From Titanic to Costa Concordia
Human Factors reviewed in the light of Maritime Resource Management

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World Maritime University established 1983 by IMO

Who are we?

- Average Age (students): 34 years
- Women / Men (students): 35% / 65%
- Student / Faculty: < 10 / 1
- Graduates from Countries: 163
- Total WMU Alumni: 3,240
- Students from Countries 2012: 38
- Ph.D. Program: 4 years
- M.Sc. Program: 14 months
- English Program: 3 months
- Immediate Employment: 99%
- Remains in Sweden: 1%
100 years in between ...

Titanic (1912) vs. Costa Concordia (2012)

Pictures: www.titanicuniverse.com; www.shipfriends.gr
Some persistent human factors reviewed ...

No attempt to speculate about the two accidents, but to:

- Identify similarities between the accidents on the human factors side
- Mention some human factors not only noticed during the two accidents
- Discuss why these factors have so far not been addressed
- Outline options for improvement
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 makes reference to several reported conversations on the bridge between officers and the master about the ice and how likely it will be to see it under the given weather circumstances. (page 28-29)

- From tests made with a sister ship the report concludes that it would have required 37 seconds to change the course of the ship at an assumed speed of 22 knots to the extent made prior to the collision with the iceberg as it was testified during the investigation. This meant that the iceberg was sighted in a distance of approximately 450 meters off the ship (500 yards). (page 29, 30-31)

- The total capacity in the lifeboats was 1178 persons. There were 3560 life belts on board (page 18). The report lists 2201 persons on board - 885 crew and 1316 passengers. (page 23)
Similarities?

COSTA CONCORDIA (2012)

- At around 20:30 the ship did not alter course to a northwesterly direction in order to get on a parallel track to the island of Giglio as this was originally planned. Instead, the ship continued its westerly course to get closer to the island and only from 20:40 onwards altered the course to a northerly direction.

- While approaching the island on a parallel course, the ship came too close to an underwater rock in front of a langue of land. The langue of land was not marked with buoys or lighthouses. The captain eventually realized that he was too close to the shore and tried to turn the ship shortly before the collision with the underwater rock.

- The captain intentionally maneuvered the ship close to the island off the originally programmed track.

- All electronic equipment on the bridge that would indicate risks of groundings were working.

- Evidence from AIS records show that a similar close passing of the island was at least done once before in August 2011.
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 ...

- Authority gradient
- Group think and the desire for harmony
- Cognitive hysteresis
- Unanticipated side-effects of the introduction of new technology or regulations
- Efficiency thoroughness trade-offs (ETTO)
- ...

Alandia Marine Insurance Seminar 26 April 2012
Authority gradient

USCG CUYAHOGA (1978)

The ability to challenge decisions taken on a higher level of authority
Authority gradient

BOW MARINER (2004)
GREEN LILY (1997)
...
Group think or the desire for harmony ...

BÖHLEN (1976)

Are critical comments appreciated ...?
Group think or the desire for harmony ...

... were they all in agreement?
Cognitive hysteresis

What do you see and what does it require to change this?
Unanticipated side effects of new technology ...

ANDREA DORIA vs. STOCKHOLM (1952)

New technologies and procedures change the system ...
Efficiency thoroughness trade-offs (ETTOs)

TORREY CANYON (1967)

How to balance operational priorities and safety concerns ...
Are these issues typical only for the maritime sector?
Problem issue 1 – 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>
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<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>
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<td>“focus on the entire management chain; from the boardroom to the ship”</td>
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Problem issue 2 – accident investigation & follow-up

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

Contributing factors to accidents

- Flag State influences (20.4%)
- Organizational influences (56.5%)
- Unsafe supervision (13.9%)
- Preconditions for unsafe acts (3.5%)
- Unsafe acts (5.7%)
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)
How were human factors treated?

Human factors in the maritime sector

- Bridge Resource Management / Bridge Team Management
Bridge Resource Management

STCW 2010 Manila Amendments

- Competence: Maintain a safe navigational watch

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<td>Knowledge, understanding and proficiency</td>
<td>Methods for demonstrating competence</td>
<td>Criteria for evaluating competence</td>
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**Bridge resource management**

Knowledge of bridge resource management principles, including:

- .1 allocation, assignment, and prioritization of resources
- .2 effective communication
- .3 assertiveness and leadership
- .4 obtaining and maintaining situational awareness
- .5 consideration of team experience

Assessment of evidence obtained from one or more of the following:

- .1 approved training
- .2 approved in-service experience
- .3 approved simulator training

Resources are allocated and assigned as needed in correct priority to perform necessary tasks.

Communication is clearly and unambiguously given and received. Questionable decisions and/or actions result in appropriate challenge and response.

Effective leadership behaviours are identified.

Team member(s) share accurate understanding of current and predicted vessel state, navigation path, and external environment.
The search for single causes is often too simple

A systemic view is required

- Functional resonance

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
    - ...
Any questions?

Questions & Answers
Thank you!

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

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