propulsion & steering
  - Safety
  - Stability & watertight integrity

- **Design**
  - Shipyards, Suppliers, Trainers
  - Hull
  - Accommodation
  - Machinery
  - Systems

- **Build**
  - Shipyards, Suppliers, Trainers
  - Habitability
  - Maintainability
  - Workability
  - Controllability
  - Maneuuvrability
  - Survivability

- **Mitigating risk to the Human Element**
A recent business mantra runs "If you are not managing risk, you are managing the wrong thing". System engineering is the process by which systems are decomposed and specified to a point where they can be acquired with acceptable risk.

Human-centred design is the means by which the risks arising from a mismatch between seafarers, their ship, its systems and operational procedures are mitigated. Being human-centred entails early and continued focus on the requirements of people who are going to use a system throughout its life.

User requirements are derived from human factors data considered in the context of the particular ship, its manning, outfitting and operation. A large amount of human factors data is already captured in Regulation, Standards and organisational knowledge.

This centrespread includes a set of checklists for the type and location of human factors data required during the planning and specification of a new ship or ship system. For novel situations, new equipment or unusual manning, new data may be needed. Who collects this data depends on what it is about and how it can be most beneficial. For example, manufacturers are best placed to collect information on the use of equipment, owners for workspaces, and operating companies for training and manning.
In a passenger ship it is the comfort, safety and pleasure of the passengers that comes first, which can present the designer with a number of interesting challenges. Stephen M Payne OBE, the Chief Naval Architect of Carnival Corporate Shipbuilding (and designer of Queen Mary 2) reflects on some of the design aspects of this ship.

During her first year of operation the Queen Mary 2 has shown off her paces and has been universally acclaimed as ‘the only way to cross’. She embodies all the latest technology and passenger comforts and is set to maintain the transatlantic ferry way to cross. She embodies all the latest technology and passenger comforts and is set to maintain the transatlantic ferry.

The size of the ship at 150,000 grt (the largest passenger ship ever built) enabled a superlative array of signature public rooms to be provided as well as 1,310 cabins ranging from modest insides to magnificent bi-level duplexes. To justify the return on investment Queen Mary 2 has to maximise her earning potential by increasing the proportion of premium rate balcony cabins above that of normal cruise ships and by taking full advantage of the axiom of ‘economy of scale’. To maximise the number of balcony cabins the public rooms were placed low down in the ship with a much larger than cruise ship normal deck height to provide sufficient volume to enable some impressive public rooms to be incorporated. This was especially the case where the two adjacent public room decks were combined into double height rooms, some with domes extending into the cabin decks above.

Time is also critical. The QM2 is designed for a six-day transatlantic crossing with a ten-hour turn around at each port. It is crucial that her schedule is maintained. To offload her passengers and luggage on arrival, dispose of garbage, refuel and embark her new passenger load and their luggage requires a minimum of ten hours. If the ship is delayed this can seriously impact on her departure with a cumulative knock on effect through the season resulting in cancelled flights, hotel bookings and reimbursements to passengers etc.

On her maiden transatlantic crossing in April 2004, Queen Mary 2 encountered two North Atlantic storm systems. Despite these, her reserves of power in combination with her strength and overall design enabled her to maintain her schedule and arrive in New York on time. This performance is delivered silently without the knowledge of the passengers and, even at full speed, noise and vibration levels are almost non-existent.

For further information about the Queen Mary 2 go to: http://www.cunard.co.uk/cruise-ships/queen-mary-2/
With the obvious exception of Noah’s ark, seafarers have historically had little involvement in the design of the vessels on which they are engaged. Naval architects designed, shipbuilders constructed and successive generations of seafarers were then left to operate vessels that frequently failed to meet the legitimate expectations of the professional mariner.

This situation is widely perpetuated today, but the problem is not universal. Visionary shipowners, conscious of the beneficial experience of the end-user, have for decades been directly involving sea-staff in the design process for newbuild vessels. How short sighted it is that this practice is not more widespread.

Within the family-owned tanker fleet of F T Everard & Sons, a long-standing philosophy of consultation between sea-staff and shore-based management has benefited the development of concepts for new vessels. Sea-staff have consequently been directly involved with equipment manufacturers and software developers, and have been embedded as members of the newbuild supervision team at the shipyard. A new generation? Not really, it is just enlightened thinking in the late 1970s that has evolved into a design process that consistently delivers vessels surpassing those of their contemporaries and has more recently produced vessels that are the most advanced of their type in existence.

After deciding to construct new vessels, this process of consultation (which is ongoing even without such a project) is conducted in various ways, the ever-present cornerstone being the close professional relationship between sea-staff and shore-staff. Ship visits regularly introduce a system whereby the standards for passenger ship safety have been agreed. This philosophy is based on the premise that the regulatory framework should place more emphasis on the prevention of a casualty from occurring in the first place and that future passenger ships should be designed for improved survivability so that, in the event of a casualty, persons can stay safely on board as the ship proceeds to port.

Passenger ship safety. The guiding philosophy, strategic goals and objectives for passenger ship safety have been agreed. This philosophy is based on the premise that the regulatory framework should place more emphasis on the prevention of a casualty from occurring in the first place and that future passenger ships should be designed for improved survivability so that, in the event of a casualty, persons can stay safely on board as the ship proceeds to port.

Identify the good and build upon it

What’s new... IMO Maritime Safety Committee 79th session
A twin hulled 180gt high speed passenger craft, while conducting Builder’s Sea Trials at night, grounded during a turn at high speed. The investigation report highlights a number of failings in navigation, planning and Bridge Resource Management but it also focuses on some significant design problems.

This was the first of three identical vessels to be operated by a long-term charterer, who provided the shipbuilder with the detailed design specification for the vessels, based on their expected operating requirements. During the design and build stages, the shipbuilder’s trials master was given copies of the vessel’s operations manual and details of layout of the operating compartment. Despite the trials master bringing some deficiencies to the attention of the builders, the charterers subsequently directed that no changes should be made to the layout.

The report concludes that the vessel’s operating compartment was poorly designed and equipped and did not comply with the High Speed Craft Code. Further deficiencies included: poor instrumentation layout, light pollution from the passenger cabin, faulty instrumentation and control station window demisting difficulties.

In addition to the problems and faults found with the bridge design and instrumentation before and during the trials, no Electronic Chart Display and Information System (ECDIS) or Electronic Navigational Chart (ENC) system was fitted to the vessel.

The report makes a number of important recommendations, not least one for the Flag State to take forward - with the appropriate committees and subcommittees of the IMO - the introduction of requirements for:

- All high speed craft to be fitted with navigational instruments designed to cope with the unique requirements of high-speed craft. In particular, a display such as ECDIS or ENC, which gives an instantaneous indication of charted position, to be fitted on all vessels except those solely engaged on line-of-sight voyages.
- A minimum of two type rated people to be required to navigate a high speed craft except where the vessel’s voyage is a short line-of-sight passage. Each of the navigators should have navigation/control stations within the operating compartment.
- A global standard layout of navigational instrumentation for the operating compartment of all high speed craft.
- Measures to ensure that the administration has early involvement in the design approval of all high speed craft operating compartments.

Flag Administrations, owners, designers, builders and operators involved with the design, build and commissioning of high speed craft are strongly advised to read the full report which can be downloaded from:

https://assets.digital.cabinet-office.gov.uk/media/547c70c0ed915d4c0d0000cf/Katia.pdf