Addressing the human element

Alert!

Human resources considerations

Recruitment

- Crew nationality
- Language onboard
- Selection criteria
- Physical characteristics for the tasks to be done
- Terms & conditions of service
- Appropriate competencies
- Appropriate experience
- Disciplinary & complaints process
- Leave & travel arrangements
- Medical screening

Manning

- Minimum safe manning compliance
- Tasks, duties & responsibilities
- Numbers, grades & roles
- Watchkeeping patterns
- Hours of work & rest
- Fatigue management
- Retention measures
- Continuity at handover
- Succession planning
- Promotion paths

Education & Training

- Required knowledge, skills & abilities
- STCW competencies
- System-specific training
- In-house/onboard training facilities
- Management/leadership training
- Technical training
- Safety & security training
- Induction
- Onboard familiarisation
- Safety drills
- Onboard continuation training
- Distance learning
- CPD

Social & organisational considerations

Organisational Configuration

- International conventions & regulations
- Industry best practice
- Company structure
- Roles & responsibilities
- Company standing orders
- Organisational culture
- Staffing
- Communication & connectivity
- Job design
- Career development

Social environment

- Intended role
- Security as practiced
- Safety as practiced
- Trust
- Ethos, core values, pride, allegiance
- Individual habits & personality
- Leadership styles
- Health & wellbeing awareness – mental & physical
- Risk awareness
- Communication/working language
- Team dynamics

Ways of working

- Environmental/capability stressors
- Impact of fatigue/stress
- Degree of automation
- Policies, processes & procedures
- Guidelines & practices
- Working hours
- Methods of communication
- Information sharing
- Recording, reporting & feedback procedures
- Easy to understand operating instructions & procedures

Human factors considerations

Achieved through Human Factors Engineering (HFE)

Habitability

- Religious & cultural differences
- Need for privacy
- Bathroom facilities
- Messing arrangements
- Facilities for personal recreation & study
- Communications connectivity
- Need for natural light
- Storage space for personal effects
- Furnishing, interior design & decoration
- Cleanability
- Surface coverings

Maintainability

- Shipboard maintenance policy
- Through-life support
- Onboard expertise
- Accessibility
- Provision & location of tools
- Location of heavy spare parts
- Bench space
- Removal routes
- Noise protected communications
- Policy for onboard spares
- Storage of spare parts and supplies
- Handling of heavy parts
- Disposal of parts & equipment

Manoeuvrability

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

Controllability

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

Workability

- The users
- Tasks
- Fitness for task
- Equipment
- Accessibility
- Communications
- Signage
- Protective equipment
- Size, shape & gender
- Strength & stamina
- Posture

Security

- Company/ship physical, documentary & cyber security policies
- Human threat landscape (error, misuse and abuse)
- Relationship between security and safety
- Updating of security knowledge
- Seafarer role in protective measures
- Training for confidence and knowledge
- Awareness of, and response to, threat
- Team cohesion
- Management of security risks

Survivability

- Availability of manpower
- Emergency response systems & procedures
- Ship layout & equipment fit
- Firefighting & damage control systems & equipment
- Lifesaving appliances
- Personal Survival & medical kits
- Search & rescue communications
- Escape & evacuation routes
- Crisis management plans

Occupational Health and Safety

- Company/ship occupational health & safety policies
- Health & wellbeing
- Personal health
- Health awareness – mental & physical
- Short/long term hazards to health
- Safe working practices
- Tripping/falling/bumping/crushing hazards
- Provision, maintenance, access & use of PPE
- Accident recording, reporting, investigation & feedback

System safety

- Hazards to/from crew
- Human element in analysis of risks
- Human element in treatment of risks
- Ability to respond
- Ability to monitor
- Ability to learn
- Ability to anticipate
- Business imperative
- Potential for human & organisational error
- Potential for environmental damage & pollution
- Training & familiarization

Human element **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.

To download this centrespread together with associated centrespreads go to www.he-alert.org/docs/published/he01355 or scan the QR Code

An A to Z of Ergonomics

ATTENTION - the faculty or power of mental concentration. **Divided** ~ applying one's mind to two or more tasks at the same time; **Selective** ~ monitoring several channels or sources of information at the same time so as to perform a single task; **Focussed** ~ concentrating on one channel or source of information; **Sustained** ~ concentrating over a prolonged period of time so as to detect infrequent signals.

BODY MEASURES - the ranges in size, shape and strength of the human body as a function of gender, race, and regional origin (Anthropometrics). The mechanics of human movement (Biomechanics).

CONTEXT OF USE - the users, tasks, equipment (hardware, software and materials) and the physical and social environments in which a system is used.

DISPLAY - a device or feature designed to provide status, position, or condition information to the operator through visual or auditory feedback.

ERGONOMICS - the study and design of working environments (e.g., ship bridges, machinery control rooms, galleys) and their components, work practices, and work procedures for the benefit of the worker's efficiency, effectiveness, health, comfort, and safety.

FUNCTION ALLOCATION - the process by which tasks or functions are allocated between humans and machines/systems, and/or amongst different operators/maintainers.

GOOD PRACTICE - learning from other organisations that have developed successful projects or approaches to problems.

HUMAN PERFORMANCE - human sensory capabilities (e.g., sharpness of eye, hearing ability, sensitivity to touch), and the impact of environmental factors (e.g., lighting, noise) on human sensory systems, as well as mental capabilities for storing and processing information and for making decisions.

INTEGRATED SYSTEM - a collection of applications on computer based systems and equipment designed to provide correct, sufficient, timely and unambiguous information to, and support control by, one or more users.

JOB DESIGN - the specification and achievement of successful job performance, typically focussing on tasks, responsibilities, accountabilities, knowledge and skill requirements.

KNOWLEDGE - a theoretical and/or practical understanding of a subject.

LAYOUT - the integration of people with equipment, systems, and interfaces, such as controls, displays, alarms, video-display units, computer workstations, labels, ladders, stairs, and overall workspace arrangement.

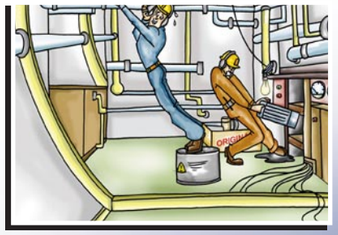
MAINTAINABILITY - designing operational maintenance tasks to be rapid, safe and effective in order to allow equipment and systems to achieve a specified level of performance. This includes consideration of access, removal routes, tools, expertise, disposal, and through life support.

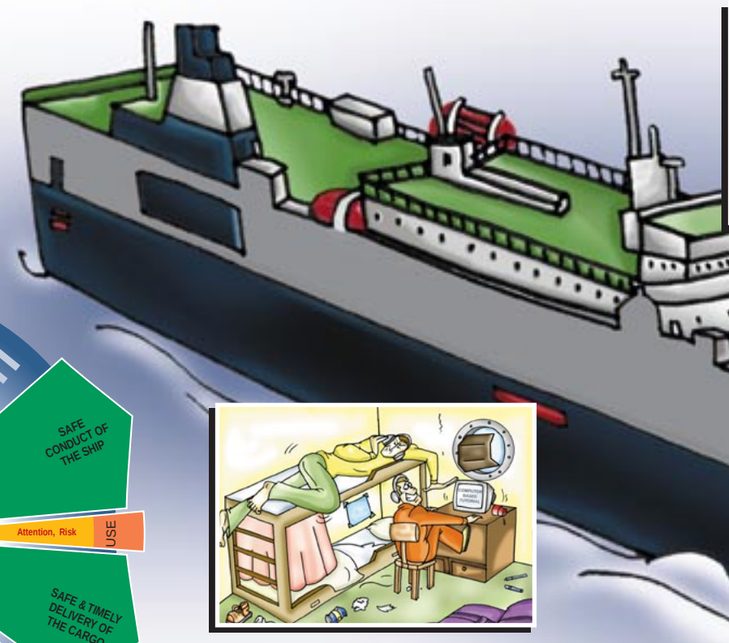
NORMAL - conforming to a standard; regular, usual, typical.

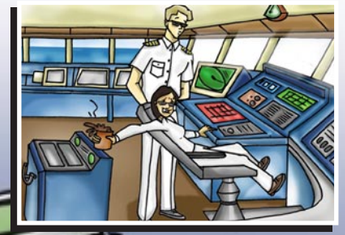
OCCUPATIONAL HEALTH AND SAFETY (OHS) - the effect of work, the working environment and living conditions on the health, safety and well-being of the person.

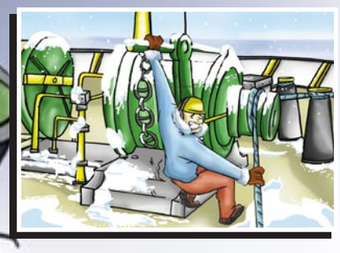
PERFORMANCE SHAPING FACTORS - the environmental, ergonomic and job design factors that are correlated with effective and safe task performance by a human working within a system. (See Alert! Issue No 2).

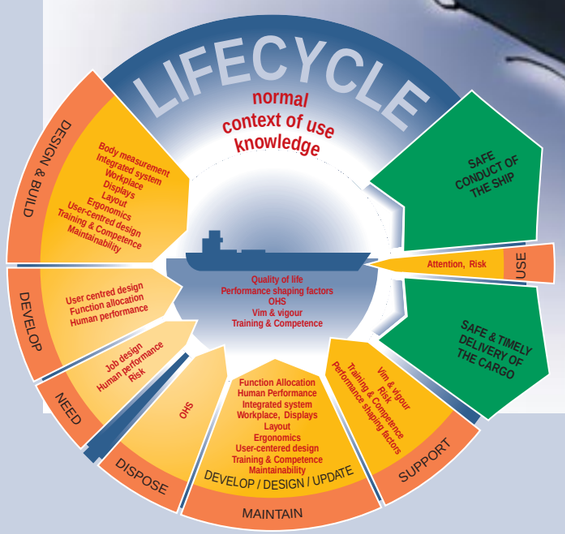
QUALITY OF LIFE - the combination of good occupational health and safety, good workplace design, good management and the impact on a person's physical and psychological fitness to work at sea.











If you don't get the ergonomics right, overall ship performance may be compromised!

WORKPLACE DESIGN - the physical design and arrangement of the workplace and accommodation - the whole ship - taking into consideration environmental conditions such as weather, temperature, humidity, air quality, lighting, noise, vibration, cleanliness, ship motion (pitching & rolling), and its effect on the safety and performance of personnel.

USER-CENTRED DESIGN - designing for users with users, in order to achieve systems that are effective, efficient, safe and satisfying to use.

VIM & VIGOUR - maintenance of strength and stamina through appropriate diet, rest periods, exercise, periodical medical review etc.

TRAINING & COMPETENCE - the development of skills or knowledge through instruction or practice; and the levels of proficiency achieved for the proper performance of functions onboard ship in accordance with internationally agreed criteria, incorporating prescribed standards or levels of knowledge, understanding and demonstrated skill.

RISK - the probable rate of occurrence of a hazard causing harm and the degree of severity of the harm.

SYSTEM - a combination of interacting elements (human and/or machine) organized to achieve one or more stated purposes.

People: Mind, Body & Spirit The 7 needs of the mariner

MIND

Driver	Education, training, competencies	motivator:	Knowledge, understanding, aptitude, skill, proficiency	leads to:	Competence
Driver	Self awareness, self evaluation	motivator:	Mental ability, intelligence, personality, character, sensitivity	leads to:	Attitude
Driver	Communication, direction, teamwork, empowerment, character building	motivator:	Leadership interoperability, adaptability	leads to:	Motivation

BODY

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

SPIRIT

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

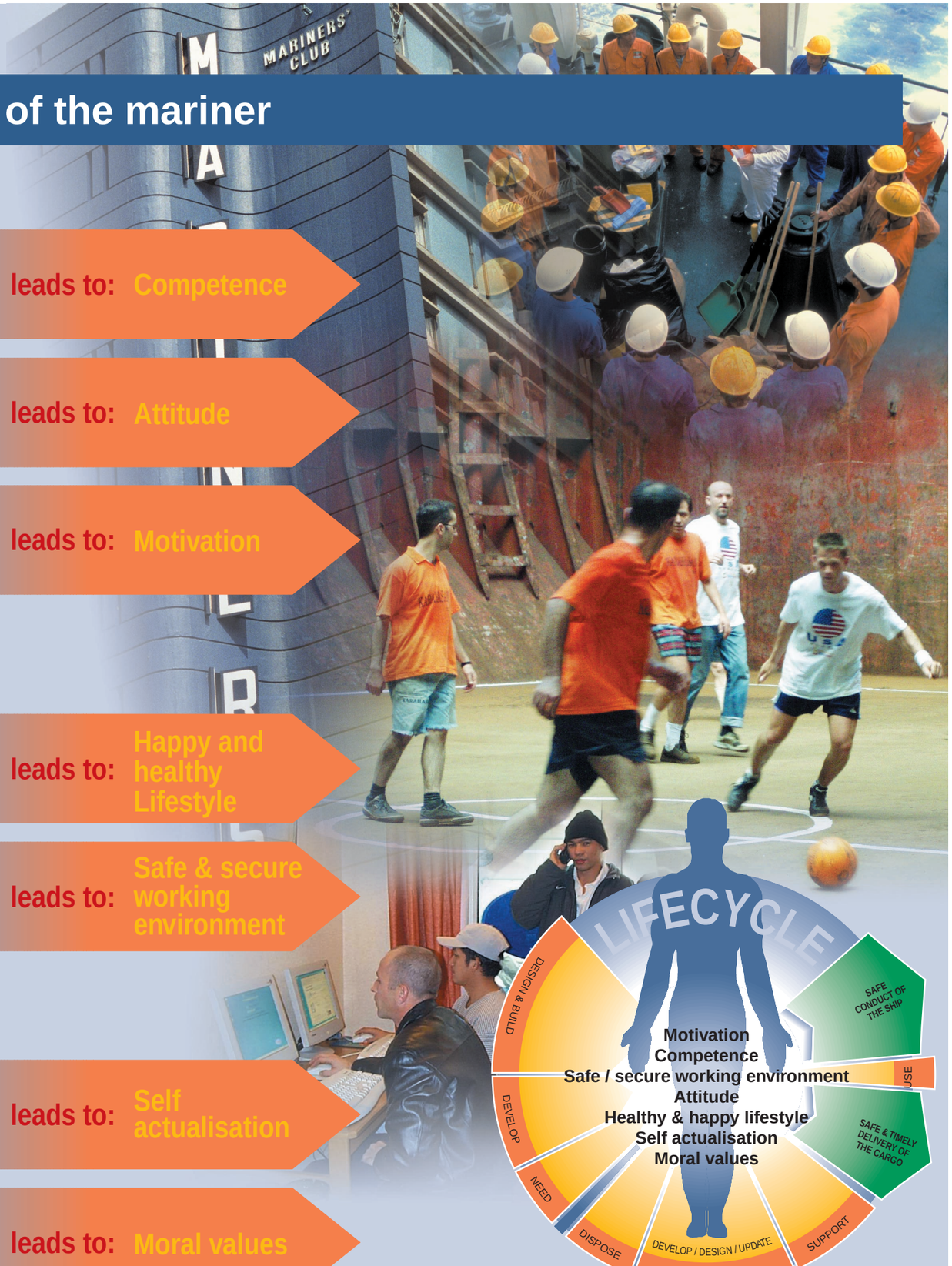
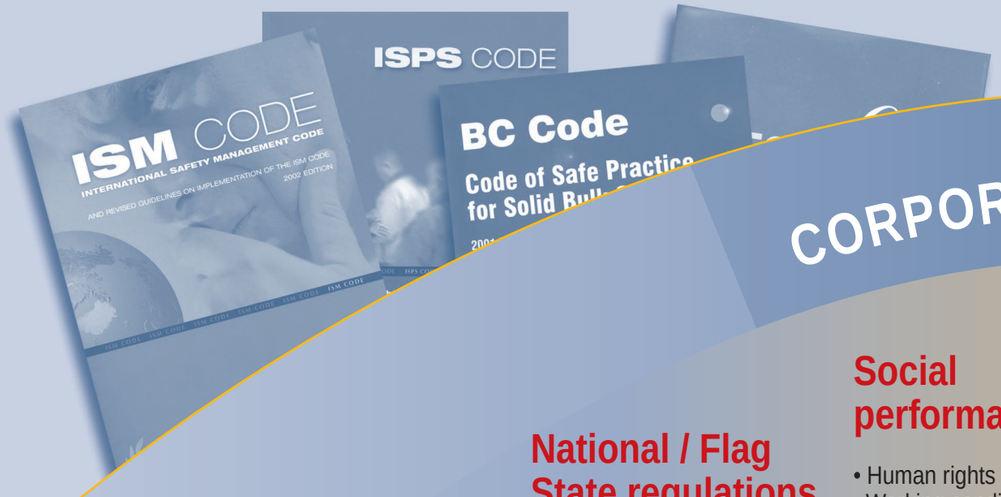


Photo credits: jalens - joachim affeldt, Seamen's Church Institute of Philadelphia and Mission To Seafarers

A total quality lifecycle



CORPORATE SOCIAL RESPONSIBILITY

International conventions, regulations & standards

Minimal International Standards for acceptable practice

- 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 / Flag State regulations, legislation & standards

- National standards for acceptable practice conforming to generally accepted international regulations, procedures and practices
- Classification rules for hull structures and machinery, set by national registered organisations (classification societies)

Social performance

- Human rights
- Working conditions
- Habitability
- Business ethics
- Partnership
- Anti-corruption

Environmental performance

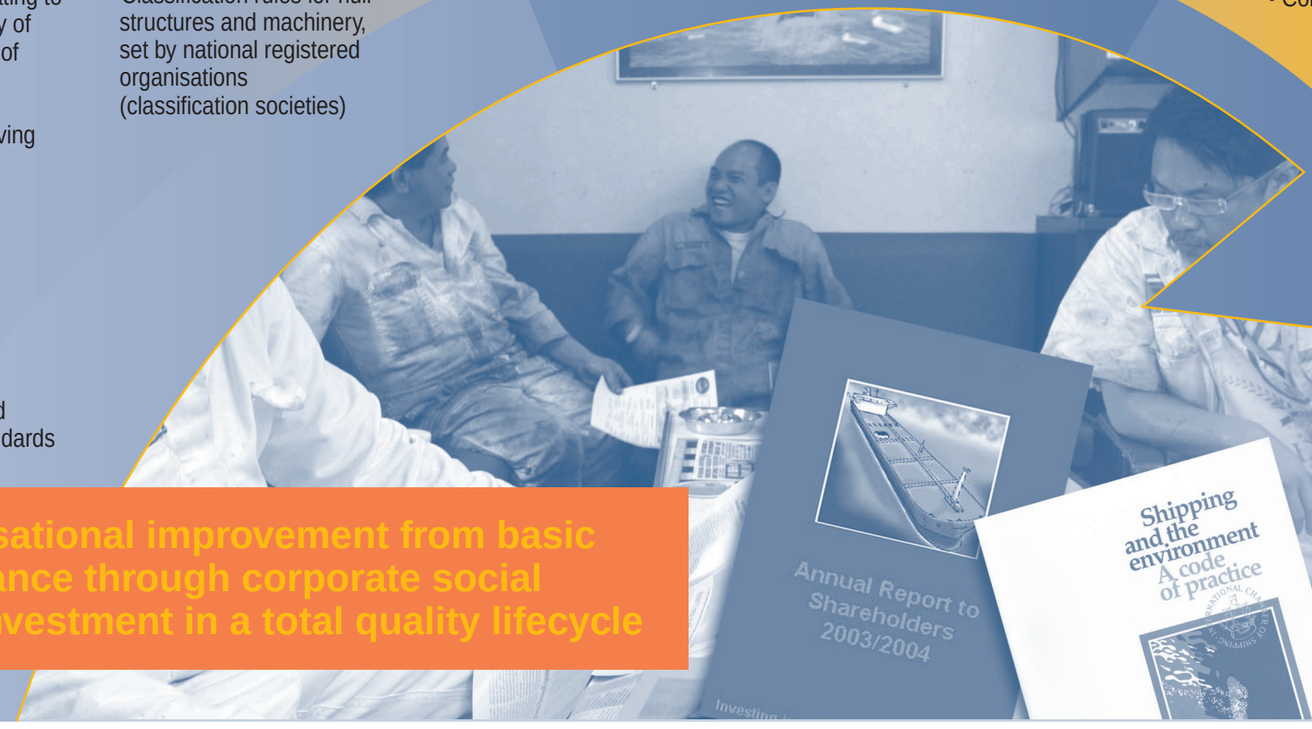
- Education & training of employees
- Regulatory compliance
- Voluntary compliance

Economic performance

- Effective and profitable operation
- Cost competitiveness
- Resource savings - more with less
- Risk reduction
- Regulatory compliance
- Shareholder / investor satisfaction

Industry standards

- Codes of practice
- Environmental awards
- Personal commitment
- Communication
- Company culture



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

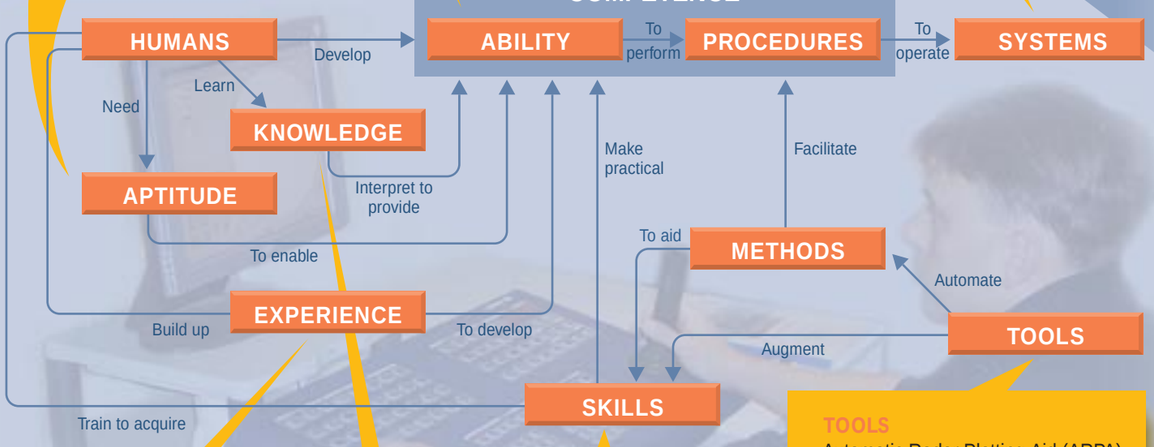
Alert!

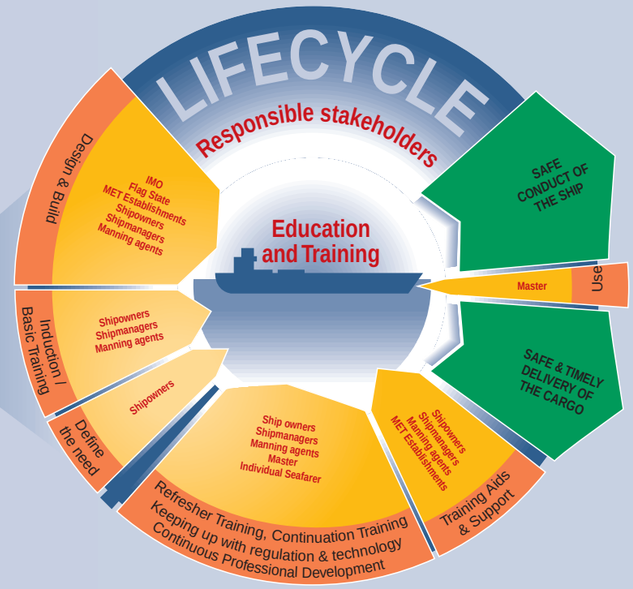
APTITUDE
Language
Attitude
Motivation
Communication
Personal attributes
Moral values
Primary Education
Secondary education
Further education
Higher education

ABILITY
Aptitude
Knowledge
Experience
Skills

COMPETENCE
Operational level
Management level
Support level

SYSTEMS
Ship and machinery control
Navigation and communication
Power Management
Cargo control
Alarms and monitoring equipment
Propulsion control
Surveillance





EXPERIENCE
Proficiency
Professionalism
Continuous assessment
Keeping up with technology
Continuous Professional Development
Lifelong learning

SKILLS
Awareness
Communication
Information management
Language
Leadership
Management
Proficiency
Teamwork

TOOLS
Automatic Radar Plotting Aid (ARPA)
Automatic plotting devices
Electronic Navigation Charts
Temperature monitoring
Electronic logbooks
Liquid level control
Decision support software
Data loggers
Mimic displays

KNOWLEDGE
Controlling the operation of the ship
Care for persons onboard
Cargo handling & stowage
Marine engineering
Maintenance & repair
Electrical electronic & control engineering
Radio communications
Personal survival
Fire prevention & firefighting
Elementary First Aid
Personal safety & social responsibilities
Survival craft & rescue boats
Fast rescue boats
Advanced firefighting
Medical First Aid
Medical care onboard ship
Safety
Security
Management and administration

TRAINING DELIVERY
Induction
On the job training
Distance learning
Computer Based Training (CBT)
Simulation
Training vessel
Onboard continuation training
Refresher training
Task specific training
Cascade training
Self education

OTHER TRAINING NEEDS
NOT CURRENTLY IMO SPECIFIED
AIS
Ballast Water Management
Bridge Resource Management
Crew Resource Management
Diet
Drug and Alcohol Prevention
Electronic surveillance equipment
Enclosed Space Entry
Engine Room Resource Management
Engine Room Systems Management
Environmental Awareness
Fitness and health
Helicopter Operations at Sea
High Speed Navigation
International Safety Management Code
Inventory Control
Leadership and teamwork
Managing fatigue
Maritime Resource Management
Principles behind and operation of IBS and INS
Personal attributes
Practical shiphandling
Risk & Safety Management
The use of electronic charts
Vulnerability of electronic position fixing devices

IMO MODEL TRAINING COURSES
(FOR USE BY TRAINING ESTABLISHMENTS)
Advanced Fire Fighting
Assessment, Examination and Certification of Seafarers
Chief and Second Engineer Officer (Motor Ships)
Crowd Management/Passenger Safety
Dangerous, Hazardous and Harmful Cargoes
Elementary First Aid
Engineer Officer in Charge of a Watch
Tanker Familiarization
Engine-Room Simulator
Fire Prevention and Basic Fire Fighting
General Operator's Certificate for GMDSS
Hull and Structural Surveys
ISPS - Company Security Officer
ISPS - Port Facility Security Officer
ISPS - Ship Security Officer
Marine Accident and Incident Investigation
Maritime Search and Rescue Mission Co-ordinator
Maritime English
MARPOL 73/78 - Annex I
MARPOL 73/78 - Annex II
Master and Chief Mate
Medical Care
Medical First Aid
Officer in Charge of a Navigational Watch
Oil Tanker Cargo and Ballast Handling Simulator
On-Board Assessment
On-Board Ship Administration
Operational Use of ECDIS
Personal Safety and Social Responsibilities
Personal Survival Techniques
Port State Control
Proficiency in Crisis Management/Human Behaviour
Proficiency in Fast Rescue Boats
Proficiency in Survival Craft and Rescue Boats
Radar, ARPA, Bridge Teamwork and Search and Rescue
Radar Navigation, Radar Plotting and Use of ARPA
Radio Personnel
Restricted Operator's Certificate for GMDSS
Safe Packing of Cargo Transport Units (CTUs)
Second-Class Radioelectronic Certificate for GMDSS
Ship Simulator and Bridge Teamwork
Specialized Training for Oil Tankers
Specialized Training for Chemical Tankers
Specialized Training for Liquefied Gas Tankers
Survey of electrical Installations
Survey of Fire Appliances and Provisions
Survey of Life-Saving Appliances and Arrangements
Survey of Machinery Installations
Survey of Navigational Aids and Equipment
Training Course for Instructors

A human-centred approach to ship & system design

Alert!

Mitigating risk to the Human Element

Identify need
Owner / Operator

- Build / buy / charter
- Class
- Flag
- Ship Management
- Crew Management
- Crew nationality

Define concept
Owner / Operator

- Operational role
- Operating pattern
- Trading routes
- Political & economic constraints
- Cost
- Fuel economy

Environment:
- Weather
- Sea conditions
- Temperature
- Humidity
- Light
- Noise
- Vibration
- Ship movement

- System ergonomic requirements
- Human v technology

- Automation
- Manning levels
- Crew capabilities
- Training specification

Define requirements
Operator / End Users

Class notation:
- Type
- Special features
- Service restrictions

Context of use:
- Business
- Task
- User
- Software
- Hardware
- Organisational environment
- Physical environment

Liveware:
- The human element
- Personal capabilities & limitations

Human factors:
- Job, person, organisation & management

Human-human interactions:
- Management
- Supervision
- Crew interactions
- Communications
- Training

Specify functions
Integrator

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

- Habitability
- Maintainability
- Workability
- Controllability
- Manoeuvrability
- Survivability

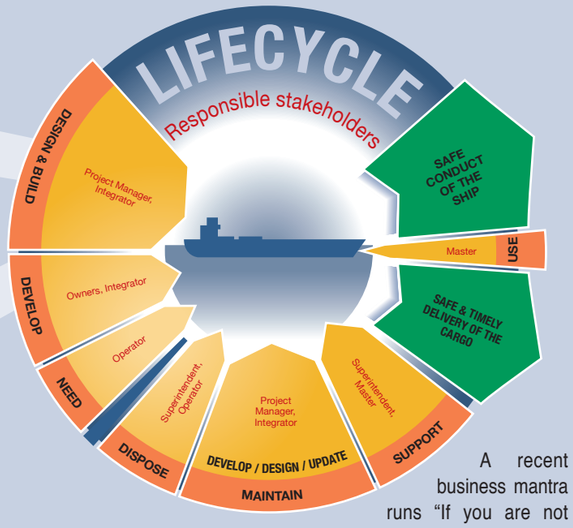
Hardware:
Workstations
Displays
Controls
Accommodation
Galleys
Recreational spaces

Software:
Organisation
Policies
Procedures
Manuals
Checklists
Charts
Drawings
Publications
Information Technology

Design
Shipyard, Suppliers
Trainers

- Hull
- Accommodation
- Machinery
- Systems

Build
Shipyard, Suppliers
Trainers



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

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

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

This centrespread includes a set of checklists for the type and location of human factors data required during the planning and specification of a new ship or ship system. For novel situations, new equipment or unusual manning, new data may be needed. Who collects this data depends on what it is about and how it can be most beneficial. For example, manufacturers are best placed to collect information on the use of equipment, owners for workspaces, and operating companies for training and manning.

An A to Z of Ergonomics
(Alert! issue 3)

Exploring Human Factors
(Alert! issue 2)

Mind, body & spirit
The 7 needs of the mariner
(Alert! issue 4)

The development and maintenance of the human component of ship systems
(Alert! issue 6)

In the next issue:
Shipbuilding

Photo: Harrit & Sørensen a/s

Addressing the human element during build

Alert!

Identify need
Owner / Operator

Define concept
Owner / Operator

Define requirements
Operator / End Users

Specify functions
Integrator

Design
Shipyard, Suppliers
Trainers

Build
Shipyard, Suppliers
Trainers

Test
Shipyard, Suppliers, Owner

Installation & Commissioning
Systems Integrator
Class/Flag

Acceptance testing
Ship builder, Integrator, Owner/Operator, End users, Class/Flag (safety issues)

In service
Owner, Operator

Context of use
Business
Task
User
Software
Hardware
Organisational Environment
Physical Environment

Class notation
Type
Special Features
Service Restrictions

The Human Element
Personal capabilities & limitations
Human Factors
Management
Supervision
Crew interactions
Communications
Crew training/familiarisation

VALIDATION

VERIFICATION

Habitability
Maintainability
Workability
Controllability
Manoeuvrability
Survivability

Type Approval against:
IMO
IEC
ISO
ITU
(Class, Flag, Notified Body)

Checklist
Basic design for people
Standards
Regulation

Integrating people & equipment

Effective
Productive
Acceptable
Safe
Operable

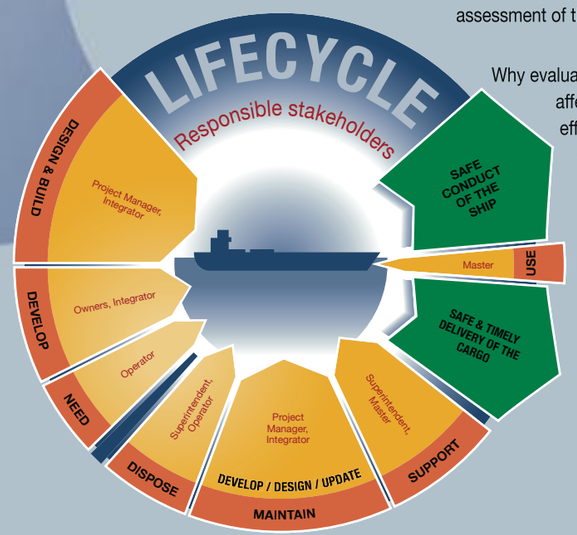
Full operation

Whole ship system
(Task, 'Fit for purpose')

Workstations
Displays
Controls
Accommodation
Galleys
Recreational spaces
Organization
Policies
Procedures
Manuals
Checklists
Charts
Drawings
Publications
Information Technology

Unit/Sub-system

Component



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 decreases motivation.

Photo: Angloeastern Shipping

The human face of regulation — Good intentions and human nature

Alert!

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

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

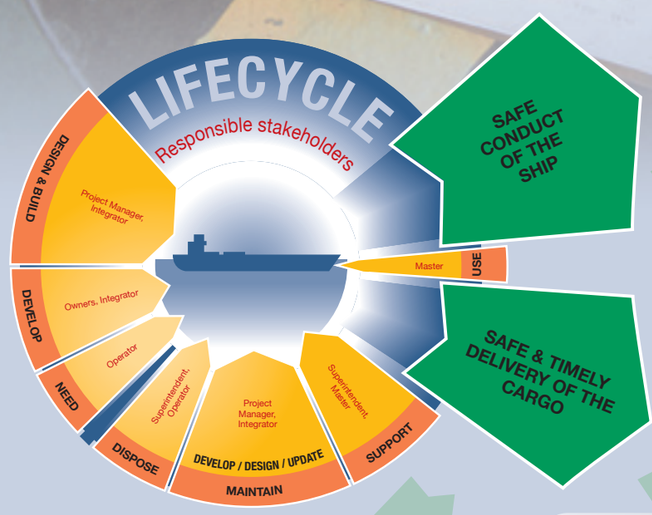
ISM Code

Intent:

- Safe practices in ship operation
- Safe working environment

Side effects:

- Added documentation
- More inspections
- Ever-increasing reliance on checklists
- Violations of poorly specified procedures
- Increase in operational efficiency rather than improved safety
- 'Death by ISM'
- Criminalisation of the seafarer



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

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.

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

COLREGs

Intent:

- Safe navigation of the ship
- Avoidance of collision

Side effects:

- Inability to deal with real situations
- Reluctance to reduce speed
- Disputes over interpretation
- Near misses and forced groundings
- Vessel Traffic Services
- Marine Electronic Highway

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

Photos: jalens - joachim affeldt

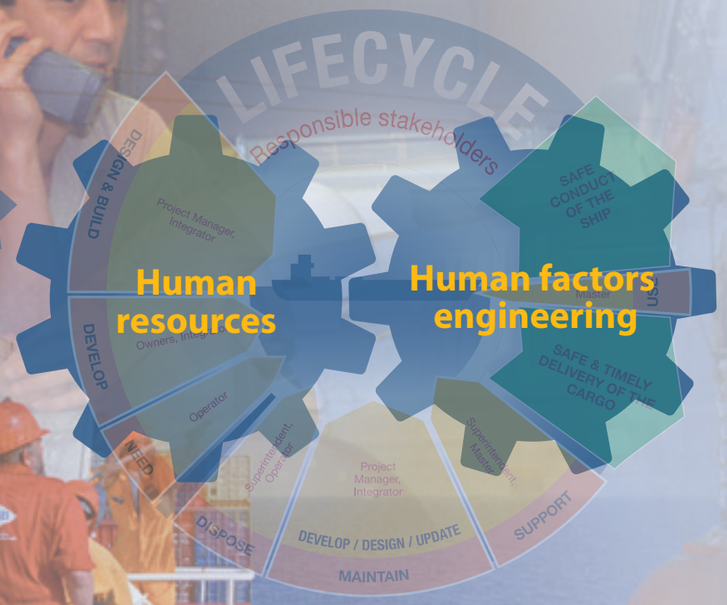
Integrating the human element A rough guide

Alert!

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



Habitability
Comfortable, clean (cleanable) & convivial accommodation, washing & toilet facilities, messrooms, group meeting and exercise areas

Manoeuvrability
The most appropriate manoeuvring capabilities

Maintainability
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

Controllability
Integrating people with equipment, systems and interfaces

Survivability
Adequate firefighting, damage control, lifesaving and security facilities to ensure the safety & security of crew, visitors & passengers

Occupational Health and Safety
The effect of work, the working environment and living conditions on the health, safety and wellbeing of the person

System safety
The risks from people using (or misusing) the system

Photography: jalens - joachim affeldt

Human resources considerations

Manning:
- 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
- Cleanability
- Surface coverings
- Shipboard maintenance policy
- Tripping / falling / bumping / crushing hazards
- Signage
- Understandable operating instructions & procedures
- Company culture

Human factors engineering considerations

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

Maintainability:
- Through-life support
- Onboard expertise
- Accessibility
- Provision & location of tools
- Location of heavy spare parts
- Bench space
- Removal routes
- Noise protected communications
- Policy for onboard spares
- Storage of spare parts and supplies
- Handling of heavy parts
- Disposal of parts & equipment

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

Controllability:
- 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

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

System safety:
- Hazard 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

Survivability:
- Availability of manpower
- Emergency response systems & procedures
- Ship layout and equipment fit

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

Photography (except bridge image): jalens - joachim affeldt

Fatigue Causes, effects and mitigation

Alert!

Causes

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

Effects

- Inability to concentrate
- Slow response
- Loss of control of bodily movements
- Mood changes
- Headaches
- Heart palpitations / irregular heart beats
- Rapid breathing
- Diminished decision - making ability
- Poor memory
- Attitude changes
- Giddiness
- Sudden sweating fits
- Insomnia
- Loss of appetite
- Leg pains / cramps

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 caffeine 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

Master

- 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
  - Shore leave, onboard recreation & family communication
  - Workable & safe watchkeeping arrangements
  - Job rotation
  - Crew education & training to recognise & 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 resources
- Ensure adequate heating, ventilation, air-conditioning & lighting
- Minimize noise & vibration
- Establish shipboard practices for dealing with fatigue incidents
- Encourage healthy lifestyle

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
  - 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 recognise & 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
- 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

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
- Design control centres, machinery control rooms, cargo control rooms etc, bearing in mind the integration of people with equipment, systems and interfaces, & the need to avoid boredom monotony, reduced vigilance and mental overload

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

Alert!

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.

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.

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

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, are 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'.

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.

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.

Noticeboards
For the display of important information to the crew, such as watch and station bills, safety notices, company bulletins, social events etc..

Orders, instructions & procedures
The 'what to do' and 'how to do it' of safe ship operations. All should be clearly defined, easy to understand and in a working language or languages understood by the ship's personnel.

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.

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.

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.

SMCP
Standard Marine Communication Phrases. A comprehensive standardized safety language, covering all major safety-related verbal communication, including phrases to cover the more important safety-related fields of verbal shore-to-ship, ship-to-shore, ship-to-ship and on-board communications.

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.

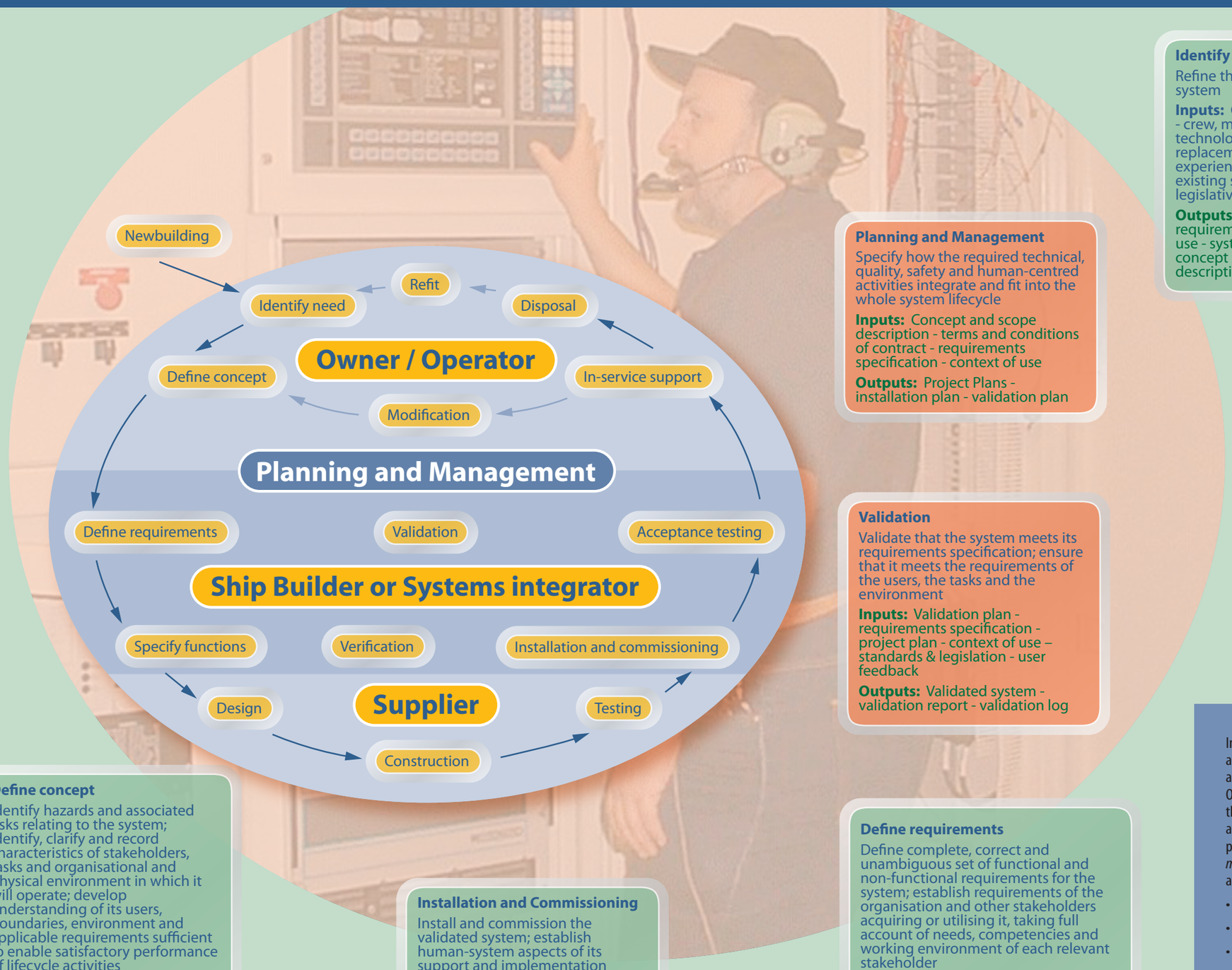
User feedback
Seeking the input of those who live and work aboard ship in order to improve the design of the ship and its systems, in terms of its habitability, maintainability, workability, controllability, manoeuvrability and survivability.

Visual signals
The use of flags, signs, symbols, hand signals and gestures to inform, direct and communicate especially to those who have difficulty in understanding and communicating because the commonly used language onboard is not their native language.

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.

Automation - Trust and Dependability

Alert!



Identify need

Refine the need for a system

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

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

Planning and Management

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

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

Outputs: Project Plans - installation plan - validation plan

Design

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

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

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

Validation

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

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

Outputs: Validated system - validation report - validation log

In-service support

Operate and maintain the system to keep the required dependability

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

Outputs: Operation & maintenance log - monitoring log

Define concept

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

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

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

Installation and Commissioning

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

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

Outputs: Installed system – Trained users

Define requirements

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

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

Outputs: Requirements specification - revised context of use

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

- Promotes a systems-oriented view of software intensive systems development;
- Gives user and usability requirements equal emphasis with technical requirements;
- Takes account of operation and maintenance;
- Supports the assessment of innovative designs;

And

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

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

Exploring rogue behaviour

Alert!

Apathy
Lack of interest or concern

'I don't care'

Solution:

- Check for illness, fatigue, 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

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')

Invulnerability
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

Assumptions
Facts, orders or statements that are taken for granted

'I though that was what you said'

Solution:

- Do not be afraid to seek clarification of what is said
- Do not act on scant information

Drudgery
Dull, irksome, fatiguing, uninspiring 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

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
- Check the facts on which a view is based

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
- Promotion/changes in responsibility
- Encourage team work and interaction

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

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

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 procedure
- Conduct regular table top exercises on lessons learned from accident investigation reports
- Leadership and assertiveness training
- Crew Resource Management training

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

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 procedure
- Learn from the mistakes of others
- Conduct regular table top exercises on lessons learned from accident investigation reports

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

Ignorance
Lack of knowledge, education or awareness

'I don't know'

Solution:

- Consistency in standards of education and training
- Task/system specific training, taking into account the job, the operational role and operating pattern of the ship, and the environment in which it is likely to work
- Clear and concise technical operating and maintenance manuals
- Make it OK to observe on the performance of a colleague or superior
- Make it OK for anyone to ask for a check/critique

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

Contempt
The taking of unnecessary risks, with scant regard for regulations and guidelines

'It won't happen to me'

Solution:

- Do not take unnecessary risks
- Ensure compliance with regulations and follow proper procedure
- Conduct regular table top exercises on lessons learned from accident investigation reports
- Leadership and assertiveness training
- Crew Resource Management training

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

Seclusion
Shutting away or keeping apart from others

'Leave me alone'

Solution:

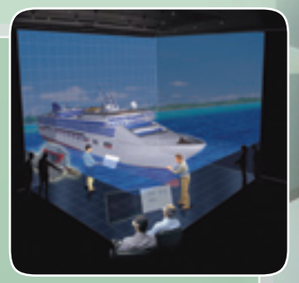
- Seek support from peers
- Seek guidance from the more experienced
- Leadership and assertiveness training
- Crew Resource Management training

photos: Seafarers International Research Centre

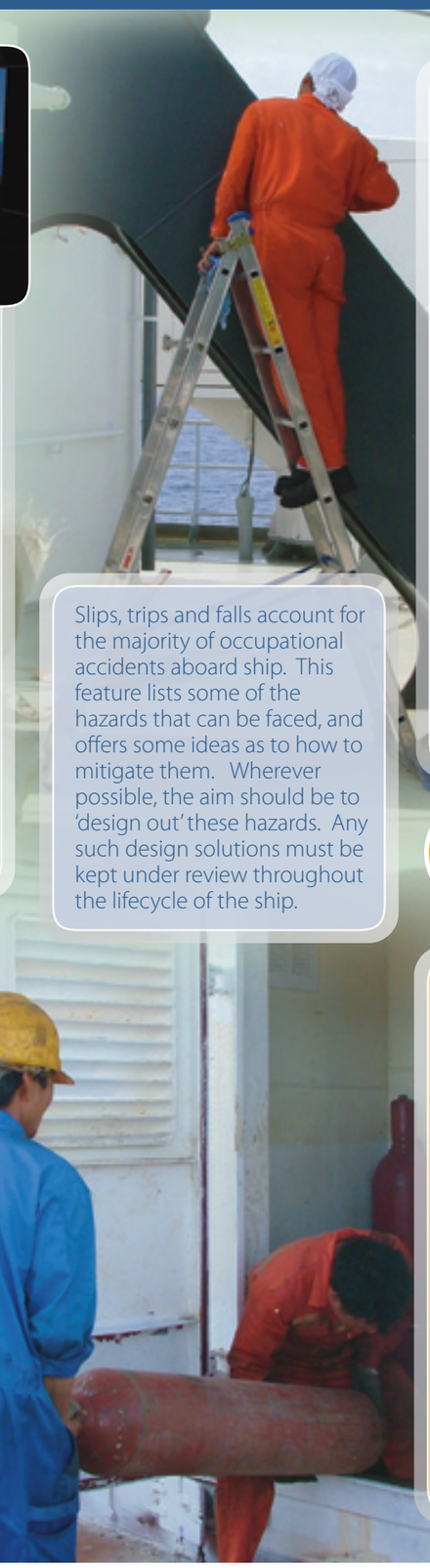
Mitigating slip, trip and fall hazards

Alert!

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



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.

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
- Unguarded openings
- Unguarded ladders or platforms
- Unstable work surfaces
- Vertical unprotected ladders
- Working over the side or aloft

Hazards

Build

- Employ the operational experience of seafarers
- Seek advice from Human Factors specialist
- Ensure unguarded openings are properly guarded
- Ensure gangways are properly secured
- Ensure all handrails are secure
- Ensure ladders (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 skid areas

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 arrester systems
- Wear correct personal protective equipment (PPE)
- Wear lifejackets when working in the vicinity of ship's side
- Wear safety harness when aloft

Trips

- Loose fittings on stairs
- Carrying of stores/equipment obscuring view
- Changes of deck level
- Cleats, bitts, 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
- Trailing wires and cables and hoses
- Uneven surface or steps
- Unmarked deck fittings

Maintain

- 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 ladders (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

'Hazard' photos: Seafarers' International Research Centre

The good guide to seafarer health, safety and wellbeing

Alert!

Accident prevention
Create and maintain a safe working environment and promote safe behaviour through a programme of proactive accident prevention by identify 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 particularly 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 and 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 fulfilment 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 to prevent diseases and improve health overall.

Occupational Health
Ensure the health, safety and wellbeing of all onboard through good and effective 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, gymnasiums, 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, incidences 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)!

Photo credits: Tabletennis - ICSW. All others - SIRC

Recruitment & retention - perceptions, experience & expectations

Alert!

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

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'

Train

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

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

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

Photos: Jalens

Education, training & development - a route map

Alert!

Entry

- Secondary Education

Induction

- Initial briefing
- Introduction to the industry
- Introduction to the workplace
- In-house Training
- Company Familiarisation

Vocational

- Further / Higher Education
- Work-based training

Basic Training

- Underpinning Knowledge
- STCW Short Courses

Academic

Certificate / Diploma / Degree

Task / System Specific Training

Continuation Training

Advancement

- Promotion onboard or into Shore Management
- General maritime sector activities

Diversification

- Post-Graduate Education (Masters / Degree / Doctorate)
- Advanced Skills Training

Continuing Professional Development

Guidelines for action

- Take a risk-based approach to examine historical events and future plans
- Adopt standards of competence
- Assess competency on the job (at sea).
- Prioritise critical competencies
- Determine the most effective training solutions to meet need
- Instigate internal and external audit processes for training performance and learning outcomes
- Measure consequences of training on the business

CMS process

1. Examine business goals
2. Identify competence needs
3. Assess seafarer competency
4. Map competence gaps
5. Plan gap closure
6. Implement training solutions
7. Evaluate results

STCW Qualifications

COMPETENCE

HUMANS — Develop → ABILITY — To perform → PROCEDURES — To operate → SYSTEMS

HUMANS — Learn → KNOWLEDGE — Interpret to provide → ABILITY

HUMANS — Need → APTITUDE — To enable → ABILITY

HUMANS — Build up → EXPERIENCE — To develop → ABILITY

ABILITY — Make practical → SKILLS

PROCEDURES — Facilitate → METHODS

METHODS — To aid → SKILLS

TOOLS — Automate → METHODS

TOOLS — Augment → SKILLS

HUMANS — Train to acquire → SKILLS

Continuing professional development

- **Research** — What do you want? How can it be achieved?
- **Plan** — A CPD plan tailored to your needs
- **Activities** — Actual learning, courses, activities to promote your CPD
- **Reflect** — Critical analysis of the impact of your efforts

Information management - bringing it all together

Alert!

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
- Valve 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 (QSEMS)
- 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. swine flu)
- System/Equipment manuals
- Operating instructions

Education & Training

- Records of Training
- Training Videos/DVDs
- 'Getting started'DVDs for new equipment
- CBT programmes
- Posters
- Magazines and bulletins

Regulation

- Official Log Book
- Garbage Record Book
- Radio Log Book
- Hours of rest records
- Ship security records
- Closing of Openings Record Book
- Controlled Drugs Register
- Muster lists
- Ship's certificates
- Certificates of competency
- Ballast water exchange log book

- ISO 9000 and 14000 records
- TMSA records
- Charterer requirements records
- Software/data version control

Ship's Administration

- Crew lists
- Stores Declaration
- Crew Agreement
- Bunker Declaration
- Standing Orders/Instructions
- Garbage Management Plan

Navigation & Communications

- Integrated Bridge System
  - Passage execution
  - Communications
  - Machinery control
  - Loading, discharging and cargo control
  - Safety and security
- Electronic Chart Display and Information Systems (ECDIS)
- Alarms
- Charts (ENC or paper)
- Magnetic compass
- Gyro compass
- Radars
- Automatic radar plotting aids
- Echo sounders
- Speed/distance indicators
- Rudder angle indicators
- Propeller direction/revolution indicators
- Rate-of-turn indicators
- Radio-direction finders
- GPS/GLONASS
- DGPS/DGLONASS
- Long Range Identification and Tracking (LRIT)
- Loran
- Voyage Data Recorder (VDR)
- Voyage Management System
- Route planning data
- Bridge movement book
- Compass deviation book
- Deck log book

- Records of navigational activities
- Voyage analysis reports
- Checklists
- System/Equipment manuals
- Operating instructions
- Standing Orders/Instructions

- Compass deviation curve
- Manoeuvring information
- Radar shadow sector diagram
- Ship Radio Licence
- R/T operating instruction cards

- Meteorological services and warnings
- Search and rescue services
- Ships' routeing
- Ship reporting systems
- Vessel traffic services
- Aids to navigation
- Nautical charts & publications
- Life-saving signals
- Danger messages
- Distress messages
- Port Guides
- Notices to Mariners
- Flag State Notices and Regulations

Marine Engineering & Electro-technical

- Machinery control and surveillance systems
- Vibration monitoring
- Planned Maintenance
- Conditioned based maintenance
- Power Management Systems
- Survey and inspection reports

- Engine room log book
- Fresh Water Maintenance Log
- Bunker Declaration
- Oil Record Books
- Sounding book

- Bilge Sampling records
- Oily Water Separator (OWS) Performance Analysis
- 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

Emergency & Security

- Shipboard Emergency Plans
- Stability, loading and ballasting information
- Damage control plans
- Ship Security Plan
- Ship's drawings
- Position reports
- Port documents
- Cargo plans
- Loading/discharge plans
- ISPS documentation
- Anti-piracy guidance
- LSA manufacturer's instructions
- Confidential reporting scheme summaries
- National incident investigation body reports
- Search and rescue capability during passage
- Offship communications during emergency (Owner, SAR, Technical support...)

Personal

- Crew phone/text/email
- Crew internet
- Entertainment (DVD/CD/Games)

Communication systems

- VHF DSC
- VHF radiotelephony
- MF DSC
- Imarsat
- EPIRB
- Maritime Safety Information
- NAVTEX/SafetyNET
- Email
- Telephone
- Facsimile
- Telex
- System/Equipment manuals
- Operating instructions

Communication modes

- Person to person
- Email
- Telephone
- Facsimile
- Telex
- Mail
- Paper
- AIS
- Computer print out

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
- Audit
- 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 it 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** - user's attention is directed towards information required
- **Legibility** - information is easy to read
- **Comprehensibility** - meaning is clearly understandable, unambiguous, interpretable, and recognizable

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

Alert!

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, 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 the 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/ Administrations

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 (as amended); the International Regulations for Preventing Collisions at Sea, 1972 (as amended); and STCW 1978 (as amended)
- the contents of the ILO Maritime Labour convention 2006 (MLC, 2006)
- the rights, 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, so as to reduce the risk to passengers, crews and port personnel and 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

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

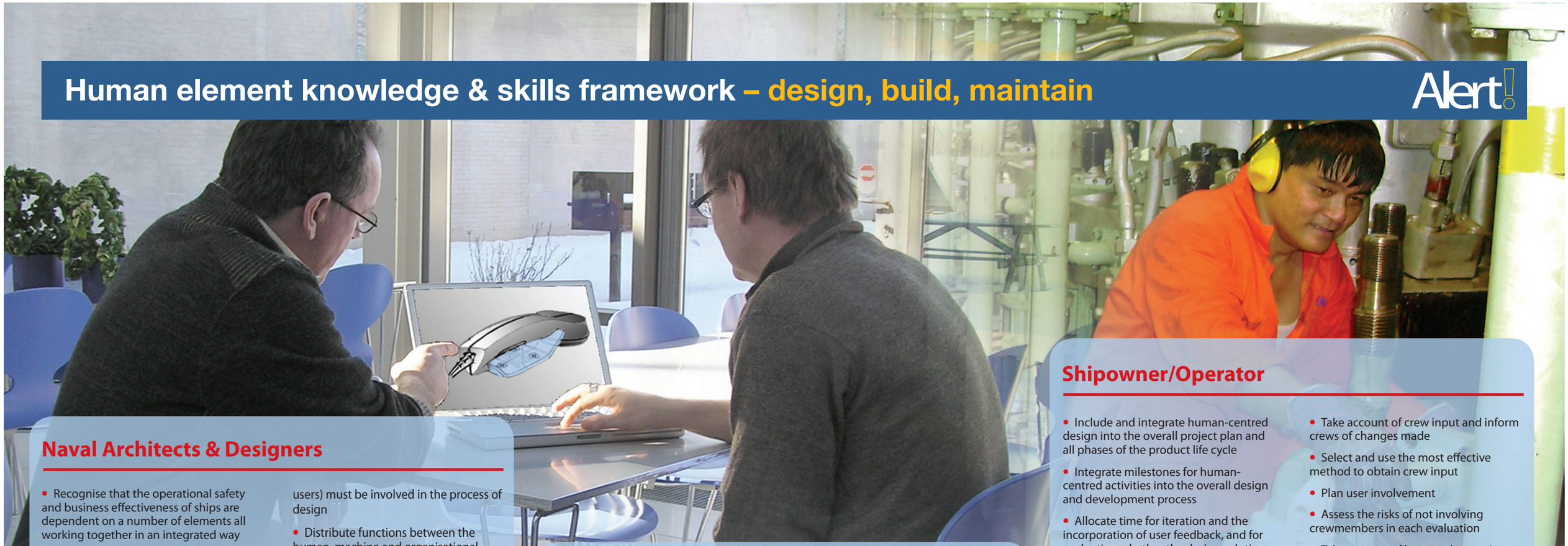
Be fully conversant with and fully understand the need to implement:

- pertinent IMO, ILO, WHO and other regional instruments relevant to maritime safety and protection of the marine environment
- 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 and to the vessels and their cargoes, in accordance with the requirements of the ISPS Code

Crew photograph: Jalens
Conference photograph: IMO

Human element knowledge & skills framework – design, build, maintain

Alert!



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

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

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 mindful 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

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

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 guides
- Define and maintain human element processes, methods, tools, techniques and test facilities
- Perform research into required ship and system usability for future operating concept
- 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 benefits
- Identify human element issues and aspects of ship operation and design that require crew input
- Take account of crew input and inform crews of changes made
- Select and use the most effective method to obtain crew input
- Plan user involvement
- Assess the risks of not involving crewmembers in each evaluation
- Take account of human element issues in acquisition
- Include human element review and sign-off in all reviews and decisions
- Take effective actions to address human element risks
- Assess the extent to which human element considerations are likely to be met by proposed operations
- Review the design and operation of the ship for adherence to regulations and industry guidelines
- Analyse feedback on the operation of the ship and inform the company of emerging issues
- Maintain contact with all involved staff throughout the introduction of the ship or new operation
- Test that the ship and its systems will meet the needs of the crew, the operation and the environment
- Build the required competencies into training and awareness programmes
- Identify, specify and deliver the training and support for the operation of the ship

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

Lefthand image - copyright: Harrit & Sorensen a/s

A human-centred approach to HSEQ

Alert!

LEADERSHIP – COMMUNICATION – COMMITMENT

Manoeuvrability

Maintainability

System safety

Occupational Health and Safety

Personnel

Manning

Planning
Resources
Resonsibilities & authories
Risk assessment
Corrective action etc.

Implementation
Shipboard operations
Drills & exercises
Recruitment & training etc.

- 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

Safe conduct of the ship
Safe & timely delivery of the cargo

- STCW
- Investing in people
- 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

Managers

DPA

Ship

- Feedback
- Education & training
- Corrective action
- Preventive action
- Safety alerts
- Security alerts
- Case studies

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

Training

Workability

Controllability

Habitability

Survivability

Analysis

Feedback
Internal audits
Management review
Accident reports
Non-conformities etc.

Photo: Joachim Affeldt

Maritime Educators and Trainers – Knowledge, Skills & Attributes

Alert!

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

Human element
- Understanding the Human Element
- Relevance in design, build and operations
- Benefits of addressing the human element
- Regulatory expectations
- Basic Ergonomics and the effect of context of use on human performance

Subject matter knowledge
- Having a generous foundation of knowledge

Training design
- Psychology of learning
- Knowledge of lesson planning procedures
- Identifying and writing lesson objectives
- Selecting instructional methods and materials
- Planning assessments

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

Experience
- Currency
- Leadership
- Professional judgement
- Technical skills

Safety awareness
- Setting a good example
- Basics of accident investigation

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
- Taking account of impact of other duties and time available for training
- Applying a human-centred approach to the design of training

Technical proficiency
- Having a deep understanding of the subject
- Understanding the difficulties that non-experts have with a subject

Leadership, management, and cultural awareness
- Training of leadership skills
- Motivation of people
- Working together with different nationalities, religions and mentalities
- Affect of ergonomic factors on performance and motivation

Pedagogy
- Understanding the fundamentals of pedagogy
- Understanding of instructional strategies

Teaching Ability
- Ability to transfer skills and knowledge to a diverse audience
- Building learner confidence in the instructor and promoting credibility
- Facilitating learning and answering questions
- Solid presentation skills
- Classroom management skills
- Teaching methodologies
- Ability to gauge learner understanding through facial expressions, body language and comments
- Ability to read, write, synthesize, evaluate, make decisions and communicate ideas
- Use of feedback to improve teaching and materials

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
- Human-centred approach in training design

Understanding
- Flexible in teaching style
- Adaptable
- Understanding of human nature
- Awareness of the usability of the training delivered
- Awareness of the ergonomics of training

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

Personnel – Recruitment and retention, identification of required skills, crewing mixes, maintenance of competencies

Alert!

Plan
- Competence Management planning
- Crewing mixes
- HR KPIs
- Human resources strategy
- Human resources technical best practices
- Identification of required skills
- Maintenance of competencies

Attract
- 'A job for life'
- Career development
- Company branding
- Contact with home
- Decent working and living conditions
- Fair salaries
- Fair terms of employment
- Fair treatment
- Family support
- Good career prospects
- Good safety record
- Happy & healthy lifestyle
- Health protection,
- High tech ships & systems
- Medical care
- Quality of life
- Reputation
- Respect
- Responsible employer
- Safe & secure working environment

Recruit
- Ability
- Aspirations
- Commitment
- Education
- Motivation
- Self discipline

Lifecycle
(See also **Alert!** Issue No. 19)

Induct
- Welcome into the Company
- Joining 'The Team'

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

Mentor
- Advisor
- Experience
- Inspiration
- Leader
- Motivator
- Network enabler
- Role model
- Wisdom

Retain
- Supporter
- A job for life'
- Career development
- Career progression
- Company branding
- Contact with home
- Decent working and living conditions
- Fair salaries
- Fair terms of employment
- Fair treatment
- Family benefits
- Forward planning
- Good career prospects
- Happy & healthy lifestyle
- Health protection
- High tech ships & systems
- Medical care
- No blame culture
- Quality of life
- Respect
- Retirement planning
- Safe & secure working environment
- Stability of employment
- Support from ashore
- Training
- Two-way communication

Considerations (See also **Alert!** Issue No. 11)

Manning
Numbers required to do the job in both normal and emergency situations

Personnel
Ensuring the correct mix of people onboard to operate and maintain the ship and its systems

Training
Competency and familiarity with the ship and its systems

Human Resources

Achievers (See also **Alert!** Issue No. 4)

Competencies, Education, Training	Aptitude, Knowledge	Proficiency	**Competence**
Self-awareness, Self-evaluation	Character, Intelligence, Mental ability	Personality, Sensitivity	**Attitude**
Character building, Communication, Direction	Empowerment, Teamwork	Adaptability, Interoperability	Leadership	**Motivation**
Balanced diet, D&A testing, Exercise, Habitability	Hygiene, Medical screening, Recreation, Rest	Energy, Physical Fitness, Physical strength	Stamina, Wellbeing	**Happy & healthy lifestyle**
Ergonomics, Physical security	Protective equipment, Safe working practices	Safety culture, Security awareness	**Safe & secure working environment**
Conscience, Cultural integration, Leadership	Personal Ethics, Remuneration, Supervision	Esteem, Expectation, Fellowship, Identity, Loyalty	Security, Sense of belonging, Sense of purpose, Trust	**Self-actualisation**
Faith, Religious belief	Self-discipline	Cultural awareness	**Moral values**

The complete guide to ship manning

Alert!

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))
www.imo.org/KnowledgeCentre/IndexofIMOResolutions/Documents/A%20-%20Assembly/1047(27).pdf
- A rough guide to Minimum Safe Manning
www.he-alert.org/documents/published/HE01125.pdf
- Recommendations Relating to the Application of Requirements Governing Seafarers' Hours of Work and Rest
www.ocimf.com/mf.ashx?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

Fatigue management

Causes, effects and mitigation

- Alert! Issue 13 Centrespread
www.he-alert.org/documents/centrespreads/centrespread_13.pdf
- Alert! Issue 13 Vodcast
www.he-alert.org/user/vodcast13.asp

Responsibilites

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)
www.imo.org/OurWork/HumanElement/VisionPrinciplesGoals/Documents/1014.pdf
- Crew Endurance Management System (USCG)
www.he-alert.org/documents/published/HE00520.pdf
- Crew Endurance Decision Support Software
www.uscg.mil/hq/cg5/cg5211/docs/DSS.zip
- ISF Watchkeeper
www.home.isfwatchkeeper.com
- MARTHA
www.warsashacademy.co.uk/about/resources/martha-software-and-documents.zip
- MLC 2006 Pocket Checklist
www.ukpandi.com/fileadmin/uploads/uk-pi/LP%20Documents/Checklists/ILO%20MLC%20pocket%20checklist_September%2012.pdf
- ILO MLC Smartphone App
www.ukpandi.com/loss-prevention/apps/
- Fatigue Advisor Resource (Maritime New Zealand)
www.he-alert.org/documents/published/he01130.pdf
- Wheelhouse Fatigue Checklist (Maritime New Zealand)
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/mf.ashx?ID=9d7d7e0f-562f-4a2e-96aa-481565bc9e7a
- The Nautical Institute Fatigue Forum
www.nautinst.org/en/forums/fatigue/index.cfm

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

An A to Z of maritime education and training

To access all the source documents, scan the QR Code

Alert!

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/HE00785.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

www.he-alert.org/documents/bulletin/Alert!_20.pdf

Alert! Issue No. 31, page 6

www.he-alert.org/documents/bulletin/Alert!_31.pdf

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

www.he-alert.org/documents/published/he01150.pdf

The Manila Amendments to the Seafarers' Training, Certification and Watchkeeping (STCW) Code, Regulation B-I/6 Art 6-11

www.he-alert.org/documents/published/he01155.pdf

Work-based learning - the development of vocational learning and skills whereby the student has the opportunity to apply in the workplace the academic knowledge acquired while at University/College

www.he-alert.org/documents/published/he01160.pdf

Self-directed learning - A process in which students take the initiative to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes.

Blended learning - a flexible approach to delivery that combines distance learning/ e-learning/ work-based learning with face-to-face university/college teaching/ learning methods

Education & training
Education – 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

www.he-alert.org/documents/bulletin/Alert!_6.pdf

FAMILIARISATION
Knowledge and understanding of a ship and its systems

Alert! Issue No. 8, page 1

www.he-alert.org/documents/bulletin/Alert!_8.pdf

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 teamworking skills at operational level, and leadership and managerial skills at management levels

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

http://www.mindtools.com/pages/article/cultural-intelligence.htm

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

Attribute – a quality or characteristic of a person

Alert! Issues 22-30

www.he-alert.org/user/download.asp

LIFELONG LEARNING
Ongoing learning activity, to improve knowledge, skills and competence. A key component of Continuing 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.he-alert.org/documents/bulletin/Alert!_20.pdf

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/bulletin/Alert!_31.pdf

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

www.he-alert.org/documents/bulletin/Alert!_20.pdf

ON JOB TRAINING
Onboard continuation training and drills 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/bulletin/Alert!_20.pdf

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

www.he-alert.org/documents/centrespreads/centrespread_4.pdf

http://en.wikipedia.org/wiki/Personal_development

QUALITY ASSURANCE
To verify the quality of maritime training providers globally to a uniform standard

www.dnv.in/industry/maritime/servicessolutions/competence/classificationoftraining/CertificationofManagementSystems.asp

REMINDERS
The use of aide-mémoires, performance aids, reminder cards, cribsheets, 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 to have an up to date appreciation of modern day ship operations and of the new technology aboard ships

Alert! Issue No. 6, page 6

www.he-alert.org/documents/bulletin/Alert!_6.pdf

Alert! Issue No. 20, page 2

www.he-alert.org/documents/bulletin/Alert!_20.pdf

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.he-alert.org/documents/bulletin/alert!_20.pdf

www.mntb.org.uk/en-GB/National-Occupational-Standards

www.investorsinpeople.co.uk/Needs/BusinessPriorities/DevelopingPeople/Pages/default.aspx

Photo: Vario Images, VP 3673362, Student in shipping training room

Habitability A rough guide to MLC 2006 Regulation 3.1 Accommodation and recreational facilities

Alert!

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, panelling 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
- Adequate ventilation
- Air conditioning
- Independent ventilation to open air for sanitary spaces
- Adequate heat

A3.1.8 Lighting
- Sleeping rooms and mess rooms lit by natural light plus adequate artificial light

A3.1.9 Sleeping accommodation
- Individual sleeping room for each seafarer
- Separate sleeping rooms for men and for women
- Adequate size and properly equipped to ensure reasonable comfort and to facilitate tidiness
- Separate berth for each seafarer
- Minimum inside dimensions of a berth
- 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
- 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 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, chests 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

To download this centrespread with links scan the QR code

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

Ergonomics and maintainability A rough guide

Alert!

Ergonomics and the work environment

Manual valve operation, access, location and orientation

- Guidance Notes for the Application of Ergonomics to Marine Systems, Section 9 - ABS (2013)

Stairs, vertical ladders, ramps, walkways and work platforms

- Guidelines for the Design of the Means of Access for Inspection, Maintenance and Operation of Commercial Ships - Bureau Veritas (2008)
- 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
- Guidance Notes for the Application of Ergonomics to Marine Systems, Section 7 - ABS (2013)

Inspection and maintenance

- Guidance Notes for the Application of Ergonomics to Marine Systems, Section 10 - ABS (2013)
- A guide to managing maintenance in accordance with the requirements of the ISM Code – IACS Rec. No. 74

Working environment

- Code on noise levels on board ships – IMO Resolution MSC.337(91)
- Ships and marine technology -- Ship's bridge layout and associated equipment - Requirements and guidelines - ISO 8468:2007
- 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
- Guidance Notes for the Application of Ergonomics to Marine Systems, Appendix 2 - ABS (2013)
- The Human-Centred Approach - A Best Practice Guide for Ship Designers and Builders – Lloyd's Register (2013)

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
- Inform the organisation's decisions regarding one or more human element issues
- Test the design with real users

Habitability

- ILO MLC 2006, Title 3 - Accommodation, recreational facilities, food and catering
- Alert! Issue No. 34, January 2014 centrespread and page 8

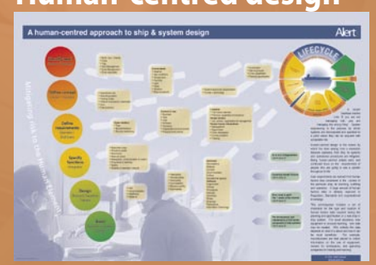
Fatigue mitigation

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

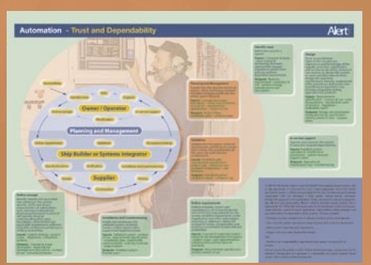
Issue No.3 - Definitions

Issue No.17 - Mitigating slip, trip and fall hazards

Issue No.7 - Human-centred design



Issue No.15 - Automation



Ergonomic criteria for control room equipment and layout A checklist

Alert!

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/errors 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 ❑
- Sufficient 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 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 teamworking & 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

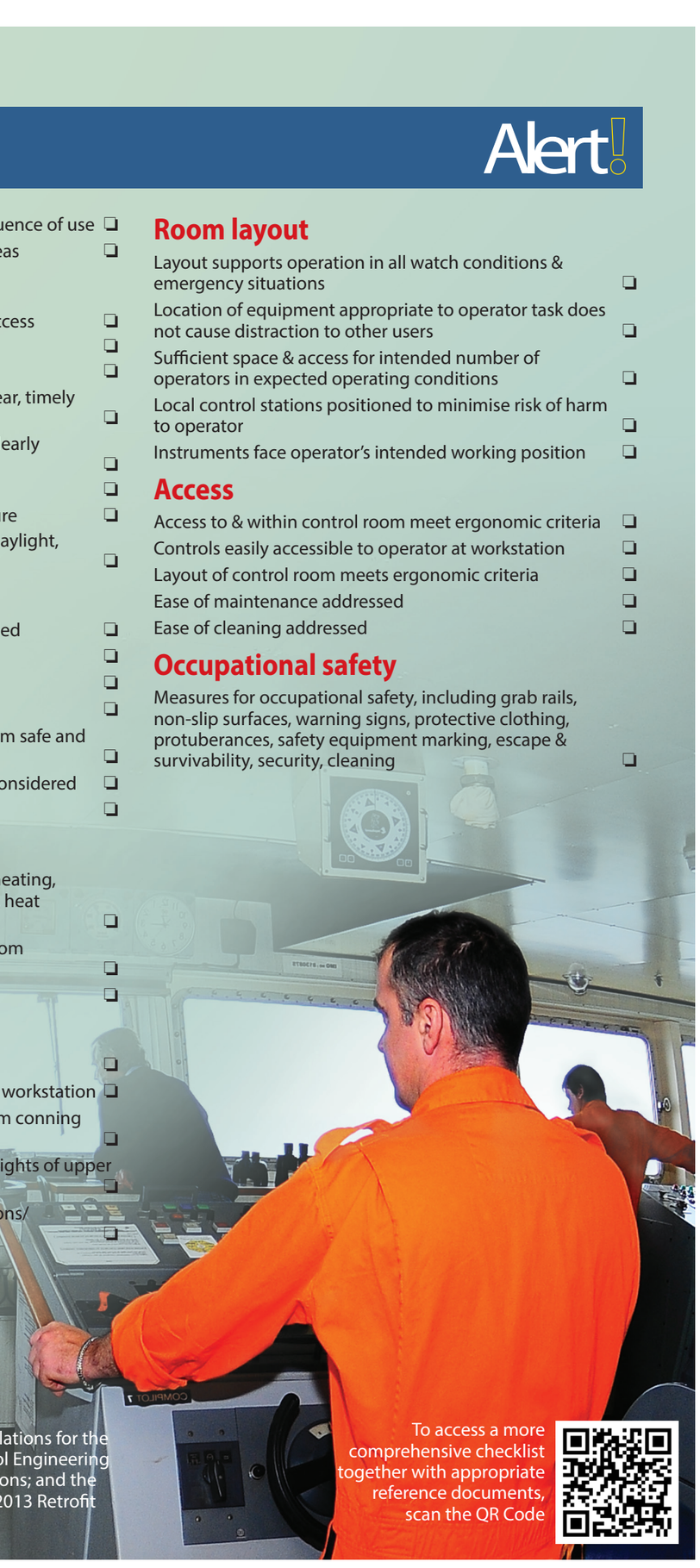
- Layout supports operation in all watch conditions & emergency situations ❑
- Location of equipment appropriate to operator task does not cause distraction to other users ❑
- Sufficient space & access for intended number of operators in expected operating conditions ❑
- Local control stations positioned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

Access

- Access to & within control room meet 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, 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

Survivability - Resolutions and Circulars and Industry Guides

Alert!

	Conventions, Codes and Guides	Training and Drills
Firefighting and Damage Control	• SOLAS Chapters II & XII A • FSS Code • FTP Code • IS Code • ISM Code • STCW Code • Industry Guides	• SOLAS Chapter II-2 Part E Regulation • SOLAS Chapter II-2 Part E Regulation 16 • ISM Code Section 8 • STCW Code • IMO Model Courses
Livesaving	• SOLAS Chapter III • LSA Code • ISM Code • STCW Code • Industry Guides	• SOLAS Chapter III Part B Section 1 Regulation 19 • SOLAS Chapter III Part B Section 1Regulation 30 • SOLAS Chapter III Part B Section V Miscellaneous Regulation 35 • ISM Code Section 8 • STCW Code • IMO Model Courses
Personal Survival/Medical	• STCW Code • IMO Revised Recommendations for Entering Enclosed Spaces • Industry Guides	• STCW Code • IMO Model Courses
Communications /Search and Rescue	• SOLAS Chapter IV • SAR Convention • IAMSAR Manual • GMDSS Manual • IMO SMCP • International Code of Signals • Industry Guides	• STCW Code • IMO Model Courses
Crisis Management	• ISM Code • STCW Code • Industry Guides	• STCW Code Section 8 • STCW Code • IMO Model Courses
Security	• SOLAS Chapters XI-1 and XI-2 • ISPS Code • SUA Convention • Industry Guides	• STCW Code • IMO Model Courses

Lessons Learned

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

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

Exploring Occupational Health and Safety

Alert!

OCCUPATIONAL HEALTH AND SAFETY

The effect of work, the working environment and living conditions on the health, safety and wellbeing of the person

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 ambient factors 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 world of work
- 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

For a version of this Centrespread complete with website links go to:
www.he-alert.org/www.he-alert.org/docs/published/he01330
or scan the QR Code

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

Safety

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

Issue No.13
Fatigue: Causes, effects and mitigation

Issue No.17
Mitigating slip, trip and fall hazards

Issue No.18
The good guide to seafarer health, Safety and wellbeing

Issue No.32
The complete guide to ship manning

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

Alert!

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

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

Crew

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

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

Externally driven

Externally driven

Internally driven

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

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

Off ship/voyage

- Noise
- Vibration
- Heat
- Lighting
- Cargo

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

Environment on/off ship

The Process

Communicate & consult

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

Monitor & review

Issue No.26
A human-centred approach to HSEQ

http://www.he-alert.org/filemanager/root/site_assets/centrespreads/centrespread_26.pdf

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 centrespread 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/ISO3100_doc.pdf