Human errors

• Human error is defined as the behaviours, originated from psychological processes (such as perception, attention, memory, thinking, problem solving, decision making) and evaluated against performance standards, that are initiated by situations where it is possible to act another way considered to be right.
Human error in shipping

- Human error costs the maritime industry $541m a year, according to the UK P&I Club.
- From their own analysis of 6,091 major claims (over $100,000) spanning a period of 15 years, the Club has established that these claims have cost their members $2.6bn, 62% of which is attributable to human error.
<table>
<thead>
<tr>
<th>Cause classification</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deck officer error</td>
<td>30</td>
</tr>
<tr>
<td>Crew error</td>
<td>15</td>
</tr>
<tr>
<td>Engine officer error</td>
<td>2</td>
</tr>
<tr>
<td>Pilot error</td>
<td>8</td>
</tr>
<tr>
<td>Shore person error</td>
<td>7</td>
</tr>
<tr>
<td>Equipment failure</td>
<td>9</td>
</tr>
<tr>
<td>Mechanical failure</td>
<td>6</td>
</tr>
<tr>
<td>Structural failure</td>
<td>7</td>
</tr>
<tr>
<td>Others</td>
<td>16</td>
</tr>
</tbody>
</table>
Human error in shipping

• An analysis conducted by IMO in 2006 indicates that 150 of 187 (80%) instances of groundings and collisions were caused by human error.

• Likewise, another analysis carried out by ABS with regard to 150 accidents from 1992-2001 suggests that human error was primarily responsible for approximately 85% of maritime accidents.

• The most common human errors are improper judgment and watchkeeping, followed by failure to comply with regulations.
Category of human errors

• **Category 1**: caused by incorrect or incomplete knowledge, memory failures or attentional failures, associated with unintended characteristics.

• **Category 2**: stems from motivational factors, e.g. attitudes, beliefs, social or organisational culture.
Classification of human error Category 1

• Skill based human errors
• Rule based human errors
• Knowledge based human errors
Classification of human error Category 2

• Routine violations: promoted by a relatively indifferent environment, i.e. one that rarely punishes violations or rewards compliance.
• Optimising violations: corner-cutting i.e. following the path of least resistance.
• Exceptional violations:
<table>
<thead>
<tr>
<th>ERROR TYPE</th>
<th>DESCRIPTION</th>
<th>POSSIBLE CAUSES</th>
<th>PRECONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slip</td>
<td>Unintended deviation from a correct plan of action</td>
<td>Attention failure, Mis-timing</td>
<td>Distraction from task, Preoccupation with other things</td>
</tr>
<tr>
<td>Lapse</td>
<td>Omission/repetition of a planned action</td>
<td>Memory failure</td>
<td>Change in nature of task, Change in task environment</td>
</tr>
<tr>
<td>Mistake</td>
<td>Intended action inappropriate to the circumstances</td>
<td>Sound rule applied in inappropriate circumstances, Application of unsound rule</td>
<td>Failure to appreciate rule deficiencies</td>
</tr>
<tr>
<td>Mistake</td>
<td>Erreoneous judgement in situation not covered by rule</td>
<td>Insufficient knowledge or experience – immaturity, Time/emotional pressures</td>
<td>Organisational deficiency, Inadequate training</td>
</tr>
<tr>
<td>Routine violation</td>
<td>Habitual deviation from required practice</td>
<td>Natural human tendency to take path of least resistance</td>
<td>Indifferent operating environment (no penalties); no rewards for compliance</td>
</tr>
<tr>
<td>Exceptional violation</td>
<td>Ad hoc infringement of regulated practice</td>
<td>Wide variety – dictated by local conditions not planned for</td>
<td>Particular tasks or circumstances</td>
</tr>
</tbody>
</table>

海事風險評估與安全管理研究室
Non-technical-skill human factors influencing safety

- Fatigue
- Stress
- Situation awareness
- Decision making
- Communication
- Language and culture diversity
- Teamwork
- Safety culture
Fatigue

• Research has illustrated that there are potentially disastrous outcomes from fatigue in terms of poor health and also diminished performance.

• It revealed that 23% of 98 human error related ship casualties were caused by fatigue (Raby and McCallum, 1997)
Fatigue

• A study surveyed 1,000 officers in 1995, 77% felt that fatigue has significantly risen in the past 3-10 years, 84% felt that stress was also more prevalent.
• A further study in 2001 based on 563 seafarers revealed that 50% of the respondents worked more than 85 hours in a week and 66% indicated that extra manning was necessary.
• Results from a study of Australian seafarers in 2002 revealed that 70% of seafarers reported poor to very poor sleep.
Fatigue

- A study conducted in 2003 based on onboard assessment with 177 seafarers over 7 vessels concluded that fatigue is greater in the near sea sector than in support shipping.
- It also identified the factors predicting fatigue, including working hours, sleep problems, tour length, job demands, stress at work and standing watch.
- Ship types also had a role in predicting fatigue; seafarers working on ferries reported higher levels of fatigue than the others.
Stress

- Seafarers reported significantly higher levels of stress from sources of work pressure than did the normative group from an onshore population, in particular, on items that assessed relationships with others and the home/work interface.
- The survey conducted in 2002 comprised of crew, masters, officers, pilots and engineers. It is noted that over 65% of engineers, 60% of crew and over 60% of masters reported moderate to high stress levels.
Situation awareness

• Situation awareness is the perception of the elements in the environment within a volume of space and time, the comprehension of their meaning and the projection of their status in the near future.
Situation awareness

• Research conducted in 2002 examining human error in maritime operations from 177 accident reports 1987-2000 shows that 71% of human-error accidents on ships are situation awareness related problems.
Decision making

• A study in 2003 demonstrates that higher levels of collision threat are associated with an increase in self-related mental workload and also in a detriment in performance on a secondary task.
• This shows the potential consequences of having to monitor numerous pieces of equipment concurrently and such a detriment in performance on secondary task could have potentially serious consequences in a real life situation.
Communication

• An analysis by Canadian Transportation and Safety Board (CTSB) reviewing 273 accidents 1987-1992 with vessels in Canadian pilotage waters indicated that 42% of the sample involved misunderstanding between the pilot and master or officer of watch, or the lack of communication.
Communication

• Approximately 80% of the pilot, master and officer group responded that communications are “often” or “always” effective.
• When asked if a pilot makes sure his orders are understood and acknowledged by the officer, 84% of the pilots responded that it was the case, while only 50% of the masters and 50% of the officers agreed with this statement.
Communication

• When asked whether the officer asks for clarification if he is unsure of the pilot’s intentions, 90% of the officers, 76% of the masters and only 39% of the pilots responded that the officer “always” or “often” asks for clarification.

• When asked if the officers are reluctant to question a pilot’s decision, 92% of the masters and 81% of the officers responded “sometimes” and 12% of the officers expressed that they were “always” reluctant to question the pilot.
Language and culture diversity

- A study conducted in 2001 shows that seafarers frequently suggested that communication difficulties are the only or main drawbacks of mixed nationality crew.
- It also indicated that the results of miscommunication ranged from mild annoyance to formation of potentially hazardous situations.
Language and culture diversity

• A study conducted in 2003 based on the questionnaire from 2,558 seafarers from 27 different countries demonstrates a potential existence of regional cultures.

• The study also revealed that vessels with crews from a single country or from two countries have better attitudes towards safety than those with multinational crews.
Teamwork

• In the CTSB study, there are questions evaluating teamwork, 96% of the masters, 100% of the officers and 85% of the pilots stated that teamwork was “often” or “always” as important as technical proficiency.

• However, when asked about their experience of the masters, officers and pilots working as a team, only 51% of the masters, 46% of the officers and 38% of the pilots stated that they “always” work as a team.
Safety culture

• Safety culture was first developed in relation to the Chernobyl disaster and is defined as the assembly of characteristics and attitudes in organization and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance.
Safety culture in shipping

• A safety culture means that safe and proper methods of shipping and doing business in the maritime industry are not only economical but a way of life.

• Moreover, safety culture of an organisation is the product of individual and group value, attitudes, perceptions, competencies and patterns of behavior that determine the commitment to, and the style of, a safety management of the organisation.
Safety measures for reducing human errors

- Bridge resource management
- Crisis management and human behaviour
- International Safety Management Code
- International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 78/95/2010
Bridge resource management

- Bridge Resource Management (BRM), or as it is also called Bridge Team Management (BTM), is the effective management and utilization of all resources, human and technical, available to the Bridge Team to ensure the safe completion of the vessel’s voyage.
- BRM focuses on the officer skills including teamwork, teambuilding, communication, leadership, decision making and resources management.
Bridge resource management

• BRM is a training initiative based on the non-technical skills integral to best practice.
• Such non-technical skills include communication, teamwork, situation awareness, leadership, decision making and workload management, which contribute to enhanced safety performance.
Objectives of BRM

• Develop and use a detailed passage plan to anticipate and manage workload demands and risks.
• Share a common view of the intended passage and the agreed procedures to transit the passage with all members of the Bridge Team.
• Set appropriate manning levels and make contingency plans based on anticipated workload and risks.
• Make roles and responsibilities clear to Bridge Team members.
• Involve all team members in problem solving.
• Acquire all relevant information early and anticipate dangerous situations.
• Team members clearly understand the chain of command including the way decisions and instructions are made, responded to, and challenged.
Benefits of BRM

- Maintains its situational awareness;
- Continually monitor the progress of the vessel making appropriate adjustments and corrections as necessary to maintain a safe passage;
- Acquire relevant information early;
- Appropriately delegate workload and authority;
- Anticipate with dangerous situations;
- Undertake appropriate contingency plans when called for;
- Recognize the development of an error chain;
- Take appropriate action to break the error-chain sequence.
Crisis management and human behaviour

- Leadership, command and effective communications
- Definition, types and nature of a crisis
- Human behaviour and the responses during emergencies
- Stress and it's effects on crew and passengers
- Crowded management
Bridge resource management courses by Lairdside Maritime Centre

• Understand basic human behaviour and the effect of cultural background and personality types
• Understand the causes and effects of stress and fatigue and the importance of maintaining good sleep patterns
• Achieve the best use of available crew resources for the safe navigation of the vessel
• Apply effective communication and team working skills
• Safe navigation procedures and risk awareness
• Operations in restricted / pilotage waters
Lairdside Maritime Centre
Bridge simulator in Lairdside Maritime Centre, LJMU
Courses offered by Lairdside Maritime Centre

- Bridge navigation
- Crisis management and human behaviour
- GMDSS
- ISM auditors
- ISPS security
- Medical
- Onboard assessment
- Safety training
- Pilot training
- Escort towing
- Training for STCW instructors
Bridge navigation

- ARPA
- Bridge resource management
- Crew resource management
- ECDIS
- Escort towage
- General ship handling
- High speed navigation
- Navigation and radar
Bridge and engine-room resource management course by International Maritime Training Center

- Introduction to B.E.R.M.
- Understanding the 'Human Factors'
- Effective communication
- Multicultural awareness
- Effective team-work
- Interaction between ranks
- Management and leadership on board
- Time management and workload
- Judgment and Decision-making
- The states of the mind
- Contingency management
- Integrated Case-studies
- Role-play exercises
- Summary - managing human resource