From Titanic to Costa Concordia – a century of lessons not learnt

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Costa Concordia – 13 January 2012

Overview about this presentation

- Human factor analysis in the accident investigation report
- The Costa Concordia accident in a historical perspective
- Deficiencies of the accident investigation
- Discussion
Human factor analysis in the accident investigation (I)

Report submitted to MSC 92

- Human factor related key findings
  - “the Master’s unconventional behaviour ... represents the main cause of the shipwreck.” (p. 9)

- Contributing from a human factor perspective
  - BRM related issues
    - No clear handover between Master and C/O
    - Inattention of Master due to other persons on the bridge
    - Inattentive bridge team
    - “… passive attitude of the Bridge Staff. Nobody seemed to have urged the Master ... ot to give warning ...”
Human factor analysis in the accident investigation (II)

Report submitted to MSC 92

- Contributing from a human factor perspective
  - Emergency management
    - Unfamiliarity with the procedures to abandon the ship
    - Lack of leadership from the bridge
    - Dissorriented crew
  - Shipping company involvement
    - No questioning of the decisions of the Master
    - In appropriate cooperation with the SAR services
    - Qualification of the crew – e.g. communication problems
100 years in between ...

Titanic (1912) vs. Costa Concordia (2012)

Pictures: www.titanicuniverse.com; www.shipfriends.gr

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Similarities?

TITANIC (1912)

- The ship’s track was 25 miles south of the area for field ice, well within the area "Icebergs have been seen within this line in April, May and June." (page 24)

- Several sailing directions mention the danger resulting from ice in this area. (page 25)

- Ice warnings were first received 48 hours before the accident and acknowledged. Several other warnings were received before the collision. (page 26-28)

- The master and the officers on watch were aware of the presence of ice in the vicinity of the ship. They expected to reach it before midnight (ship collided 23:40). (page 29)

- The officers were confident to identify ice in a safe distance from the ship (2nd officer about the ice "... I judged I should see it (the ice) with sufficient distinctness and at a distance of a mile and a half, more probably two miles."). (page 28)
Similarities?

TITANIC (1912)

- The report lists several conversations between officers and the master about the ice and how likely it will be to see it. (page 28-29)

- From tests made with a sister ship the report concludes that the iceberg was sighted in a distance of approximately 450 meters. (page 29, 30-31)

- The total capacity in the lifeboats was 1178 persons. The report lists 2201 persons on board - 885 crew and 1316 passengers. (page 23)
Similarities?

TITANIC (1912) vs. COSTA CONCORDIA (2012)

- Both captains were very experienced and had immaculate service records prior to the accidents. They had spent their entire professional life at sea without larger accidents.
- Both captains were aware of the potential dangers, but felt that the risks so small that they easily could be controlled – without the need of changes in speed and course.
- In case of the TITANIC, no officer on the bridge objected to the navigation of the ship. So far, no information was published that officers on the COSTA CONCORDIA disagreed with the maneuvers of the captain.
- Both accidents resulted into emergency situations for which the ships were not built (beyond design-base accidents). Both scenarios were considered as being highly unlikely.
Human factors reviewed

Technology and regulations have changed, but human factors ...

- Possible Titanic factors
  - Authority gradient
  - Group think and the desire for harmony
  - Cognitive hysteresis
  - Efficiency thoroughness trade-offs (ETTO)
  - Organizational factors
- Additional Non-Titanic factors
  - Communication
Authority gradient

USCG CUYAHOGA (1978)

The ability to challenge decisions taken on a higher level of authority
Group think or the desire for harmony ...

BÖHLEN (1976)

Are critical comments appreciated ...?
Cognitive hysteresis

What do you see and what does it require to change this?
Efficiency thoroughness trade-offs (ETTOs)

TORREY CANYON (1967)

How to balance operational priorities and safety concerns ...
How were human factors treated?

Human factors in the maritime sector

- Often accidents were attributed to single causes
- Reactive approaches in follow-up to an accident rather than proactive approaches in ship safety
- Preferred way following accidents were technical regulations until the end of the 1990s (double hull in case of the EXXON VALDEZ)
- Changes in design, new regulations or training were suggested
- A few examples only where the system as such was changed (HERALD OF FREE ENTERPRISE – ISM Code)
Problem issue (1) – accident investigation & follow-up

What safety problems are identified during accident investigation? (Schröder-Hinrichs et al. (2011))

- Contributing factors to accidents
  - Flag State influences
  - Organizational influences
  - Unsafe supervision
    - Preconditions for unsafe acts
    - Unsafe acts
  - 3.5%
  - 13.9%
  - 5.7%
  - 56.5%
  - 20.4%
Problem issue (1) – accident investigation & follow-up

Human factors in the maritime sector

- Bridge Resource Management / Bridge Team Management
### Problem issue (1) – accident investigation & follow-up

**STCW 2010 Manila Amendments**

- Competence: Maintain a safe navigational watch

<table>
<thead>
<tr>
<th>Knowledge, understanding and proficiency</th>
<th>Methods for demonstrating competence</th>
<th>Criteria for evaluating competence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bridge resource management</strong></td>
<td>Assessment of evidence obtained from one or more of the following:</td>
<td>Resources are allocated and assigned as needed in correct priority to perform necessary tasks</td>
</tr>
<tr>
<td>Knowledge of bridge resource management principles, including:</td>
<td>.1 approved training</td>
<td>Communication is clearly and unambiguously given and received Questionable decisions and/or actions result in appropriate challenge and response</td>
</tr>
<tr>
<td>.1 allocation, assignment, and prioritization of resources</td>
<td>.2 approved in-service experience</td>
<td>Effective leadership behaviours are identified</td>
</tr>
<tr>
<td>.2 effective communication</td>
<td>.3 approved simulator training</td>
<td>Team member(s) share accurate understanding of current and predicted vessel state, navigation path, and external environment</td>
</tr>
<tr>
<td>.3 assertiveness and leadership</td>
<td></td>
<td></td>
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<tr>
<td>.4 obtaining and maintaining situational awareness</td>
<td></td>
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<tr>
<td>.5 consideration of team experience</td>
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</table>
Problem issue (1) – accident investigation & follow-up

The search for a single course is often too simple - A systemic view is required

- Functional resonance

Problem issue (1) – accident investigation & follow-up

Some of the issues not questioned by the investigators

- Earlier passages
- Training and qualifications of the crew
- Emergency training
- Working language
- ...

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Problem issue (2) - Missing collective memory

Why is the collective memory lacking?

- Examples
  - Communication problems on board

Scandinavian Star (1988)  
Costa Concordia (2012)
Problem issue (2) - Missing collective memory

Why is the collective memory lacking?

- Examples
  - Fire fighting training

Angelina Lauro (1979)

Carnival Splendor (2010)
Problem issue (3) – organizational culture in shipping

The “F/S Principle in Maritime Safety”

There is no collective memory of the lessons that could be learnt.

You do the stereotype follow up – changing a procedure, a checklist ...

You are frustrated and surprised if you do not see improvements or similar accidents happen in future.

You look quickly at accidents.

The classical F loop
Problem issue (3) – organizational culture in shipping

The “F/S Principle in Maritime Safety”

You follow up on the lessons learnt

You look at the system and develop solutions in consultation with all parties affected and involved

You will see improvement in the overall safety performance

You carefully assess the learning potential of an accident

The desireable S loop
Problem issue (3) – organizational culture in shipping

How to handle maritime safety more effective

- Key performance indicators
  - Tanker Management and Self Assessment
  - Intermanager KPIs

Picture: Intermanager
Problem issue (3) – organizational culture in shipping

Types of organizational cultures in shipping companies (Mathiesen, 1994)

<table>
<thead>
<tr>
<th>Evasion culture</th>
<th>Compliance culture</th>
<th>Safety culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>“When costs of complying with the Rules and Regulations is considered to be high, so are the benefits of evading them”</td>
<td>“a situation where the shipowners strive to comply with Rules and Regulations as this is the ‘Ticket to Trade’”</td>
<td>“a situation where owners are engaged in a continuous process to improve safety and see this as their management philosophy and operational mode to reduce losses”</td>
</tr>
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<td></td>
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<td>“focus on the entire management chain; from the boardroom to the ship”</td>
</tr>
</tbody>
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A systemic view

Ship and shore are part of the same system

- There is a need to go beyond currently considered frameworks to foster a safety culture and to stimulate organizational learning
  - Issues to be considered, among others
    - Worker engagement
    - Team psychological safety and leader inclusiveness
    - Credence giving
    - Ship-shore communication
    - Shore-staff training
    - ...
Conclusions

Is the focus on technology, regulations etc. the best focus to avoid accidents?

- Remember it is (so far) always a human operator handling the ships and the installed technology
- Personnel and human factors should be given a higher priority in lessons learnt from accidents
Any questions?

Questions & Answers
Further information

For more information regarding the issues addressed in this presentation, refer to


Thank you!

Many thanks to Erik Hollnagel for stimulating discussions related to the topic.

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