Human factors considerations will raise human element issues which if not addressed can become system hazards.

In ship design and operation this list of Human Element considerations should be examined for issues.

Where these are identified the potential hazards to effectiveness, efficiency, safety and user satisfaction should be assessed and addressed as appropriate.
People: Mind, Body & Spirit The 7 needs of the mariner

**MIND**

**Driver**
- Education, training, competencies
  - motivator: Knowledge, understanding, aptitude, skill, proficiency
  - leads to: Competence

**BODY**

**Driver**
- Self awareness, self evaluation
  - motivator: Mental ability, intelligence, personality, character, sensitivity
  - leads to: Attitude

**SPIRIT**

**Driver**
- Communication, direction, teamwork, empowerment, character building
  - motivator: Leadership interoperability, adaptability
  - leads to: Motivation

**Driver**
- Balanced diet, habitability, hygiene, exercise, rest, recreation, medical screening, D&A testing
  - motivator: Energy, physical fitness, physical strength, stamina, wellbeing
  - leads to: Happy and healthy Lifestyle

**Driver**
- Ergonomics, safe working practices, protective equipment, physical security
  - motivator: Safety culture, security awareness
  - leads to: Safe & secure working environment

**Driver**
- Personal ethics, conscience, cultural integration, leadership, supervision, remuneration
  - motivator: Pride, sense of purpose, identity, aesthetics, conviction, trust, expectation, realisation, belonging, loyalty, esteem, fellowship, security
  - leads to: Self actualisation

**Driver**
- Religious belief, faith, self discipline
  - motivator: Cultural awareness
  - leads to: Moral values

The 7 needs of the mariner:
- Pride, sense of purpose, identity, aesthetics, conviction, trust, expectation, realisation, belonging, loyalty, esteem, fellowship, security
- Energy, physical fitness, physical strength, stamina, wellbeing
- Safety culture, security awareness
- Leadership interoperability, adaptability
- Knowledge, understanding, aptitude, skill, proficiency
- Mental ability, intelligence, personality, character, sensitivity
- Self awareness, self evaluation

Photo credits: jalens – joachim affeldt, Seamen’s Church Institute of Philadelphia and Mission To Seafarers
A potential organisational improvement from basic regulatory compliance through corporate social responsibility to investment in a total quality lifecycle.
The development and maintenance of the human component of ship systems
A human-centred approach to ship & system design

Identify need
Owner / Operator
- Build / buy / charter
- Class
- Flag
- Ship Management
- Crew Management
- Crew nationality
- Operational role
- Operating pattern
- Trading routes
- Political & economic constraints
- Cost
- Fuel economy

Define concept
Owner / Operator
- The human element
- Personal capabilities & limitations
- Human factors
- Job, person, organisation & management
- Human-human interactions
- Management
- Supervision
- Crew interactions
- Communications
- Training

Define requirements
Operator / End Users
- The human element
- Personal capabilities & limitations
- Human factors
- Job, person, organisation & management
- Human-human interactions
- Management
- Supervision
- Crew interactions
- Communications
- Training

Specify functions
Integrator
- The human element
- Personal capabilities & limitations
- Human factors
- Job, person, organisation & management
- Human-human interactions
- Management
- Supervision
- Crew interactions
- Communications
- Training

Design
Shipyards, Suppliers, Trainers
- Hull
- Accommodation
- Machinery
- Systems
- Class notation:
  - Type
  - Special features
  - Service restrictions
- Environment:
  - Weather
  - Sea conditions
  - Temperature
  - Humidity
  - Light
  - Noise
  - Vibration
  - Ship movement
- Systems ergonomic requirements
- Human v technology
- Environmental challenges:
  - Physical environment
  - Organisational environment
  - Hardware
  - User
  - Business
  - Context of use:
  - Survivability
  - Manoeuvrability
  - Controllability
  - Workability
  - Maintainability
  - Habitability
- Human factors:
  - Mind, body & spirit
- Human-centred principles:
  -.clipart: "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 Regualtion, 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.

Build
Shipyards, Suppliers, Trainers
- Automation
- Manning levels
- Crew capabilities
- Training specification
- Weather
- Environment:
  - Physical environment
  - Organisational environment
  - Hardware
  - User
  - Business
- Context of use:
  - Survivability
  - Manoeuvrability
  - Controllability
  - Workability
  - Maintainability
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In the next issue:
Shipbuilding

Photo: Harrit & Sørensen a/s

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.

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Addressing the human element during build

The operability requirements in the specification will only have an effect if the detailed design, selection of components, Factory Acceptance Tests (FAT), installation, commissioning, and sea trials take account of the needs, limitations and capabilities of the crew. Evaluation of the developing systems is required, taking into account how the equipment will be used, the crew’s competence and motivation, their training, the procedures that they will be following and the type of supervision.

Type approval does not fully address ergonomic issues. Design is more about reduction of costs, and system integration is (at best) about making sure that everything is working on the day the ship is delivered. Therefore, additional monitoring is required if the Human Element is to be successfully addressed during build. That is to say:

- Has the manufacturer followed the standards for the intrinsic ergonomic properties of working and living spaces and equipment? This includes health and safety issues from Class, Flag and ILO.
- Has the designer taken account of necessary attributes, context of use (user, task, physical and social environment) and maintainability of the layout and ship’s sub-systems? In addition to good operational design this includes the requirements of Class, Flag and ILO, for operational safety.
- Can typical crew perform the intended working procedures with the provided equipment? Is the ship operable in terms of the effectiveness, productivity, acceptability and safety of the crew’s work?

The crew form an essential part of the operational ship system. Integration includes ensuring that they are recruited, trained and worked according to the assumptions behind the specification. ISM requires assessment of the risk to operability from any change.

Why evaluate operability? Because it affects the bottom line. Poor effectiveness means human error. Lack of productivity means inefficient use of limited manpower. Safety problems mean compensation or increased premiums. Low acceptability decrease motivation.
The human face of regulation  Good intentions and human nature

Minimum Safe Manning

Intent:
- Acceptable work routines
- Safe operation of the ship

Side effects:
- Selection of Flag based on lowest manning
- Fatigue and overwork
- Ship operated in an unsafe condition
- Misreporting of hours worked
- Reduced training opportunities
- Poor staff retention

Class Rules & Regulations

Intent:
- Technical fitness for purpose

Side effects:
- 'Glass ceiling' instead of 'safety net'
- Belief that safety can be outsourced
- Concealment of defects
- Trading of safety
- Obeying the letter of the law
- Change of Class

STCW

Intent:
- Proper education & training
- Adequate experience
- Skills & competence

Side effects:
- Forged certificates
- Seafarers treated as a commodity
- Private certification schemes
- Minimum investment in training
- Lack of trust between shipmates

International Labour Conventions

Intent:
- Safe & secure working environment
- Decent working & living conditions
- Fair terms of employment
- Healthy lifestyle

Side effects:
- Low sign-up by flag states
- Flagging out
- Unscrupulous employers

International Health Regulations

Intent:
- Prevent/protect/control disease
- Ship sanitation

Side effects:
- Crew may not receive treatment for notifiable diseases
- Crew not informed about risks
- Covert spread of disease
- Flagging out

ISPS Code

Intent:
- Detect/deter acts which threaten security

Side effects:
- Criminalisation of the seafarer
- Reduced quality of life
- Divisive treatment of crews
- Poor staff retention

Appropriate rules and regulation

- Conventions, protocols, recommendations, codes, guidelines and resolutions, relating to standards of maritime safety, efficiency of navigation and prevention and control of marine pollution from ships:
  - Maritime conventions on working and living conditions and basic human rights
  - International Health Regulations
  - Standards and regulations for telecommunications operations
  - International standards for business, government and society
  - International standards for electrical, electronic and related technologies
  - Classification design, construction and through-life compliance rules and standards
  - National standards for acceptable practice conforming to generally accepted international regulations, procedures and practices
  - Classification rules for hull structures and machinery

These Rules and Regulations are all developed with the intention of making the maritime industry, and the workers in it more safe, responsible and dependable. However, in putting Rules and Regulations into practice in the wide range of organisational types and cultures that make up the international maritime industry, we find that the Human Element plays a part, and unexpected and unwanted side effects emerge. These side effects are usually due to lack of understanding of the intent and benefits of the Regulation or lack of commitment in performance of necessary duties. The side effects are frequently at variance with the intent of the Regulation and in the worst cases damage the reputation of the Regulation and even the industry as a whole.

The message is that the Regulator and other parties involved in the implementation of Rules and Regulations must take account of realistic human behaviour when faced with new requirements and design to minimise the unwanted, but likely, side effects.
Integrating the human element  A rough guide

Personnel
Correct mix of people onboard to operate and maintain the ship and its systems.

Manning
Number of people required for the safe operation and security of the ship and for the protection of the marine environment in both normal & emergency situations.

Training
Competency and familiarity with the ship and its systems.

Human resources considerations
- Tasks, duties & responsibilities
- Numbers, grades & capacities
- Watchkeeping patterns
- Hours of work & rest
- Required competencies

Personnel:
- Nationality of officers/ratings
- Selection
- Training
- Physical characteristics for the tasks to be done
- Terms & conditions of service
- Expected competencies

Training:
- Required knowledge, skills & abilities
- STCW requirements
- Specific training
- Appropriate courses
- In-house/onboard training facilities
- Management/leadership training
- Technical training
- Safety & security training
- Onboard familiarisation
- Onboard safety drills
- Onboard continuation training

General considerations
- International conventions / regulations
- Crew nationality
- Working language
- Size, shape & gender
- Strength & stamina
- Posture
- Religious & cultural differences
- Intended role
- Ship’s operating pattern
- Tours of duty
- Watchkeeping patterns
- Environmental stressors
- Impact of fatigue/stress
- Degree of automation
- Cleanliness
- Surface coverings
- Shipboard maintenance policy
- Tripping / falling / bumping / crushing hazards
- Signage
- Understandable operating instructions & procedures
- Company culture

Human factors engineering considerations
- International conventions / regulations
- Crew nationality
- Working language
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Habitability:
- Religious & cultural differences
- Need for privacy
- Bathroom facilities
- Messing arrangements
- Facilities for personal recreation & study
- Need for natural light
- Storage space for personal effects
- Furnishing, interior design & decoration

Workability:
- The Users
- Tasks
- Fitness for task
- Equipment
- Accessibility
- Communications
- Signage
- Protective equipment

Maintainability:
- Control room, workstation, display screen layout
- Computer dialogue design
- System integration
- Communications
- Alarm philosophy & management
- Direct & peripheral vision
- Daytime/nighttime vision
- Dazzle
- Controls & switches
- Reflection
- Glare

Contrrollability:
- Operational maintenance tasks to be rapid, safe and effective to allow equipment and systems to achieve a specified level of performance

Survivability:
- Operational maintenance tasks to be rapid, safe and effective to allow equipment and systems to achieve a specified level of performance

OCCUPATIONAL HEALTH AND SAFETY
The effect of work, the working environment and living conditions on the health, safety and wellbeing of the person.

Occupational Health and Safety
- Occupational Health & Safety policy
- Safe working practices
- Development of a safety culture
- Permit to work
- Health awareness – mental & physical
- Medical screening
- Medical support
- Balanced diet
- Provision, maintenance, access & use of Personal Protective Equipment
- Short / long term hazards to health
- Recording, reporting & feedback procedures

System safety
- Favourable identification
- Potential for human error
- Risk Analysis
- Management of risks
- Operating instructions & procedures
- Communication/working language
- Business imperative
- Training & familiarization
- Potential for environmental damage & pollution
- Recording, reporting & feedback procedures

Manoeuvrability:
- The most appropriate manoeuvring capabilities

Manoeuvrability:
- Potential weather conditions
- Communications
- Minimum / maximum manouevring speed
- Propulsion / manoeuvring systems configuration
- Critical system redundancy
- Available harbour services
- Through life costs
- Protection of the environment
- Fuel economy

Controlability:
- Integrating people with equipment, systems and interfaces

Drainability:
- Operational maintenance tasks to be rapid, safe and effective to allow equipment and systems to achieve a specified level of performance

Human factors:
- Comfortable, clean (suitable) & conveniend accommodation, working & toilet facilities, messrooms, group meeting and exercise areas

Habitability:
- Operational maintenance tasks to be rapid, safe and effective to allow equipment and systems to achieve a specified level of performance

Workability:
- Context of use

Manning:
- Operational maintenance tasks to be rapid, safe and effective to allow equipment and systems to achieve a specified level of performance

System safety
- The risk from people using (or misuseing) the system.

Survivability:
- Operational maintenance tasks to be rapid, safe and effective to allow equipment and systems to achieve a specified level of performance

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System safety
- The risk from people using (or misuseing) the system.
Mitigating fatigue

**Seafarer**
- Try to get deep, uninterrupted sleep 7 to 8 hours per 24-hour day
- Take strategic naps (up to 20 minutes)
- Develop pre-sleep routine, eg: warm shower, light reading, write-up personal diary, meditation/yoga
- Ensure dark, quiet, cool sleeping environment & comfortable bed
- Avoid interruptions during extended period of sleep.
- Eat/drink lightly before bed
- Visit toilet before trying to sleep
- Avoid alcohol & caffeine prior to sleep
- Avoid coffee at least 6 hours before bedtime
- Minimize disturbance of rest/sleep periods
- Take break between work periods
- Get sufficient sleep before high activity periods
- Maintain fitness for duty
- Eat regular, well-balanced meals
- Exercise regularly
- Accurately record hours of work & rest

**Mariner**
- Implement Company’s Fatigue management plan in respect of:
  - ISM Code requirements for clear, concise guidance on operational procedures
  - Adequate rest for joining crews before assuming duties
  - Allowing time for proper hand over on crew change
  - Language barriers, social, cultural and religious isolation
  - Interpersonal relationships, stress, loneliness, boredom, social deprivation & increased workload as a result of small crew numbers

**Shipowner/Shipmanager**
- Develop fatigue management plan to cover:
  - ISM Code requirements for clear, concise guidance on operational procedures
  - Adequate rest for joining crews before assuming duties
  - Allowing time for proper hand over on crew change
  - Voyage length, time in port, length of service & leave ratios
  - Language barriers, social, cultural and religious isolation
  - Shore leave, onboard recreation & family communication
  - Workable & safe watchkeeping arrangements
  - Job rotation
  - Crew education & training to recognize & mitigate fatigue
  - Monitoring & effective management of crew hours of work & rest
  - Create open communication environment for reporting fatigue
  - Establish procedures for scheduling shipboard work & rest periods
  - Rotate tasks requiring high physical or mental demand with low-demand tasks
  - Schedule potentially hazardous tasks for daytime hours, & ensure crew adjusted for working in their day time
  - Ensure that adequate rest is received by all - encourage napping
  - Promote individual record keeping of hours rested/worked.
  - Re-appraise traditional work patterns & areas of responsibility to establish most efficient utilization of resource
  - Ensure adequate heating, ventilation, air-conditioning & lighting
  - Minimize noise & vibration
  - Establish shipboard practices for dealing with fatigue incidents
  - Encourage healthy lifestyle

**Naval Architect/Designer**
- Provide for adequate and comfortable accommodation, galleys, messrooms & recreational spaces, having due regard for variations in size, shape & gender of seafarers, and for the various environmental stressors such as noise, heat, cold, humidity & vibration
- Minimize fatigue inducing environmental stressors including ship movement, excessive noise, vibration, inadequate ventilation, poor lighting, excessive heat or cold, too much/too little humidity & poor air exchange in enclosed working & accommodation spaces. Minimize unnecessary sustained exertion (physical or mental) in the workplace
- Design operational maintenance tasks to be rapid, safe and effective to allow equipment & systems to achieve a specified level of performance, with the minimum of sustained exertion
- Interpersonal relationships, stress, loneliness, boredom, social deprivation & increased workload as a result of small crew numbers
- Provision for shore leave, onboard recreation & family communication
- Workable & safe watchkeeping arrangements
- Job rotation
- Crew education & training to recognize & mitigate fatigue
- Monitoring & effective management of crew hours of work & rest
- Provide adequate & comfortable accommodation (including bunks)
- Provide adequate quality & quantity of food for proper nutrition
- Minimize fatigue inducing environmental stressors
- Modify ship designs to minimize fatigue stressors
- Keep telephone calls & e-mails to the Master to a minimum & have due regard for time zone differences

**Effects**
- Diminished decision making ability
- Poor memory
- Inability to concentrate
- Slow response
- Loss of control of bodily movements
- Mood changes
- Headaches
- Heart palpitations / irregular heart beats
- Rapid breathing
- Leg pains / cramps

**Causes, effects and mitigation**

**Fatigue**

- Lack of sleep
- Insufficient rest time between work periods
- Stress
- Noise / vibration
- Ship movement
- Food timing, frequency, content & quality
- Medical conditions & illnesses

**Causes**

- Poor quality of sleep
- Poor quality of rest
- Boring / repetitive work
- Inadequate ventilation, poor lighting, excessive heat / cold, poor air exchange
- Effects of alcohol, drugs & caffeine
- Excessive work load
- Poor workspace design

**Keeping awake & alert**
- Bright lights, cool dry air, obtrusive or loud music, and some invigorating aromas (such as peppermint) may temporarily increase alertness
- Caffeine may combat sleepiness but only for short periods
- Running, walking, stretching & chewing gum can stimulate levels of alertness
- Active conversation can help you stay awake
- Mixing tasks requiring high physical or mental work with low-demand tasks can be beneficial
- NB: Alcohol, caffeine and some over-the-counter medications DISRUPT sleep
The alphabet of effective communication

**Alarm System Management**
Alarms can be distracting, can cause confusion and be ignored by those who are not aware of their sources and implications. Careful design and management of alarm systems is required.

**Effective communication**
The successful transmission of information through a common system of symbols, signs, behaviour, speech, writing, or signals, by physical, mechanical or electronic means.

**Feedback**
Exchanges of ideas, information and knowledge between crew and management ashore.

**Gossip, grapevine**
An unofficial means of communication, which is normally founded on speculation and rumour; indicates a lack of effective communication.

**Handbooks and operating instructions**
Ensure that documents that explain how to use, maintain and operate the ship and its equipment are written in the native language of the reader, and not technically complicated, and are easy to understand.

**Illustrations**
Use imagery, photos, drawings and cartoons to inform and illustrate, in order to reach out to non-native English speakers—‘a picture is worth a thousand words’.

**Language barriers**
Some seafarers may be unwilling to admit their difficulty in understanding and communicating because the commonly used language onboard is not their native language.

**Management seminars**
A means of bringing together seafarers from different ships and shore management, to exchange ideas, information and knowledge.

**Questionnaires & checklists**
Usability and quality assurance questions that require a ‘yes’ or ‘no’ answer. Checklists, if properly used, can be of assistance to ensure that nothing has been forgotten when carrying out a procedure. Can lead to a ‘tick in the box’ culture that in turn can breed complacency.

**Paperwork**
An abundance of correspondence (both paper and electronic), statistical reports, and questionnaires and checklists can sidetrack the seafarer (especially the master or the chief engineer) from his primary purpose of working the ship, if it is not carefully controlled.

**Rule of the Road**
The International Regulations for Preventing Collisions at Sea. A form of silent communication requiring vessels to take positive action to avoid the risk of collision, by standing on, altering course or adjusting speed, backed up by sound and light signals. Otherwise known as the Collision Regulations or Colregs.

**Telephony**
Active management policies should be put in place to ensure telephones (especially mobile telephones) are not used to call the master or crew at inappropriate times, eg when navigating in busy or confined waters or when resting and in a substantially different time zone from that of the caller.

**Working language**
English shall be used on the bridge as the working language for bridge-to-bridge and bridge-to-shore safety communications as well as for communications on board between the pilot and bridge watchkeeping personnel unless those directly involved in the communications speak a common language other than English.

**Display**
A device or feature designed to provide status, position, or condition information to the operator through visual or auditory feedback.

**Journals, Newsletters and Bulletins**
Professional journals, company newsletters and noticeboard bulletins inform the crew of important issues that have an effect on their professional life, health, safety and welfare.

**Keeping in touch**
Telephone communications, and email and internet facilities enable crew to keep in touch with their families.

**Breakdowns in communication**
Can be due to faulty, incomplete, or imprecise information or data, or through failing to interpret a message because of language, social or cultural differences.

**Cultural understanding**
Recognise, interpret and correctly react to people, incidences or situations that are open to misunderstanding due to cultural differences.

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Automation - Trust and Dependability

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;
- Gears 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.
Exploring rogue behaviour

Apathy
Lack of interest or concern
‘I don’t care’
Solution:
- Check for fatigue, sickness, incorrect nutrition, lack of physical fitness
- Investigate personal circumstances, in particular worries about family or job
- Develop a ‘company culture’ to encourage communication and empowerment
- Provide the seafarer with a safe and secure working environment, decent working and living conditions, fair terms of employment and a healthy lifestyle

Assumptions
Facts, orders or statements that are taken for granted
‘I thought that was what you said’
Solution:
- Do not be afraid to seek clarification of what is said
- Do not act on scant information

Boredom
The state of being weary and restless though lack of interest
‘What shall I do to pass the time away?’
Solution:
- Redistribute work more evenly
- Ring the changes on responsibilities
- Promote or change in responsibilities
- Encourage teamwork and interaction

Complacency
Self-satisfaction especially when accompanied by unawareness of actual dangers or deficiencies
‘I can’t be bothered’
Solution:
- Do not take unnecessary risks
- Ensure compliance with appropriate regulations and follow proper procedures
- Conduct regular table top exercises on lessons learned from accident investigation reports
- Leadership and assertiveness training

Compliance
A disposition to yield to others
‘You know best’
Solution:
- Do not be afraid to challenge the decisions of others
- Leadership and assertiveness training

Contentment
Feeling or showing satisfaction with one’s situation
‘I am happy with the situation’
Solution:
- Be sure that you know right from wrong
- Ensure that everyone has the same perception of the risks (he who can keep his head when all around are loosing theirs simply does not understand the facts of the situation)

Dumbing down
Simplifying to the point of meaninglessness
‘If you treat me like an idiot, I’ll behave like an idiot’
Solution:
- Do not dumb down to beyond the point of meaninglessness
- Find out what level of instruction/control crew are happy with and design the work and instructions to that level
- Collect feedback, especially after the introduction of new procedures
- Understand the capabilities and motivation of your crew

Familiarity
Too close an acquaintance with a procedure
‘I know it all’
Solution:
- Regularly review and test procedures
- Conduct regular onboard continuation and refresher training
- Make it OK to observe on the performance of a colleague or superior
- Make it OK for anyone to ask for a check/critique

Drudgery
Dull, irksome, fatiguing, uninteresting or menial work
‘Why do I have to do this?’
Solution:
- Rotas/sharing/teaming-up
- Ensure systems/equipment are best for the job
- Set safe performance targets to give a secondary meaning to achievement
- Introduce rewards/preference

Ignorance
Lack of knowledge, education or awareness
‘I don’t know’
Solution:
- Take five to assess the risks before doing anything new or after an unexpected occurrence
- Conduct near miss and incident reporting analysis
- Encourage comment on the performance of a colleague or superior
- Consign the ‘gung ho’/‘macho’ seafarer to history

Impulsiveness
Inclined to act on impulse rather than thought
‘I know what I am doing’
Solution:
- ‘Take five’ to assess the risks before doing anything new or after an unexpected occurrence
- Conduct near miss and incident reporting analysis
- Encourage comment on the performance of a colleague or superior
- Consign the ‘gung ho’/‘macho’ seafarer to history

Involvement
Impervious to danger or risk
‘It won’t happen to me’
Solution:
- Conduct regular table top exercises on lessons learned from accident investigation reports
- Do not reward this sort of ‘hero’
- Make it hurt even if they get away with it
- Monitor young/bold staff

Predictability
To foretell on the basis of observation or experience
‘I know what will happen next’
Solution:
- Always look for six explanations for a situation
- Consider the downside of getting it wrong (assess the risks)
- Consider the probabilities
- Check the facts on which a view is based
- Conduct ‘what if?’ analysis

Risk taking
Taking an action where the outcome is uncertain, often in contravention of norms, regulations or procedures
‘I’ll take a chance’
Solution:
- Do not take unnecessary risks
- Ensure compliance with regulations
- Follow proper procedures
- Learn from the mistakes of others
- Conduct regular table top exercises on lessons learned from accident investigation reports

Routinisation
The effects of habitual or mechanical performance of an established procedure
‘I’ve done it so many times before’
Solution:
- Regularly review and test procedures
- Conduct regular onboard continuation and refresher training
- Crew Resource Management training

Seclusion
Shutting away or keeping apart from others
‘Leave me alone’
Solution:
- Seek support from peers
- Seek guidance from the more experienced
- Leadership and assertiveness training
- Crew Resource Management training

Perception
To regard something as being the case
‘That is my interpretation of the situation – I do not agree with yours’
Solution:
- Adopt a policy of ‘strong opinions, weakly held’
- Consider the power-distance (is admitting being wrong clouding judgement?)
- Encourage comment on the performance of a colleague or superior
- Always look for six explanations for a situation
- Consider the downside of getting it wrong (assess the risks)
- Consider the probabilities
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Mitigating slip, trip and fall hazards

**Design**
- Accessible anchorages for scaffolding and fall arrest systems
- Adequate handrails on bulkheads and platforms
- Adequate lighting
- Anti-slip deck surfaces
- Arrangements for barriers
- Avoid vertical ladders as primary means of escape
- Climber safety rails
- Collapsible masts for maintenance of equipment
- Control panels and displays at ground level instead of at heights
- Deck and other edge protection
- Design to minimize need to go aloft
- D-hole connectors in tanks
- Employ the operational experience of seafarers
- High coefficient of friction treads for ladders
- Ladders and access points to be away from edges or protected by guard rails
- Ladders and safety rails built into systems
- Long life coatings and extended maintenance periods for confined spaces
- Make stairs uniform throughout the vessel
- Personal fall arrest systems
- Place sensors and controls outside tanks
- Provide bolt down guards for unguarded openings
- Provide for rough weather lifelines on upper decks
- Provide handrail extensions that can be collapsed when hatches are closed
- Provide secure handrails at tops of ladders
- Replacement of scaffolding with mobile lifts where feasible
- Robotic inspection devices for fuel tanks
- Safe means to raise tools and equipment to elevated work platforms
- Seek advice from Human Factors specialist
- Stowage for loose objects
- Walkthrough of traffic and escape routes

**Falls**
- Corroded ladders
- Deck Openings and Edges
- Inadequate anchorages or tie off points for fall arrest gear
- Improperly secured gangways
- Inadequate guardrails in confined spaces, tanks & voids
- Inadequate scaffolding
- Inattention
- Lack of guardrails, chain or man ropes at hatch openings
- Loss of balance
- Poor illumination
- Poor ladder or handrail design
- Poor traction
- Removed engine room plates
- Shaky ladder or a ladder with slippery or broken rungs
- Slippery surfaces
- Striking by moving equipment
- Uneven surfaces
- Unsecured windlasses
- Vertical unprotected ladders
- Working over the side or aloft

**Build**
- Employ the operational experience of seafarers
- Seek advice from Human Factors specialists
- Ensure unguarded openings are properly guarded
- Ensure gangways are properly secured
- Ensure all handrails are secure
- Ensure guardrails (portable or fixed) are properly secured
- Ensure scaffolding is properly secured and guardrails fitted
- Post safety & warning notices
- Mark all tripping hazards
- Conduct regular safety inspections
- Wear correct personal protective equipment (PPE)

**Slips**
- Inappropriate footwear
- Inattention
- Loose/unanchored/unattached rugs & mats
- Oil & grease
- Polished deck surfaces
- Wet or slippery decks
- Worn non slip areas

**Trips**
- Loose fittings on stairs
- Carrying of stores/equipment obscuring view
- Changes of deck level
- Cleats, bits, pad eyes and other fittings at deck level
- Door sills
- Frayed rugs/carpets
- Inadequate handholds
- Inadequate slip resistance
- Inappropriate footwear
- Inattention
- Insufficient illumination,
- Loose or no handrails or stair rails
- Miscellaneous rubbish around decks, eg plastic bags
- Sloping decks
- Smoke/steam obscuring view
- Trailling wires and cables and hoses
- Uneven surface or steps
- Unmarked deck fittings

**Slips, trips and falls account for the majority of occupational accidents aboard ship. This feature lists some of the hazards that can be faced, and offers some ideas as to how to mitigate them. Wherever possible, the aim should be to design out these hazards. Any such design solutions must be kept under review throughout the lifecycle of the ship.**

**In service**
- Clean up spills
- Comply with Codes of safe working practices
- Conduct regular safety briefings
- Conduct regular safety inspections
- Conduct regular safety training
- Conduct table top exercises of lessons learned
- Do not leave equipment, stores lying around the decks
- Ensure proper stowage of stores & equipment
- Erect safety rails
- Follow safety procedures
- Follow the principle of ‘one hand for the ship and one for yourself’
- Mark unavoidable tripping hazards
- Post safety notices
- Provide extra lighting when needed
- Rig upper deck safety lines in rough weather
- Use personal fall arrest systems
- Wear correct personal protective equipment (PPE)
- Wear lifejackets when working in the vicinity of ship’s side
- Wear safety harness when aloft

**Hazards**
- Retrofit fall arrest systems, climber safety rails etc
- Review adequacy of lighting
- Renew anti slip deck surfaces
- Repair deck and other edge protection
- Renew friction treads for ladders
- Replace corroded/broken ladders & handrails
- Retrofit bolt down guards for unguarded openings
- Ensure unguarded openings are properly guarded
- Ensure gangways are properly secured
- Ensure all handrails are secure
- Ensure guardrails (portable or fixed) are properly secured
- Ensure scaffolding is properly secured and guardrails fitted
- Post safety & warning notices
- Mark all tripping hazards
- Conduct regular safety inspections
The good guide to seafarer health, safety and wellbeing

Accident prevention
Create and maintain a safe working environment and promote safe behaviour through a programme of proactive accident prevention by identifying hazards, assessing risks and implementing necessary preventative measures, before accidents and ill-health arise.

Benefits
Provide advice to seafarers and their families on the benefits that are available to them with regard to medical care, sickness benefits, unemployment benefits, old-age benefits, employment injury benefits, family benefits, maternity benefits, invalidity benefits and survivors’ benefits.

Company Culture
Develop a company culture by building trust through a policy of openness, good communication and empowerment such that the employee and his/her family feel valued and involved as part of the Company.

Discipline
Encourage self-discipline and the adoption of a code of good conduct and effective complaints procedures.

Employment Conditions
Provide a safe and secure working environment, decent working and living conditions and satisfactory terms of employment.

Fair Treatment
Take all necessary measures to ensure that seafarers are treated fairly following a maritime accident and during any investigation and detention by public authorities and ensure that any detention is for no longer than necessary.

Good Housekeeping
Ensure that the workplace and living accommodation is kept clean, tidy and free from slip, trip and fall hazards and from the inappropriate storage of harmful substances and fire sources.

Habitability
Provide adequate and comfortable accommodation, galleys, messrooms and recreational spaces, having due regard for the variations in the size, shape and gender of the seafarer, and for the various environmental stressors such as noise, heat and vibration.

Information Exchange
Employ the use of company newsletters and noticeboard bulletins to inform the crew of important issues that have an effect on their professional lives, health, safety and welfare.

Job Satisfaction
Instil a sense of fulfillment and pride in the job, through good work practices, adequate remuneration, encouraging good working relationships, status, security, recognition, responsibility and advancement.

Keeping in touch
Provide access to ship-to-shore telephone communications, and email and internet facilities onboard ship to enable crew to keep in touch with their families.

Lifestyle
Ensure the seafarer has the energy, physical fitness, physical strength, stamina and a sense of wellbeing to enable him/her to do the job – through a balanced diet, good hygiene, exercise, rest and recreation, together with acceptable standards of habitability and regular medical screening, including drug and alcohol testing.

Motivation
Give the seafarer a sense of leadership, interoperability and adaptability through good communication, direction, teamwork, empowerment and character building.

Nutrition
Encourage proper nutrition, adequate rest and sleep, regular exercise and good hygiene to help prevent diseases and improve health overall.

Occupational Health
Ensure the health, safety and wellbeing of all onboard through good occupational health and safety policies.

Port Welfare
Continue to pursue the establishment of National Seafarers’ Welfare Boards and Port Welfare Committees on a world-wide basis, in order to achieve a global minimum standard of seafarers’ welfare.

Quality of life
Ensure that good occupational health and safety, good workplace design and good management have a positive impact on a person’s physical and psychological fitness to work at sea such that he/she will want to return to remain with the same Company or return to the same ship after leave.

Recreational facilities
Provide adequate recreational facilities aboard ship, including: recreational spaces, gymnasia, recreational computers, libraries, televisions, radios and DVD players.

Sport
Create international understanding and cooperation between seafarers of all nations through peaceful competitions in healthy sport activities.

Training & Education
Provide appropriate training in safety and security, and education in fatigue management.

Understanding other cultures
Recognise, interpret and correctly react to people, incidents or situations that are open to misunderstanding due to cultural differences.

Vim and Vigour
Maintain strength and stamina through appropriate diet, rest periods, exercise, periodical medical review etc.

Working practices
Encourage a safety culture and greater security awareness through good ergonomics, safe working practices and the provision of protective equipment, together with proper physical security.

Xtra Mile
Go the extra mile to ensure a safe, healthy, happy and motivated workforce.

Yardstick
Benchmark employee benefits or satisfaction against other operators.

Zeal
Look after the health safety and wellbeing of the seafarer and he/she will approach the job with zeal (enthusiasm and eagerness)!
Recruitment & retention - perceptions, experience & expectations

**Attract**

**PERCEPTIONS**
- Poor image of shipping
- Criminalisation
- Piracy
- Pollution
- Major passenger incidents
- 'Worse things happen at sea'

**REQUIRED EXPECTATION**
- Responsible employer
- Company branding
- Happy & healthy lifestyle
- Safe & secure working environment
- Decent working and living conditions
- Fair terms of employment
- Quality of life
- Health protection
- Medical care
- Family support
- Contact with home
- High tech ships & systems
- Good career prospects
- Career development
  - 'A job for life'
  - 'A job worth doing' (respect for doing it and self-respect when working in this industry)

**Recruit**

**PERCEPTIONS**
- Poor education
- Lack of interest
- Unregulated manning agencies
- 'Scraping the barrel'/anyone with money for certificates

**REQUIRED EXPECTATION**
- Good education
- Motivation
- Commitment
- Ability
- Self discipline
- Aspirations
- Professionalism and pride

**Train**

**PERCEPTIONS**
- Minimum training to comply with regulations
- No ship/system specific training
- No on board continuation training
- No career development training

**REQUIRED EXPECTATION**
- Competency
- Ship/system specific training
- Onboard continuation training
- Company seminars
- Career development
- Continuous Professional Development

**Induct**

**PERCEPTIONS**
- No interest in new recruits
- No sense of Company brand

**REQUIRED EXPECTATION**
- Welcome into the Company
- Join the Team
- 'You’re a sailor now'

**Retain**

**PERCEPTIONS**
- Bad employer
- Badly run ships
- Poor working and living conditions
- Poor pay & conditions
- No support
- No career prospects
- No career development

**REQUIRED EXPECTATION**
- Company branding
- Happy & healthy lifestyle
- Safe & secure working environment
- Decent working and living conditions
- Fair terms of employment
- Quality of life
- Health protection
- Medical care
- Family support
- Contact with home
- High tech, usable ships & systems
- Good career prospects
- Career development
- 'A job for life in the industry'
### Information management - bringing it all together

#### Cargo operations
- Bills of Lading
- Cargo List
- Cargo Record Book
- Dangerous goods list
- Loading/unloading plan
- Passenger list or return
- Stevedore damage reports
- Ballast Water Data
- Tank/Pipeline Hold diagrams
- Cargo pumping arrangements
- Checklists
- System/Equipment manuals
- Operating instructions
- Standing Orders/Instructions
- Tank Level monitoring
- Value monitoring
- Ballast activity
- Emission reports
- Stability, loading and ballasting information
- Temperature or humidity requirements or restrictions

#### Health, Safety & Wellbeing
- Accident Log
- Medical/ Sick-Bay Log
- Safety Posters
- Safety Information
- Safety Bulletins
- Minutes of safety meetings
- Fatigue Guidelines
- Port welfare information guides
- Family support information
- Medical advice
- Quality, Safety and Environmental Management Systems (QEMS)
- Health and Safety Reports
- Results of exit interviews
- Staff suggestion schemes
- Confidential reporting scheme summaries
- National incident investigation body reports
- Topical health guidance (e.g. sneeze flu)
- System/Equipment manuals
- Operating instructions

#### Education & Training
- Records of Training
- Training Videos/DVDs
- ‘Getting started’ DVDs for new equipment
- CBT programmes
- ‘Getting started’ DVDs for new equipment
- Software/data version control
- Charterer requirements records
- ISO 9000 and 14000 records
- Through life cost/opportunity cost etc.

#### Communication
- VHF DSC
- VHF radiotelephony
- MF DSC
- Inmarsat
- EPIRB
- Maritime Safety Information
- NAVTEX/SafetyNET
- Email
- Telephone
- Facsimile
- Telegram
- Personal

#### Logs
- Log of Oil to Sea Interests
- Log of Fuel Oil/Lube Oil Purifier Settings
- Log of Oil to Sea Interfaces
- Checklists
- System/Equipment manuals
- Operating instructions
- Standing Orders/Instructions
- Tank Level monitoring
- Valve monitoring
- Ballast activity
- Emission reports
- Machinery and electrical space drawings

#### Databases
- Use of information technology
- Usability of information
- Data entry
- Checking
- Usability of information systems
- Number of reporting systems
- Maintenance and management of data
- Data analysis for operational and safety issues
- Assignment of responsibility for data and information management
- Asset value of information
- Auditing
- Through life cost/opportunity cost etc.

#### For each job/task:
- What set of information needs to be communicated?
- Why is this information being communicated?
- Where is it going to / where will it be stored?
- How will it be communicated/understood stored?
- When is it needed / how long will it be needed?

#### For any information:
Should be combined with other information to add value and increase efficiency?

#### Aim for the following in the presentation of information (whatever the format - even spoken):
- Clarity - the information content is conveyed quickly and accurately
- Discriminability - the displayed information can be distinguished accurately
- Conciseness - users are not overloaded with extraneous information
- Consistency - unique design, conformity with user’s expectation
- Detectability - users attention is directed towards information required
- Legibility - information is easy to read
- Comprehensibility - meaning is clearly understandable, unambiguous, interpretable, and recognizable

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Human element knowledge & skills framework - Regulation, Administration & Management

International Regulator
- consider the human element
- take input from seafarers or their proxies, during the development or amendment process related to any Resolution, Instrument or Circular
- provide guidance on the human element aspects of the application and/or implementation of any proposed solution being provided for Administrations, ship owners/managers, seafarers and surveyors
- provide safeguards against single person errors and organizational errors
- present information for seafarers in a form that can be presented to and is easily understood by the seafarer
- consult human element experts in the development of solutions
- set the necessary levels of knowledge, skills, abilities and experience for personnel employed in the maritime sector to properly perform job tasks,
- properly manage risks through management systems, programmes, procedures, policies, training, documentation, equipment, etc
- be aware of the necessary conditions to sustain the safety, health and comfort of those working on board
- reduce the risk of illness, injury, or death in the event of a catastrophe such as fire, explosion, spill, collision, flooding, or intentional attack
- consider desired human performance in emergency situations for detection, response, evacuation and survival and rescue and the interface with emergency procedures, systems, facilities and equipment
- provide detailed mandatory standards of competence and other mandatory provisions necessary to ensure that all seafarers are properly educated and trained, adequately experienced, skilled and competent to perform their duties in a manner which provides for the safety of life and property at sea and in a protection of the marine environment
- prevent and suppress terrorism against ships and improve security aboard and ashore, in order to reduce the risk to passengers, crews and port personnel on board ships and in port areas, to the vessels and to their cargoes
- provide practical guidelines for the investigation of human factors in marine casualties and incidents
- establish and require the enforcement of principles and rules which ensure a uniform minimum international standard for the safety of life at sea

Legislators/ Administrators
Fully understand:
- the importance of the requirements of pertinent IMO, ILO, WHO and regional instruments relevant to maritime safety and protection of the marine environment
- the essential importance of properly addressing the human element for safety of life at sea, safety of navigation and protection of the marine environment
- the need to promote safety of life at sea by establishing and requiring the enforcement of, principles and rules which ensure that a uniform national standard is maintained, at least in line with the required minimum international standard

Be fully conversant with and fully understand the need to implement:
- the international standards on ship safety, human security and quality ship management in the context of SOLAS 1974, the International Regulations for Preventing Collisions at Sea, 1972 (as amended); and STCW 1978 (as amended)
- the ILO Maritime Labour convention 2006 (MLC, 2006), in respect of seafarers’ employment and social rights to ensure a safe and secure workplace that complies with safety standards; fair terms of employment; decent working and living conditions on board ship; health protection, medical care, welfare measures and other forms of social protection
- the obligations and procedures to ensure international health security, within the context of the International Health Regulations 2005 (IHR)
- other regional instruments relevant to maritime safety and protection of the marine environment
- measures to prevent/suppress terrorism against ships and to improve security aboard and ashore, in order to reduce the risk to passengers, crews and port personnel on board ships and in port areas, to the vessels and their cargoes, in accordance with the requirements of the ISPS Code

Recognize the need to:
- investigate human factors in marine casualties and incidents, and act on the findings
- properly consider the human element when developing/amending national maritime instruments related to safety, security and protection of the marine environment
- provide safeguards against single person errors and organizational errors
- present information for seafarers in a form that can be presented to and is easily understood by the seafarer
- consult human element experts in the development of solutions
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Seek and exploit expert guidance and advice on human element issues
- perform research to develop human element data as it is required
- develop or provide relevant staff with human element skills
- develop a plan to achieve and maintain the optimum level of usability throughout ship operations
- identify the specialist skills required and plan how to provide them
- manage a lifecycle plan to address HE issues

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- the international standards on ship safety, human security and quality ship management in the context of SOLAS 1974, the International Regulations for Preventing Collisions at Sea, 1972 (as amended); and STCW 1978 (as amended)
- the ILO Maritime Labour convention 2006 (MLC, 2006), in respect of seafarers’ employment and social rights to ensure a safe and secure workplace that complies with safety standards; fair terms of employment; decent working and living conditions on board ship; health protection, medical care, welfare measures and other forms of social protection
- the obligations and procedures to ensure international health security, within the context of the International Health Regulations 2005 (IHR)
- other regional instruments relevant to maritime safety and protection of the marine environment
- measures to prevent/suppress terrorism against ships and to improve security aboard and ashore, in order to reduce the risk to passengers, crews and port personnel on board ships and in port areas, to the vessels and their cargoes, in accordance with the requirements of the ISPS Code

Shipowners/ Shipmanagers
Fully understand
- the essential importance of properly addressing the human element for safety of life at sea, safety of navigation and protection of the marine environment
- the importance of safety at sea, prevention of human injury or loss of life and avoidance of damage to the environment, in particular to the marine environment/property
- that the cornerstone of good safety management is commitment from the top
- the importance of safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment and to property, in accordance with the requirements of the ISM Code

Fully understand the need to:
- establish and communicate a policy for the human-centred approach to ship design/operations
- have a policy for using human element data
- maintain increased awareness of usability
- facilitate personal and technical interactions on human element issues
- seek and exploit expert guidance and advice on human element issues
- perform research to develop human element data as it is required
- develop or provide relevant staff with human element skills
- develop a plan to achieve and maintain the optimum level of usability throughout ship operations
- identify the specialist skills required and plan how to provide them
- manage a lifecycle plan to address HE issues

IHR: International Health Regulations 2005 (IHR)
ISM: International Safety Management
ISPS: International Ship and Port Facility Security
Human element knowledge & skills framework – design, build, maintain

Naval Architects & Designers
- Recognise that the operational safety and business effectiveness of ships are dependent on a number of elements all working together in an integrated way.
- Fully understand the importance of the human element to assure good design and construction, as well as operational aspects.
- Ensure that the introduction of technology and reductions in manning take account of responsibility and human competence, capabilities and limitations (e.g. fatigue and stress) or available procedures and resources.
- Fully understand that an ergonomics approach to design must be human-centred.
- Fully understand that design must take full account of the nature of the task and its implications for the human.
- Be aware that the environment in which a system, product, service or facility is intended to be used has to be identified and described.
- Be mindful that ergonomics must be considered early and continuously within the design process.
- Be mindful that sufficient attention should be given to the application of ergonomics principles in order to prevent any negative effects.
- Be mindful that ergonomics criteria must be established for the design.
- Be mindful that conceptual and detailed designs shall take account of ergonomics criteria.
- Be mindful that the users (or potential users) must be involved in the process of design.
- Distribute functions between the human, machine and organisational elements of the system best able to fulfil each function.
- Develop a practical model of the user’s work from the requirements, context of use, allocation of function and design constraints for the system.
- Produce a description of how the system will be used.
- Produce designs for the user-related elements of the system that take account of the user requirements, context of use and human element data.
- Be aware that evaluation of the ergonomic design of any system, product or service must be based on established ergonomic criteria.
- Revise design and safety features using feedback from evaluations.

Project Managers
- Understand that human-centred design should be planned and integrated into all phases of the product life cycle.
- Understand that any plan for human-centred design should form part of the overall project plan.
- Be mindful of the need to adopt process modelling and assessment as an element in the assurance of timely and effective system delivery.
- Be aware that the design process is iterative.
- Be aware that the design team should include multi-disciplinary skills and perspectives.
- Be mindful that project planning should allocate time and resources for the human-centred activities.
- Ensure that users are involved throughout the lifecycle such that the design is driven and refined by user-centred evaluation.
- Fully understand and specify the context of use such that design is based upon an explicit understanding of users, tasks and environments.
- Fully understand the need to identify user needs and specify the user requirements.
- Ensure that the design addresses the whole user experience.
- Ensure that design solutions include ergonomics and user requirements.
- Be mindful of the need to consider the relative importance of ergonomics in the project.
- Be mindful of the need to identify and describe the environment in which a system, product, service or facility is intended to be used, taking full account of the nature of the task and its implications for the seafarer.
- Be mindful of the need to design for the target population and the whole user experience.
- Be mindful of the need to drive and refine the design by user-centred evaluation and use of established ergonomic criteria.
- Include multi-disciplinary skills and perspectives in the design team.

Shipowner/Operator
- Include and integrate human-centred design into the overall project plan and all phases of the product life cycle.
- Integrate milestones for human-centred activities into the overall design and development process.
- Allocate time for iteration and the incorporation of user feedback, and for evaluating whether the design solution satisfies the user requirements.
- Identify the range of skills and viewpoints required.
- Involve workers or users (or potential workers or users) in the process.
- Identify and use the most suitable formats for exchanging human element data.
- Include human resources and human-centred design in corporate procedures, standards and guidelines.
- Define and maintain human element processes, methods, tools, techniques and test facilities.
- Perform research into required ship and system usability for future operating concepts.
- Define usability as a competitive asset.
- Set usability objectives for ship operation.
- Develop user-centred infrastructure.
- Perform early analysis of the future operating concept.
- Identify expected context of use for possible future operating concepts.
- Relate human element issues to business.
- Identify human element issues and aspects of ship operation and design that require crew input.

Note: The type of user involvement will differ for different roles. For equipment and systems design the understanding and usability of complex and novel functions will be a major issue and this will require fairly direct user input. For naval architects the issues will probably be related to ergonomics, health and safety, interior design and other aspects that have been standardised and there may even be regulation. However, wherever there is uncertainty users will have to be involved in some way.

Note: The senior management of manufacturers and shipyard have a responsibility to analyse and understand the value of quality in use in terms of their products and to champion HCD.

Note: Responsibility for usability rests with the owner/operator. However, naval architects, designers and project managers need to address many of these topics so that they have the capability to respond to owner/operator requests.

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A human-centred approach to HSEQ

The principles for a human-centred approach to HSEQ
- Any changes to procedures, working practices, equipment and systems are based on an explicit understanding of users, their abilities, the expected work, and the working environment
- All aspects of the user’s experience of procedures, working practices, equipment and systems are considered - from proposal to disposal
- Users are involved throughout any change
- Changes to procedures, working practices, equipment and systems are driven and refined by trials with users
- Relevant skills and knowledge are identified and applied
- Time and resources are allowed for adjustments and corrections

HSEQ Improvement Feedback Implementation Planning

- Competence
- Appraisal
- Education & training
- Working conditions
- Safety climate
- Learning from accidents
- Learning from near misses
- Manning & watch systems
- Fatigue/stress management
- Team working
- ‘Making safety’
- Rewarding success
- Communication
- Consequences of human error
- Operating procedures
- Maintenance procedures
- Management procedures
- Documentation
- Publications
- System performance & reliability
- Instrumentation
- Automation
- Customer feedback
- Company culture
- Communications
- Performance
- Claims

- STCW
- ILO Conventions
- Occupational health and safety
- ISM
- ISPS
- IMO Resolutions, conventions & guidelines
- Industry Guides
- ISO 9001, 14001, OHSAS 18001
- Corporate Social Responsibility
- Environmental awards
- Voluntary codes
- Charterer’s standards

- Accident reports
- Safety meeting minutes
- Safety reports
- Management reports
- Operational reports
- Technical reports
- Environmental reports
- Security reports
- Inspections
- Suggestions
- Crew appraisals
- Internal audit reports

Photo: Joachim Affeldt
Maritime Educators and Trainers – Knowledge, Skills & Attributes

Knowledge

- **Professional experience**
  - ‘Knowledge of the sea’
  - Seagoing experience

- **Conventions, resolutions, rules and regulations**
  - Knowledge of IMO, ILO, WHO
  - Conventions & Resolutions
  - Flag State regulations
  - Classification

- **Industry standards**
  - Knowledge of Best Practice Guides and other industry standards appropriate to the subject being taught

- **Continuous professional development**
  - Updating of knowledge

- **Management theory**
  - Basics of management science
  - Understanding of cultural differences
  - Basic understanding of social systems

Skills

**Human element**
- Ability to recognise human element issues and predict consequences
- Ability to recognise the impact of shaping factors in the context of use on performance, motivation and safety

**Communication**
- Presenting information in a manner that can be understood by the learners
- Communicating complex ideas in a clear and concise manner
- Translating information using a vocabulary that the learner can understand
- Interpersonal skills

**Continuous professional development**
- Updating of skills and knowledge

**Learning**
- Seeking feedback from students
- Designing or planning of learning
- Feedback and assessment
- Valid, reliable, fair, clear and unambiguous assessments

**Lesson Planning**
- Focussing on the trainees’ needs in the planning stages
- Focussing on the trainees’ needs in the classroom

Attributes

**Attitude**
- Self-awareness
- Self-motivation
- Mental ability
- Intelligence
- Personality
- Character

**Professionalism**
- Professional standards

**Integrity**
- Moral soundness
- Honesty
- Freedom from corrupting influences
- Unprejudiced

**Transparency**
- Openness
- Accountability

**Temperament**
- Confident
- Respect for peers and students
- Polite
- Firm
- Courteous
- Calm
- Patient

**Impartiality**
- Independent
- Unbiased
- Consistent
- Informed decision making

**Communication**
- Clear
- Effective

**Motivation**
- Enthusiasm
- Adaptability

**Empathy**
- Ability to bond with students

**Inspiring**
- Exploiting students’ talents, skills and abilities

**Willing to Learn**
- Willingness to learn from other teachers and students

**Dedication to excellence**
- Getting the best from students
- Encouraging sharing of ideas
- Willingness to help students achieve
- Pride in student accomplishments
### Safe Manning

**Considerations**
- Operational functions
- Operational factors to consider
- Relevant instruments
- Task capability
- Attributes
- Workload assessment
- Hours of work and hours of rest requirements
- Watchkeeping patterns

**Guidance & Tools**
- IMO Principles of Minimum Safe Manning (Resolution A.1047(27))
- A rough guide to Minimum Safe Manning
- Recommendations Relating to the Application of Requirements Governing Seafarers’ Hours of Work and Rest
  - [www.ocimf.com/m扶衣ch?ID=9d7d7e0f-562f-4a2e-96aa-481565bc9e7a](http://www.ocimf.com/m扶衣ch?ID=9d7d7e0f-562f-4a2e-96aa-481565bc9e7a)

### Organization & Management

**Performance Influencing Factors**
- Top Level Management
- Personnel
- Operational
- Technical
- Safety Management

**Guidance & tools**
- Alert! Issue 2 Centrespread
  - [www.he-alert.org/documents/centrespreads/centrespread_2.pdf](http://www.he-alert.org/documents/centrespreads/centrespread_2.pdf)

### Future considerations

- Remote platform/system monitoring
- Traffic Organization Services
- Navigational Assistance Services
- Remote pilotage
- Autonomous vessel operations

### Other considerations

- Need for additional crew (above minimum manning)
- Administration officer
- Information Management officer

### Supernumeraries

- Company representatives
- Mooring crews
- Cargo crews
- Training officers
- Officers/ratings under training
- Riding gangs

### Fatigue management

**Causes, effects and mitigation**
- Alert! Issue 13 Centrespread
- Alert! Issue 13 Vodcast
  - [www.he-alert.org/user/vodcast13.asp](http://www.he-alert.org/user/vodcast13.asp)

**Responsibilities**

- **Ship designer**
  - ‘Design out’ debilitating effects of noise, temperature, motion, vibrations, intensity of lighting etc

- **Shipowner/shipmanager**
  - Comply with Safe Manning requirements
  - Develop a fatigue management plan
  - Authorise master to anchor if crew are fatigued

- **Seafarers**
  - Identify the causes of fatigue
  - Take appropriate and early measures to prevent fatigue
  - Review watchkeeping patterns
  - Comply with hours of work and hours of rest

**Guidance & tools**

- IMO guidelines on fatigue mitigation and management (MSC/Circ.1014)
- Crew Endurance Management System (USCG)
- Crew Endurance Decision Support Software
- ISF Watchkeeper
  - [www.home.isfwatchkeeper.com](http://www.home.isfwatchkeeper.com)
- MARTHA
  - [www.warsashacademy.co.uk/about/resources/martha-software-and-documents.zip](http://www.warsashacademy.co.uk/about/resources/martha-software-and-documents.zip)
- MLC 2006 Pocket Checklist
LC%20Pocket%20Checklist%20September%202012.pdf)
- ILO MLC Smartphone App
- Fatigue Advisor Resource (Maritime New Zealand)
  - [www.he-alert.org/documents/published/he01130.pdf](http://www.he-alert.org/documents/published/he01130.pdf)
- Wheelhouse Fatigue Checklist (Maritime New Zealand)
  - [www.he-alert.org/documents/published/he01135.pdf](http://www.he-alert.org/documents/published/he01135.pdf)
- Recommendations Relating to the Application of Requirements Governing Seafarers’ Hours of Work and Rest
  - [www.ocimf.com/m扶衣ch?ID=9d7d7e0f-562f-4a2e-96aa-481565bc9e7a](http://www.ocimf.com/m扶衣ch?ID=9d7d7e0f-562f-4a2e-96aa-481565bc9e7a)
- The Nautical Institute Fatigue Forum
AWARENESS
Public awareness and understanding of the maritime industry and the vital role it plays in sustaining day-to-day life around the world, especially for the promotion of careers in the maritime industry
www.maritimeindustryfoundation.com/index.htm

BEST PRACTICE
Voluntary training standards beyond the requirements of SOLAS and STCW, such as:
The Tanker Officer Training Standard (TOTS) – www.he-alert.org/documents/published/he00570.pdf

COMPETENCE MANAGEMENT SYSTEM
Identifying present and future competence needs, facilitating comprehensive communication between sea and shore regarding training, and turning competence goals into business results
Alert! Issue No. 20, page 3
Alert! Issue No. 31, page 6

DISTANCE LEARNING
Learning that takes place with the instructor and learner(s) in physically separate locations
- e-learning - learning that is primarily in an electronic format, i.e., Computer-Based Training (CBT), which may or may not involve the internet
The Manila Amendments to the Seafarers' Training, Certification and Watchkeeping (STCW) Code, Regulation B-1/6 Art 6-11
www.he-alert.org/documents/published/he01150.pdf
The Manila Amendments to the Seafarers’ Training, Certification and Watchkeeping (STCW) Code
www.he-alert.org/documents/published/he01155.pdf
The Manila Amendments to the Seafarers’ Training, Certification and Watchkeeping (STCW) Code
www.he-alert.org/documents/published/he01170.pdf
STCW prescribed mandatory training requirements in resource management, leadership and teamwork skills at operational level, and leadership and managerial skills at management level
The Manila Amendments to the Seafarers' Training, Certification and Watchkeeping (STCW) Code
www.he-alert.org/documents/published/he01175.pdf

EDUCATION & TRAINING
- the gradual process of acquiring knowledge through learning and instruction. The development of personal attributes through upbringing and observation and gaining knowledge through textbooks
Training - the development of skills or knowledge through instruction or practice. A planned systematic development of the aptitude, knowledge, understanding, skill, attitude and behaviour pattern required by an individual, so that he/she can adequately carry out a given task or perform in a particular job
Alert! Issue No. 6, page 1

FAMILIARISATION
Knowledge and understanding of a ship and its systems
Alert! Issue No. 8, page 1
ISM Code, Article 6.3:
www.he-alert.org/documents/published/he01165.pdf

INDUCTION
A process for helping a newcomer to the industry to settle into new working and social environments
www.he-alert.org/documents/published/he01170.pdf

GAP ANALYSIS
Assessing the gap between the knowledge, skills and attitudes that the people in the organization currently possess against the knowledge, skills and attitudes that they require to meet the organization’s objectives. The root of a training Needs Analysis (TNA) – a review of learning and development needs for staff within the organisation
Alert! Issue No. 11, page 2
www.he-alert.org/documents/bulletin/Alert_11.pdf
www.cipd.co.uk/hr-resources/factsheets/identifying-learning-talent-development-needs.aspx

HUMAN ELEMENT LEADERSHIP & MANAGEMENT
STCW prescribed mandatory training requirements in resource management, leadership and teamwork skills at operational level, and leadership and managerial skills at management level
The Manila Amendments to the Seafarers' Training, Certification and Watchkeeping (STCW) Code
www.he-alert.org/documents/published/he01175.pdf

INTER CULTURAL EDUCATION
Understanding the cultural backgrounds, beliefs and attitudes of different nationality groups
www.he-alert.org/documents/published/he01180.pdf

JOB ANALYSIS
The first stage in the process of defining the nature and purpose of the role and the skills and attributes needed to carry out a job, which forms the basis of a job description and person specification
www.mindtools.com/pages/article/newTCS_02.htm

KNOWLEDGE, SKILLS & ATTRIBUTES
The key components of a Competency Framework
Knowledge - the theoretical or practical understanding of a subject
Skill - proficiency that is acquired or developed through training or experience

ATTITUDE – a quality or characteristic of a person
Alert! Issues 22-30
www.he-alert.org/user/download.aspx

LIFELONG LEARNING
Ongoing learning activity, to improve knowledge, skills and competence. A key component of Contingent Professional Development (CPD) – the process that enables maritime professionals to take control of their own learning and development by carrying out activities that ensure they are competent and successful throughout their career, both at sea and ashore
Alert! Issue No. 20, page 6
www.nautinst.org/en/membership/CPD/

MENTORING
A work related or professionally based partnership between two people which gives them the opportunity to share their professional and personal skills and experiences, and to grow and develop in the process
Alert! Issue No. 31, page 8
www.he-alert.org/documents/published/he01185.pdf
www.he-alert.org/documents/published/he01190.pdf

NEW OPPORTUNITIES
Encouraging seafarers to fulfil their career aspirations, preparing them for promotion onboard or into shore management, or directing them towards post-graduate education or advanced skills training to allow them to diversify into the wider maritime sector
Alert! Issue No. 20

ON-JOB TRAINING
Onboard training activity and exercises to ensure compliance with SOLAS/ISM and other international conventions and resolutions, and for the updating of individual skills
Alert! Issue No. 20, page 3
www.he-alert.org/documents/published/he01195.pdf

PERSONAL DEVELOPMENT
Improving personal awareness and identity, developing talents and potential, building human capital and facilitating employability
http://en.wikipedia.org/wiki/Personal_development

QUALITY ASSURANCE
To verify the quality of maritime training providers globally to a uniform standard
www.dnv.na/industry/maritime/servicesolutions/competence/classification/training/Certification/ManagementSystems.asp

REMINDERS
The use of aide-mémoires, performance aids, reminder cards, booklets, descriptive labels, etc. to assist the teaching/learning process
Alert! Issue No. 2, page 1
www.he-alert.org/documents/bulletin/Alert_2.pdf

SIMULATION
A realistic imitation, in real time, of any shiphandling, radar and navigation, propulsion, cargo/ballast or other ship-system incorporating an interface suitable for interactive use by the trainee or candidate either within or outside of the operating environment
www.he-alert.org/documents/published/he01200.pdf
www.he-alert.org/documents/published/he01205.pdf

TRAINING THE TRAINER
Ensuring that maritime college lecturers and trainers are appropriately qualified to teach/train those competencies for which they are employed to teach and have to date appreciation of modern day ship operations and of the new technology aboard ships
Alert! Issue No. 6, page 6
Alert! Issue No. 20, page 2
Alert! Issue No. 20, page 2

UPDATING/REVALIDATION
The revalidation of certificates of competency
The Manila Amendments to the Seafarers’ Training, Certification and Watchkeeping (STCW) Code, Regulation I/11
www.he-alert.org/documents/published/he01210.pdf

VODCASTS
Short films that can be viewed online or downloaded to a PC or Mobile device, aimed at anyone with an interest in the Maritime Human Element
http://www.he-alert.org/user/vodcasts.asp

WORKFORCE DEVELOPMENT
Developing and supporting people to ensure access to a skilled and flexible workforce
Alert! Issue No. 20, page 6
www.mnto.org.uk/en-GB/National-Occupational-Standards
www.investorsinpeople.co.uk/Needs/BusinessPriorities/DevelopingPeoplePages/default.aspx

WEREEDNESS
Public awareness and understanding of the maritime industry and the vital role it plays in sustaining day-to-day life around the world, especially for the promotion of careers in the maritime industry
www.maritimeindustryfoundation.com/index.htm

ATTACHMENT
To access all the source documents, scan the QR Code
Standard A3.1 – Accommodation and recreational facilities

A3.1.6 Accommodation spaces
- Adequate headroom
- Adequate insulation
- Sleeping rooms situated above the load line amidships or aft
- No direct openings into sleeping rooms from cargo and machinery spaces, galleys, storerooms, drying rooms or communal sanitary areas
- Internal bulkheads, paneling and sheeting, floors and joinings suitable for purpose and conducive to ensuring healthy environment
- Proper lighting
- Sufficient drainage
- Acceptable occupational and onboard living environment for seafarers

A3.1.7 Ventilation & heating
- Comfortable seating accommodation
- Table/desk
- Drawer or equivalent
- Lockable clothes locker of ample space fitted
- Adjoining sitting room, day room or equivalent
- Minimum inside dimensions of a berth
- Separate berth for each seafarer
- Minimum floor areas
- Adjoining sitting room, day room or equivalent additional space for master, chief engineer and chief navigating officer
- Lockable clothes locker of ample space fitted with shelf or drawer or equivalent
- Table/desk
- Comfortable seating accommodation

A3.1.10 Mess Rooms
- Apart from sleeping rooms, as close as practicable to galley
- Adequate size and comfort
- Properly furnished and equipped (including ongoing facilities for refreshment)

A3.1.11 Sanitary facilities
- Convenient access
- Meeting minimum standards of health and hygiene
- Reasonable standards of comfort
- Separate facilities for men and for women
- Within easy access of the navigating bridge, machinery space or near engine room control centre
- Minimum of one toilet, one wash basin and one tub or shower or both for every six persons or less who do not have personal at a convenient location
- Washbasin, hot and cold running fresh water in each sleeping room
- Hot and cold running fresh water in all wash places

A3.1.12 Hospital accommodation
- For ships carrying 15 or more seafarers and engaged in a voyage of more than three days' duration
- Used exclusively for medical purposes

A3.1.13 Laundry facilities
- Appropriately situated and furnished laundry facilities

A3.1.14 Spaces on open deck
- For seafarers when off duty
- Of adequate area

A3.1.15 Offices
- Separate offices/common ship's office for use by deck and engine departments

A3.1.17 Recreational facilities, amenities and services
- To meet the special needs and for the benefit of all seafarers onboard

Guideline B3.1 – Accommodation and recreational facilities

B3.1.1 Design and construction
- External bulkheads of sleeping rooms and mess rooms - insulation
- Machinery casings, boundary bulkheads of galleys & other spaces in which heat is produced - insulation
- Protection from heat effects of steam and/or hot-water service pipes
- Sleeping rooms, mess rooms, recreation rooms & accommodation space alleyways - insulation to prevent condensation/overheating
- Bulkhead surfaces & deckheads - easy clean material
- Bulkhead surfaces & deckheads - construction likely to allow ventilation
- Harbour vermin
- Material & construction for decks
- Non-slip surfaces
- Composite flooring

B3.1.2 Ventilation
- Control of ventilation
- Air-conditioning systems
- Availability of power

B3.1.3 Heating
- Operation
- Means of heating
- Radiators and other heating apparatus

B3.1.4 Lighting
- Provision of electric light
- Sleeping rooms - electric reading lamp
- Standards of natural and artificial lighting

B3.1.5 Sleeping rooms
- Adequacy & comfort of berth arrangements
- Bathroom & toilet
- Sleeping room sharing - watchkeepers
- Sleeping room sharing - petty officers
- Adjoining sitting room, day room - second engineer
- Space occupied by berths & lockers, chest of drawers seats
- Small or irregularly shaped spaces
- Arrangement of berths - tiers
- Arrangement of berths - along ship's side
- Height of berth
- Framework & lee-board of berth - approved material
- Tubular frames (of berths)
- Comfort of mattresses
- Mattress and cushioning material/ stuffing
- One berth placed over another - dust-proof bottom
- Furniture material
- Curtains
- Mirror, small cabinets for toilet requisites, book rack & coat hooks

B3.1.6 Mess rooms
- Mess room facilities
- Separate mess room
- Mess rooms - floor area
- Tables & seats
- Refrigerator, hot beverages & cool water facilities
- Lockers for mess utensils & facilities for washing utensils
- Table tops & seats - damp-resistant material

B3.1.7 Sanitary accommodation
- Washbasins and tub baths
- Toilets
- Sanitary accommodation intended for the use of more than one person
- Laundry facilities

B3.1.8 Hospital accommodation
- Design
- Arrangement of entrance, berths, lighting, ventilation, heating & water supply
- Number of hospital berths
- Sanitary accommodation

B3.1.9 Other facilities
- Separate facilities for engine department personnel to change their clothes

B3.1.10 Bedding, mess utensils and miscellaneous provisions
- Supply of clean bedding & mess utensils
- Quality of bedding
- Plates, cups and other mess utensils - easily cleaned
- Supply of towels, soap & toilet paper

B3.1.11 Recreational facilities, mail and ship visit arrangements
- Review of recreational facilities and services
- Furnishings for recreational facilities
- Facilities at no cost to the seafarer
- Forwarding of seafarers' mail
- Partners, relatives & friends as visitors on board when in port
- Partners accompany seafarers on occasional voyages

B3.1.12 Prevention of noise and vibration
- Location of accommodation and recreational and catering facilities
- Acoustic insulation
- Soundproofing of centralized control rooms for engine-room personnel
- Insulation of working spaces
- Limits for noise levels for working and living spaces
- Accommodation/recreational /catering facilities – exposure to excessive vibration

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Ergonomics and maintainability: A rough guide

Human-centred Design best practice

1. Understand and specify context of use
   - Establish, clarify and communicate the characteristics of the users, their tasks and the technical, organisational and physical environment in which the system will operate
   - Document the characteristics of the intended users and their tasks, including user interaction with other users and other systems
   - Describe the real operational environment of the system, including the factors that affect the performance of users

2. Specify the user requirements
   - Establish, clarify and communicate the requirements of the users of the system
   - Identify and analyse relevant groups of users, and their task needs
   - Define the requirements of the users of the system
   - State the user criteria for the performance of the system of work against operational and functional objectives
   - Address user requirements in the system design

3. Produce design solutions
   - Allow the design options for the product system of work to take account of the human element
   - Consider human element issues in the trade-off between design options
   - Trade-off usability against other design criteria
   - Design all user aspects of the system, e.g. jobs, roles, documentation & staffing
   - Incorporate user input direct and/or as feedback from evaluations in the design

4. Evaluate
   - Provide design information, new risks and issues, i.e. feedback on how to improve the system
   - Demonstrate the fulfilment of user requirements, i.e. inform decisions on whether the system is adequate
   - Address user requirements in the system design

Ergonomics and the work environment

- Manual valve operation, access, location and orientation
- Stairs, vertical ladders, ramps, walkways and work platforms
  - Human element recommendations for structural design of lighting, ventilation, vibration, noise, access and egress arrangements – IACS Rec. No. 132 Section 4.6 - Access and Egress Design

Inspection and maintenance

- Code on noise levels on board ships – IMO Resolution MSC.337(91)
- Guidelines for engine-room layout, design and arrangement - IMO MSC/Circ.834
- Guidelines on ergonomic criteria for bridge equipment and layout – IMO MSC/Circ.982
- Guidelines on the application of SOLAS Regulation V/15 to INS, IBS and bridge design – IMO SN.1/Circ.265
- Human element recommendations for structural design of lighting, ventilation, vibration, noise, access and egress arrangements – IACS Rec. No. 132
- Recommendation for the application of SOLAS Regulation V/15 bridge design, equipment arrangement and procedures – IACS Rec. No.95
- Provisions on occupational accidents, injuries and diseases – ILO MLC Guideline B4.3.1

The application of ergonomics to design

- Ergonomic principles in the design of work systems - ISO 6385:2004

Fatigue mitigation

- IMO MSC/Circ.1014 - Guidance on fatigue mitigation and management
- Module 7 - Shipboard fatigue and the naval architect/ship designer

Issue No.3 - Definitions

- Issue No.7 - Human-centred design
- Issue No.17 - Mitigating slip, trip and fall hazards

Habitability

- ILO MLC 2006, Title 3 - Accommodation, recreational facilities, food and catering
- Alert Issue No. 34, January 2014 centrespread and page 8
Ergonomic criteria for control room equipment and layout  A checklist

User interaction
- In accordance with ergonomic standards
- Response speed sufficient for interaction without disrupting task
- Comfortable for long watches
- Operator interface permits monitoring, control/supervision of machinery/equipment
- Visual/audible/mechanical feedback acknowledges operator input
- Functions requested by operator confirmed by displays on completion

Visual clarity
- Information clear
- Display formats free from irrelevant information
- Logical grouping & structure of information
- Display formats not densely packed/cluttered
- No distraction from user's primary tasks

Consistency
- Information consistently presented within & between sub-systems
- No confusion/erroneous through inconsistencies
- Graphical symbols and colour coding in accordance with recognised International Standard
- Symbols used in mimic diagrams consistent across all displays
- Screen layout & arrangement of information consistent
- Flashing of information reserved for unacknowledged alerts or transient states

Compatibility with users' expectations
- Information/labelling in accordance with recognised standards/conventions
- Information in form that users are accustomed to
- Control functions work as users expect
- Equipment mode obvious to user

Alarms
- Provision of alarms consistent with Human Hazard Assessment
- No unnecessary alarms
- Alarm philosophy based on good practice
- Accepting/cancelling alarms do not cause distraction/excessive workload
- Alarms prioritised/grouped to reflect urgency
- Captions/alarm list messages easily understood
- Different audibles easy to distinguish
- Suffient alerting when user busy with other item of equipment

Error prevention and correction
- Failure indications clear & unambiguous
- Sufficient information to identify cause of failure
- Assistance in recovering from user error
- ‘Undo’ function provided
- Single user errors identified and avoidable
- Operator confirmation provided for control action that could affect safety of ship

Flexibility and control
- Equipment needs meets needs of different users
- User ‘in control’ of sequence of commands/actions
- Able to switch between tasks with some incomplete
- Obvious to team who is in control of particular function(s)
- Transfer of control compatible with good watchkeeping procedures

Situation awareness
- Functional overview display provided
- Equipment & arrangements assist operator in maintaining awareness of overall situation
- Operator not absorbed in what equipment is doing
- ‘Head-down mode’ avoided

Automation and status indication
- Operating mode of machinery & equipment clearly indicated
- Defects/failures & their implications obvious to user
- Able to override automation or intervene part way through process
- No monotonous monitoring tasks
- Procedures & assigned tasks address failure modes

Support for operator tasks
- User interaction in accordance with task requirements
- Needs of all watch conditions & situations considered
- Specific needs of particular users considered
- Workstation design supports teamwork & assignment of tasks
- Operator able to crosscheck control actions

Supporting tasks
- Adequate storage of manuals, log books, work surfaces, etc.
- Able to perform background tasks at workstation
- Background or supporting tasks do not cause distraction or additional workload

Panel layout
- Panel layout logical
- Items grouped & sequenced in manner that supports correct use & helps to prevent errors
- Controls & displays positioned according to frequency, urgency and criticality

Controls & displays grouped according to sequence of use
- Keyboards divided logically into functional areas

Controls, displays & labelling
- Controls, displays & labelling clear & easy to access
- Purpose of each control clearly indicated
- Controls and indicators easily distinguishable
- Displays & indicators present operator with clear, timely & relevant information
- Operating mode of machinery & equipment clearly indicated
- Failure indications clear & unambiguous
- Sufficient information to identify cause of failure
- Display visibility satisfactory in conditions of daylight, darkness or no natural light

Documentation design
- Appropriate formats of documentation provided
- Documentation consistent with equipment
- Documentation provided in correct language
- Documentation easy to use
- Documentation does not cause distraction from safe and effective watchkeeping
- Needs of all watch conditions and situations considered
- Specific needs of particular users considered

Environment
- Control room environment meets criteria for heating, ventilation, air conditioning, airflow, humidity, heat sources; noise; vibration; ship movement
- Lighting sufficient to avoid glare/reflections from working & display surfaces, flicker-free
- Non-reflective or matt finish on surfaces

Field of view
- External view meets Regulatory requirements
- Satisfactory horizontal field of view from each workstation
- Satisfactory vertical field of view over bow from conning & manoeuvring positions
- Window inclination, dimensions, framing & heights of upper & lower edges satisfactory
- Satisfactory view between different workstations/ operators

Room layout
- Layout supports operation in all watch conditions & emergency situations
- Location of equipment appropriate to operator task does not cause distraction to other users
- Sufficient space & access for intended number of operators in expected operating conditions
- Local control stations positioned to minimise risk of harm to operator
- Instruments face operator’s intended working position

Access
- Access to & within control room meets ergonomic criteria
- Controls easily accessible to operator at workstation
- Layout of control room meets ergonomic criteria
- Ease of maintenance addressed
- Ease of cleaning addressed

Occupational safety
- Measures for occupational safety, including grab rails, non-slip surfaces, warning signs, protective clothing, protuberances, safety equipment marking, escape & survivability, security, cleaning

Adapted from Lloyd’s Register Rules and Regulations for the Classification of Ships, Part 6 & lower edges satisfactory
Adapted from Lloyd’s Register Rules and Regulations for the Classification of Ships, Part 6, Chapter 1 Control Engineering Systems, Section 3 Ergonomics of control stations; and the ATOMOS IV SOLAS Regulation V/15 Template 2013 Retrofit and Newbuild

To access a more comprehensive checklist together with appropriate reference documents, scan the QR Code
For a comprehensive list of Industry Guides and relevant sections of SOLAS and STCW go to: www.he-alert.org/docs/published/he01300 or scan the QR Code

**Survivability - Resolutions and Circulars and Industry Guides**

- **Conventions, Codes and Guides**
  - SOLAS Chapters II & XII A
  - FSS Code
  - FTP Code
  - IS Code
  - ISM Code
  - STCW Code
  - Industry Guides

- **Training and Drills**
  - SOLAS Chapter II-2 Part E Regulation
  - SOLAS Chapter II-2 Part E Regulation 16
  - ISM Code Section 8
  - STCW Code
  - IMO Model Courses

- **Firefighting and Damage Control**
  - SOLAS Chapters II & XII A
  - FSS Code
  - FTP Code
  - IS Code
  - ISM Code
  - STCW Code
  - Industry Guides

- **Livesaving**
  - SOLAS Chapter III
  - ISM Code
  - STCW Code
  - Industry Guides

- **Personal Survival/Medical**
  - STCW Code
  - IMO Revised Recommendations for Entering Enclosed Spaces
  - Industry Guides

- **Communications /Search and Rescue**
  - SOLAS Chapter IV
  - SAR Convention
  - IAMSAR Manual
  - GMDSS Manual
  - IMO SMCP
  - International Code of Signals
  - Industry Guides

- **Crisis Management**
  - ISM Code
  - STCW Code
  - Industry Guides

- **Security**
  - SOLAS Chapters XI-1 and XI-2
  - ISPS Code
  - SUA Convention
  - Industry Guides

- **Lessons Learned**
  - Marine Accident Investigation Reports
  - IMO Lessons learned for seafarers
  - Confidential Hazardous Incident Reporting Programme (CHIRP)
  - Mariners’ Alerting and Reporting Scheme (MARS)
  - MAIF Investigation Manual
  - IMO Model Course

- **Maritime Accident Investigation (MAIIF) Investigation Manual**
  - IMO Model Courses

- **IMO SMCP**
  - International Code of Signals
  - Industry Guides

- **IMO Revised Recommendations for Entering Enclosed Spaces**
  - Industry Guides

- **IMO Model Course**
  - IMO Model Course

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- **IMO Model Course**
  - IMO Model Course
Exploring Occupational Health and Safety

**Health & Wellbeing**

**Personal health**
- Health awareness
- Medical screening
- Pre-employment Medical Examination (PEME)
- Medical support
- Wellness at sea
- Fitness training
- Mental Health

**Wellbeing**
- Taking care of oneself and others
- Taking responsibility for personal learning and welfare
- Managing feelings
- Developing a positive and active attitude to life
- Building relationships with others
- Coping with isolation, loneliness and stress
- Recognising depression
- Dealing with fatigue
- Balanced diet
- Drug & alcohol testing
- Exercise
- Habitability
- Hygiene
- Medical screening
- Recreation
- Rest
- Energy
- Physical fitness
- Physical strength
- Stamina

**Welfare**
- Company family support structure
- Company family support information
- Staff suggestion schemes
- Communication with home

**Safe working practices**
- Awareness of onboard occupational health and safety hazards
- Behavioural safety
- Permits to work
- Personal Protection Equipment (PPE)
  - Provision
  - Maintenance
  - Accessibility
  - Proper use
- Enclosed space entry procedures

**Safety culture**
- Company culture
- No blame culture

**Accidents**

**Recording**
- Accident log
- Medical/Sick-Bay log

**Reporting**
- Health and safety reports
- Minutes of safety meetings
- Accident/near miss reports

**Investigating**
- Internal accident investigation
- Safety Accident investigation
- Flag State investigation
- P&I investigation

**Feedback**
- Safety posters
- Safety alerts/bulletins
- Confidential reporting scheme summaries
- Accident investigation reports
- Lessons learned

**Codes, Guidelines & Advice**

- ILO Guidelines for implementing the occupational safety and health provisions of the Maritime Labour Convention, 2006 (ILO)
- ISM Code (as it applies to health and safety)
- ILO Code of Practice on accident prevention on board ship at sea and in port
- ILO Code of Practice on occupational hazards in the workplace
- ILO Code of Practice on safety in the use of chemicals at work
- ILO Code of Practice on protection of workers against noise and vibration in the working environment
- ILO Code of Practice on the Management of alcohol and drug-related issues in the workplace
- ILO Code of Practice on HIV/AIDS and the workplace
- ILO Guidelines on the medical examinations of seafarers (ILO)
- Joint WHO/ILO briefing note for workers and employers on Ebola Virus Disease
- ICS basic advice for shipping companies and seafarers on implementing an effective safety culture
- IMO MSC-MEPC.2/Circ.3 Guidelines on the basic elements of a shipboard occupational health and safety programme
- International Medical Guide for Ships
- The Ship Captain’s Medical Guide
- ISWAN Training on Board Fitness Program
- The Mental Health of Seafarers
- Wellness at sea project
- Seafarers Centre Directory
- Port welfare partnership
- IMHA Member and Clinic Directory (which includes P&I Club approved PEME centres)
- ITF Seafarers Health Briefings
- ITF Seafarers Balance your diet briefing
- ILO Stress Prevention at Work Checkpoints

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The human element and human-system aspects of risks in the context of total HSSEQ onboard ship

There are a growing number of codes and standards and guidelines related to different aspects of maritime Health Safety, Security, Environmental and Quality (HSSEQ) management, including:

- ISM Code (Safety & Environmental Protection)
- Guidelines for implementing the occupational safety and health provisions of the Maritime Labour Convention, 2006
- ISPS Code (Security)
- ISO 9001 (Quality)
- ISO 31000:2009 (Risk Management)

The core of these is Risk Management, for which ISO 31000:2009 provides generic guidelines. When managing risk it is important to consider the human element.

This centrepread focuses on the human element and human-system aspects of risks in the context of total HSSEQ onboard ship. See also: A structured approach to Enterprise Risk Management (ERM) and the requirements of ISO 31000 published by the Institute of Risk Management (IRM) - https://www.theirm.org/media/886062/ISO31000_doc.pdf

HSSEQ - Risks & Hazards

On ship/Ship

- Computer hacking
- Slip, trip & fall hazards
- Insufficient spares
- Noxious substances
- Fire
- Flood
- Effects of piracy/robbery
- Effects of terrorist attack

Operator error
- Isolation
- Depression
- Fatigue
- Poor health
- Disease
- Communication
- Teamwork
- Piracy/robbery

Crew

- Experience
- Education & training
- Risk awareness
- Manning levels
- Food preparation
- Catering
- Medical
- PPE

Environment on/off ship

- Noise
- Vibration
- Heat
- Lighting
- Cargo

- Heavy weather
- Ice
- Extremes of heat
- Extremes of cold
- Heavy seas
- Air pollution
- Water pollution
- Oil pollution
- Cargo

Off ship/voyage

- Port disruption
- Terrorist attack
- Piracy
- Robbery
- Cyber attack

- Communications failure
- Breakdown
- Navigational failures
- Other vessel collision

Internally driven

- Propulsion failure
- Power failure
- Machinery failure
- Systems failure
- Equipment failure
- Computer failure
- Poor maintenance
- Insufficient spares

Externally driven

- Experience
- Education & training
- Risk awareness
- Manning levels
- Food preparation
- Catering
- Medical
- PPE

The Process

Communicate & consult
- Establish the context
- Identify risks from/to crew
- Analyse & evaluate risks
- Address human element in treatment of risks

Monitor & review
- Establish the context
- Identify risks from/to crew
- Analyse & evaluate risks
- Address human element in treatment of risks

Issue No.26
A human-centred approach to HSEQ


There are a growing number of codes and standards and guidelines related to different aspects of maritime Health Safety, Security, Environmental and Quality (HSSEQ) management, including:

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