The Human Element

Best Practice for Ship Operators

Continuous Improvement of the Human Element

The Lloyd's Register Group

May 2007 Version 1.0

Human Factors

Human Resources

Management

Lloyd's Register

Contents

Foreword – The human element

Modern commercial maritime transport is, in overall terms, highly reliable and safe. Nevertheless, the industry is still seeking to improve, and it faces increased external pressures to reduce the number of casualties. The record of safety improvement over the recent past is impressive, despite the increasing age of the world fleet.

The introduction of improved technical standards, including more demanding survey regimes and stronger regulation enforced through a rigorous Port State Control system, has had a strong positive influence on safety. However there is a limit to how much additional improvement is possible if attention is only focused on the structural, mechanical, electrical and electronic components. Further improvements will require a focus on the way that a ship is used; in other words, considering the overall ship system. This cannot ignore the people operating it, often known as the 'human element'.

There is no accepted international definition of the term 'the human element'. In the maritime context, the US Coast Guard defines it as "human and organizational influences on marine safety and maritime system performance". It can be taken to embrace anything that influences the interaction between a human and any other human, system or machine onboard ship. The International Maritime Organization (IMO) has been addressing these issues since 1991.

Although the phrase may be fairly recent in origin, the impact of people in the maritime safety system has been with us as long as mankind has sailed the seas. Nevertheless, the particular issues that this presents are not constant. Continuous vigilance and effort is required from the shipping industry to ensure that they are responded to effectively.

The people, systems and machines have changed, not only through the increase in technology, but also because of the need for operators to maintain the competitive edge by reducing running costs. This has resulted in a reduction in manning scales and the employment of multinational, multicultural and multilingual crews.

Furthermore, the introduction of new technology and computer-based systems has changed the way in which mariners are presented with information. The computer screen displays all information in the same way, thus effectively filtering cues that exist on manual systems. For example, navigators can see the style of survey on an old chart and are prompted to check its accuracy visually, but computer-based information does not discriminate between old and new surveys. Similarly, machinery control rooms display all sensor data to the same standard, but do not make allowances for the occasions when the sensor is misplaced or some other event makes the readings misleading.

It would be possible to conclude that these observations simply reflect industrial practice and that levels of risk are compatible with design limitations and operational practices. From a professional point of view this position is unacceptable because improvements can be achieved through good safety management and can be demonstrated by those companies that apply consistent attention to human element issues.

These human element issues need attention across the maritime industry, as they are becoming critical for the following reasons:

- The norms of past experience amongst the seafaring population are not immediately transferable to computer-based control systems and other new technologies;

- Competition in shipping services has reduced manning levels so that back up may not be available in critical situations;

- Ships are operating to tighter schedules and to more critical tolerances;

- Ships are becoming more integrated into transport chains, so the consequences of failure are greater;

- There is growing international public pressure to protect the marine environment;

- The majority of crews are employed from supplier countries which may have different cultures and languages, and differing attitudes towards lifestyle, training and education, compared with the operator;

- Shipyards and equipment manufacturers are concerned with optimising their production methods and do not always work together to develop integrated, operator-focused systems;

- Lack of attention to the human/system interface, in terms of the design, layout and integration of systems, and training in their use, is the root cause of many accidents;

- Ships trials do not fully test all the ship systems;

- Competence requirements are not keeping pace with changes in regulation and technology;

- International regulation lags behind the operational needs of modern ship systems; and

- There are ship types (container, passenger, gas etc) that are getting larger, such that the consequences of a single failure are more significant.

IMO has set out its 'vision, principles and goals' for the human element in Resolution A.947(23), reproduced on the following page. This recognises "the need for increased focus on human-related activities in the safe operation of ships, and the need to achieve and maintain high standards of safety, security and environmental protection for the purpose of significantly reducing maritime casualties". It also states that "human element issues have been assigned high priority in the work programme of the Organization because of the prominent role of the human element in the prevention of maritime casualties".

We strongly support this initiative and believe that the key to improvement is in the close involvement of all stakeholders. This document presents a model of best practice in addressing human element issues for ship operators. We have developed it for use in education and company improvement activities and intend to provide a comprehensive support framework for its use.

Vaughan Pomeroy

Technical Director, Marine Business,

Lloyd's Register

IMO Resolution A.947(23):

HUMAN ELEMENT VISION, PRINCIPLES AND GOALS FOR THE ORGANIZATION

Adopted on 27 November 2003
ANNEX

VISION

To significantly enhance maritime safety, security and the quality of the marine environment by addressing human element issues to improve performance.

PRINCIPLES

a) The human element is a complex multi-dimensional issue that affects maritime safety, security and marine environmental protection. It involves the entire spectrum of human activities performed by ships' crews, shore-based management, regulatory bodies, recognized organizations, shipyards, legislators, and other relevant parties, all of whom need to co-operate to address human element issues effectively.

b) The Organization, when developing regulations, should honour the seafarer by seeking and respecting the opinions of those that do the work at sea.

c) Effective remedial action following maritime casualties requires a sound understanding of human element involvement in accident causation. This is gained by thorough investigation and systematic analysis of casualties for the contributory factors and the causal chain of events.

d) In the process of developing regulations, it should be recognized that adequate safeguards must be in place to ensure that a single human or organizational error will not cause an accident through the application of these regulations.

e) Rules and regulations which address seafarers directly should be simple, clear and comprehensive.

f) Crew endurance, defined as the ability to maintain performance within safety limits, is a function of many complex and interacting variables including individual capabilities, management policies, cultural factors, experience, training, job skills, and work environment.

g) Dissemination of information through effective communication is essential to sound management and operational decisions.

h) Consideration of human element matters should aim at decreasing the possibility of human and organizational error as far as possible.

GOALS

a) To have in place a structured approach for the proper consideration of human element issues for use in the development of regulations and guidelines by all committees and sub-committees.

b) To conduct a comprehensive review of selected existing IMO instruments from the human element perspective.

c) To promote and communicate, through human element principles, a maritime safety culture, security consciousness and heightened marine environment awareness.

d) To provide a framework to encourage the development of non-regulatory solutions and their assessment, on the basis of human element principles.

e) To have in place a system for identifying and disseminating maritime interests studies, research and other relevant information on the human element, including the findings of marine and non-marine incident investigations.

f) To provide educational material for seafarers designed to increase their knowledge and awareness of the impact of human element issues on safe ship operations, and help them do the right thing.

g) To provide a framework for understanding the very complex system of interrelated human element factors, incorporating operational objectives, personal endurance concerns, organizational policies and practices, and environmental factors, in order to facilitate the identification and management of risk factors in a holistic and systematic manner.

_____

Purpose of this guide

Lloyd's Register has developed this statement of best practice in managing the human element. It is intended to help ship operators to address *human element issues*[1], in accordance with the IMO 'human element vision, principles and goals'. In particular it is aimed at helping operators to "*significantly enhance maritime safety and the quality of the marine environment by addressing human element issues to improve performance*". It also embraces the IMO principle that "*the human element is a complex multi-dimensional issue that affects maritime safety, security and marine environmental protection*", and that it "*involves the entire spectrum of human activities performed by ships' crews, shore-based management, regulatory bodies, recognized organizations, shipyards, legislators, and other relevant parties*".

This document provides a reference of best practice to support an examination of the extent to which *human element issues* are considered in eleven areas of management practice. It also describes best practice for human resources and *human-centred* design.

Best practice in addressing *human element issues* is set out at four levels. This allows ship operators to take a continuous improvement approach to revising the *orientation* and *scope* of their management practices with respect to the human element.

The approach taken is to support ship operators in making more effective use of existing activities and documentation, rather than generating an additional 'paper trail'.

Background

The contribution of the human element to maritime safety and quality is crucial. To raise awareness of this, Lloyd's Register has supported the Nautical Institute in publishing the award-winning **Alert!** bulletin. This document presents best practice to support the next step - a transition from awareness to effective action.

We have also taken a leading role in the codification of best practice in addressing *human element issues* through research, consultancy and the publication of international standards. These standards were used as the basis for the guidance set out in this document (see Part 4, Section 4.2).

Benefits

A structured review using this guide provides evidence that a ship operator is responsive to *human element issues*. We believe that this will be an important factor in attracting and retaining quality crewmembers. The best practice set out here will also assist in meeting the requirements of the ILO Maritime Labour Convention.

Human element issues are associated with the vast majority of accidents and incidents. We believe that the ability to demonstrate that this major source of *risk* is being addressed will be of interest to clients, charterers and insurers.

The review will contribute to measures of corporate social responsibility, since it includes consideration of *risks* to the community and environment, and to workplace health and safety.

For the shipping industry as a whole, use of this guide will demonstrate that it is acting in accordance with the IMO Human Element Vision, Principles and Goals.

---

[1] Terms highlighted in *italics* within the document are defined in the glossary in Part 5.

Scope

The *scope* of *human element considerations* is set out in Table 1, the summary checklists on the next two pages. They have been broadly divided into 'delivering people' (human resources) and 'delivering *systems*' (*human-centred* design).

How to use this guide

This guide is expected to inform three distinct types of use:

a) Overview; getting started

The guide provides an overview of the need to manage the human element across all aspects of shipping company operations, including the drivers and benefits. It will enable a company that has not previously integrated management of the human element into its practices to start doing so.

b) Implementation of human element management

The guide will enable a company that recognises the value of managing the human element, but is unsure how best to do so, to integrate it into its practices.

c) Assessment/review of best practice

For a company that is already managing the human element, the guide will enable a review of whether the practices in place represent best practice. This independent check provides confirmation of the benefits of best practice already in place, and guides continuous improvement where the potential is identified.

When reading each area, it is useful to remember that it applies to the *scope* set out in Table 1, which should be used in support. The figures presented for each area display large amounts of technical information with respect to best practice in the area. Users of this guide are strongly advised to treat each figure as part of the technical content of the guide and to study it in depth before making any degree of assessment, or implementing practices, for that area.

The following key applies to the figures:

Pink boxes	Drivers for improvement changes, including regulations and guidance
Cream boxes	Aims to be achieved by improvement Aspects of design or operation that can be changed Resources for continuous improvement – methods or sources of information
Blue boxes	Human element data, often to be used as an input to a process
Blue ovals	Processes or procedures

Human resources considerations

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

Manning
Company ensures ships have the number of people required for the safe operation and security of the ship and for the protection of the marine environment in both normal and emergency situations

Training
Company continues to ensure personnel are competent and familiar with the ship and its systems
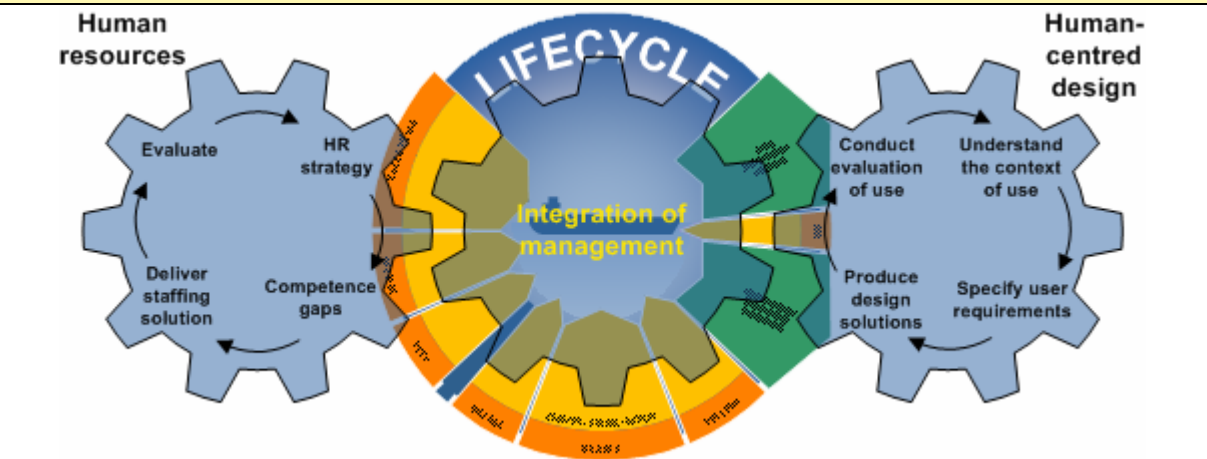
Human factors considerations

Habitability
Company ensures accommodation, washing and toilet facilities, messrooms, group meeting and exercise areas are comfortable, clean (or cleanable) and convivial

Manoeuvrability
Company ensures its ships have the most appropriate manoeuvring capabilities

Workability
Company ensures its ships and systems are appropriate for the work situation (*context of use*)

Maintainability
Company ensures operational maintenance tasks, manuals, diagnostics and schematics are rapid, safe and effective to allow equipment and systems to achieve a specified level of performance

Controllability
Company ensures appropriate integration of people with equipment, systems and interfaces

Survivability
Company ensures that there are adequate firefighting, damage control, lifesaving and security facilities to ensure the safety and security of crew, visitors and passengers

Occupational health and safety
Company ensures appropriate consideration of the effect of work, the working environment and living conditions on the health, safety and wellbeing of workers

System safety
Company ensures appropriate consideration of the risks from people using (or misusing) ship systems

Human resources considerations

Personnel
- Nationality and language
- Selection
- Training
- Physical *characteristics* for the tasks to be done
- Terms & conditions of service or employment
- Expected competencies
- Experience levels
- Payment arrangements
- Disciplinary process
- Leave, travel arrangements

Manning
- Tasks, duties & responsibilities
- Numbers, grades & capacities
- Watchkeeping or shift patterns
- Hours of work & rest
- Required competencies
- Retention
- Continuity at handover
- Succession planning
- Teamworking
- Promotion paths

Training
- Required knowledge, skills & abilities
- STCW requirements
- System-specific training
- In-house/onboard training facilities
- Management/leadership training
- Technical training
- Safety & security training
- Induction
- Onboard familiarisation, safety drills and continuation training

General considerations

- International conventions/regulations
- Crew nationality
- Working language
- Size, shape & gender
- Strength & stamina
- Posture
- Religious & cultural differences
- Welfare facilities

- 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 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

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

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

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

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

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

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

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

Table 1: Summary checklists of human element considerations.

1. Part 1: The Lloyd's Register Group human element initiative and guidance

1.1. Addressing human element issues

The human element is all-encompassing, with a great many *human element considerations*, whether general, human resources or human factors. The summary checklists in Table 1 on the previous pages illustrate this critical point. They give a fair indication of where *human element issues* may occur when there is a mismatch between user need and the work situation. Some success can be achieved by running campaigns on an issue-by-issue basis. However, such campaigns do not address the need to manage the many issues facing an operator at any one time, and their effects are often limited in scope and duration.

To examine the way that a ship operator addresses *human element issues*, it is necessary to look at **how** work is done ashore and at sea. This process view also allows issues to be addressed in a balanced fashion.

Addressing the issues in this way could involve implementing improvement actions. However a company that has decided its current performance level is satisfactory may be able to look at reducing the cost of staying at the same level. Alternatively a company could identify that its performance is well above the benchmarked industry norm, and be able to transfer some of the resources it applies there to improve another area.

Integration of the human element into an organisation does not 'just happen'; it needs management practices and technical activity. Management practices need to integrate the human element into the design and operation of the ship and the operator.

We believe that the key to improving performance is to develop those areas of management practice where all of the *human element considerations* contained in the checklists in Table 1 can be addressed. This best practice guide aims to promote continuous improvement in key areas of management practice by enabling these areas to become more '*human-centred*'. Section 1.3 elaborates this. Applying the best practice in this guide will enable balanced action on the human element, with an overall benefit to safety.

> **A human-centred approach provides a structure for the consideration of human element issues. The principles of the human-centred approach are:**
> - Continuous improvement, learning from experience, trials or prototypes.
> - Early, continuing, effective crew input.
> - The matching of ships and systems to people and tasks.
> - Teamwork and co-operation between stakeholders.

The *human-centred* approach supports the development of a safety culture, and helps the crew to act as a safety barrier, rather than to be seen as only a source of error or *risk*. The practice set out here has been found to contribute to business success in a number of sectors of industry. We believe that the *human-centred* approach also improves job satisfaction, which leads to better recruitment and retention of quality staff, as well as encouraging safer operations overall.

1.2. Guidance for management and technical practices

The content of the guide has been drawn from good practice in a number of sectors where it has been found to contribute to safety and good employment. It has been written in a way that allows an assessment to be made of the extent to which the practices are performed.

As Figure 2 shows, this guide describes the best practice in eleven areas of management practice. It also includes two additional areas of best practice, for human resources and *human-centred* design. These are presented in a different format from the other areas, since they are not intended to have a specific assessment carried out against them. Instead the principles they describe underlie best practice in the eleven management practice areas. If these two continuous improvement cycles are in operation within a company, evidence will be found across all areas of its management practices.

The eleven directly assessable management practice areas are presented first, as follows:

Three of the eleven address policy ("setting the scene" within the organisation) for the human element, i.e. the practices of the company at a corporate and strategic level:

- Management commitment to the human element;

- Integrating the management and use of human element data;

- Integrating the human element into concept and strategy.

Three others address management ("walking the talk" on a day-to-day basis), i.e. what the company management does about the human-*system* issues on a day-to-day basis:

- Gathering and using crew input and feedback;

- Integrating the human element into value for money decisions;

- Integrating the human element into trade-off decisions and risk management.

Five of the eleven address operations ("doing the work"), and are based on addressing human-*system* issues in each stage in the *lifecycle*, (as illustrated in figure 2). They are concerned with integrating the human element into:

- Addressing human element issues in current operations, in-service ships;

- Addressing human element issues in starting an operation;

- Addressing the human element in repair and modification;

- Addressing the human element in laying up or selling on;

- Addressing the human element in design and build.

Following these the technical processes for human resources and *human-centred* design are presented.
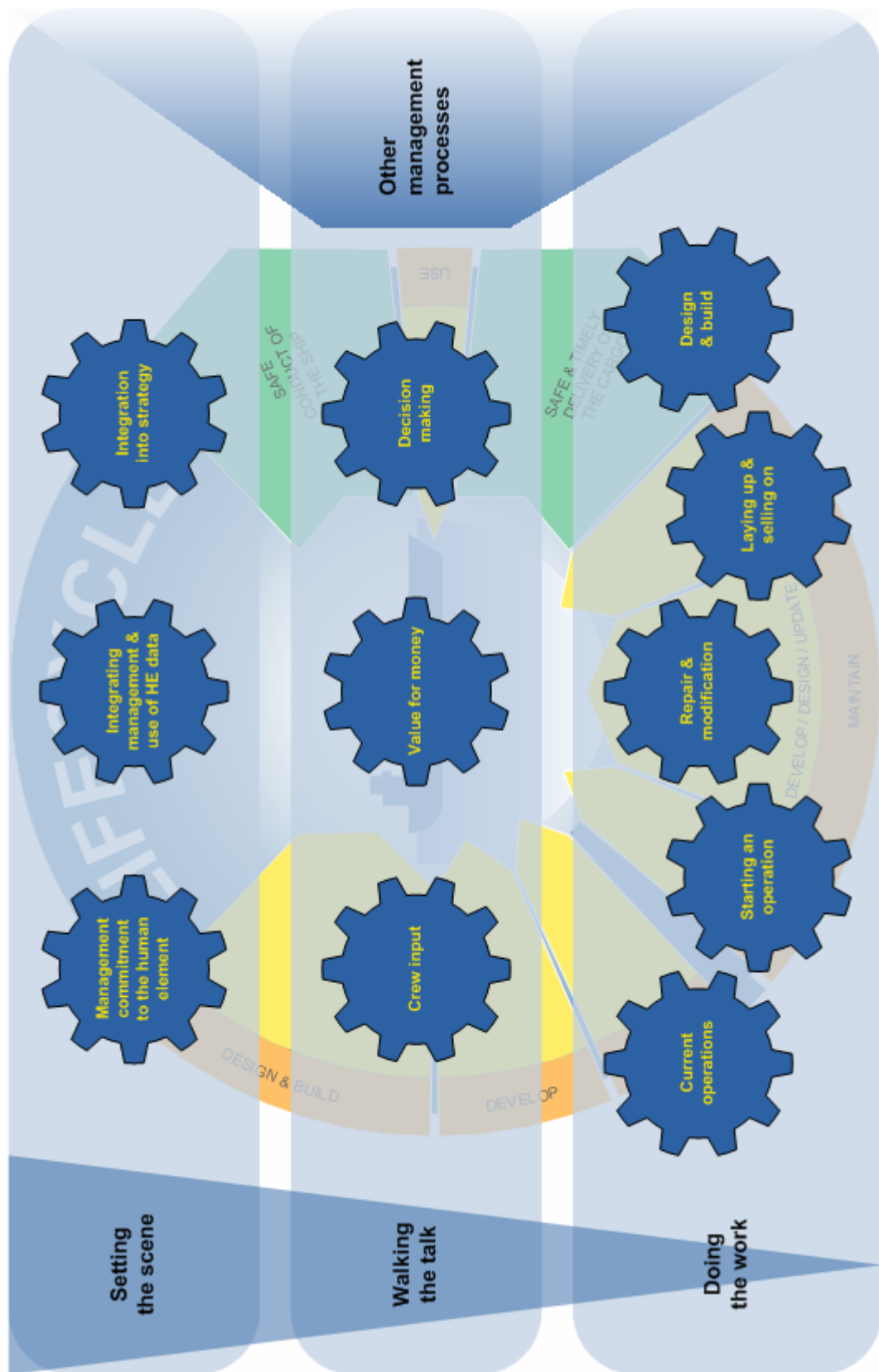
Figure 2: The areas of best practice in addressing the human element

1.3.   Continuous improvement in the human element

This guide provides a framework for the assessment of a ship operator's **capability** to address *human element issues*. The human element guidance defines best practice in ship operations through the life cycle (e.g. new build) and in management practice (e.g. *risk management*). It describes management practices that enable a ship operator to resolve *human element issues*, and **integrate** the human element into the operation of the company. The supporting technical practices of human resources and human-centred design are also defined.

Using the guide will help ship operators to improve their consideration of the human element by adjusting the *orientation* and *scope* of their management practices in a staged manner. The change in **orientation** gives greater emphasis to identifying *human element issues* and to acting on them. The change in **scope** is to integrate *human element issues* into the way that existing practices such as purchasing, *risk management* etc. are carried out.

1.4.   The key components of the improvement cycle
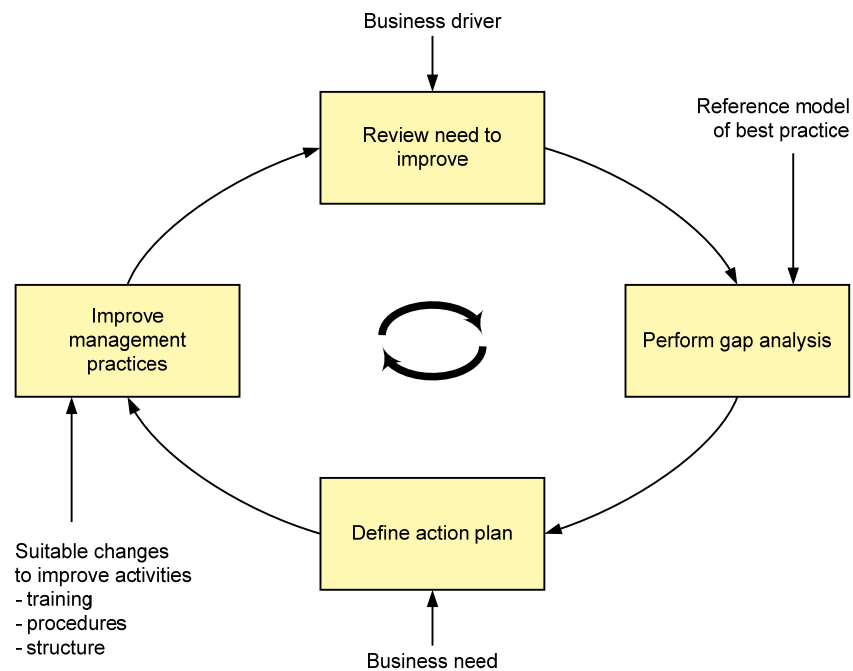
Figure 3: The continuous improvement cycle

The need to address *human element issues* is stimulated by a business driver such as competition pressure, regulatory needs or a recovery plan. Performing a *gap analysis* identifies shortfalls against a reference model of best practice. Improvement actions are identified and prioritised in an action plan. Improvement activities are then put in place. These can include training and awareness raising, changes to *procedures* or changes to company structure and communications. Progress is reviewed against the external requirements, and a new *gap analysis* undertaken. Part 4 of this guide outlines the Lloyd's Register methodology for continuous improvement in the human element.
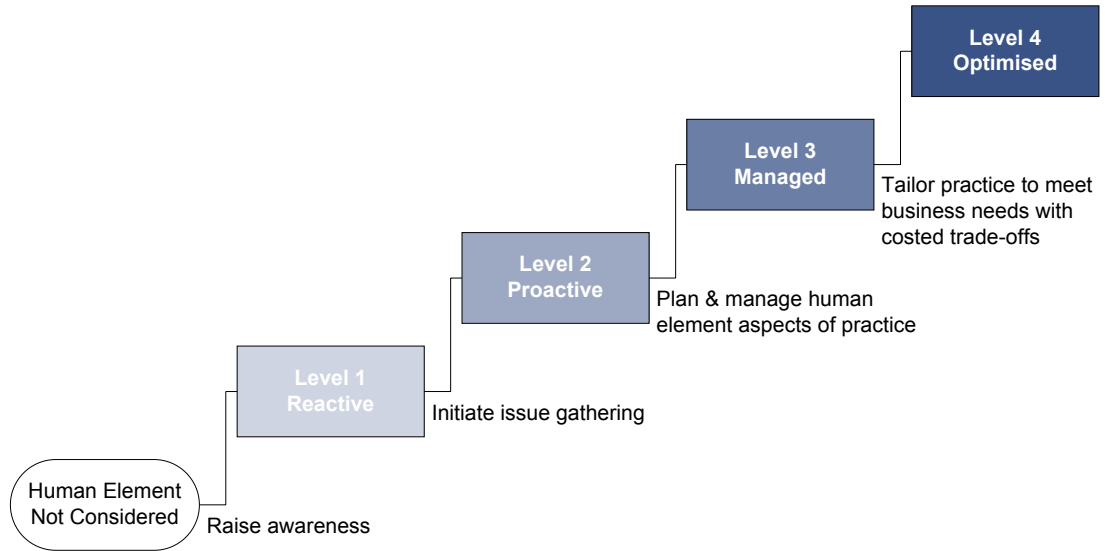
Figure 4: Levels of capability in addressing human element issues

The best practice framework supports the improvement cycle by presenting the guidance at four levels progressing beyond 'no consideration'. The levels are:

N/A: No consideration of the human element. *Human element issues* are not addressed.
Level 1, **Reactive**:   Feedback on *human element issues* is gathered, the company listens to issues, reviews them and acts on them. The achievement of Level 1 may involve a change in *orientation*.
Level 2, Proactive: The ship operator seeks out *human element issues*, takes action to gather data, and then acts on it. Achieving Level 2 is likely to require a change in the *scope* of company practices.
Level 3, **Managed**: *Human element issues* are addressed as part of a plan, and there is a managed programme of work considering them. Achieving Level 3 is likely to involve some changes in both *scope* and *orientation*.
Level 4, Optimised. The ship operator is able to consider *human element issues* as part of the business *strategy* and to make costed *trade-offs* between topics such as manning, automation and operations. For example, a plan can be shown to be the best possible on the basis of a numerical analysis.

1.5. Structure of best practice

The guidance is structured as follows:

- **Title**: identifies the area of management practice where consideration of the human element is to be reviewed.

- **Purpose:** defines objectives and outcomes to be achieved by effective consideration of the human element in that area of management practice.

- **Benefits and outcomes:** the benefits and outcomes for the organisation that fully considers the human element in that area of management practice.

- **Life at each level:** a summary of what might be seen in a company operating at each level within that area.

- **Aim:** the overall goal associated with the staged practices following it.

- *Best practice indicators* (BPIs): allow an objective measurement of the standards currently delivered by the ship operator's management *system*.

Where outcomes directly overlap with existing statutory requirements, they have been put in brackets and italics.

Note: For some management areas to be in place at all, the company is required to be proactive. In these cases level 1 has no meaning and there is therefore no BPI. Some areas are crucial foundations for other areas, in these cases level 3 is necessary and sufficient for optimised performance and there is no level 4 BPI. Areas where these special cases apply are identified within the guide.

2. Part 2: The eleven areas of management best practice for integrating the human element

Policy – Areas 1, 2, 3: "Setting the scene" within the organisation

This group of areas is concerned with the senior-level management of the human element within an organisation. It is called "setting the scene" as it is concerned with the overwhelming degree of influence that senior shore management practices have on safe and effective human element management throughout the company. This is where the authority lies to influence purchasing decisions, as well as much of the responsibility for creating a culture of safe working and a motivated staff.

Successfully addressing this group of areas will mean that management of the human element is integrated across all parts of the organisation. The appropriate resources will be made available to enable this. *Human element data* will be used to develop company *procedures*, and *human element issues* will be a crucial consideration in the production of company standards.

Companies operating at the lower levels of *capability* in these areas will be likely to make use of marine sector human factors resources, and general human resources inputs. Companies at the higher levels are likely to apply best practice from similar industries, and to seek to learn from practice in other industry sectors. Progression through the levels will be associated with a move away from a superficial or compliance-focused approach to management, where a checklist-style attitude may be common. Instead a company will incorporate relevant processes and principles, after an informed evaluation of what is appropriate for its own operations, as an integral part of its business.
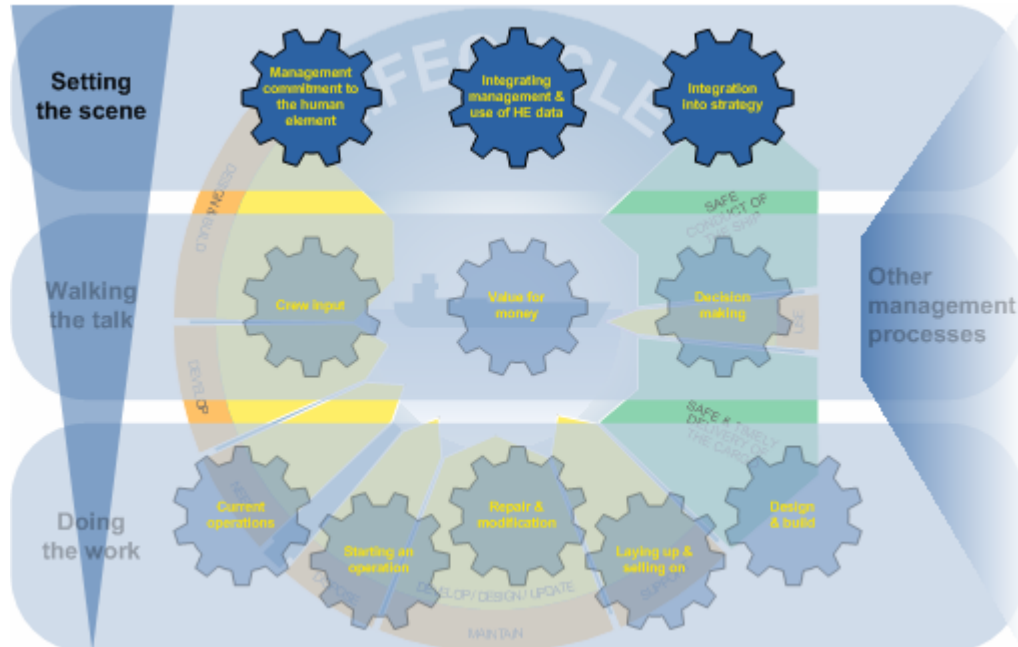
Figure 5: The three policy areas

2.1.   Area 1 Management commitment to the human element

The **purpose** is to promote and manage human element activities to reflect the needs of safe and effective operation, and provide the necessary resources.

The **benefits** of successfully addressing the human element in this area are:

- *Stakeholders* understand the *policy* and *procedures* related to the human element.

- The application of human element techniques and resources is cost-effective.

Successfully addressing the human element in this area achieves the following **outcomes**:

- There is a *policy* for addressing *human element issues*.

- Suitable tools, methods, resources (including staff) are made available.

- There is a plan that adapts to emerging *human element issues*, with allowances for feedback loops.
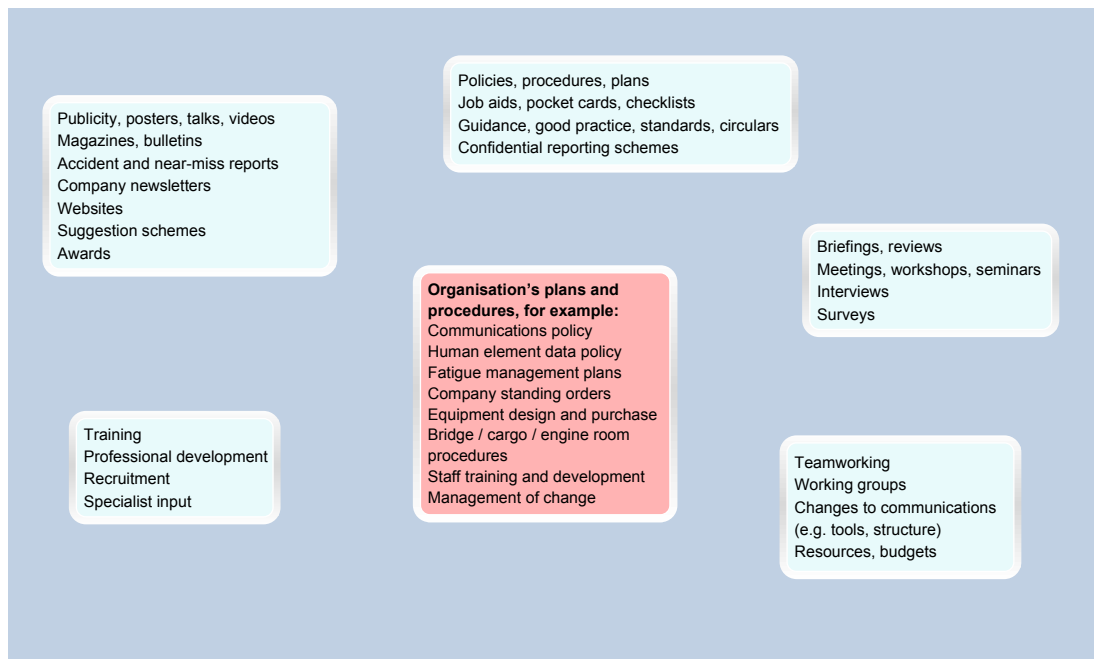
Figure 6: Resources to address human element issues, and existing company plans and procedures that can be used as support.

Area 1: Life at each level.

Level 1 – A *policy* is in place for valuing and using *human element data*, i.e. the benefits of taking a *human-centred* approach are acknowledged. Although this suggests a degree of proactivity, a *policy* is an essential requirement for further development.

Level 2 – Communications about *human element issues* are put in place, and training is provided when required. The company recognises that *usability* can be quantified and can be improved. Activities requiring specialist knowledge are performed.

Level 3 – The organisation supports the addressing of *human element issues*. Resources are made available to do this and to implement the *policy*. Human factors and human resources skills are recognised as disciplines within the company.

Level 4 – A through-life plan exists for every ship and every operation, specifying where and when human element activities will be carried out. This provides the infrastructure to support strategic activities in all other areas, as it underpins financial and other resource provision.

HE.1: Management commitment to the human element

Aim: Commitment to, and support for, addressing the human element.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	HE.1.1 Establish and communicate a *policy* for the *human-centred* approach.	Promote and maintain a *human-centred* approach within the company. Establish a *multi-disciplinary* culture in project teams. Maintain company focus on a *human-centred* approach in activities which may have an impact on *usability*. Take specific account of *human element issues* in the management of projects and the organisation.
	HE.1.2 Have a *policy* for using *human element data*.	A *policy* exists which encourages the use of human element guidance and findings throughout the company, found by examining literature, research or experiments. Although this suggests a degree of proactivity, a *policy* is an essential requirement for further development.
2	HE.1.3 Maintain increased awareness of *usability*.	Promote understanding of the *context of use*. Promote the involvement of ship and shore staff in HE evaluations. Use training, awareness raising, case studies, incident data, award schemes, championing, bulletins and in-house magazines.
	HE.1.4 Facilitate personal and technical interactions on *human element issues*.	Promote inter-departmental working, e.g. using *multi-disciplinary* or cross-boundary working groups. Use documents and working groups to control interactions and dependencies between activities that address HE issues and other organisational activities. For example, the interface between installation and support, or equipment purchase and training.
	HE.1.5 Seek and exploit expert guidance and advice on *human element issues*.	Promote use by all *stakeholders* of guidance and advice from human element professionals. The specialist human element input will be used to good effect, but on an ad-hoc issue-by-issue basis.
	HE.1.6 Perform research to develop *human element data* as it is required.	Specialists are used to acquire and analyse *human element data*. The company arranges for specific human *element issues* to be investigated, e.g. through surveys.
3	HE.1.7 Develop or provide relevant staff with human element skills.	This may be accomplished through the recruitment, training or retention of consultants or advisors. Existing staff may be developed to a benchmarked level, e.g. the award of a qualification recognised by a professional body. Whether human element professionals are external or internal, the company will supervise them to check that the required output is being delivered.
	HE.1.8 Develop a plan to achieve and maintain the optimum level of *usability* throughout ship operations.	The plan specifies how and when HE activities integrate into company activities. It makes allowance for *iteration* where necessary by including a feedback loop; it includes long-term monitoring of use and identifies the need for and cost of crew involvement. Reporting lines between staff addressing HE issues in different parts of the ship operator organisation are defined. Resources are allocated for effective communication between *stakeholders*. The plan identifies HE data requirements. It states which methods will be included, and how they will link together through-life and produce work packages. The plan defines outputs and criteria for success for each activity, and defines milestones related to concrete stages and achievements.
	HE.1.9 Identify the specialist skills required and plan how to provide them.	A *multi-disciplinary* team is required to produce and maintain safe and effective ship operations. Although some HE activities may be conducted by human element professionals, most are performed as part of the function of existing staff. There is a need to identify a single point of contact who has authority for HE activities.
4	HE.1.10 Manage a *lifecycle* plan to address HE issues.	Produce and review budgets relating to HE activities. Ensure that consideration of the human element does not add unnecessary overheads. Recognise *usability* as a long-term issue requiring maintenance. Identify resources for prioritisation and performance of corrective activity.

2.2. Area 2 Integrating the management and use of human element data

The **purpose** is to facilitate information feedback, exchange and other communication about *human element issues*, including the provision of *human element data* in standard formats.

The **benefits** of successfully addressing the human element in this area are:

- Communication between *stakeholders* is effective.

- *Human element data* is used consistently.

- Resources are used cost-effectively.

Successfully addressing the human element in this area achieves the following **outcomes**:

- Correct, adequate, timely and unambiguous *human element data* are made available.

- Understandable *human element data* are provided in suitable formats that are part of the ship operator's company *procedures*.

- Human element resources are maintained, and the value from their use is examined and improved.

International conventions, regulations & standards
Conventions, protocols, recommendations, codes, guidelines and resolutions – safety, navigation, pollution
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 practice conforming to international regulations, procedures and practices
Classification rules for hull structures and machinery

Management systems:
Safety
Security
Environment

Planned maintenance
Through-life support

Corporate information resources:
Data management
Standards
Tools and methods

SOLAS
ISM Code
STCW 95
Colregs
Minimum Safe Manning
ISPS Code
International Maritime Labour Convention 2006
IHR 2005
ITU Standards
ISO Standards
IEC Standards
IACS Rules, Guidelines & Regulations

Industry standards
Codes of practice
Quality management standards
Competence management systems
Self assessment programmes
Fatigue and crew endurance management policies

Personnel system:
Recruitment
Training
Promotion
Retention
Disciplinary procedures

Purchasing
Inspection
Auditing
Chartering
Flag
Class

Figure 7: Existing company procedures that can be used to incorporate the human element, and their external drivers.

Area 2: Life at each level.

Level 1 – No BPI at this level. The company *procedures* are aimed at achieving regulatory compliance alone. The human element is not specifically considered beyond this.

Level 2 – The company recognises that for the value of the *human element data* generated to be realised, it needs to be in an appropriate and common format. This means it can be meaningfully communicated throughout the organisation, from its source to the location where it can best be used (this includes feedback).

Level 3 – The *human element data* is managed so as to facilitate its most effective use in promoting and managing the human element itself. The required tools and methods are documented to support planning in this area. Common terms and data types are used in a coherent manner.

Level 4 – The information management methods and techniques are not only maintained in their existing formats but customised to best suit the organisation. The strategic infrastructure is in place to gain value from the data in new ways.

HE.2: Integrating the management and use of human element data

Aim: Information about the human element is gathered, generated and communicated with the minimum of additional documentation.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	No BPI at this level.	*[(No specific BPI at level 1. Company procedures are aimed only at achieving regulatory compliance.)]*
2	HE.2.1 Identify and use the most suitable formats for exchanging *human element data*.	Define common data formats and exchange *procedures*. Present human aspects of design and operation in a form suitable for *trade-off* studies. For example, personnel costs or performance presented in a form that can be traded off against equipment costs or performance. Provide readily understood feedback from evaluations. Work towards a common method of working e.g. commonality of checklists, review formats, *risk* and issue management. Ensure that the *context of use* forms part of the information used for equipment selection, installation, recruitment, training.
3	HE.2.2 Include human resources and *human-centred* design in corporate *procedures*, standards and guides.	Examples of *procedures*, standards and guides are those for quality assurance, change control, process and method maintenance, and resource management. Ensure that this is carried out as an integral part of the infrastructure management for the organisation.
	HE.2.3 Define and maintain human element resources (including human element processes, methods, tools and techniques, test facilities).	Select HE processes, methods, tools and techniques to best account for legislative requirements and industry guidelines. Revise HE processes, methods, tools and techniques in light of experience and external developments. Apply lessons from the use of tools and methods to understand and improve the *effectiveness* of the HE process.
	HE.2.4 Develop a common terminology for HE issues across the company.	All relevant *stakeholders* (e.g. training providers, manning personnel, safety managers, superintendents) develop a common language for HE issues. Present the *context of use* in a comprehensible form with a description of the real operational environment and its implications. Work to promote a *systems approach*.
	HE.2.5 Produce coherent data standards and formats.	Data from different sources can be analysed together coherently. Trends and other operational information can be extracted efficiently.
	HE.2.6 Develop and maintain adequate data search methods.	The organisation has the means to make the best use of the data over the period of time for which it is likely to be relevant. *Human element data* can be extracted to support corporate *strategy*, including response to new industry requirements.
4	HE.2.7 Define rules for the management of data.	The organisation maintains itself at a strategic level by gaining value from the information gathered. This may include the commissioning of new research. It will include the capture of organisational learning regarding HE activities, for example maintenance of a 'lessons learnt' database.
	HE.2.8 Customise tools and methods as necessary for particular projects.	Match methods and techniques to the organisational maturity with respect to HE issues. Match methods and techniques to the particular stage in the life cycle of the project. Make maximum use of the tools and methods in common use within the organisation. These could include business process modelling and task analysis, common cost models, and prototyping environments.

2.3. Area 3 Integrating the human element into concept and strategy

The **purpose** is to establish a focus on *human element issues* (including *usability*, health and safety) in those aspects of shipping operations that deal with the business *strategy* (current and future), markets, options for future operations and planning their concept.

The **benefits** of successfully addressing the human element in this area are:

- Costing includes personnel costs and *soft costs*.

- Assessments and forecasts of performance take human and organisational performance into account.

- New concepts are less likely to encounter problems with operational acceptance.

Successfully addressing the human element in this area achieves the following **outcomes**:

- Human element *risks*, and the impact of a future concept on *stakeholders*, are considered.

- The ship operator takes future purchasing *strategy* into account when defining organisational change.

- There is senior management support for the improvement of resources related to the human element.

- The safety and *effectiveness* of the ship operator's operations are at a competitive level.

Figure 8: Human element issues can be considered as part of a range of strategy decisions.

Area 3: Life at each level.

Level 1 – No BPI at this level. A company has to be proactive if it is to have a *strategy* rather than just react to events.

Level 2 – The company considers the *human element issues* related to future operations. There is an awareness of the need to respond to external influences such as changes in labour supply to the industry.

Level 3 – Analysis of *stakeholder usability* requirements is structured and managed. There is senior level support for a user-centred approach to be applied to the company operations.

Level 4 – Proactive analysis of future human element requirements is carried out right from the start of the business planning process. It is thorough, including evaluating outside influences such as new legislation and internal information sources e.g. consultation with employees. Both the business and the human element implications of any plan are taken into account.

HE.3: Integrating the human element into concept and strategy

Aim: Business planning takes full account of the human element.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	No BPI at this level.	[It is not possible to address this area reactively – the company either actively seeks relevant information for the purposes of integrating it into its concept and *strategy* or it does not collect it at all.]
2	HE.3.1 Present future operating context and human resources options and constraints to *stakeholders*.	Identify future people supply issues. State requirements and constraints imposed by other developments within the future operating context (e.g. ports, traffic management). Identify the relationships between ship and *system* options and training options. Safety, and health and safety, legislation will be an influential factor. Relevant environmental legislation will also contribute.
2	HE.3.2 Start to consider *soft costs* in the business case.	Include the human element in the business case for future *operating concept*. Include the *'soft' costs* of introduction, operation and disposal, and human contributions to *system effectiveness*, including human error and human resilience in recovering from *system* failures.
3	HE.3.3 Perform research into required ship and *system usability* for future *operating concept*.	Benchmark equivalent concepts using relevant criteria, for example *usability* and safety. Test the *usability* of proposed ship equipments, layout, support, competing or alternative *systems* and/or *system* concepts. Use prototypes to stimulate *stakeholder* input to concept requirements. Research may be just expert analysis if the organisation has established that this provides sufficient input.
3	HE.3.4 Describe the objectives which the ship operator wants to achieve through use of the concept.	Company acknowledges that there are different types of staff with different contexts of use, who may need specific objectives. Objectives are ideally set as measurable criteria. At an early stage *stakeholders* other than users may also be involved.
3	HE.3.5 Identify and analyse the roles of each group of *stakeholders* likely to be affected by the concept.	Describe the potential crews and support staff, their *characteristics*, and the manning and personnel constraints and requirements imposed on/by the concept. Assess the significance and relevance of the concept to all staff involved. Assess stability of *stakeholder* requirements. Document issues related to *usability* and emerging user needs. This will include reference to *competence* levels where appropriate.
3	HE.3.6 Define *usability* as a competitive asset.	Business management understands *usability* and human element activities, and they are included as part of the business *strategy*.
3	HE.3.7 Set *usability* objectives for ship operation.	Business management sets demands on *usability* for ship operation. For example, ships with safe and effective operation are rewarded. Objectives may need to be determined at a number of levels of detail.
3	HE.3.8 Follow competitive situation in the market place.	This means that business management is interested in how the *usability* of their ship operations compares to that of competitors and they: a) define and maintain a position relative to the market place b) are aware of the marketplace in order to make changes if necessary.
3	HE.3.9 Develop user-centred infrastructure.	Senior management directly control the funds to maintain/improve user-centred design skills, resources, technology, awareness and culture.
4	HE.3.10 Perform early analysis of the future *operating concept*.	This is started very early. Analyse the good, bad and necessary aspects of existing *systems*. Assess the human and organisational impact of the *operating concept* to be introduced. Explore options for safe and effective operation.
4	HE.3.11 Identify expected *context of use* for possible future *operating concepts*.	Elicit and take account of trends and expectations in society, for example in forthcoming legislation. Elicit staff input regarding operation of future *systems* in their expected context.
4	HE.3.12 Relate *human element issues* to business benefits.	For example, establish through-life cost accounting in order to assess the costs and benefits of a user-centred approach. Fully understand the human element implications of any business opportunity, and fully understand the business implications of any *human element issue*.

Management – Areas 4, 5, 6: "Walking the talk"

This group of areas is where the company's commitment to the human element translates into management practices. It is concerned with ensuring that the human element is considered within everyday management activity. It is called "walking the talk" as it relates to the practical application of the company's stated views on the human element and its importance within the business.

Successfully addressing this group of areas demonstrates that middle-level management decisions and activities are informed by consideration of the human element. There is good communication within the organisation, especially including feedback from the frontline staff to the senior shore management. *Human element issues* are considered effectively when making spending decisions. *Trade-off* decisions take full account of the human element when managing safety, business and operational *risks*.

Companies operating at the lower levels of *capability* in these areas will gain benefits from consideration of the human element. However this will not be as efficient as it could be, since it will not be fully integrated across the full range of their operating decisions as part of a structured plan. Companies at the higher levels will gain the full benefit from consideration of the human element, as its positive and negative implications are incorporated into management decisions right from the earliest stages. Progression through the levels will see human element consideration being thoroughly and efficiently integrated into the day-to-day and long-term management activities of the company.

Figure 9: The three management areas

2.4.   Area 4 Gathering and using crew input and feedback

The **purpose** is to effectively involve and consult crew and support staff on each significant aspect of the ship and its *systems* in order to improve its *usability*, health and safety, or performance.

NB The term "crew" is used to refer to the master, officers and ratings. "Staff" is used for both ship and shore workers.

The **benefits** of successfully addressing the human element in this area are:

- Communication between the crew and other *stakeholders* is effective.

- The crew and other *stakeholders* are aware of the *human element issues*, and of the changes made as a result of their input.

Successfully addressing the human element in this area achieves the following **outcomes**:

- The need for crew involvement is identified and accepted by the ship operator.

- Crew or other *representative seafarers* are selected and made available to provide input in sufficient numbers and in a timely fashion.

- Crew involvement is widespread and effective.

- Resulting changes to design, operation, training, manning are reported back to the crews.

Customer feedback
Inspection reports, NCRs
Confidential reporting schemes
SMS annual report
Docking list

Ship visits

Voyage reports
Vessel reviews
Incident, near miss, LTI reports
Confidential incident reports
SMS deficiency reports
Post-installation checks
Maintenance feedback
Condition reports

Safety committee
Crew appraisals
Medical reports
Disciplinary reports
Training feedback
Working hours records
Master's reports

Shore visits
Officers' conferences
Masters' review of procedures
Pre- and post-voyage briefings

Figure 10: Crew input and feedback from various sources can be used to improve safety and effectiveness.
Crew need to hear about changes resulting from their input

Area 4: Life at each level.

Level 1 – Crew input and feedback on the range of *human element considerations* described in Table 1 is received and acted on. It may not be received in the most desirable format. This may lead to misinterpretation or incorrect inferences being drawn. Shore staff may make efforts to represent the information if this is the case, but this will prolong the process. Information about *human element issues* is unlikely to be explicitly volunteered, especially if the language abilities of the crew are poor.

Level 2 – Users are supported in putting forward ideas and suggestions, to encourage company-wide input. The company makes active and considered decisions regarding the best method of involving users, and which users should be involved. The relative merits of alternative options such as questionnaires, toolbox talks or informal gatherings are compared as part of this consideration.

Level 3 – Seeking and responding to crew involvement is a routine part of operations. The information is used to meet the requirements of rules and policies. The process is included in plans, e.g. the selection of a new radar *system* will follow consultation with previous and future users. The *risks* of not involving users are considered to decide when it might not be necessary, e.g. for a minor change or purchase.

Level 4 – No BPI at this level. There is no additional requirement for this area beyond level 3. It is a fundamental area to support the other areas, so while a high score in Area 4 is essential for successful management of the human element, fully achieving level 3 is sufficient evidence of addressing this foundation requirement area.

HE.4: Gathering and using crew input and feedback

Aim: Maximum value is gained from crew knowledge and experience in the operation of the ship and its *systems*.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	HE.4.1 Identify *human element issues* and aspects of ship operation and design that require crew input.	Encourage *stakeholders* to consider the seafarer and obtain crew input. Remind staff and suppliers that ship operation is performed by real people and so *usability* is necessary. Provide management support for crew input.
	HE.4.2 Take account of crew input and inform crews of changes made.	Crew input may require interpretation and explanation to enable appropriate changes to be made. A valid and justified reason for not making changes may also result. Feedback to crews is provided for information, commitment and validation.
2	HE.4.3 Select and use the most effective method to obtain crew input.	Methods that support continuing input rather than one-shot or intermittent involvement are preferred. The best input is from crew that have been briefed about the topic and what input is needed. This may not be possible under some circumstances, and other people who know the job that users do now may be used. Methods need to consider the crew perspective and the type of information required. Crews may be given training in how to review a ship and its operation.
3	HE.4.4 Plan user involvement.	Crew involvement in ship operation and design is organised to take account of the differences between crewmembers, for example in their physical *characteristics*, training, language, culture and responsibilities. The type of involvement is planned. There is a clear and recognised process that allows *seafarer representatives* to highlight unresolved *human element issues*.
	HE.4.5 Assess the *risks* of not involving crewmembers in each evaluation.	Crew involvement is considered when preparing company plans and programmes. Barriers to effective involvement are reviewed, and then mitigated.
4	No BPI at this level.	[No additional requirement beyond level 3. Area 4 is a fundamental support area for overall management of the human element, so nothing extra is required at the optimised level beyond fully achieving level 3.]

2.5.　Area 5 Integrating the human element into value for money decisions

The **purpose** is to take account of the human element in the acquisition, supply and operation of *systems* and the management of services.

The **benefits** of successfully addressing the human element in this area are:

- *Human element issues* are supported and promoted within the various supplier organisations.

Successfully addressing the human element in this area achieves the following **outcomes**:

- The results of examining human *effectiveness*, cost and *risk* are fed into investment decisions.

- *Human element issues* are considered during acquisition.

- *Human element issues* are considered as part of the official sign-off of purchases.

- Human element *capability* is reviewed.
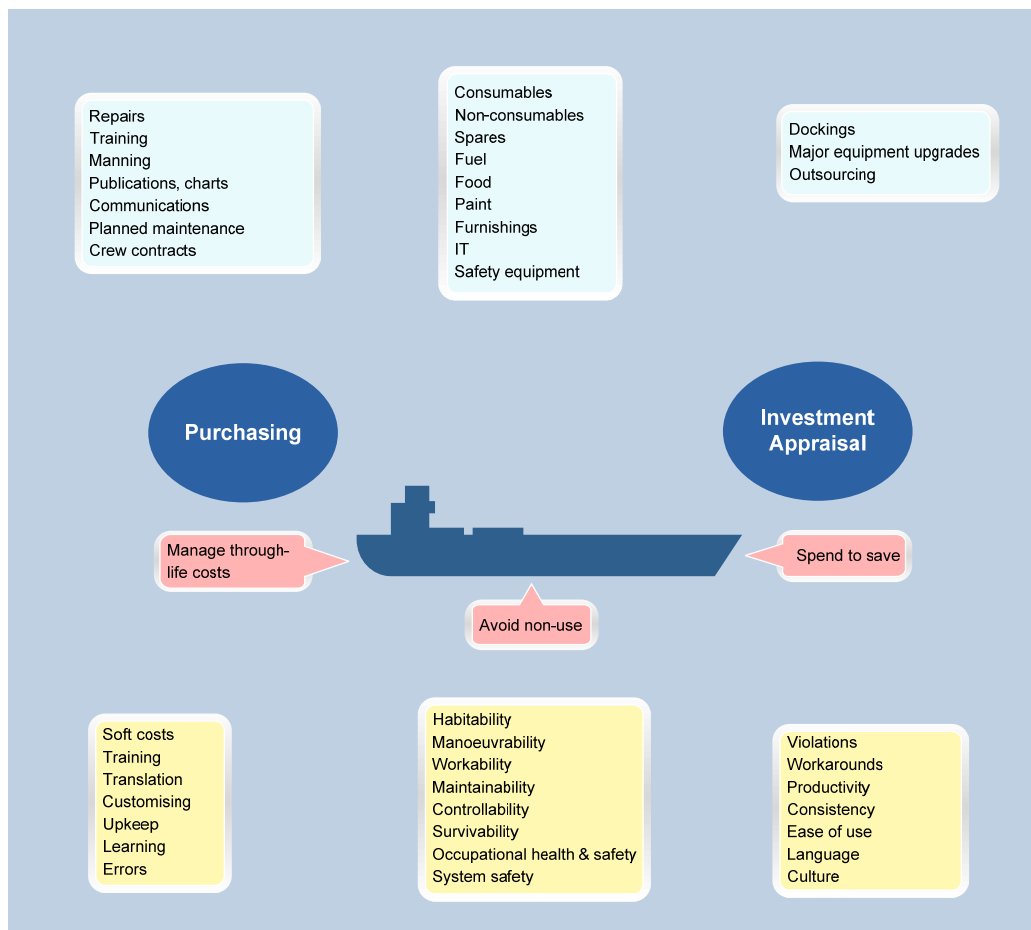
Figure 11:　Considering the human element in purchasing and investment decisions can give better value for money

Area 5: Life at each level.

Level 1 – No BPI at this level. Consideration of the human element in purchasing and value for money decisions has to be proactive. Once a purchase has been made or a contract placed, it is too late for any crew input to have a fully effective impact.

Level 2 – Purchase orders include specific requirements that will ensure that the needs of the users are served by a new item or service. For example, the instruction to buy new flashlights will include the requirement that they must have built-in pocket clips. Such requirements can come from crews and/or specific industry guidance. Technical requirements account for *human element issues*. Programmes of work include provision for crew input and feedback, and make use of the principles of *human-centred* design.

Level 3 – Consideration of *human element issues* is a formal part of the purchasing process, with the intention of achieving highest value for the financial investment. For example, draft specifications and potential solutions are reviewed for *human element issues*, enabling a statement at sign-off that the human element has been considered in the decision. People making purchasing decisions have access to human element skills and expertise.

Level 4 – Investment in e.g. training, new equipment or refits is informed by cost/benefit analysis that considers the human element, including employment and training, support and management, productivity, and the *risks* of errors and violations. Companies that deal with the organisation, such as suppliers, have entered into formal arrangements to review their use of human element best practice.

HE.5: Integrating the human element into value for money decisions

Aim: The human element is fully taken into account in the acquisition, supply and operation of *systems* and the management of services.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	No BPI at this level.	[Consideration of the human element in purchasing and value for money decisions has to be proactive - once a purchase has been made or a contract placed, any crew input will have minimal impact.]
2	HE.5.1 Take account of *human element issues* in acquisition.	Provide *human element data* and advice to purchasing processes in general. For example, include human element requirements in invitations and tenders, contracts management and purchasing. Review programmes of work and technical requirements for human element aspects. Assess manufacturers and suppliers for their ability to address *human element issues*. Include human element aspects in approval and sign-off.
3	HE.5.2 Include human element review and sign-off in all reviews and decisions.	The reviewed *human element issues* include *usability*, health and safety, manning, ease of training. The necessary skills and expertise are included in the review. The required knowledge is held by those with signatory authority.
4	HE.5.3 Take account of *human element issues* in financial management.	Provide and review human element aspects of investment appraisals, cost effectiveness analyses, business cases and high-level metrics or other financial performance indicators. Use through-life and other suitable total cost models as part of financial analysis.
	HE.5.4 Assess and improve human element *capability*.	Carry out human element *gap analyses* of *stakeholders* in company operations including supplier organisations.

2.6.   Area 6 Integrating the human element in trade-off decisions and risk management

The **purpose** is to include *human element issues* in decision making, *trade-off* and *risk management* studies, in order to mitigate the *risk* to safe and effective ship and company operation.

The **benefits** of successfully addressing the human element in this area are:

- Company *risk management* continues to encompass *human element issues*.

- Analyses of human performance, cost and *risk* are fed into company operations.

Successfully addressing the human element in this area achieves the following **outcomes**:

- The impact of changes in human performance, cost and *risk* on overall ship and company operations are identified.

- Potential conflicts between *human element issues* and other *risks* and issues are traded off or otherwise reconciled.

- Company resources are allocated on the basis of an explicit assessment of the human element *risks* to safe and effective operation.
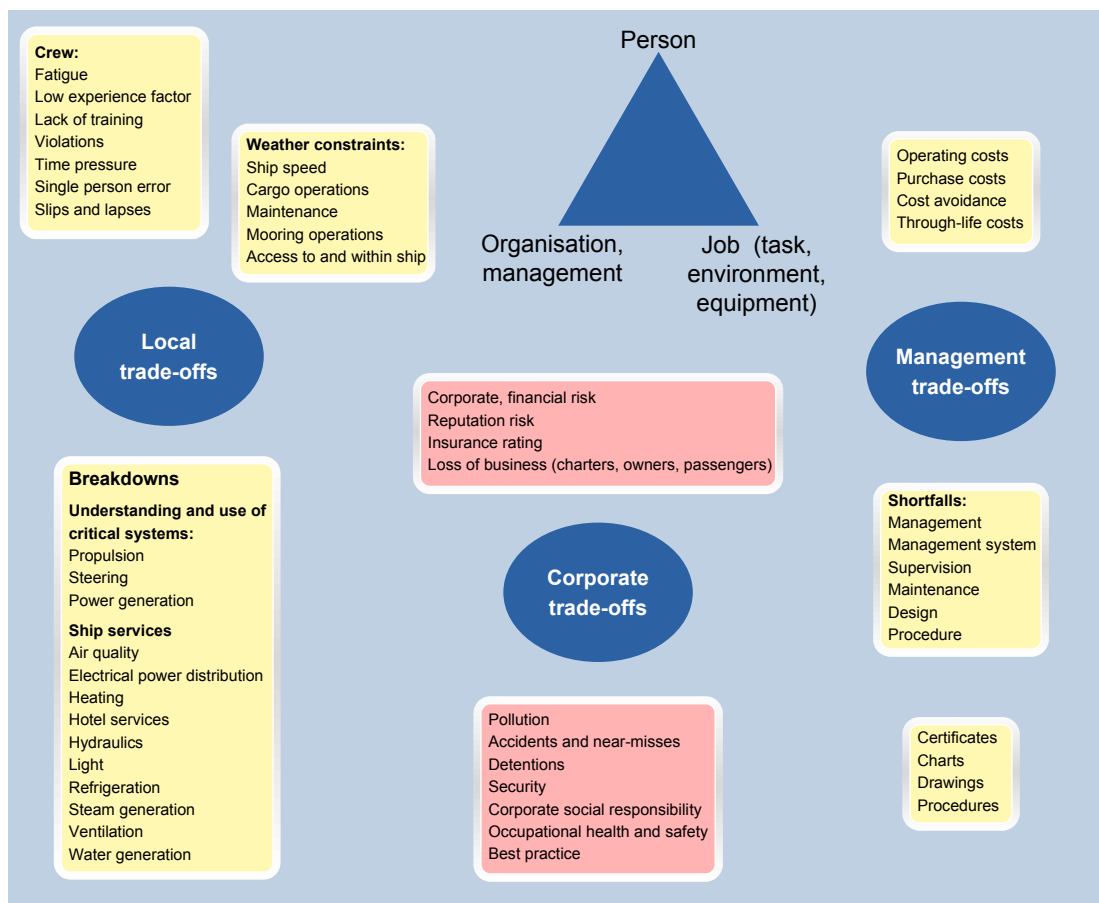
Figure 12: The human element is both a major source of risk and a significant defence against harm, and must be considered in decision making.

Area 6: Life at each level.

Level 1 – *Risks* to and from people and other *human element issues* that should be considered in decision making are considered when they come to the attention of the company. However this is likely to be as a side-effect of some other information being provided. The extent of the usable knowledge about the issue is reliant on the degree of relevant information which the report happens to contain.

Level 2 – Resources are applied once a *human element issue* has been identified. For example, if a decrease in retention is noticed, the company investigates what might have caused this and feeds the findings into any resultant redesign of its *policies* and *procedures*. The company may already be doing this for hardware problems, but here it relates specifically to *human element issues*. The approach is ad-hoc as the need arises rather than systematic.

Level 3 – Identifying emerging *human element issues* and *risks* to and from people, assessing their possible safety and operational consequences, and acting accordingly, is a continuous process. It receives the necessary resources and is carried out by the company on a routine basis. Because it is routine, the requirement to do so is incorporated into planning and can be foreseen.

Level 4 – No additional BPI. *Trade-off* studies and *risk management* are tools to support overall management of a company. Beyond level 3, improvements relate to greater depth in the same activities, rather than a different level of management.

HE.6: Integrating the human element in trade-off decisions and risk management.

Aim: The allocation of resources for mitigation of *risks* to ship operation takes full account of the human element.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	HE.6.1 Identify emerging *human element issues*.	*(The company is sensitive to* human element issues *within the data it produces and assesses.)*
1	HE.6.2 Take effective actions to address human element *risks*.	These actions may require changes to equipment or to operating practices. If this is not acknowledged and acted on, crewmembers will take their own unauthorised steps to fill the gap between what they require from the *system* and what it delivers. *Trade-offs* will have to consider training costs, design costs and operational implications.
2	HE.6.3 Assess the extent to which *human element considerations* are likely to be met by proposed operations.	Take account of the effect of the *context of use*, e.g. other equipment and likely operating conditions at sea. Assessment of *effectiveness* requires consideration of the effects of a change in one aspect of a *system* on others.
2	HE.6.4 Evaluate: – the current severity of emerging human element *risks* – the *effectiveness* of current actions.	The evaluation will consider *human element issues*, with operational and *lifecycle* cost *risks* taken into account as well as safety *risks*. Some *trade-offs* will have to consider external limits such as applicable employment laws or operational requirements.
3	HE.6.5 Plan and manage the use of *human element data* in addressing *human element issues*.	The level of human element information which is considered sufficient to inform any *risk management* decision is defined. The data allows resources to be prioritised to match emerging *human element issues*, as well as the identification of causes for change.
4	No BPI at this level	[*Risk management* is a tool to support overall company management. Improvements beyond level 3 relate to greater depth in the same activities, rather than a different level of management.]

Operations – Areas 7, 8, 9, 10, 11: "Doing the work"

This group of areas is where the consequences of the company's management of the human element can be seen in the frontline operations. It connects the organisational management of the human element to the operational end of the business, and it is where the benefits are realised from the first two groups of areas. The scope of the areas covers the complete *lifecycle* of the ships in a company's fleet. Not all companies will be doing all of the areas at all times, for example if their fleet is a static size and composition. However they are all areas where *human element considerations* will arise, and structuring the areas like this allows best practice to be applied to the full *lifecycle*.

While Areas 1 to 6 have a crucial influence on management of the human element throughout the organisation, Areas 7 to 11 have the most immediately direct influence on the crews of the ships. Successfully addressing this group of areas will mean that the human element is managed effectively at the operations end of the business. *Human element considerations* will inform the selection, design or build of a new ship or item of equipment, and the ongoing operation of the ship during its service with the company. *Human element issues* will also be managed when the company disposes of the ship.

Companies operating at the lower levels of *capability* in these areas will be starting to incorporate *human element considerations* into the way they operate the ships in their fleet. Companies at the higher levels will be fully managing *human element issues* across the *lifecycles* of their ships. Each area has a people and a *systems* aspect, and these are increasingly integrated at higher levels of *capability*. Progression through the levels will see improvements in the matching between ships and *systems* (the 'hardware') and the people using them (the 'software'). This will be achieved by appropriate alterations to the type and *usability* of the ships and *systems*, and the number and *competence* of the crews. The former will be achieved through increasingly *human-centred* design, and the latter through increasingly effective management of the company's human resources.

Figure 13: The five operations areas

2.7.   Area 7 Addressing human element issues in current operations, in-service ships

The **purpose** is to ensure that *human element issues* arising from the operation, support and maintenance of the ship and its *systems* are given sufficient attention. This includes manning, crew training, day-to-day navigation, cargo and engineering operations and any special circumstances, routine maintenance and all provisioning and other support activities.

The **benefits** of successfully addressing the human element in this area are:

- The operation of the ship is more responsive to changes in the needs of the crew (e.g. demands of their tasks or the mission, or operating conditions including weather).

- The operation of the ship is more responsive to changes in the needs of its *stakeholders* (e.g. owner, ship manager, or flag state).

- The *usability* of the ship and its *systems* is maintained at required levels.

Successfully addressing the human element in this area achieves the following **outcomes**:

- *(*Procedures *for the safe operation of the ship and for the health and safety of the crew are complied with).*

- The through-life use of the ship is monitored for continuing 'fitness for purpose'. The operating pattern of the ship remains compatible with the limitations imposed by its design.

- The crew competencies required to operate and support the ship and its *systems* are identified and continuously reviewed over time.

- Ship maintenance and *maintainability* requirements for support are met by the ship and its *systems*.
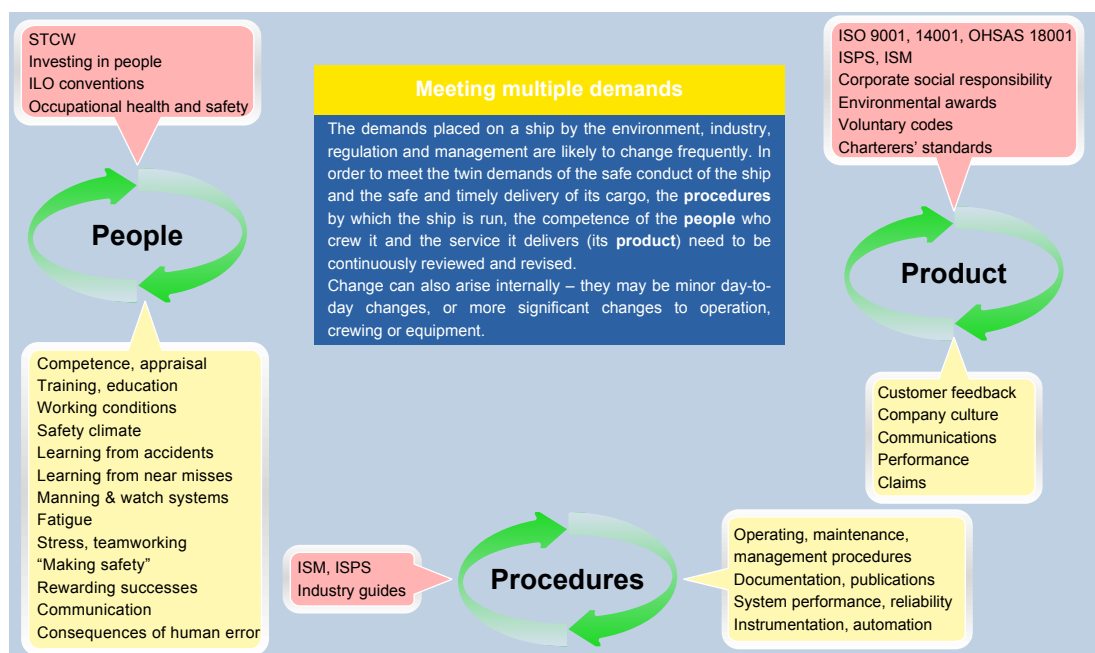
Figure 14: The operation of the ship is reviewed to check it meets changing demands

Area 7: Life at each level.

Level 1 – The information flows between the ship and its operator are captured and the operator is sensitive to them. The management style revolves around minor adjustments rather than step changes. Continuous improvement can still be achieved, but in a slow manner.

Level 2 – Information about the current situation is actively sought, and this relates specifically to the human element. The framework for this may revolve around current *occupational health and safety*, regulatory and industry guidelines or requirements (including those that are sector-specific). Human element *risks* are incorporated into the *risk* register.

Level 3 – There is a proactive programme of human element-related investment in the operation. Training can be based on knowledge of what would be most appropriate and most resource-efficient. The possibility, and possible consequences, of human error are considered.

Level 4 – Business benefits from these efforts can now be seen. The right people are deployed on the right ships in the right numbers. This appropriateness is known rather than assumed, due to feedback loops, evaluation of the effects of changes, the facility to check reactions, and proactive tackling of human error and training.

HE7: Addressing *human element issues* in current operations, in-service ships

Aim: The operation of the ship through life is monitored to ensure safe and effective operation.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	HE.7.1 Review the influence of change in the operating pattern on the safe and effective operation of the ship.	Review the effect on safe and effective operation of changes to: – operating pattern, environmental conditions – external events in the real world, e.g. political constraints – task demands (nature of work and pace) – crew (numbers, training, skills, organisation) – equipment and/or layout. Health hazards are re-assessed if the operation of the ship is changed.
	HE.7.2 Analyse feedback from crew to improve operations.	*This activity is based on feedback from the crew about the operation of the ship and its systems.*
	HE.7.3 Ensure that the ship meets regulatory requirements relating to *survivability*.	Review facilities and equipment for compliance with regulatory requirements for *survivability* and emergency preparedness.
	HE.7.4 Take action on issues arising from reviews of operations.	*Crew reviews and assessments feed into actions to improve the operation of the ship and its systems. Continuous improvement in the operation of the ship may require specialist support and advice.* *Analyse incident reports for* human element issues.
2	HE.7.5 Assess the *occupational health and safety risks* to the crew.	*The* occupational health and safety *and wellbeing* risks *to the crew are assessed as part of the* risk *assessment for the ship. This will be comprehensive and wide-ranging and include assessment of hazards to mental health including stress and cultural or language isolation.*
	HE.7.6 Review the design and operation of the ship for adherence to regulations and industry guidelines.	Perform a regular survey of workplaces and accommodation spaces to ensure that they and the software and hardware continue to meet the statutory requirements and industry guidelines. Review the crew and their training for continuing compliance with statutory requirements and industry guidelines. Ensure that health and safety education and training is carried out. Monitor trends in sickness and accident records for health and safety problems. Analyse near-miss information for *human element issues*. Review the design of the ship to validate that it meets its specification.
3	HE.7.7 Deliver training and other forms of awareness-raising to crew and support staff.	*Effective training is delivered to meet identified training needs (rather than just statutory requirements) and to facilitate the transition to new designs of jobs and new teamworking arrangements. There is continuing delivery of training and education (awareness-raising, e.g. toolbox talks, onboard safety training, breakdown drills etc.) to crew and support staff to meet identified training needs. There will be basic training for* system usage, and ongoing training to promote crew development where necessary.
	HE.7.8 Review the *risks* to the public and environment arising from human error in the operation of the ship.	The *risks* arising from human error should be related to the overall *risk* assessment of the ship operation. *Risks* arising from deliberate misuse should also be assessed.
4	HE.7.9 Operate to a crewing *strategy*.	Develop options on staffing, recruitment and the education, training and professional development of crewmembers that are co-ordinated with maintenance, equipment, and operational *procedures*. Examine operational costs in order to assess the cost of personnel options. Apply organisation-level human resources *strategy* to ship and equipment acquisition. Present ship manning concepts for operation and support (e.g. for senior management approval).

2.8. Area 8 Addressing human element issues in starting an operation

The **purpose** is to ensure that the human element is given sufficient attention throughout the introduction and validation of a new operation. This could include, for example, operating on a new route, carrying a new type of cargo, changing charter or changing the *policy* on manning or the sourcing of crews.

The **benefits** of successfully addressing the human element in this area are:

- The fit between the ship and its *system*, its operational goals and the operational needs of the crew is reviewed.

- The *human element issues* associated with re-organisation and training are aligned with the introduction of the new ship or operation.

- The ship carrying out a new operation is incorporated into the organisation of the ship operator e.g. the safety management *system*, the support organisation, human resources.

- The ship meets statutory requirements.

- The costs, timescales and resources required to put the ship into service are fully understood.

Successfully addressing the human element in this area achieves the following **outcomes**:

- The ship and its *systems* are adapted to meet the requirements of the particular operation.

- The transition is made to new designs of jobs and new teamworking arrangements.

- Introduction and rollout are not adversely affected by *human element issues*.

- The operational acceptance of the ship and its *systems* include critical human element criteria.
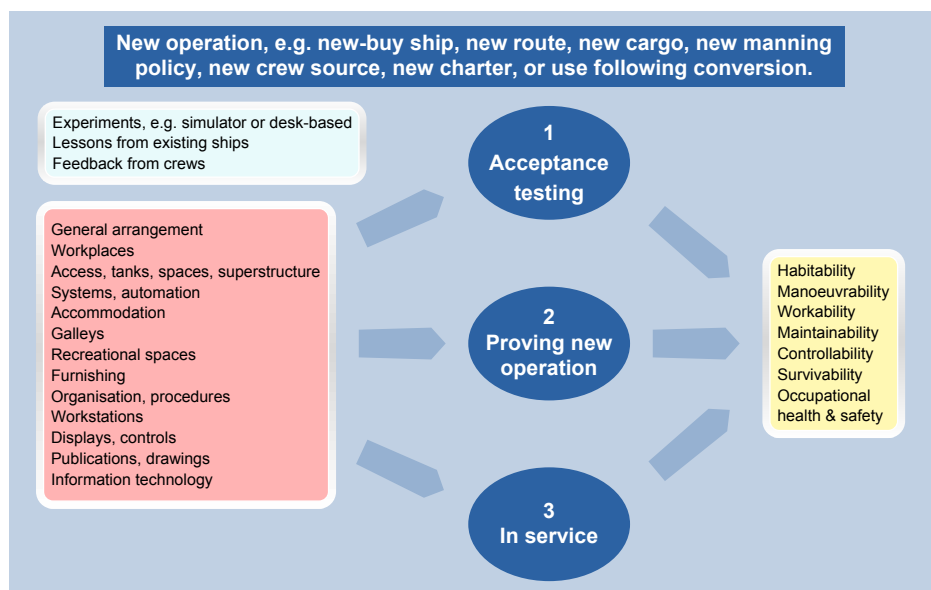
Figure 15: Feedback on the operation of the ship and its procedures can improve the safety and effectiveness of a new operation

Area 8: Life at each level.

Level 1 – Before starting an operation, lessons are applied from existing ships to other operations or ships. During the transition and bedding-in, information streams are viewed for emerging *human element issues*. Appropriate action may then be taken once a particular concern has become apparent. This can include "active reactiveness", e.g. providing reassurance to the staff when starting something which is new to them. There will be a tighter feedback loop than usual, so that concerns can be acted on quickly when expressed.

Level 2 – Specific studies related to the new operation are carried out, for example on the feasibility of the operation with regards to working or crewing in a particular manner. Experiments will be used, e.g. deliberately operating a ship in a different way, carrying out task studies and job designs, or doing health and safety studies. The findings are reflected through to future operations, perhaps via simulation, tabletop or desk-based activities. Activities to change competencies will be carried out if the need becomes apparent.

Level 3 – The plan aims for new operations to be introduced without complications. The right training, equipment, number of people or other resources are provided at the right time to the right people. If problems are identified, corrective action is taken in a timely fashion.

Level 4 – There is a rollout *strategy* for any new operation. However the plan does not have to be followed strictly if it becomes inappropriate, perhaps due to changing circumstances – flexibility is built-in to allow necessary adaptation. *Human element issues* are considered in assessments and approvals at all component stages as well as when declaring overall successful completion.

HE.8: Addressing *human element issues* in starting an operation - e.g. new buy, new charter, following conversions, new ship role

Aim: New business operations take full account of the human element.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	HE.8.1 Analyse feedback on the operation of the ship and inform the company of emerging issues.	Feedback is received and analysed to extract the *human element data* and, where appropriate, make it known to the relevant parts of the organisation. The feedback could take the form of formal and informal reports, interviews etc.
	HE.8.2 Maintain contact with all involved staff throughout the introduction of the ship or new operation.	Ensure that *human element issues* are given sufficient attention during the introduction of the new ship or operation. This may include re-organisation of jobs and working practices, reporting responsibilities, etc.
2	HE.8.3 Test that the ship and its *systems* will meet the needs of the crew, the operation and the environment.	Safety and health hazards are evaluated in the context of the new operation. Evaluation includes *procedures*, manuals, documentation and IT. Review the ship and its *systems* for adherence to regulations and industry guidelines. "Try before you buy."
	HE.8.4 Build the required competencies into training and awareness programmes.	Competencies include not only the crew but also support staff.
3	HE.8.5 Identify, specify and deliver the training and support for the operation of the ship.	Training and support are developed in parallel with the introduction of the new service. Training is based on an explicit analysis of the need. For examples see Figure 16. *Procedures* are developed and tested *iteratively*, i.e. reviewed and refined, using feedback information, until they take full account of the *human element issues*.
4	HE.8.6 Evolve options and constraints into a rollout *strategy* covering technical, integration, manning issues.	There is a plan which ensures that people are available for the introduction of the new service. The *strategy* includes: – Allowance for adaptation during the introductory period, including revision of training and maintenance. – Ensuring *human element issues* are included in assessment and approval. – Specifying a realistic time line and kill line for the project. – Knowing the costings for rollout.

POTENTIAL TRAINING NEEDS

All IMO Model Courses, PLUS others not currently covered, for example:

Automatic Identification Systems (AIS)	High-speed navigation
Ballast water management	Inventory control
Bridge resource management	ISM Code
Crew resource management	Leadership and teamwork
Diet	Managing fatigue
Drug and alcohol prevention	Maritime resource management
Electronic surveillance equipment	Personal attributes
Enclosed space entry	Practical shiphandling
Engine room resource management	Principles behind and operation of Integrated Bridge
Engine room systems management	Systems (IBS) and Integrated Navigation Systems (INS)
Environmental awareness	Risk & safety management
Fitness and health	Use of electronic charts
Helicopter operations at sea	Vulnerability of electronic position fixing devices

Figure 16: Potential training needs for a new operation.

2.9.   Area 9 Addressing the human element in repair and modification

The **purpose** is to ensure that modifications to the ship and its equipment take account of *human element issues* identified in service, and that the human element is managed during major work originating from the company office.

The **benefits** of successfully addressing the human element in this area are:

- The ship continues to meet the requirements of the crew and operational *effectiveness*.

- *Human element issues* associated with the repair and modification activities are managed.

- *Human element issues* are supported and promoted with the prime contractor.

- The costs, timescales and resources of removal of the ship from service take account of human-*system* issues.

Successfully addressing the human element in this area achieves the following **outcomes**:

- Crew requirements and *human element issues* are taken into account in refit and repair.

- The human element *risks* both from and to the repair work are considered.

- The appropriate resources are made available for the work.

- The need for the work to consider the human element is identified and accepted by the ship operator, and promoted to the prime contractor.

Occupational health & safety
Crew health & welfare
Work and rest hours
Time pressure
Boredom, isolation, morale
Personal protective equipment
Internal & external environmental conditions

NB This area covers major work originating in the company office, not work originating in the planned maintenance system and implemented by crews – this is addressed under Area 7, Current Operations

Sources to inform changes to equipment and layout:
Collect and analyse in-service reports
Analyse internal and external audit findings
Analyse incidents and near-misses
Crew debriefing on operations
Handbooks & operating instructions
Ship performance and financial figures
Ship and company safety meeting minutes
Regulatory developments

Specification and planning

Acceptance testing against:
Habitability
Maintainability
Workability
Controllability
Manoeuvrability
Survivability

Programme of trials and testing

Availability of onboard services
Power generation
Heat
Light
Air conditioning
Catering facilities
TV/radio
Telephones
Firemain

Dry docking

Availability of shore support
Waste disposal
Fuel
Fresh water
Fresh provisions
Catering facilities
Telephones
Access to shore
Emergency response

Testing and return to service

Major work planned by office
Time out of service
Repair yard
Dock / dry dock
Major retrofit at sea – additional specialised staff

Ship / shore / yard
Authority
Responsibilities
Communications

Number, designation and competence of standby crew and shore staff
Senior officers/junior officers/ratings
Deck
Marine engineering
Electro-technical
Hotel services
Supervision
Competence
Experience
Training

Compliance:
Flag state
Local regulatory or procedural requirements (port or harbour)
Prime contractor's requirements
Permanent
Temporary
After return to service

Ship and dock or yard safety & security
Onboard firefighting
Stability
Mooring arrangements
Emergency response
Gas freeing
Control of access
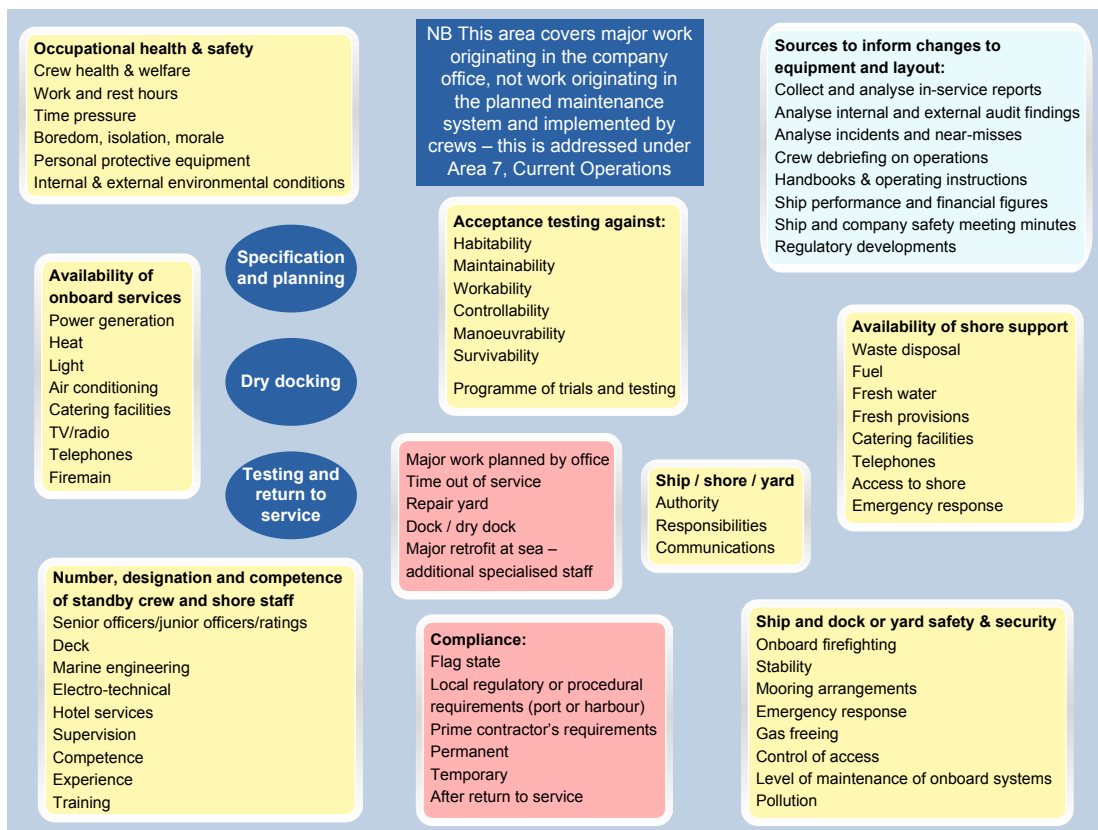Level of maintenance of onboard systems
Pollution

Figure 17: Human element considerations affect, and are affected by, planned repair, refit and modification activities.

Area 9: Life at each level.

Level 1 – The company responds to *human element issues* identified by the crew by including improvements to the ship or its *systems* in the work programme. A list of essentially or statutorily required actions is built up, but *human element issues* may not be specifically considered as an integral part of this. The company responds to emerging *human element issues* during a period of repair or modification work, for example by adjusting the resources that are made available to suit the requirements of the yard or its environment.

Level 2 – The company identifies *human element issues* that can be resolved during the repair period, e.g. by questionnaire. The human element aspects of changes being made (e.g. for statutory or commercial reasons) are included in the specification, using crew input, best practice guidance or both. The changes made are tested for human element aspects, e.g. by post-docking checks. The company predicts in advance how well the people, budget and time available will match up with the requirements of the work to be carried out. This will include consideration of language restrictions where applicable, as well as numbers of people. It takes steps to ensure that any crewmembers or shore staff involved are able to live and work safely, and to avoid boredom if their role is passive. The company finds out requirements for retrofit or alteration from crews and other *stakeholders* when problems are suspected.

Level 3 – Gathering data on how to improve ships is a routine activity. Improvements are considered at fleet and individual ship levels, with transfer of lessons learned. The *usability* of the ship is assessed after docking. There is a plan to ensure that the schedules and resources are appropriate for the repair or modification work to be done. Equipment altered or installed achieves *usability*. It is known that the regulatory and class requirements for the ship and its flag state, and any local requirements for the yard or port state, will be met throughout the period of work and when the ship returns to service. The required information which is necessary to ensure this is collected as a matter of routine. *Human element data* automatically builds up from normal operating *procedures*.

Level 4 – The company can cost-justify work on purely *human element considerations*. There may be changes to the ship in anticipation of changes to the crew or manning arrangements. Post-work tests are used to improve methods for data gathering and analysis as well as to influence future work. The human element aspects of repair and modification activities are incorporated into the company's *strategy* so that the costs and benefits of addressing them are known. The resource and schedule requirements of both the prime contractor and the company are known to be appropriate and balanced. The matching of people and *systems* is integral to the repair or modification work carried out. Equipment *usability* levels are known to be optimised to the requirements of the crew and the company.

HE.9: Addressing the human element in repair and modification

Aim: Repair and modification work takes full account of the human element.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	HE.9.1 Respond to *human element issues* that arise during the period of repair and modification.	Crew in attendance are rotated, increased or reallocated elsewhere if it is found that the work pattern is inappropriate. Alternative accommodation arrangements are made for staff if living conditions onboard become unsafe or unhygienic.
	HE.9.2 Address ship *human element issues* in the specification.	The *human element issues* that have been identified by the crew are considered in drawing up the specification. Improvements to the *usability* of the ship and its *systems* are included to address known issues.
2	HE.9.3 Identify *human element issues* that can be addressed during the repair period.	The company seeks to identify *human element issues*. Issues are considered and prioritised, and potential solutions are identified for inclusion in the work to be done.
	HE.9.4 Include human element requirements in the specification.	Human element requirements are included in the specification, using input from the crew, industry guidance or both. Assess yards and suppliers for their ability to address *human element issues*. Include human element aspects in approval and sign-off.
	HE.9.5 Test the changes for human element aspects.	After the work the changes to the ship are checked to assess how well *human element issues* have been resolved, human element requirements have been met and whether any new issues have emerged.
	HE.9.6 Predict the resources that the planned work will require.	Consider how many and what types of crew and shore staff, e.g. superintendent, will be needed during the work. Consider how long the work will take, and what impact this will have on work/rest patterns, morale etc. Find out any relevant regulatory or procedural requirements that will apply and define any constraints that result.
	HE.9.7 Assess the *risks* and health and safety issues associated with the repair or modification work.	Identify and assess the *risks* to the crew in attendance during the work. This will take account of hazards to both physical and mental health.
3	HE.9.8 Use routine data gathering to identify and prioritise improvements.	There is regular gathering of *human element data* that is used in developing the specification. Lessons learned are transferred between ships.
	HE.9.9 The *usability* of the ship is assessed after the work.	The assessment of the *usability* of the ship after the work covers the whole ship, not just the specific changes made.
	HE.9.10 Inclusion of human element requirements in changes is a formalised process.	Human element requirements and issues are included in work and equipment specifications as a matter of formal routine. *Human element issues* include *usability*, health and safety, manning and ease of training. The people developing the specifications have access to the necessary skills and expertise.
	HE.9.11 Preparations for the repair or modification work are made in advance.	It is decided and communicated to crewmembers in advance whether they will be required to stay with the ship during the work, or whether they will be reallocated or put on leave. The crew of the ship concerned on the preceding voyage(s) are given long notice of any preparatory work which must be done, to allow them to incorporate it into their existing work plans and crew rotas.
4	HE.9.12 Operational *strategy* is an input to the specification.	Changes to the ship are made in anticipation of organisational or management changes. For example, accommodation is revised before changes to crewing arrangements.
	HE.9.13 Evaluate cost and time schedules against *human element considerations*.	Fully understand the implications for the human element of planned schedules or resource availability. Fully understand the implications for the schedule or resource requirements of *human element considerations*.
	HE 9.14 Develop a plan to achieve the optimum level of *usability* from the work.	It is known that the completed work or e.g. retrofitted equipment meets the requirements of the company and the users at sea.\n\nIt is known that new or altered planned maintenance *systems* are usable on the ship without the need for duplication, and without conflicting with existing operations.

2.10.   Area 10 Addressing the human element in laying up or selling on

The **purpose** is to take account of the needs of the crew and support staff in laying-up or selling on.

The **benefits** of successfully addressing the human element in this area are:

- There is support for the crew and support staff during and after decommissioning.

- Health and safety issues associated with removal from service or decommissioning are reduced to an acceptable level.

- *Human element issues* associated with removal from service or decommissioning, e.g. carelessness or violations, are reduced to an acceptable level.

Successfully addressing the human element in this area achieves the following **outcomes**:

- The re-allocation of crew and support staff is defined and actioned.

- The hazards to crew, support staff and the environment are monitored.

- Lessons are learned for future operations or replacement ships.
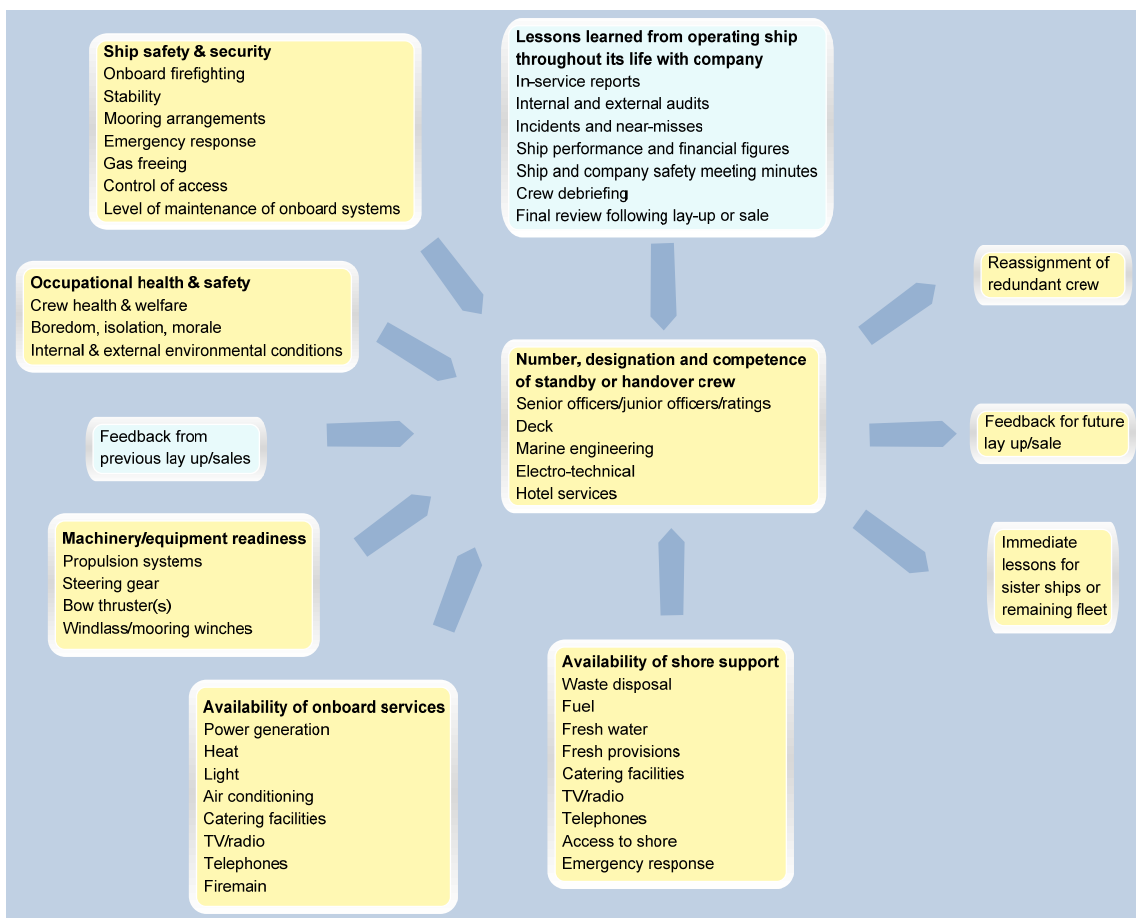
Figure 18: Taking a ship out of service brings both human element considerations during the activity, and the opportunity to learn lessons from the outgoing ship for other current or future ships.

Area 10: Life at each level.

Level 1 – As a minimum, experiences when laying up are recorded. The sources and types of information are the same as for a ship in operation, but now notice is taken of lessons to be applied next time the same activity is carried out. However these lessons are not acted on immediately for the ship in question.

Level 2 – Specific studies related to taking the ship in question out of service are carried out. This will include experimentation, either practically or virtually by simulation or desk-based activities.

Level 3 – A plan is in place for laying up or selling on the ship, to allow the process to be managed. A number of ships and operations are considered when deciding how best to reallocate, lay off or transfer the affected staff, after capturing and understanding their skills and training. There is a company-wide staff development plan, which considers a comprehensive list of vacancies or other opportunities.

Level 4 – There is consideration of not only individual employees but also the whole ship, which brings business benefit. The company develops people towards long-term business goals, by considering future plans as well as immediate concerns.

HE.10: Addressing the human element in laying up or selling on

Aim: The human element is fully taken into account when taking a ship out of service.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	HE.10.1 Collect and analyse in-service reports to learn lessons for future ships or operations.	This activity uses information generated as issues emerge. Lessons from operation are gathered to help future operations with other ships, updates to other ships. Lessons from laying up and selling on are learned for use on future occasions.
2	HE.10.2 Conduct debriefing and analysis for future ships and operations.	This activity is specifically conducted as a learning activity. An early start may be needed in some situations e.g. to influence new build.
	HE.10.3 Identify *risks* and health and safety issues associated with removal from service.	The health and safety issues and *risks* to the crew laying up or standing by during handover are assessed, for example the reduced facilities on board. This forms part of the *risk* assessment for the ship.
3	HE.10.4 Define how the crew and support staff will be re-allocated, laid off, transferred to other duties.	A plan is in place to manage any reallocation, laying off, or transfer. This takes account of people's skills and training.
4	HE.10.5 Take into account team structures and social networks.	Explicitly understand relationships between senior officers and how they can be used to best advantage in future. For example, consider whether the crew of a very successful ship should be kept together as a good team, or dispersed to spread good practice.

2.11. Area 11 Addressing the human element in design and build

The **purpose** is to present the needs and to represent the interests of the crew and support staff to naval architects, designers, equipment manufacturers etc. This occurs in the specification, design and acceptance of the ship, whether first of class or a sister ship.

The **benefits** of successfully addressing the human element in this area are:

- Hazards to and from the crew are identified, and reduced to and maintained at an acceptable level.

- The design option that best fits the operational requirements is evolved.

- Potential *human element issues*, and scope for improvements in operability, are identified and included in *trade-off* studies.

Successfully addressing the human element in this area achieves the following **outcomes**:

- The design is based on trials of prototypes by potential crew members.

- The principles of *human-centred* design are applied in the development of the ship and its *systems*.

- The through-life human element costs (e.g. crew, training costs), *effectiveness* (e.g. human performance) and *risks* are known.

- Feedback and further requirements from the crew are collected and used.
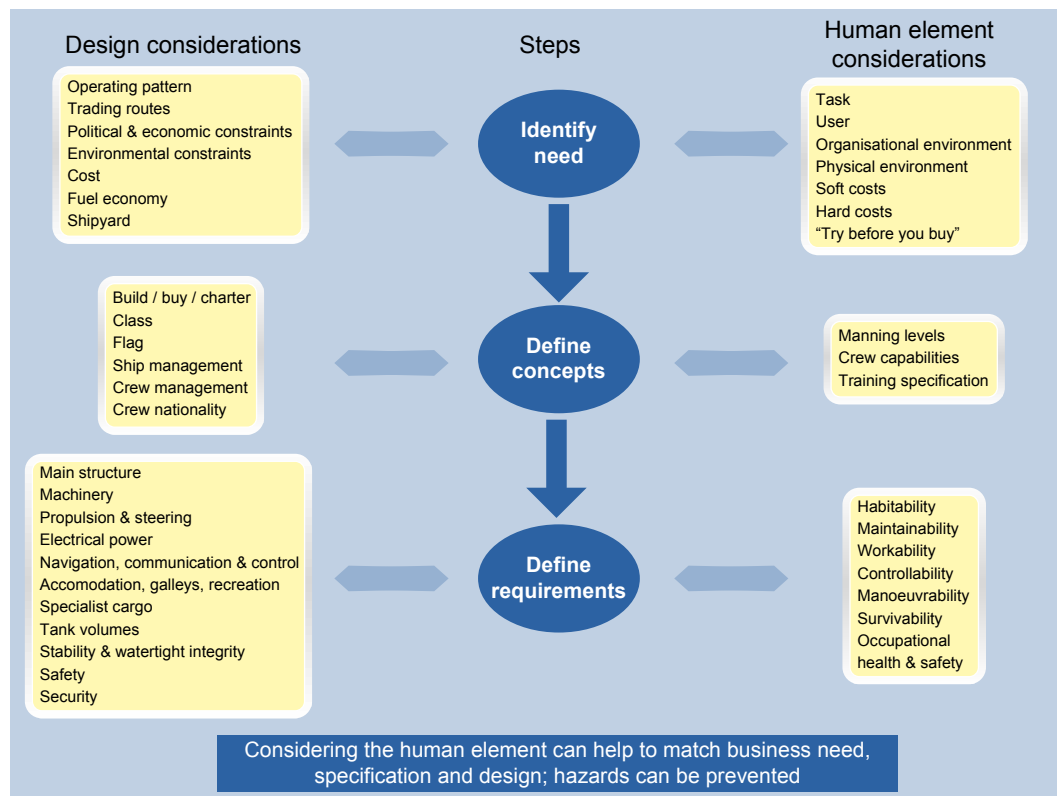
Figure 19: A human-centred approach to ship and system design

Area 11: Life at each level.

Level 1 – The company ensures that type approval and regulatory requirements are met. The preferences and needs of the crew are captured, but based on anecdotes rather than a formal review when developing specifications. Specific complaints and any history of maintenance problems, for example from a sister ship or previous use of the same item of equipment, will be considered.

Level 2 – Input is collected from crew carrying out real tasks in a realistic environment. Feedback from an existing sister ship is obtained where applicable. Prototype surveys and human reliability analyses are carried out.

Level 3 – A ship is produced that is known to be fit for its purpose, and at a known cost. However, while the cost is known, it cannot be stated with certainty that this represents the best possible value for money.

Level 4 – The company is fully aware of the benefits of the chosen design options. They are selected due to best fitting the organisation as well as being best practice. There is a competitive driver for the design and building, and it is known that the ship will meet its through-life operating targets.

HE.11: Addressing the human element in design and build

Aim: The human element is fully taken into account during the design and building of a new ship.

LEVEL	BEST PRACTICE INDICATOR	BEST PRACTICE GUIDANCE
1	HE.11.1 Predict the *occupational health and safety risks* to the crew.	*(Potential sources of work-related injuries, ill-health and diseases are predicted in relation to preventing and controlling them.)*
2	HE.11.2 Review the developing ship and/or *systems*.	Experienced crew are made available to stand by a new ship during the build, or to deal with the manufacturer of equipment, to check that the users' requirements are being met.
	HE.11.3 Collect input from the crew (or *representative seafarers*) on the *usability* of the developing ship and its *systems*.	Input is best collected from crew carrying out real tasks in a realistic environment. Evaluate *occupational health and safety* hazards. Assess *usability* of prototypes and collect comments. Assess the *effectiveness* of training.
	HE.11.4 Assess the *risks* to the community and environment arising from human error in ship operations.	Consider how the design and build options could affect safe and effective operations, especially the influence of design *characteristics* on the potential for crew error. Review potential hazards and their consequences to identify where improvements could be made to 'design them out'.
3	HE.11.5 Ensure the production of *human-centred* solutions for each design option.	For novel ship, *system* or equipment options, propose crewing solutions with allowances for training, support and safety. Take account of best practice in ergonomics and the human sciences. Ensure that the ship and its *systems* are compatible with supporting *systems* e.g. maintenance. See also HR and HCD areas (Areas 12 and 13).
	HE.11.6 Try out key aspects of the ship and its *systems* before they are built.	Test design solutions with crew or *representative seafarers* e.g. use simulations, mock ups, models. Include enough of the ship or the *systems* to test safeguards and the safety of operations.
4	HE.11.7 Generate design options for each aspect of the ship and its *systems* related to operation and its effect on *stakeholders*.	Design solutions are selected not only on the basis of being best practice but also for best suiting the organisation. The choice takes account of through-life operating targets.
	HE.11.8 Design for customisation.	Design allows for customisation to meet local, cultural or operational needs on an ongoing basis, rather than once only during the design and build process.

3.   Part 3: Technical best practice for human resources and human-centred design

These two underpinning technical processes are concerned with the correct and timely delivery of the right people for the job and of *systems*, equipment and technical resources that are 'fit for purpose' i.e. with good *usability*. In contrast to Areas 1-11, they do not affect the management of the whole of the shipping company, and are not directly concerned with the integration of the human element into company activities. For these reasons they are presented in a different format from Areas 1-11.

The statements of best practice are written for assessment purposes, and are not a complete solution for, say *competence* management, or for technical activities within a specific company. However, they provide a set of requirements and criteria to assist in the development of company-specific solutions for *competence* management and for technical activities such as *procedure* writing.

This part describes the underlying technical processes behind engineering human resources and *human-centred* design, which are essential in developing a truly *human-centred* organisation. The guidance will therefore be useful for all operators. However carrying out an assessment against these processes will not be fully worthwhile until the company has been judged to be operating at or above level 2 in the eleven core areas. Companies operating at level 2 will have no requirement to carry out these final two areas, but those aspiring to progress to level 3 and beyond in all areas of human element management practice will need to account for them.
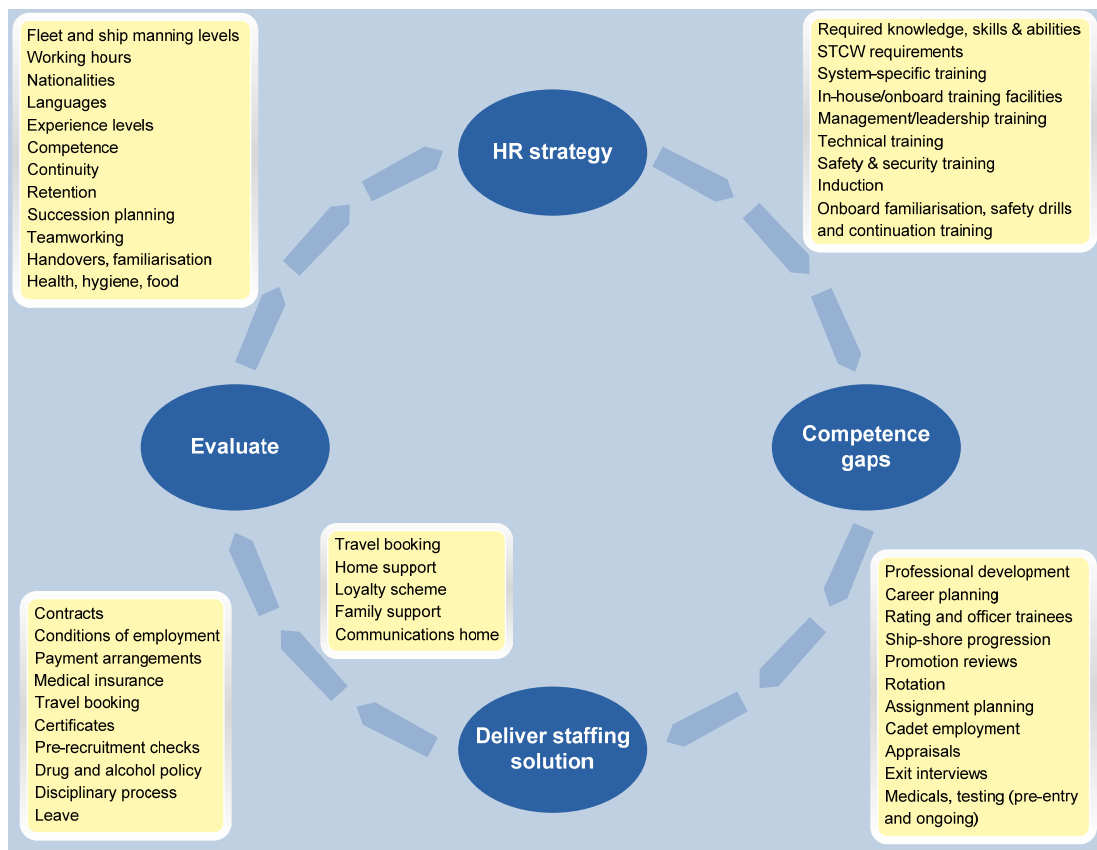
Figure 20: A continuous improvement cycle for human resources

3.1. Area 12 Human resources

The **purpose** is to achieve safe and effective operation in the most timely and cost-effective manner by provision of the correct number of competent crew and support staff.

NB the terms "staff" and "staffing" are used throughout this guide as general terms for both ship and shore workers, and "crew" refers to both ratings and officers.

The **benefits** include:

- The physical and cognitive capabilities required to train for, operate, maintain and sustain ship operations are defined and made available.

- The instruction or education, and on-the-job or group training required to give staff their essential values, attitudes, knowledge, and job skills are provided.

- The workload requirements for ship operation, maintenance and support, and undertaking of associated training are defined and optimised.

- The HR *strategy* for the organisation adapts to changes in organisational needs and technical and operational context.

As a result of successful implementation of this process the following **outcomes** are achieved:

- The crew and support staff are specified, deployed and maintained within a given social environment throughout the life of the *system*.

- The desired outcomes for the organisation are defined and promulgated.

- The operational, technical and organisational requirements for safe and effective ship operation by the organisation are used in staff development.

- Individual and collective training requirements are reconciled with technical requirements and desired outcomes.

There are four processes within the human resources area:

- HR.1 Define and operate a human resources *strategy*;

- HR.2 Define standard competencies and identify gaps;

- HR.3 Define staffing solution and delivery plan;

- HR.4 Evaluate operational solutions and obtain feedback.

The scope of the operation to be assessed will be resolved at the start of the assessment exercise. Possibilities include the operation of a single ship, operation of a set of similar ships or all operations by the ship operator or a company such as a manning agency.

| **HR.1 DEFINE AND OPERATE A HUMAN RESOURCES STRATEGY** |

The purpose is to operate an HR *strategy* based on the company business objectives that includes a mechanism for recording and implementing lessons learnt.

The staffing, recruitment, technical and operational strategies are interrelated. The *trade-off* between the requirements arising from each is dynamic. The ranking of importance between strategies is not fixed. HR *strategy* includes recruitment, selection, staffing and succession planning, terms and conditions, training development. Users may include teams. Skills means knowledge, skills and attributes

As a result of successful implementation of this process the following outcomes are achieved:
- Staff work together to achieve the objectives of the organisation.
- HR recruitment, training and delivery strategies take account of feedback.
- The overall performance of the ships and their *systems* is consistent with required *capability*.

HR.1.1	Decide the goals, behaviours and tasks of the organisation
HR.1.2	Define the global numbers, skills and supporting equipment needed to achieve those tasks
HR.1.3	Decide how many people are needed to fulfil the *strategy* and what ranges of *competence* they need
HR.1.4	Set up a mechanism for implementing and recording lessons learnt
HR.1.5	Feed findings back into future HR recruitment, training and delivery strategies
HR.1.6	Enable and encourage people and teams to work together to support the organisation's objectives

| **HR.2 DEFINE STANDARD COMPETENCIES AND IDENTIFY GAPS** |

The purpose is to identify the changes to existing staffing and personnel resources and skill demands imposed by planned operations and predict staff availability over planned future developments.

Overall *effectiveness* of ship operations is dependent on crew *effectiveness*, and so there is a need to address this. It is easy to manipulate the equipment but not the user's abilities. Assess the contribution of user goals and tasks towards the overall *effectiveness* of ship operations and hence identify equipment options to enable the user to realise these goals, i.e. fit the equipment to the user rather than expecting the user to adapt to the equipment.

As a result of successful implementation of this process the following outcomes are achieved:
- Existing and future human resources are clearly stated, explicitly identifying any shortfalls that may limit safe and effective ship operations.
- Numbers and skills are known, and when they are required.
- There is a detailed and regular staffing and personnel audit.

HR.2.1	Identify current tasking/duty
HR.2.2	Analyse gap between existing and future provision
HR.2.3	Identify skill requirements for each role
HR.2.4	Predict staff wastage between present and future
HR.2.5	Calculate the available staffing, taking account of working hours, watchkeeping patterns and operating cycles, including physical limitations and contingency
HR.2.6	Compare the available staff with the operational requirements to define the gap, and communicate requirement to design of staffing solutions
HR.2.7	Create *capability* to meet ship operating requirements in the future (undertake succession planning)
HR.2.8	Produce and promulgate a validated statement of shortfall by number and range of *competence*

HR.3 DESIGN STAFFING SOLUTION AND DELIVERY PLAN PROCESS

The purpose is to deliver individual and collective training solutions reconciled to the requirements of safe and effective ship operations.

The HR process reminds the organisation that ships have to be manned, resourced, supported and maintained. Staff will have to be developed to meet these roles. The crew will need to work to any employment regulations and working hours restrictions that apply, and within an incentives framework. The organisation can also be reminded that the ship operation will eventually end and that this will involve human action.

As a result of successful implementation of this process the following outcomes are achieved:
• Sufficient, suitably capable staff are deployed at the right time and in the right place to operate and support the ship and its *systems*.
• The technical and operational requirements of the ship operation are integrated into staff development.

HR.3.1	Identify and allocate the functions to be performed
HR.3.2	Specify and produce job designs and *competence*/skills required to be delivered
HR.3.3	Calculate the number of people required
HR.3.4	Generate costed options for delivery of training and/or redeployment
HR.3.5	Evolve options and constraints into an optimal implementation plan
HR.3.6	Develop and trial training solution with representative users
HR.3.7	Deliver final training solutions to designated staff according to agreed timetable
HR.3.8	Identify any opportunities for redeployment

HR.4 EVALUATE SHIP OPERATIONS AND OBTAIN FEEDBACK

The purpose is to provide data on ship operations in order to improve staffing provision and deployment, ship and *system* design, and operational deployment.

As a result of successful implementation of this process the following outcomes are achieved:
• The strengths and limitations of ship operations with the current staffing are described.
• The contributions of unofficial shortcuts or workarounds to ship operations and support are identified.
• Operational data to support the safety management *system* are obtained.

HR.4.1	Develop a *strategy* for data gathering
HR.4.2	Provide means for user feedback
HR.4.3	Conduct assessments of *usability*
HR.4.4	Interpret the findings
HR.4.5	Validate the data
HR.4.6	Check that the data are being used

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
Information technology

COMPETENCE

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

Learn
KNOWLEDGE

Need

APTITUDE

Interpret to provide

To enable

Make practical

Facilitate

To aid   METHODS   Automate

Build up   EXPERIENCE   To develop

Train to acquire

Augment   TOOLS

SKILLS

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
Human resource management programmes
Working hours templates
Planned maintenance programmes
Software support programmes
Stores and spare parts
Company policies and procedures
Industry guidance

KNOWLEDGE
Controlling the operation of the ship
Care for persons onboard
Cargo handling and stowage
Marine engineering
Maintenance and repair
Electrical electronic & control engineering
Radio communications
Personal survival
Fire prevention and 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
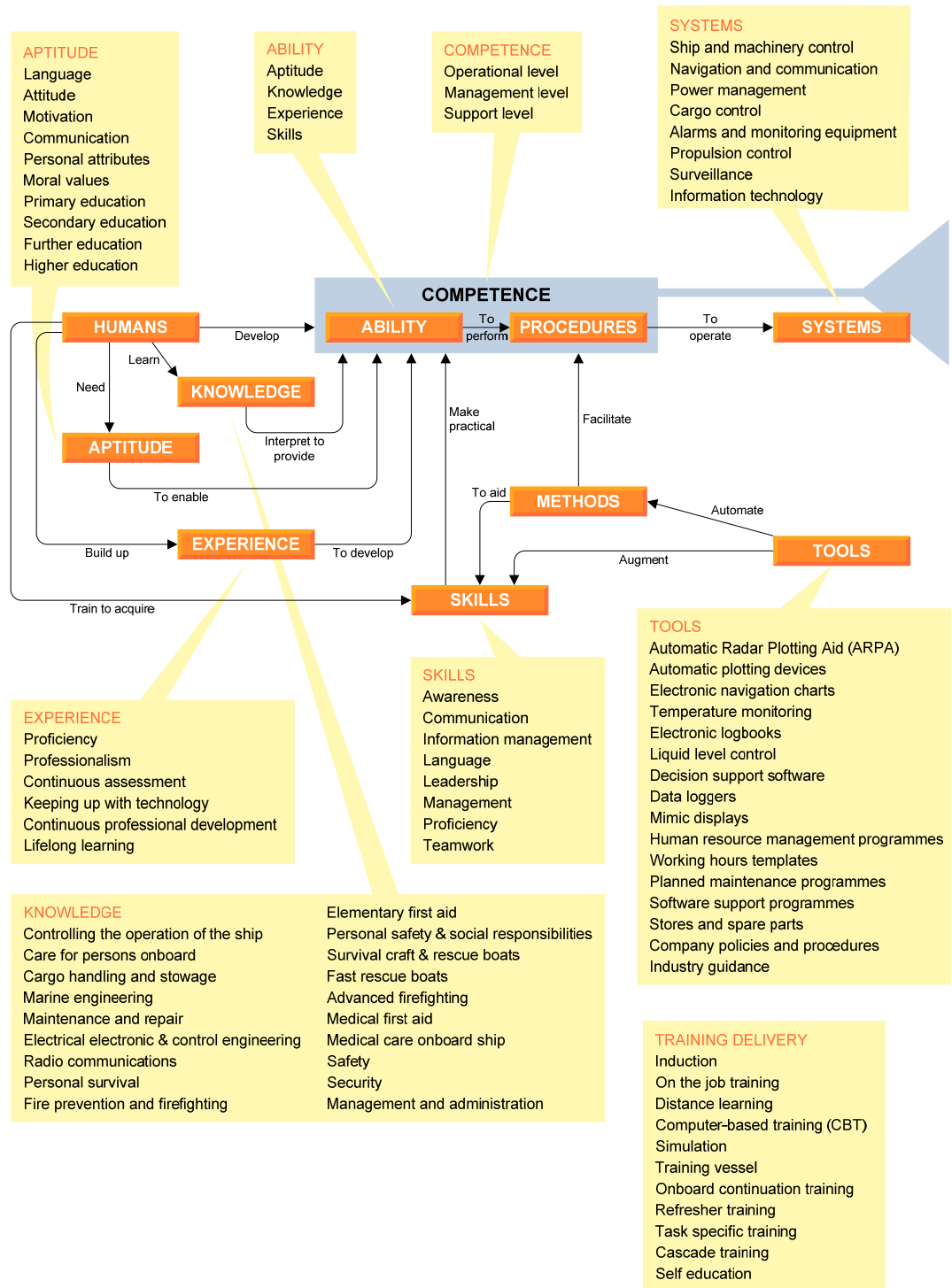
Figure 21: Developing and maintaining the competence of crews to perform the required procedures is a complex and continuous process.
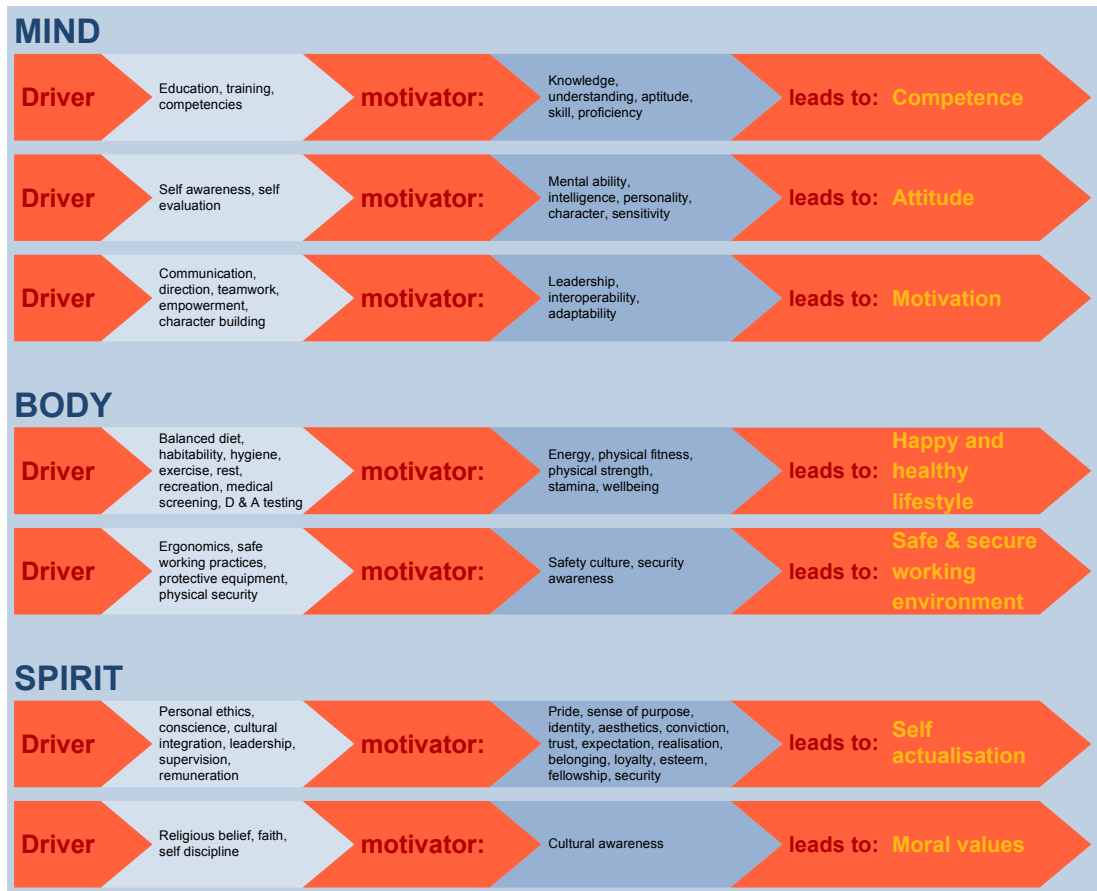
MIND

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 |

Figure 22: A company that wants to achieve certain qualities in its staff needs to be aware of the associated drivers and motivators. Both sea and shore staff have physical, physiological and spiritual needs.

3.2. Area 13 Human-centred design

The **purpose** is to ensure the *usability* of a *system*, by selecting and applying appropriate practices that use *human element data*.

This best practice for specific items and projects can be applied during installation, design, or throughout the *lifecycle*, as appropriate. It also applies to non-hardware items such as *procedures* or documentation.

The **benefits** are that human *characteristics* are taken into account and there is assurance of the degree of safe and effective operation.

As a result of successful implementation of this process the following **outcomes** are achieved:

- The *system* (or equipment, *procedure* etc.) meets crew needs in its *context of use*.

- Possible adverse effects of use on human health, safety and performance are addressed.

- The crew *effectiveness*, *efficiency* and satisfaction with the *system* are known.

Human-centred design best practice comprises the following four processes:

- HCD.1 Understand the *context of use*;

- HCD.2 Specify user requirements;

- HCD.3 Produce design solutions;

- HCD.4 Conduct evaluation of use.
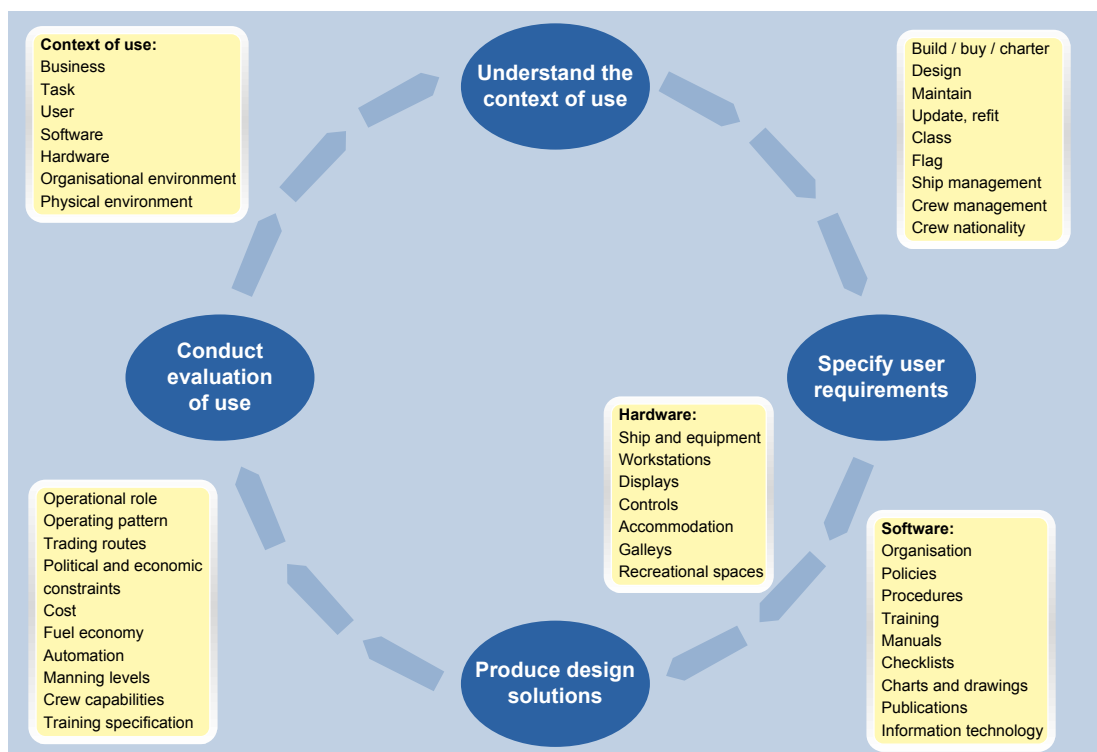
Figure 23: A continuous improvement cycle for human-centred design.

HCD.1 UNDERSTAND THE CONTEXT OF USE

The purpose is to establish, clarify and communicate the *characteristics* of the users, their tasks and the technical, organisational and physical environment in which the *system* will operate.

As a result of successful implementation of this process the following outcomes are achieved:
- The *characteristics* of the intended users and their tasks, including user interaction with other users and other *systems*, are documented.
- The real operational environment of the *system*, including the factors that affect the performance of users, is described.
- The human element implications for the *system* arising from the *context of use* are included in the *system* constraints and requirements.

HCD.1.1	Define the scope of the *context of use* for the *system*
HCD.1.2	Analyse the tasks and the *system* of work (Describe the tasks in terms of user and organisational activities – not in terms of equipment functions or features. Describe the activities/tasks that users perform to achieve the intended user or organisational goals for the *system*.)
HCD.1.3	Describe the *characteristics* of the users
HCD.1.4	Describe the real operational environment and the way that this shapes the role of the *system*. Describe the *system* of work as an entity and provide a context description for both the *system* and the *system* of work.
HCD.1.5	Describe the *characteristics* of any equipment external to the *system* and the working environment. For example non-*system* equipment which may be commercial-off-the-shelf or from different manufacturers, existing equipment and *systems*, and technical infrastructure with which the users will directly interact.
HCD.1.6	Describe the location, workplace equipment and ambient conditions. For example, lighting, noise levels, vibration, heat, hazards, dimensions of working and living space.
HCD.1.7	Analyse the implications of the *context of use*. (There may be issues related to problems with existing *systems*. Identify and analyse potential *risks* in the environment that may be made more likely by use of the *system*.)
HCD.1.8	Present these issues to project *stakeholders* for use in the development or operation of the *system*.

HCD.2 SPECIFY USER REQUIREMENTS

The purpose is to establish, clarify and communicate the requirements of the users of the *system*.

As a result of successful implementation of this process the following outcomes are achieved:
• Relevant groups of users, and their task needs, are identified and analysed.
• The requirements of the users of the *system* are defined.
• User criteria for the performance of the *system* of work against operational and functional objectives are stated.
• User requirements are addressed in the *system* design.

HCD.2.1	Set and agree the expected behaviour and performance of the *system* with respect to the user. (This can be stated in terms of the 'total experience' of the users and/or the user organisation with the *system*. It may be helpful to develop a series of standard tasks or usage scenarios that the *system* should support. These provide a useful reference for the *system* design team to work to, and for the users to check the prototype *system* against. Evaluation may be based on these scenarios.)
HCD.2.2	Develop an explicit statement of the user requirements for the *system*. (The requirements of the user and the user organisation define a large part of the operational and performance requirements for the *system*. The generation of requirements is an interactive and often *iterative* process involving users and designers in collaboration. Successive iterations of the process help to establish the user requirements aspects of the *system* requirements and design specifications at progressive levels of detail. The specification of user requirements includes evaluations in order to ascertain that requirements are correct and complete. The requirements for some types of *systems* are never static or fully-defined.)
HCD.2.3	Analyse the user requirements. (Analysis can include cost-benefits, prioritisation and identification of 'show-stoppers' (issues that could result in the failure of the project to achieve minimum requirements), evaluation of prototypes with users, feasibility studies and *trade-off* studies.)
HCD.2.4	Generate and agree on measurable criteria for the *system* in its intended *context of use*.
HCD.2.5	Present these requirements to project *stakeholders* for use in the development and operation of the *system*.

HCD.3 PRODUCE DESIGN SOLUTIONS	
The purpose is to allow the design options for the product *system* of work to take account of the human element.	
As a result of successful implementation of this process the following outcomes are achieved: • Human element issues are considered in the *trade-off* between design options. • *Usability* is traded-off against other design criteria. • All user aspects of the *system* (for example, jobs, roles, documentation and staffing) are designed. • User input (direct and/or as feedback from evaluations) is incorporated in the design.	
HCD.3.1	Distribute functions between the human, machine and organisational elements of the *system* best able to fulfil each function.
HCD.3.2	Develop a practical model of the user's work from the requirements, *context of use*, allocation of function and design constraints for the *system*.
HCD.3.3	Produce designs for the user-related elements of the *system* that take account of the user requirements, *context of use* and *human element data*.
HCD.3.4	Produce a description of how the *system* will be used.
HCD.3.5	Revise design and safety features using feedback from evaluations.

HCD.4 CONDUCT EVALUATION OF USE	
The purpose is to collect and report feedback on the evaluation of the aspects of the *system* related to its use or users.	
As a result of successful implementation of this process the following outcomes are achieved: • Evaluation provides design information, new *risks* and issues, i.e. feedback on how to improve the *system*. • Evaluation demonstrates the fulfilment of user requirements, i.e. informs decisions on whether the *system* is adequate. • The organisation has information on which to base a decision regarding one or more *human element issues*. • The design is tested with real users.	
HCD.4.1	Plan the evaluation.
HCD.4.2	Identify and analyse the conditions under which a *system* is to be tested or otherwise evaluated.
HCD.4.3	Check that the *system* is fit for evaluation.
HCD.4.4	Carry out and analyse the evaluation according to the evaluation plan.
HCD.4.5	Understand and act on the results of the evaluation.

4. Part 4: Application of Human Element Gap Analysis and human element best practice

4.1. Use of Human Element Gap Analysis (HEGA)

The material in this booklet has been written with the aim of being easy to understand and apply. However, successful application does require trained staff, and self-assessment may prove problematic for many organisations. A formal HEGA provides an assurance of a proper assessment, and gives external *stakeholders* evidence of continuous improvement. Members of the Lloyd's Register Group can provide a formal HEGA to operators on request. Contact details for further information about this service can be found at the end of this guide.

Ship operators can use the data contained in this document to assess the extent to which the company is run in a *human-centred* manner, and periodically to demonstrate an attainment level for each of the eleven areas.

If a company operates at level 3 or 4 in a large number of areas, the HEGA may additionally include the areas described in Part 3 (Human Resources and Human-Centred Design).

The purpose of a Human Element Gap Analysis is to set two profiles for an organisation. Firstly to identify the level of current practice, and secondly to identify the desired future practice which forms the basis for continuous improvement.

4.2. Origin of best practice

The best practice set out here is based on an international specification, ISO PAS 18152. This standard was the subject of extensive international review, and is the most definitive statement in existence on how to address human-*system* issues.

There is considerable agreement with the best practice set out in the international standard and a wide range of regulatory and statutory requirements. The best practice set out here will assist in meeting a number of statutory requirements. However, The Human Element Gap Analysis is offered as a discretionary service, and no undertakings of statutory compliance can be made by the Lloyd's Register Group or the shipping company using the service.

The HEGA methodology draws on the successful *gap analysis* methodology used by the Lloyd's Register Group.

HEGA draws on the same theoretical background as the OCIMF quality initiative, TMSA, but the two methodologies tackle different topics.

4.3. The Human Element Gap Analysis methodology

The Human Element Gap Analysis methodology comprises the following steps:
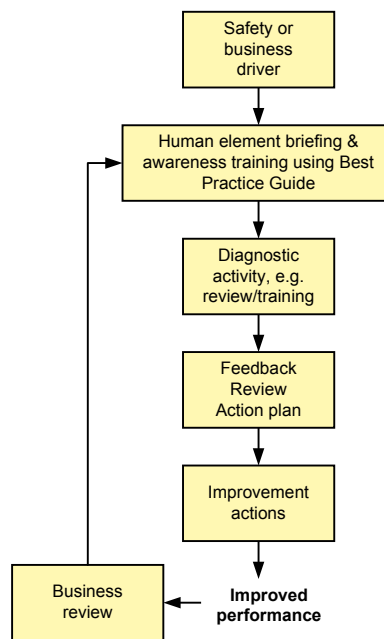
Figure 24: The steps in the Human Element Gap Analysis methodology

The business review is a short meeting with executives to examine business drivers, safety culture, the *human-centred* approach and its enablers.

The human element briefing and awareness training provides background for *gap analysis* participants such as superintendents.

Diagnostic interviews gather data on the areas of management practice – the heart of the *gap analysis*. For a company with a number of different types of ship operation, a number of separate assessments may be required.

The findings from the *gap analysis* are fed back to the company and reviewed. An action plan is formulated.

The company then carries out improvement actions in accordance with the action plan.

The improvement cycle is repeated when appropriate, decided by a review of performance against business drivers.

4.4.   Feedback to the Lloyd's Register Group

Improving the Best Practice and Human Element Gap Analysis

The Lloyd's Register Group is committed to improving this statement of best practice. The ISO standard underpinning it is subject to a periodic review cycle, which may prompt an update. It will be updated as new best practice emerges and in the light of practical application and feedback. Changes will be reviewed by appropriate committees prior to implementation.

4.5. Bibliography

4.5.1 Regulatory

IMO Resolution A.947(23) *Human Element Vision, Principles and Goals for the Organisation*, 2003. This acknowledges the need for increased focus on human-related activities in the safe operation of ships, and the need to achieve and maintain high standards of safety and environmental protection for the purpose of significantly reducing maritime casualties.

ILO Maritime Labour Convention, 2006

IMO International Safety Management (ISM) Code, 1998

4.5.2 Non-regulatory

Alert! – *The International Human Element Bulletin*, www.he-alert.org. A four-monthly bulletin, published by the Nautical Institute, aimed at improving the awareness of the human element in the maritime industry.

ISO PAS 18152:2003 *A specification for the process assessment of human-system issues*. This is the standard that provided the basis for the best practice guide.

ISO/IEC 15504 *Process assessment* defines the requirements for process assessment and process improvement frameworks.

OCIMF, *Tanker Management and Self Assessment* (TMSA), 2004. This quality management tool takes a similar continuous improvement approach.

5.   Part 5: Glossary of key terms and phrases

Unless otherwise stated, all terms used should be considered to accord with the definitions applied in ISO 9001:2000 and ISO 14001. Other terms listed here have been used with the meaning given for the purposes of this guide.

Best practice indicator (BPI):   Observable signs of the successful implementation of a management practice at a specific level. When used as part of a measurement *system*, they determine the quality of the processes and the degree to which the aims and objectives are being achieved.

Capability: The ability of a process to achieve a required goal. At a company level, capability refers to its ability as an organisation to achieve goals in a specific area, e.g. to deliver consistent performance that meets customer or regulator requirements.

Characteristics: Distinctive features of a person, object or *system*, which define its limitations and requirements.

Competence: Ability to perform *procedures* to operate systems. This is affected by factors such as a person's education, training, aptitude, knowledge and experience, as well as temporary influences such as fatigue.

Context of use: The work situation, i.e. users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used.

Controllability: Integrating people with equipment, *systems* and interfaces.

Crew: All onboard staff engaged in the routine operation of a ship, including the master, other officers and ratings.

Effectiveness: Accuracy and completeness with which users, processes, equipment or systems achieve specified goals.

Efficiency: Resources expended in relation to the accuracy and completeness with which users achieve goals.

Gap analysis: A review of how a management *system* or *procedures* has addressed, or plans to address, a set of requirements. The assessment does not result in certification, but reports on gaps within a *system* and identifies what needs to be done to close them.

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

Hard costs: A traditionally measured and recognised expense such as equipment, subcontracts or rent. There will often be a tangible result. Reductions in hard costs will often have immediate measurable financial savings. (See also *soft costs*.)

Human-centred: An approach that is characterised by the active involvement of users, and a clear understanding of user and task requirements, an appropriate allocation of function between users and technology, iterations of design solutions and *multi-disciplinary* design.

Human element: "A complex multi-dimensional issue that affects maritime safety, security and marine environmental protection. It involves the entire spectrum of human activities performed by ships' crews, shore-based management, regulatory bodies, recognized organizations, shipyards, legislators, and other relevant parties, all of whom need to co-operate to address human element issues effectively." [Source: IMO Resolution A.947(23)]

Human element consideration: An aspect of the work situation or employment that may affect safe and effective operation or quality of working life. Table 1 in the introduction to this document illustrates the range of human element considerations. They can be divided into human resources and human factors considerations. That is to say, they relate to the people, i.e. users and other *stakeholders*, and to their involvement in or interaction with a ship and its *systems* at any time in the *lifecycle* of the ship or its *systems*.

Human element data: Information about the crew or support staff, or the operation of the ship and its *systems*, or more general information about seafarers and other *stakeholders*.

Human element issue: A *human element consideration* where there is a potential mismatch between the user need and the current or proposed work situation or employment arrangements. Unresolved issues can become *risks* or hazards. The potential mismatch may be expressed as a need, want, constraint, limit, concern or factor.

Iterative: An approach to design, which applies to the design of policies and methods of operation as well as ships and equipment. Iterative design involves a series of repeated cycles where, in each cycle, the design is elaborated, refined, and tested, and the results are fed into the design focus of the next cycle. Active user involvement therefore becomes critical. Iteration provides an effective means of minimising the *risk* that a *system* does not meet user and organisational requirements (including those requirements that are hidden or difficult to specify explicitly).

Lifecycle: The stages and activities spanning the life of a ship and its *systems;* from initial concept through to disposal.

Maintainability: Operational maintenance tasks are rapid, safe and effective, to allow equipment and *systems* to achieve a specified level of performance.

Manoeuvrability: The most appropriate manoeuvring capabilities.

Multi-disciplinary: A means of providing the wide range of skills and viewpoints required to produce and maintain safe and effective ship operations. A multi-disciplinary team can be small, dynamic and temporary. Examples of the range of skills which may be required, depending on the *system*, include: operator, user, maintainer, purchaser, business analyst, trainer, marketeer, visual designer, domain expert, technical author, ergonomist, human resources or health and safety practitioner, systems analyst, programmer and logistics. It could also take inputs from different shipboard departments, e.g. deck, engine, electrotechnical or hotel.

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

Operating concept: An input to the overall *system* requirements, specifically covering its fitness for purpose in relation to the needs and expectations of the users. The operating concept

relates to the capabilities that the users will require the *system* to have, rather than the possibilities that the hardware could provide them with.

Orientation: The focus of an organisation's management practices.

Policy: A programme of actions, or a set of principles, which establishes practices to follow or rules to adhere to. It is authorised and available to all those who are affected by it. A *strategy* may be required to define how to implement it.

Procedure: A declared way of formally conducting a course of action to achieve a technical or managerial outcome. It is authorised and established.

Representative seafarers: People with similar practical experience, *competence* and outlook to the crew affected by the activity. Recent relevant operational experience is particularly important, given the pace of change.

Risk: A combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.

Risk management: The process whereby decisions are made to accept a known or assessed risk, and/or the implementation of actions to reduce the consequences or probability of occurrence. The formal risk assessment exercise is only one of many contributions to risk management. Much more important are flexibility and responsiveness to a dynamic environment and its dangers. The organisation must ensure that it is sensitive to the signals provided by internal audits, routine reporting, company and masters' reviews, accident reports, etc., and that it responds promptly and effectively.

Scope: The range of issues that are considered within management practices.

Seafarer representatives: People who present the views of serving crewmembers for consideration by the company, in formal or informal ways. They do not necessarily have to have been to sea themselves to perform this role.

Ship operator: (Term used with the same meaning as "company" in SOLAS IX/1) The owner of the ship or any other organisation or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the owner of the ship and who on assuming such responsibility has agreed to take over all the duties and responsibilities imposed by the International Safety Management Code.

Soft costs: Costs that may not have a tangible output against them, but can still have a large impact on profitability. They can include productivity, absenteeism, legal conformity, management and support costs. In contrast to *hard costs*, savings in soft costs will often not realise a cash benefit immediately, but will lead to savings over the longer term.

Staff: Company workers involved in the activity in question. This may include people who work on the ship and/or in the company ashore, permanent and/or temporary workers, and employees and/or contract workers.

Stakeholder: An interested party having a right, share or claim in the ship and its *systems* or in its possession of qualities that meet that party's needs and/or expectations. Examples include the crew, charterer, inspectors, etc.

Strategy: A means of implementing a *policy*. It may help to bridge the gap between *policy* and practice by specifying the constraints and risks to achievement.

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

System: A combination of interacting elements organised to achieve one or more stated purposes. The elements can be both human and machine, including the workplace, physical equipment, computer software, documentation, manuals, human tasks and organisational or management *procedures*.

Systems approach: Looks at the two-way interaction between a *system* and its environment. It also examines the properties of the *system* that emerge from the interaction of its component parts.

Trade-off: A decision-making activity which balances *risk* control actions to be taken with the level of *risk*, typically using the ALARP principle (As Low As Reasonably Practicable). A typical management trade-off will consider varying any or all of time, money and quality, with the positive and negative impacts that will result weighed up in the decision. This document addresses the inclusion of human-*system* issues in such studies.

Usability: The extent to which a product (ship, *system* or equipment) can be used by a specified crew to achieve specified goals with *effectiveness*, *efficiency*, safety and satisfaction in a specified *context of use*. The phrase 'safe and effective operation' is broadly equivalent to usability.

User: An individual interacting with a *system*.

Workability: Equipment and *systems* are appropriate for the work situation, including the physical and social environment of use.
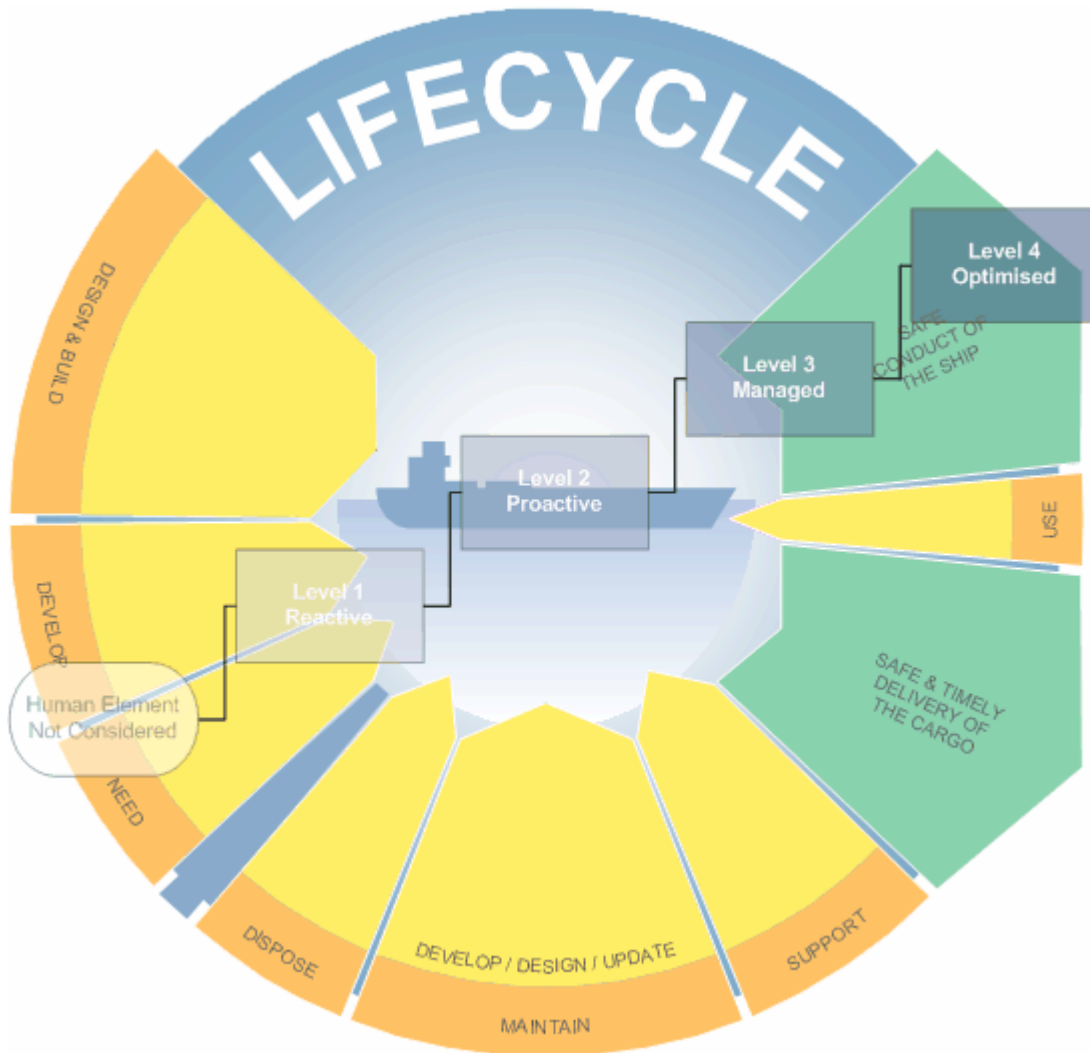
Figure 25: Management of the human element can be improved right across the ship lifecycle

Lloyd's Register

LIFE MATTERS