



SUB-COMMITTEE ON FLAG STATE  
IMPLEMENTATION  
18th session  
Agenda item 6

FSI 18/WP.1  
8 July 2010  
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**CASUALTY STATISTICS AND INVESTIGATIONS**

**Report of the Working Group**

**GENERAL**

1 The Working Group on Casualty Analysis met from 5 to 8 July 2010 under the chairmanship of Mr. Bjørn Pedersen (Norway).

2 The group was attended by representatives from the following Member Governments:

ANTIGUA AND BARBUDA  
AUSTRALIA  
BAHAMAS  
CANADA  
CHINA  
DENMARK  
FINLAND  
GERMANY  
GREECE  
JAPAN  
MALTA  
MARSHALL ISLANDS

NETHERLANDS  
NORWAY  
PANAMA  
POLAND  
REPUBLIC OF KOREA  
RUSSIA  
SAUDI ARABIA  
SWEDEN  
TURKEY  
UNITED KINGDOM  
UNITED STATES

representatives from the following Associate Members of IMO:

HONG KONG, CHINA

observers from the following intergovernmental organizations:

EUROPEAN COMMISSION (EC)  
MARINE ACCIDENT INVESTIGATORS' INTERNATIONAL FORUM (MAIIF)

and by observers from the following non-governmental organizations in consultative status:

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)  
INTERNATIONAL FEDERATION OF SHIPMASTERS' ASSOCIATIONS (IFSMA)

INTERNATIONAL ASSOCIATION OF INDEPENDENT TANKER OWNERS  
(INTERTANKO)  
THE INSTITUTE OF MARINE ENGINEERING, SCIENCE AND TECHNOLOGY  
(IMarEST)

**TERMS OF REFERENCE**

3 Taking into account the relevant decisions and comments made in plenary, the group was instructed to:

- .1 confirm or otherwise the findings of the correspondence group based on the analysis of individual casualty investigation reports (FSI 18/6 and FSI 18/6/1 and FSI 18/INF.6 and GISIS), for the Sub-Committee's approval and authorization of their release to the public on GISIS (FSI 18/6/1, paragraph 8);
- .2 confirm or otherwise the draft text of lessons learned for presentation to seafarers (FSI 18/6, paragraph 6 and annex 1), for the Sub-Committee's approval and authorization of release on the IMO website in accordance with agreed procedure;
- .3 consider and advise on the referral to the relevant committees and sub-committees of those reports reviewed by the analysts and considered by the working group and which are of interest to them. In doing so, the Working Group should submit supporting information derived from the casualty analysis procedure used for the development of recommendations for consideration by the Committees and Sub-Committees (FSI 18/6, paragraph 4);
- .4 consider and advise on the information provided from a technical perspective in document MEPC 60/16 on fair treatment of seafarers of the **M/T Hebei Spirit** (document MEPC 60/22, paragraphs 16.3 to 16.6);
- .5 consider and advise on the information concerning a new category of stability accidents (FSI 18/6/2);
- .6 consider and advise on the possibility to provide GISIS with a more detailed casualty information on the cause of accidents involving general cargo ships, including the outcome of any related studies (MSC 86/26, paragraph 19.1);
- .7 consider and advise on the views of the Sub-Committee on Fire Protection on the fire casualty on board the fishing factory vessel **Hercules** (FP 54/25, paragraphs 16.3 to 16.6);
- .8 consider document FSI 18/6/3, and advise on the possibilities to improve GISIS casualty data, as requested by MSC 87, in accordance with the recommendations made by the Formal Safety Assessment (FSA) Expert Group (MSC 87/18, paragraphs 22 and 23 and MSC 87/26, paragraph 18.6);
- .9 consider and advise on the options for re-organizing part of the Sub-Committee's work (FSI 18/17);

- .10 advise on the re-establishment of the Correspondence Group on Casualty Analysis and, if so, prepare draft terms of reference for that group; and
- .11 present a written report to plenary on Thursday, 8 July 2010.

## CASUALTY ANALYSIS AND INVESTIGATIONS

### Summary of casualty analyses

4 The group considered the draft text of the analysis of the investigation report of the fire on the fishing factory vessel **Hercules** (Incident: C0006872) and the analysis of the investigation report on the fire on the ro-ro cargo ship **Und Adriatik** (Incident: C0007200), prepared by the correspondence group (FSI 18/6, annex 2). After making some editorial amendments, the group agreed to the final text of both analyses, as set out in annex 2.

5 The group noted the observations made by the Correspondence Group (CG) in paragraph 3 of document FSI 18/6, on the quality of investigation reports, more specifically on the confirmation that the standard of report writing continues to rise. A total of 113 casualty reports have been reviewed and the majority of these reports have been of a good and professional standard in the context of chapter 14 of the Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Code), annexed to resolution MSC.255(84) and the content of a marine safety investigation report, as per paragraph 2.12 of the Casualty Investigation Code.

6 The group also noted the following comments made by the CG that nine of the reports were lacking several details mentioned by the Code, while 12 reports were of a poor standard failing to match the standards of the Code in many important areas. Some of the missing information considered important includes:

- .1 collisions where circumstances on only one of two ships are discussed;
- .2 causal elements such as mechanical and human elements not discussed;
- .3 whether procedures were established and followed not included;
- .4 assertions not based on facts and findings;
- .5 recommendations not supported by findings; and
- .6 contributing factors not discussed.

7 The group recommended that the Sub-Committee brings the safety issues to the attention of Administrations with the objective of highlighting such circumstances in future investigation reports.

8 The group noted with satisfaction the progress made on developing a consolidated report, to be accessed by the members of the CG as well as all IMO Members on IMODOCS, on analyses being compiled for a specific session of the Sub-Committee (FSI 18/INF.6) as well as the efforts made by the Secretariat to improve the data provided by the internet platform for the CG.

9 On reviewing the casualty analyses, and, having made some editorial changes, the group agreed to the amended text of these analyses for the Sub-Committee's approval and authorization of the release of the same to the public on the GISIS module.

10 In considering the quality of investigation reports, some delegations expressed concern on the level of independency of the investigations, lack of information, absence of chain of events or contributing factors. The delegation of MAIIF expressed that training on this matter will have a very positive impact on the quality of investigation reports. MAIIF also highlighted that having in mind the entry into force of the new Casualty Investigation Code there is a need for review and update the IMO's Model Course 3.11 "Marine Accident and Incident Investigation" in order to reflect developing investigation techniques and recent IMO regulations. MAIIF also expressed its willingness to cooperate with IMO in the revision process, if approved. In considering the expertise and experience of MAIIF in this matter, the group recommended to the Sub-Committee to consider instructing the Secretariat to review and update the IMO's Model Course 3.11, at its earliest convenience, for referral to the Validation Group established by the MSC, as well as to involve MAIIF in the process of revision, as appropriate.

### **Guidance to Analysts**

11 In identifying issues that may affect quality of reports, the group recalled that FSI 15, in recognizing the importance of the "Guidelines to assist investigators in the implementation of the Code" (appendix of annex of resolution A.849(20)), had agreed to consider, in the future, a revision of the Guidelines for inclusion as an appendix to the Code, after the adoption of the Casualty Investigation Code (FSI 15/18, paragraph 7.17).

12 In recalling that the Casualty Investigation Code, adopted by resolution MSC.255(84) had entered into force on 1 January 2010, the group recognized the importance of appendix 2, "Guidelines for the investigation of human factors in marine casualties and incidents", contained in the annex to resolution A.884(21) on Amendments to the Code for the investigation of marine casualties and incidents, resolution A.849(20).

13 In considering that existing guidelines need to also be preserved and updated to assist investigators, the delegation of the United States confirmed that a document on the review and update of the Guidelines for the investigation of human factors in marine casualties and incidents (annex of resolution A.884(21)), as well as of the Guidelines to assist investigators in the implementation of the Code (appendix of annex of resolution A.849(20)), will be submitted to a future session of the FSI Sub-Committee, and invited other delegations to participate in the preparation of the document.

### **Lessons Learned for Presentation to Seafarers**

14 In considering the Lessons Learned for Presentation to Seafarers (FSI 18/6, annex 1), after considerable discussion, the group agreed on the importance of keeping them anonymous in order to preserve privacies of non-public reports, avoid a high number of consultations and avoid expectancy to see reflected all report's information.

15 The group agreed that the Lessons Learned should include some details, e.g., type and size of ship, time of day and kind of water, to provide the key audience, i.e. the seafarers, with reference information.

16 After making some editorial amendments, the group agreed to the findings of the CG based on the analysis of individual casualty investigation reports (FSI 18/6/1, annex 1).

17 The Sub-Committee is invited to approve the Lessons Learned for Presentation to Seafarers, as set out in annex 1, for release on the IMO website following the review carried out by the Secretariat in co-operation with the Chairmen of the relevant Sub-Committees, according to the agreed procedure (FSI 11/23, paragraph 4.19).

18 The group also recommended the Sub-Committee to invite Administrations to distribute or facilitate access to the Lessons Learned for Presentation to Seafarers, as approved by the Sub-Committee, among maritime national educational centres, marine industry, as well as national fleets. In order to make the lessons learned easy available on the IMO website, the group also recommended that the Sub-Committee request the Secretariat to review the website and to consider alternative methods of disseminating the information.

### **Safety issues that need further consideration**

19 The group considered the issues identified by the Correspondence Group on safety issues which need further consideration (FSI 18/6, paragraph 4) on the following:

#### **.1 Seafarer Training on First Aid**

*The ATSB is aware of a number of previous instances where butter, honey or burn ointment has been applied to a casualty's burns. However, none of these substances should ever be used as a form of first aid for the treatment for burns".*

The report referenced the St. John Ambulance Australia as a source for the correct immediate treatment of burns (cooling with water). Similar advice can be found in various National Administration documents.

It has not been possible to determine from GISIS whether there are any other similar instances, but consideration should be given to investigating whether there are any systemic failings in the first aid training currently being given to seafarers – especially related to the treatment of burns.

#### **.2 Inadequate integration of pilots into bridge team**

The CG analysis of accidents frequently identified lack of an effective pilot/master interchange and/or poor bridge team management and liaison as contributory or causal to marine accidents involving collisions or groundings. Six of the reports analysed for FSI 18 have cited these issues, indicating that this is a significant problem worthy of attention by the Sub-Committee. The reports include:

- .1 tanker, COLLISION: poor bridge team management, weak communications, distraction;
- .2 container, COLLISION: inadequate pilot/bridge team liaison;
- .3 container, GROUNDING: roles and responsibilities not discussed during pilot/master exchange;
- .4 bulk carrier, GROUNDING: poor pilot/master exchange, weak communication and monitoring;
- .5 general cargo, GROUNDING: poor pilot master/exchange, weak communication; and
- .6 product carrier, COLLISION: poor pilot/master exchange, weak communication, responsibilities not agreed.

These reports have the common themes of: poor pilot/master exchanges at the start of the pilotage act; weak communications of intentions and information between the pilot and other bridge team members; and inadequate delineation of responsibilities. Specifically, pilots embarked vessels expecting little or no support from the Masters and bridge team members of the vessels they are about to go on board; and the bridge team members expect the pilots to assume all navigational functions and responsibilities. The result is that too many marine accidents are occurring because pilots are not integrated effectively into bridge teams at the point when bridge resource management needs to be at its most effective.

20 In recalling comments made in plenary, the group concurred that the role of the pilot on bridge team should be considered.

21 After extensive discussion, the group agreed to recommend to the Sub-Committee to forward to the MSC for subsequent referral to the STW Sub-Committee for its consideration the finding that **Seafarer Training on First Aid** be updated to reflect the current practices; and, the safety issues on **Inadequate integration of pilots into bridge teams**, be referred to the STW and NAV Sub-Committees for consideration and follow-up. The group also recommended the Sub-Committee to propose the MSC to refer the safety issues on **Inadequate integration of pilots into bridge teams** to the consideration of the Joint MSC/MEPC Working Group on Human Element.

22 The group further recommended to the Sub-Committee to include in the terms of reference for the CG, if established, the preparation of an extensive mapping and analysis of accidents and, if possible, trends related to inadequate integration of pilots into bridge teams having a contributing or direct cause to an accident.

#### **HEBEI SPIRIT**

23 The group considered the marine casualty of **M/T Hebei Spirit** (the allision of Crane **Barge Samsung No.1** with **M/T Hebei Spirit**) and recommend to the Sub-Committee that this matter be referred to the CG, if established, for consideration taking into account the information provided from a technical perspective in MEPC 60/16 and relevant information from the casualty investigation report (C0006497) incorporated into GISIS. (refer document MEPC 60/22, paragraphs 16.3 to 16.6)

#### **Information concerning a new category of stability accidents**

24 As instructed, the group considered document FSI 18/6/2 on Information concerning a new category of stability accidents and noted that the annex of the document was a summary of the investigation report of the German Federal Bureau of Maritime Casualty Investigation into the very serious casualty on board of the German containership **Chicago Express**.

25 The group noted that the accident investigated represents a new type of stability accident as it was not caused by any of the well known stability deficiencies parametric rolling or insufficient stability margins but rather by excessive stability, and also noted that the accident investigated was followed by two similar occurrences in 2009, one also leading to a fatality, the second to a seriously injured person on the bridge. In this context, the group, in noting the decision of the Sub-Committee to refer this document to the consideration of the SLF and DSC Sub-Committees, agreed to recommend the Sub-Committee to invite SLF and DSC to consider the causes of this casualty in their respective work, if deemed applicable.

26 The group was informed that a technical document on this matter had previously been submitted to the SLF Sub-Committee by Germany.

27 Aware that the investigation into the very serious casualty on board of the German containership **Chicago Express** has been incorporated into GISIS as incident C0007636, the group tentatively recommended referring the report to the CG, if re-established, for detailed consideration using the established procedures and submit the analysis for consideration of FSI 19.

### **Improve GISIS casualty data**

28 As instructed, the group considered document FSI 18/6/3 in order to advise on the possibility to improve the Global Integrated Shipping Information System (GISIS) casualty data. The group noted the information recalled on the Casualty Investigation Code (resolution MSC.255(84)) and MSC-MEPC.3/Circ.3 on reports on marine casualties and incidents.

29 The group noted that GISIS is currently not a statistical analysis tool, but is a very useful information library which can provide some statistical information.

30 The group, also noting the information provided on the difficulties to identify contributing factors (roots) on accident as well as the accident/incident of spill of dangerous cargo in cargo holds, agreed to review the taxonomy in MSC-MEPC.3/Circ.3 with a view to solving those difficulties. Some delegations expressed the need for more analyses on the type of accident of the spill of dangerous goods, and some other expressed that the data provided so far by the Administrations would not necessarily be useful for other analyses such as Formal Safety Assessment (FSA) due to the lack of information on contributing factors.

31 Some delegates highlighted the need to incorporate, into the GISIS database, information on the use of fire protection equipment and fire-fighting systems which were used, as well as to have information on the contributing factors to be considered and analysed.

32 Regarding paragraph 9 of document FSI 18/6/3, the delegation of the European Commission (EC) informed that the revision of MSC-MEPC.3/Circ.3 could streamline the European Marine Casualty Information Platform (EMCIP) and GISIS taxonomies allowing the provision of more casualty detailed data to IMO when transferring data from EMCIP to the casualty module of GISIS.

33 In considering the improvement of GISIS casualty data, the group agreed that there is a need to consider a revision of MSC-MEPC.3/Circ.3. However, due to the time constraints, the group was unable to consider this matter adequately in order to provide valuable advice or make recommendation to the Sub-Committee. The group recommended the Sub-Committee to refer this matter to FSI 19.

34 The group recalled the comments of the MSC (MSC 86/26, paragraph 17.15) in considering validity of the input data on FSA and its transparency, more specially that GISIS data should include more precise information on contributing factors and details of accidents and stressed the need for causes of accidents to be provided. The group recommended the Sub-Committee to remind Member States to include such information into the final version of a marine safety investigation report.

35 The group also recalled the comments of the MSC (MSC 86/26, paragraph 19.1) in considering general cargo safety matters and (MSC 86/19) that MSC 84, having discussed the best way to proceed on the matter in light of the information received to date, had agreed, in principle and among other points, that: "more detailed casualty information on the cause of accidents involving general cargo ships was needed to progress the matter, including the outcome of any related studies". The group also agreed to recommend to the Sub-Committee to remind Member States to include such information into the final version of marine safety investigation reports.

36 In considering documents MSC 86/26 (paragraph 25.12) and MSC 86/INF.8 (INTERCARGO) on bulk carrier casualty report, the group also agreed to recommend to the Sub-Committee to remind Member States to consider potential trends when conducting a marine safety investigation or analysis of marine safety investigation reports.

37 The group recalled that FSI 17 (FSI 17/WP.1, annex 2, paragraph 1.6), in considering Casualty Analysis Working Group Activities (CAWG), agreed that "the CAWG also examines the analysis of investigation reports to determine if there are potential safety issues in way of trends or recurring contributing factors". In this context, the group recommended that the Sub-Committee request the Secretariat to continue this effort to establish an internet capability for the CG to access data from GISIS in order to determine if there are potential safety issues in way of trends or recurring contributing factors, which can be reviewed and discussed in the CAWG.

#### **Fishing factory vessel HERCULES**

38 In considering document FP 54/25 the group recalled that the investigation report on the fire on the fishing factory vessel **Hercules** has been included into GISIS as Incident number C0006872 and the analysis was also submitted to FSI 18 by the CG (FSI 18/6, annex 2). The group noted the views of FP 54 regarding the fire on board the fishing factory vessel **Hercules**.

#### **RE-ORGANIZING PART OF THE SUB-COMMITTEE WORK**

39 As instructed the group considered document FSI 18/17 (Secretariat) on options which the Sub-Committee may wish to consider for re-organizing part of its work. The outcome of the discussion within the group is outlined in the following paragraphs.

40 In considering the importance of the casualty-related matters and the precedents (FSI 18/17, paragraphs 15 and 16), the group agreed that the working group and correspondence group on casualty-related matters conduct critical and fundamental work in identifying and highlighting important safety issues as well as identifying relevant new requirements. The group was unable to reach consensus on the proposed options outlined in document FSI 18/17. However, the group considered that the suggestion to meet every two or more years would seriously compromise the work of the group.

41 In considering options to better organize the work of the working group and correspondence group on casualty-related matters looking for a more efficient job, better final product and prioritized activities, the group agreed to recommend to the Sub-Committee, that the casualty analysis working group should:

- .1 continue to meet on a regular basis not less than annually;
- .2 start its work promptly based on preliminary terms of reference approved by the previous session of the Sub-Committee,



- .3 have any additional terms of reference cleared by the Sub-Committee in a timely manner to allow the group to conduct its work effectively and efficiently; and
- .4 continue improving its activities electronically in order to save time and offer a better product to the Administrations.

#### **CORRESPONDENCE GROUP ON CASUALTY ANALYSIS AND TERMS OF REFERENCE**

42 The group, taking into account the work completed at this session, agreed to recommend that the Correspondence Group on Casualty Analysis be re-established, under the coordination of Germany\*, to continue its work intersessionally under the following terms of reference:

- .1 based on the information received from Administrations on investigations into casualties, conduct a review of the relevant casualty reports referred to the group by the Secretariat;
- .2 analyse the investigation report on the collision between **Samsung 1** and **Hebei Spirit**, Incident: C0006497;
- .3 consider and advise on the information provided from a technical perspective in document MEPC 60/16 on fair treatment of seafarers of the **M/T Hebei Spirit** (document MEPC 60/22, paragraphs 16.3 to 16.6);
- .4 analyse the final investigation report on the marine accident on board of the **Chicago Express**, incorporated into GISIS as incident C000763;
- .5 conduct analyses on accidents and, if possible, identify trends related to the integration of pilots into bridge teams, as practicable;
- .6 identify safety issues that need further consideration; and
- .7 submit a report to FSI 19.

43 The group, in considering the short period of time between FSI 18 and FSI 19 for the activity of the correspondence group, recommended to the Sub-Committee to consider, during FSI 19, referring all other pending matters to the consideration, advice and recommendation accordingly of the working group of FSI 19, if established.

#### **WORKING GROUP ON CASUALTY ANALYSIS**

44 In this context, the group also recommended to the Sub-Committee to consider that the Working Group on Casualty Analysis, if re-established, should start work on the morning of the first day of the FSI 19 meeting, in accordance with Guidelines MSC-MEPC.1/Circ.2 on

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Guidelines on the Organization and method of work of the Maritime Safety Committee and the Marine Environment Protection Committee and their subsidiary bodies, as amended, under the following Provisional Terms of Reference subject to further instructions received from the plenary:

- .1 confirm or otherwise the findings of the Correspondence Group based on the analysis of individual casualty investigation reports (FSI 19/6 and FSI 19/6/1 and GISIS), for the Sub-Committee's approval and authorization of their release to the public on GISIS;
- .2 confirm or otherwise the draft text of lessons learned for presentation to seafarers (FSI 19/6), for the Sub-Committee's approval and authorization of release on the IMO website in accordance with agreed procedure; and
- .3 consider and advise to refer to the relevant committees and sub-committees those reports reviewed by the analysts and considered by the Working Group on Casualty Analysis and which are of interest to them (FSI 19/6). In doing so, the Working Group should submit supporting information derived from the casualty analysis procedure used for the development of recommendations for consideration by the committees and sub-committees.

#### **ACTION REQUESTED OF THE SUB-COMMITTEE**

45 The Sub-Committee is invited to approve the report in general and in particular to:

- .1 approve the amended text of the analysis of the investigation report of the fire on the fishing factory vessel **Hercules** (Incident: C0006872) and the analysis of the investigation report on the fire on the ro-ro cargo ship **Und Adriatik** (Incident: C0007200) for release on the GISIS module (paragraph 4 and annex 2);
- .2 endorse the group's recommendation to bring the safety issues to the attention of Administrations with the objective of highlighting the circumstances in future investigation reports (paragraphs 6 and 7);
- .3 approve the amended text of casualty analyses for release to the public on the GISIS module (paragraph 9);
- .4 note the willingness of MAIF to cooperate with IMO in the revision review and update of the IMO's Model Course 3.11 "Marine Accident and Incident Investigation" and recommend to the MSC to request the Secretariat to review and update the IMO's Model Course 3.11, at its earliest convenience, for referral to the Validation Group established by the MSC, as well as to involve MAIF in the process of revision (paragraph 10);
- .5 approve the draft text of Lessons Learned for Presentation to Seafarers, and according to the agreed procedure (FSI 11/23, paragraph 4.19), for release on the IMO website according to the agreed procedure (paragraph 17 and annex 1);
- .6 endorse the group's recommendation to invite Administrations to distribute or facilitate access to the Lessons Learned for Presentation to Seafarers among maritime national educational centres and industry, national fleets

as well as to request the Secretariat to review the website and to consider alternative ways of disseminating the information (paragraph 18);

- .7 endorse the group's recommendation to forward to the MSC for subsequent referral to the STW Sub-Committee for its consideration the finding that, **Seafarer Training on First Aid** be updated to reflect the current practices; and, the safety issues on **Inadequate integration of pilots into bridge teams**, be referred to STW and NAV Sub-Committees for consideration and follow-up as well as to referring the safety issues on **Inadequate integration of pilots into bridge teams** to the consideration of the Joint MSC/MEPC Working Group on Human Element (paragraphs 19 to 21).
- .8 endorse the group's recommendation to include in the terms of reference for the correspondence group, if established, the preparation of an extensive mapping and analysis of accidents and, if possible, trends related to inadequate integration of pilots into bridge teams having a contributing or direct cause to an accident (paragraph 22);
- .9 endorse the group's recommendation to refer the marine casualty of **M/T Hebei Spirit** to the correspondence group for analysis; and further consider and advise on the information provided from a technical perspective in document MEPC 60/16 on fair treatment of seafarers of the **M/T Hebei Spirit** (document MEPC 60/22, paragraphs 16.3 to 16.6), (paragraph 23);
- .10 endorse the group's recommendation to invite the SLF and DSC Sub-Committees to consider the causes of the very serious casualty on board of the German containership **Chicago Express** in their respective work, if deemed applicable (paragraph 25);
- .11 endorse the group's recommendation to refer the very serious casualty on board of the German containership **Chicago Express** to the correspondence group for detailed consideration (paragraph 27);
- .12 endorse the group's recommendation to refer to FSI 19 the matter related to the possibility to improve GISIS casualty data, for detailed consideration including aspects in relation to EMCIP/GISI data transfers (paragraph 33);
- .13 endorse the group's recommendation to remind Member States to include more precise information on contributing factors and details of accidents and stress the need for causes of accidents to be provided into the final version of a marine safety investigation report (paragraph 34);
- .14 endorse the group's recommendation to remind Member States to include more detailed casualty information on the cause of accidents involving general cargo ships, including the outcome of any related studies, into the final version of marine safety investigation reports (paragraph 35);
- .15 endorse the group's recommendation to remind Member States to consider potential trends when conducting a marine safety investigation or analysis of marine safety investigation reports (paragraph 36);
- .16 endorse the group's recommendation to request the Secretariat to continue this effort to establish an internet capability for the correspondence group to access data from GISIS in order to determine if there are potential safety

issues in way of trends or recurring contributing factors, which can be reviewed and discussed in the CAWG (paragraph 37);

- .17 concur with the group's recommendation on the aspects of the work of the working group and correspondence group on casualty-related matters looking for a more efficient job, better final product and prioritized activities (paragraph 41) and decide as appropriate;
- .18 re-establish the Correspondence Group on Casualty Analysis under the proposed terms of reference (paragraph 42); and
- .19 endorse the group's recommendations on the Working Group on Casualty Analysis and the proposed terms of reference during FSI 19 (paragraphs 43 and 44).

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## **ANNEX 1**

### **DRAFT TEXT OF LESSONS LEARNED FOR PRESENTATION TO SEAFARERS**

#### **1 SINKING**

##### **Cargo hold flooding and subsequent loss of vessel**

###### **What happened?**

A single-hold general cargo vessel with a cargo of clay and manganese was en route to its next destination when the weather deteriorated and the winds became south-westerly at Beaufort force 10. A trim by the head was observed and an inspection of the cargo hold revealed the presence of water; however, the location of water ingress could not be determined. Pumps were deployed, but were unable to stem the vessel's increasing draft. The vessel was abandoned and it later sank.

###### **Why did it happen?**

- Although it could not be determined with certainty, it is likely that the water ingress occurred in the forward part of the cargo hold or in the area of the rope racks welded on deck at the forward end of the vessel.
- At the time the ingress of water was discovered, the quantity of water in the hold was sufficient to trim the vessel by the stem. The vessel was not fitted with water level detectors and alarm system.

###### **What can we learn?**

- The importance of taking measures, such as the fitting of alarms, taking soundings or monitoring roll periods, to ensure the early detection of any ingress of water into the hull.

#### **2 SINKING**

##### **Engine-room flooding and subsequent loss of vessel**

###### **What happened?**

This dynamically positioned supply vessel was operating with the machinery space unmanned. At 0350 hrs the machinery space bilge alarm sounded. The investigating duty engineer found water covering the floor-plates to a height of 70 cm. He could not locate the source of the leak. He tried to pump out the compartment via the emergency bilge suction but could not reach the seawater mains isolating valves or the emergency bilge suction valve. The vessel was eventually towed to a sandbank and beached. After subsequent attempts to float her failed, she was declared a constructive total loss.

### **Why did it happen?**

The prime cause of the water ingress was found by divers to be the failure of a short, 90/10 cupro-nickel, spool piece in the seawater line to the central auxiliary cooler serving air conditioning and refrigeration services. It was located immediately prior to a steel pipe intended to act as a sacrificial anode to protect the cooling water system. The cause of the failure was presumed to be modification of the properties of the cupro-nickel, arising from the welded flanges, coupled with the exclusive extended service of the vessel in warm, high-salinity, seawater. The management had prepared a generic Emergency Manual with the intention that the master of each vessel modified it to suit the particular vessel. This included assignment of specific responsibilities for each type of emergency event. The manual also identified the need to prepare an annual list of drills to be performed each month. The plan on board the vessel did not, however, give sufficient detail to cover the type of flooding event experienced in this instance.

Contributing factors to the subsequent loss of the vessel were:

- Failure to detect the rising bilge water level until it had reached a height of 70 cm above the floor plates;
- Inaccessibility of the manually-operated emergency bilge suction valve located below the floor plates. Note that this is contrary to the requirements of SOLAS for unmanned machinery spaces;
- Inaccessibility of manually-operated seawater inlet valves at the time of discovery of the flooding; and
- The chief engineer was ashore for medical reasons at the time of the incident so there was insufficient engine-room staff on board to effectively control and cover the emergency actions required.

### **What can we learn?**

- Bilge alarm systems should be tested regularly.
- While periodic five-yearly surveys should identify wastage in piping systems, surveys are not infallible and, in some cases, even when components withstand a pressure test, subsequent corrosion can advance at an accelerated rate. Operators should include in their planned maintenance routines visual and Non Destructive Examination (NDE) inspections of below-floor-level piping systems, especially when vessels are being operated in aggressive water conditions.
- Operators should be sufficiently familiar with the location and operation of important valves to the extent that they can locate and operate them in emergency conditions.
- Owners should provide documented ship-specific procedures covering emergencies. These should be validated by actual trials. They should be available on plastic-laminated instructions/diagrams. As a minimum they should cover:

- the valves to operate (opening or closing, how accessible if flooding occurs, whether they are remote controlled or manually operated); and
- the pumps to start (location of starters and operation in an emergency).

Response to emergency situations needs to be rapid and coordinated. It is essential for management to prepare appropriate emergency plans and promote a strong safety culture to encourage correct deployment of planned procedures.

- Familiarity with the layout and function of emergency systems is essential – e.g., bilge pumping, ballast transfer and fire. Engineers should be encouraged to physically trace essential service lines themselves when first joining ships.
- Realistic drills covering such events as flooding and fire need to be conducted on a regular basis.

### **3 FIRE OR EXPLOSION**

#### **Fire in engine-room due to poor housekeeping**

##### **What happened?**

A fire started in the engine-room. The main fire pump was inaccessible due to thick black smoke and staff evacuated the engine-room, first stopping the main engine. The quick-closing fuel supply valves and the remote stops for the engine-room fans and oil pumps were operated and the emergency fire pump was started. The crew closed the dampers for the engine-room fans and the funnel vents; they rigged fire hoses to boundary cool the engine-room casing and funnel and to spray water through the open engine-room skylight. After about 50 minutes, the fire cut the electrical power supply to the emergency fire pump and water ceased to flow from the fire hoses. The fire was eventually extinguished using the fixed CO<sub>2</sub> system.

##### **Why did it happen?**

From the available evidence it was concluded that the primary fire probably started in the area outside the entrance to the third platform deck store, on the port side of the main engine. Oily rags and cotton waste used for engine-room cleaning were routinely stored there prior to burning them in the nearby incinerator. Moreover, hot ash from the incinerator was also routinely kept there in an open top cut down steel drum where it was left to cool prior to disposal.

##### **What can we learn?**

- The importance of good housekeeping practices in engine-rooms should be stressed.
- Early use of the fixed CO<sub>2</sub> following safe evacuation.

Used oily cotton waste/rags and hot ashes are a significant fire hazard and should be safely stored prior to safe and environmentally-acceptable disposal.

## **4 FIRE OR EXPLOSION**

### **Flame from oxyacetylene torch ignited material**

#### **What happened?**

Crew members were working in a confined space trying to replace a manhole cover plate. A bulkhead stiffening bracket was making it difficult to put the plate over the opening. They decided to cut away part of the bracket using an oxyacetylene torch. The flame from the torch ignited material in the machinery store on the other side of the bulkhead. The heat caused one or more camping gas cylinders in the store to explode. The explosion and fireball passed through the open manhole severely burning an engineer who was trying to extinguish the fire with a portable extinguisher. He had come straight to the workspace from his cabin and was dressed in tee-shirt and shorts.

#### **Why did it happen?**

- The crew members embarked on a hazardous enterprise without carrying out a careful risk analysis or informing all interested parties (notably the master) of their intentions.
- Although an oxyacetylene torch was being operated on a bulkhead, shared with a space housing inflammable materials and gas cylinders, this space was not emptied prior to carrying out the work, nor was a fire-watch maintained in the space. Essential fire-fighting equipment was not laid out and checked prior to carrying out the work.

#### **What can we learn?**

- Always carry out a risk analysis before carrying out hot work. Using oxyacetylene equipment is always hazardous; it is especially so when being used in a confined or restricted space.
- When carrying out hot work, always consider what is on the other side of the bulkhead and arrange a fully briefed fire-watch.
- Double-check that all necessary fire prevention and fire-fighting equipment is at hand and in good order.
- While answering calls for assistance is highly commendable, evaluate the situation and never take unnecessary risks.

## **5 FIRE OR EXPLOSION**

### **Cargo hold fire caused by hot work on cargo hold hatch cover**

#### **What happened?**

When a fitter was in the process of removing the brackets that had been welded to the hatch covers with oxyacetylene cutting equipment, a hole was inadvertently cut in the aft cargo hold hatch cover. As a result, a fire started in the cargo hold when sparks and molten metal fell into the cargo hold and onto the pallets of cargo stowed below. The crew's attempts to use the fixed fire-extinguishing system to flood the cargo hold with carbon dioxide and high



expansion foam were unsuccessful. The fire was finally extinguished when an offshore supply vessel's monitor was used to flood the cargo hold with about 700 tonnes of seawater.

### **Why did it happen?**

The fitter removing the stoppers from the cargo hold hatch covers could not read English and hence could not fully understand the requirements of the ship's safety management system hot work permit. Also the ship's cargo stowage plan was neither accurate nor complete.

### **What can we learn?**

- Ship's cargo stowage plan especially for the carriage of dangerous goods should be accurate and available on board at all times.
- Always carry out a risk analysis before carrying out hot work. Care must be taken when using oxyacetylene equipment.
- Before the work was started hot work permits should be completed and signed with full understanding of the permit's requirements by the individual carrying out, and the person in charge of the work.

## **6 FIRE OR EXPLOSION**

### **Engine-room fire**

#### **What happened?**

The ship's fire detection system indicated a fire in the engine-room about four hours after the ship departed from port. The second engineer investigated and found that No.3 diesel generator was on fire caused by the failure of a flexible fuel hose. He raised the alarm and discharged a portable extinguisher towards the fire and stopped the engine-room ventilation fans before retreating from the engine-room. The crew mustered quickly, operated systems to stop the engine-room pumps, fuel tanks quick-closing valves and prepared to fight the fire. The fire was put out finally by the engine-room Halon fixed fire-extinguishing system.

#### **Why did it happen?**

- The failure of a flexible fuel hose on No.3 diesel generator due to long-term rubbing and chafing.
- The maintenance of the generator flexible fuel hoses was inadequate and hoses longer than specified by the generator manufacturer had been used.
- Both the generator manufacturer's instruction book and the ship's safety management system provided no guidance for the maintenance or routine replacement of the flexible fuel hoses.

#### **What can we learn?**

- Flexible fuel hoses must be installed in accordance with manufacturers' specifications and should be inspected regularly for wear and tear. Flexible fuel hoses should be replaced in good time whenever there is doubt as to their suitability to continue in service.
- The value of an effective crew response to an emergency situation.

## **7 FIRE OR EXPLOSION**

### **Cargo hold fire when loading mixed metal scraps**

#### **What happened?**

The multi-purpose 1,318 GT cargo vessel with a single hold, was loaded with mixed metal scrap composed of compressed cultivators, motorcycle engines, electronic waste, iron scrap and plastics. A fire broke out at about 0825 hrs in the cargo hold. The fire was put out by the shore fire brigade at 0200 hrs the following day. There was no oil pollution resulting from the fire. However, the ship's port forward shell plating and structure were damaged.

#### **Why did it happen?**

- Flammable materials contained in the mixed metal scrap were ignited by the frictional heat being generated from iron scraps hitting each other during loading operation and being crusted by an excavator in levelling the cargo loaded in the cargo hold.
- Metal scrap mixed with compressed cultivator and motorcycles, which might contain residue fuel, was not treated as flammable material.

#### **What can we learn?**

- The safety awareness of ship staff was not sufficient. The stevedore and the shipper did not realize that metal scrap mixed with compressed cultivator and motorcycles, which might contain residue fuel, should be treated as flammable material.
- Scrap metal cargo has hidden dangers including possible toxic and flammable materials.

## **8 FIRE OR EXPLOSION**

### **Deck fire during gas-freeing operations**

#### **What happened?**

The 2,646 GT tanker was at anchor performing gas-freeing operations having completed the discharge of naphtha. A fire broke out on deck at No.4 port manhole opening while gas-freeing operations were being carried out on tanks No.3 and No.4. The fire was put out by ship staff, but the fire left one crew member dead and two injured.

#### **Why did it happen?**

- Gas-freeing operations were not conducted in accordance with the applicable guidelines and procedures.
- Uncertified ventilation fans were used during gas-freeing operations.

### **What can we learn?**

- During gas-freeing operations, properly certified equipment (EG., fan, etc.) should be used.
- During gas-freeing operation the exhaust gas should be discharged from vent posts to avoid dangerous exhaust gas being accumulated on deck.

## **9 FIRE OR EXPLOSION**

### **Cargo hold fire caused by light fittings**

#### **What happened?**

A fire broke out in the hold where a large amount of plastic and corrugated cardboard packing was stored. Very dense smoke quickly spread throughout the vessel including the bridge. The fire alarm was activated but functioned only for a short while. The smoke divers' search for personnel in the accommodation was abandoned after a short while due to lack of breathing gas. Fire fighting inside the accommodation had to be abandoned for the same reason. There were no compressors on board to recharge the bottles. One hundred and five crew members were rescued, while 11 lost their lives. The vessel burned for three weeks.

#### **Why did it happen?**

Sparks were generated in the fluorescent tubes sockets, which resulted in overheating and melting of the surrounding plastic. The burning plastic material dropped down and ignited corrugated cardboard which had been stored close to the tubes. The light fittings were of poor quality not suitable for use on board ships. The storeroom did not have the required fire protection. The fire alarm failed due to the fire destroying the wiring. Fire doors had been kept open by wooden blocks allowing the smoke and fire to spread rapidly. There were no compressors on board to recharge the bottles of breathing gas. Fire drills were insufficient. Not all crew were informed and familiar with emergency procedures.

#### **What can we learn?**

- Electrical fittings must be suitable for marine use.
- Fire detection systems must be updated along with any modifications on board ships.
- Emergency training is essential to ensure a proper emergency response by all crew members. Seafarers must familiarize themselves with emergency procedures.
- The dangers of propping open fire doors.
- Based on the risk assessment there should be sufficient fire-fighting equipment identified on board to ensure effective fire fighting.

## **10 FIRE OR EXPLOSION**

### **Cargo hold fire on a ro-ro**

#### **What happened?**

A fire was detected on the main deck of a ro-ro ship loaded with trucks. Crew members went to check the deck to ensure there was a fire because there had been several misleading alarms earlier triggered by the trucks exhaust rather than a fire. On confirmation of the fire, fire-fighters entered the main deck with water hoses to extinguish the fire. Several attempts to start the fire pumps failed and the fire spread rapidly; 27 minutes after the initial fire alarm, it was decided to activate the sprinklers, but all attempts to start the drencher pump failed. The rapidly expanding fire, together with enormous quantities of dense smoke, blocked the escape route to the lifeboat, rescue boat and raft. The crew then retreated to the foredeck from where they later jumped into the sea.

All 22 crew members and 9 passengers were rescued. The vessel burned for two days and was declared a constructive total loss.

#### **Why did it happen?**

The exact cause of the fire has not been identified, but it was concluded that it started in one of the trucks. The fixed fire-fighting system was not activated instantly, and verifying the fire alarm took 10 minutes, thus delaying the fire-fighting actions. The fire spread rapidly and fire-extinguishing equipment then failed. The cause of the pump failures could not be determined.

#### **What can we learn?**

- Any fire alarm must be taken seriously. There should be no hesitation when an alarm is raised.
- Due to the narrow gap between the vehicles on ro-ro ships, use of sprinklers or other fixed fire-fighting systems should be considered as the primary fire-extinguishing method and be activated instantly.

## **11 COLLISION**

### **Collision between a ro-ro vessel and a fishing trawler**

#### **What happened?**

At night, a ro-ro vessel and a trawler were approaching on reciprocal but parallel courses. The ro-ro vessel made a small alteration to port in order to pass clear of the trawler. When the two vessels were about three miles apart, the ro-ro vessel returned to its original heading and the trawler altered to starboard. The ro-ro vessel then used light and sound signals to warn the trawler. When the vessels were one mile apart, the ro-ro vessel's helm was put on manual steering and hard-a-port was ordered. The vessels collided and the crew of the trawler were recovered before it sank.

### **Why did it happen?**

The ro-ro vessel made a small alteration to port that was not readily apparent to the trawler. The radar on the trawler was not working and there was only one person on watch, who was navigating visually. Neither vessel made their intentions known in a timely manner.

### **What can we learn?**

- It is important to follow the COLREG and use all applicable navigation equipment.

## **12 CONTACT**

### **Controllable pitch propeller malfunction leading to contact with dock**

#### **What happened?**

In good weather, a ro-ro ferry had turned and the master was backing the ship into the link-span. As he did so, the starboard controllable pitch propeller (CPP) alarm activated, but this went unnoticed. The master moved both CPP controls to take the way off, but the starboard CPP did not respond and continued to drive astern. The asymmetric thrust caused the stern to sheer to port, initially making contact with the pile fenders on the port side. Six minutes after the original alarm sounded, the master regained control of the starboard CPP at the centreline consol, but not early enough to prevent the vessel making heavy contact with the link-span. The vessel suffered damage to the shell plating and the stern ramp was blocked by bent steel. Ashore, damage occurred to the pile fender and the loading ramp of the link span.

#### **Why did it happen?**

- The CPP failure alarm was heard on the bridge, but the bridge team could not identify which alarm was sounding.
- The engine-room staff saw the alarm had activated and had not been reset, but did not contact the bridge to check that they were taking action.
- The bridge team was not familiar with the propulsion system's emergency procedures and time was lost while they determined the appropriate action.
- The bridge CPP alarm only sounded briefly and the flashing light on the panel reverted to steady illumination after a short time. Therefore the audio and visual triggers as to which alarm was activating were too transient.
- Despite intensive investigations, the cause of the CPP failure was not found.

#### **What can we learn?**

- The value of continually monitoring engine control feedback indicators.
- The value of understanding all alarm indicators prior to an emergency situation.

## **13 COLLISION**

### **Collision during overtaking situation in confined waterway**

#### **What happened?**

A small dry bulk cargo vessel, while proceeding down a river fairway under good weather and visibility conditions, collided with a large container vessel, also proceeding down the river in the same direction.

The large container vessel had the smaller dry cargo ship on her starboard side and was approaching to overtake her. At the same time, she had another large containership, proceeding in the opposite direction, on her port side in the narrow fairway. When the two large containerships met, both of which were sailing under pilot's advice, the distance between them was only approximately 38 m. In this area the fairway was 220 m wide. When the three ships were almost abreast, the propulsion system of the dry cargo ship suddenly failed. After losing her forward propulsion and manoeuvrability, the smaller ship, which had kept to the right side of the fairway, was unable to undertake effective measures to counter the hydrodynamic forces generated during the bigger ship's subsequent overtaking. The dry cargo ship turned to port towards the overtaking vessel, ultimately colliding with it at an angle of almost 80°.

The bow of the dry cargo ship was significantly dented when it tore the starboard side hull plating of the big containership over a length of eight metres above the waterline. Both vessels retained buoyancy and were able to proceed without assistance. There were no personal injuries and no environmentally harmful substances were released as a result of the casualty.

#### **Why did it happen?**

- The main contributing factor in this accident was the main engine failure of the smaller vessel. Also the section of the river on which the triple encounter and the collision took place provided very little scope for potential evasion manoeuvres.
- By reason of her relative speed and the corresponding displacement effect, the big containership generated a low pressure area that exposed the smaller ship to strong and changing suction effects, which might have at the same time overloaded her main engine.

#### **What can we learn?**

- The risk potential of multiple ship encounter situations in narrow fairways and rivers should be taken into account during voyage planning and when navigating in such areas.
- Hydrodynamic effect of fast, large and deep draught ships, especially in shallow waters, should be well understood by pilots, officers and ship masters sailing in fairways and channels.
- All close-quarters overtaking situations are dangerous.
- Overtaking situations in narrow channels are particularly dangerous due to the amplified nature of hydrodynamic forces.

## **14 COLLISION**

### **Collision between vessels at pilot station**

#### **What happened?**

A tanker collided with a dry cargo vessel at a river entrance. The tanker was outbound and approaching the pilot station to disembark the pilot, while the dry cargo ship had just picked up a pilot a few minutes before the collision. It was daylight but dense fog reduced the visibility to about 120 metres. Both vessels were preoccupied with pilot embarkation/disembarkation preparations. There were only the pilot and the master on the bridge of the tanker. The master was distracted with manual steering and the pilot was occupied with disembarkation arrangements. Due to circumstances of traffic and tidal current, the dry cargo ship was about 0.4 miles in the way of the outgoing channel. The vessels were aware of each other's presence 6-7 minutes prior to the accident. The pilot of the tanker tried to contact the dry cargo ship for several minutes in vain. Later, the pilots had communicated their intentions and agreed that the tanker would head southerly and pass from the port side of the cargo ship. But the pilot of the tanker was again distracted with disembarkation arrangements and did not make the agreed manoeuvre. The last attempts of communication were unsuccessful due to radio interference. Shortly afterwards, both ships came in sight of each other and it was realized that a collision was imminent. The pilots advised to put the helm midship and to go full astern, however, the two vessels collided. There was a VTS in operation in the region but VTS operators were passive during the development of dangerous situations.

The tanker suffered damage to her bow. The dry cargo ship suffered damage on the port side under the forecastle area in way of the forepeak store, forepeak tank, anchor hawsepipe, and indentation under the water line in way of forepeak tank and bulbous bow. There were no injuries or pollution.

#### **Why did it happen?**

- The visibility was very poor due to dense fog and several inbound vessels and an outbound tanker were in the same area nearly at the same time, many of which were converging on the pilot boarding area.
- The vessels were distracted and preoccupied with embarkation/disembarkation arrangements. The vessels did not monitor, track or communicate with each other and did not learn each other's intentions well in advance of the accident.
- The dry cargo ship drifted too much southward, well in way of the outbound traffic due to strong tidal current. Her speed was reduced considerably as she was getting ready to pick up the pilot, and this increased her drift and she landed in way of the outbound traffic lane. The bridge team of the dry cargo ship and the pilot were late to realize the developing danger caused by the ship's position.
- The tanker did not execute the agreed avoidance action due to distraction of the pilot.
- VTS took a passive approach. It only acknowledged messages but did not warn either vessel of the other's intention, despite the very poor visibility and the position of the dry cargo ship which had drifted southwards in way of the outbound traffic lane.

- The pilots and bridge teams on both vessels did not make a full assessment of the risk of collision.
- ARPA was not used effectively on either vessel to assess the risk of collision. By the time the ARPA was used on the dry cargo ship, it was too late for it to provide reliable information.
- Effectively, no one held the con on the bridge of the tanker because both the master and pilot had deferred to the other, there was no discussion or questioning of the intentions of the dry cargo ship, and at a critical time they involved themselves with tasks that were inappropriate given the impending close quarters situation.
- The bridge on the tanker was insufficiently manned in the circumstances and conditions. It did not comply with company requirements or port authority instructions to pilots, however, no additional resources were requested by the pilot.
- The communication between all parties involved was unclear and prone to misunderstanding, and use of standard marine phrases was not practised.

#### **What can we learn?**

- The availability of VTS, having a pilot on board or approaching to pick up a pilot must not be a reason to relax or defer taking timely and efficient collision avoidance action.
- The collision avoidance action should have been taken in ample time as per Rule 8 and 19 of the Collision Avoidance Rules.

## **15 COLLISION**

### **Dragging anchor leading to collision**

#### **What happened?**

A vessel dragging its anchor (without the use of its main engine) touched twice another vessel, then moved further through the anchorage and hit a *second* ship.

#### **Why did it happen?**

- The deteriorating weather caused the vessel to drag its anchor. The ship did not have its engines available to assist it to manoeuvre clear of other ships in the anchorage.
- The master of the vessel that was struck first probably did not appreciate the risk the weather posed to his ship and to those around it. Consequently, he did not allow sufficient time in which to heave his anchor up in the prevailing circumstances and conditions.



### **What can we learn?**

- The importance of having main engines ready for immediate use in deteriorating weather conditions.
- The importance of having an appreciation of the risk posed to a ship by others in an anchorage area.
- The importance of good anchoring practice, including:
  - the amount of cable to put out;
  - the numbers of anchors to use;
  - the need to ballast down ships if possible; and
  - the importance to head for open sea before the weather conditions become too bad.

## **16 COLLISION**

### **Collision caused by fatigue**

#### **What happened?**

The two vessels collided almost head-on after neither watchkeeper took action to avoid the collision. Vessel 1 sank as a result of the collision and its chief engineer was lost.

#### **Why did it happen?**

- The watchkeeper on board vessel 1 fell asleep in the bridge reclining chair.
- Consequently, he did not maintain a look-out and did not see the approaching ship until it was too late.
- The watchkeeper on board vessel 2 assumed that the other ship would take avoiding action so did nothing despite the fact that the two ships were approaching each other on an almost reciprocal heading so as to involve a risk of collision.

#### **What can we learn?**

- The importance of managing fatigue both in port and at sea following time in port.
- The importance of keeping a proper and effective look-out.
- The importance of not making assumptions that the other ship in a risk of collision situation will take action to avoid the collision.

## **17 GROUNDING**

### **Grounding caused by poor bridge team communication**

#### **What happened?**

A dry cargo vessel in the laden condition was approaching its berth in a narrow river. She had a pilot on board. Before arriving at the berth, the visibility deteriorated. The chief officer and the master were on the bridge. The master was sitting at the steering console and steering the ship as no-one else on board knew the use of the special steering controls. An AB with a radio was in the forecabin head to act as look-out. The chief engineer was in the engine-room.

The passage continued in very poor visibility. As the vessel approached a sharp bend on the river, it reduced speed. Soon afterwards, the forward look-out reported deck lights of vessels moored on the wharf, close off the port bow. There was a series of loud exchanges in native language between the master, C/O and the AB, during which the master further reduced the engine speed and altered course to starboard away from the lights. The pilot heard the exchanges between the master and crew, but he did not understand and was not aware of their concerns over the proximity of the moored vessels, or the master's changes to the vessel's course and speed.

By the time the ship had cleared the vessels, her speed had reduced to about 2.5 knots over the ground and she was being swept bodily towards the left-hand bank of the river by the flood tide. The pilot advised the master to steer to starboard to negotiate the next bend in the river but when he noticed the vessel's insufficient speed, he advised the master to "speed up" and to "come more to starboard". A few moments later, the vessel momentarily touched the river bottom with her stern near the left-hand river bank. The master quickly put the azimuth controls to full ahead and to starboard. The vessel turned sharply and began to head across the river towards shallows in the middle of the river, and although the master put the engine controls to port, the vessel ran aground for the second time on the shallows. The pilot advised that the vessel would refloat without difficulty on the rising tide, but this advice was ignored by the master who applied full astern power. After several minutes, the master was informed by the chief engineer in native language that water was spraying from the port azimuth oil vent in the engine-room. The pilot was not made aware of this problem.

The vessel refloated after a short time by the rise of tide and with her engines operating at full astern, she slewed back across the river and again grounded for the third time from her stern. Control was regained shortly afterwards and she was berthed alongside.

After subsequent inspections, the vessel's port azimuth pod casing was found to be fractured and its propeller blades badly damaged. The vessel was given dispensation to sail to a repair port. When the vessel was later dry-docked it was established that, in addition to the damage already identified, the port azimuth drive shaft had to be replaced. There was also evidence of recent coating damage under the vessel's port quarter.

#### **Why did it happen?**

Although safe passage in the narrow river in restricted visibility required good communications and coordination between the master and pilot, there were a number of factors which indicated these were lacking on this occasion. Effective coordination between the pilot, the master and the bridge personnel was not established for communications and information exchanges and mutual understanding of each for the functions and duties of the other was not determined.

An instruction issued by the ship's manager regarding control of the ship's azimuth propulsion system was ignored. No-one but the master knew the operation and he was on the helm during the river passage because there was no other person on board who he considered competent to undertake this important task. Because the master was the helmsman, he was unable to maintain an efficient command of the navigation of his vessel. Consequently, the ability of the bridge team to navigate safely within the confines of the river in restricted visibility was seriously compromised.

The larger scale charts of the area, produced by the Port Authority, were more appropriate than the nautical chart for use by vessels navigating on the river, but unfortunately their availability had not been well promulgated. The pilot did not show the master the larger scale chart of the area that he carried.

Notwithstanding the limitations of the chart in use, the vessel's river passage was poorly planned and demonstrated complete reliance on the pilot for the vessel's safe passage. The exchange between the master and pilot was brief and failed to highlight the potential problems during the passage or the limitations of the bridge organization in restricted visibility.

#### **What can we learn?**

- Good communications and close cooperation between the master and the pilot during sailing in confined waters, especially in times of restricted visibility, is essential and should be a priority.
- Passages under pilotage should be carefully planned by vessels' crews.
- Deck officers and crew nominated to act as helmsmen on vessels fitted with special propulsion and steering systems should be trained to a defined standard. In this case, the master ignored an instruction issued by the ship's manager regarding control of the special propulsion system. He did not consider any of the crew to be sufficiently competent to undertake this task and did not train anyone. Consequently, the master himself had to stay on the helm of ship during the river passage. Because the master was the helmsman, he was unable to maintain an efficient command of the navigation of his vessel. He was overloaded at times and the ability of the bridge team to navigate safely within the confines of the river in restricted visibility was seriously compromised.
- Where locally produced charts are available, it would be extremely beneficial for embarked pilots to refer to them when discussing the intended passage during the initial exchange with the master, and to make the charts available for scrutiny during the passage.

## **18 GROUNDING**

### **Grounding caused by fatigue and alcohol consumption**

#### **What happened?**

A feeder containership was sailing in a narrow strait during the early hours of the morning. After making a course change the vessel failed to make several required course changes and did not answer radio calls from VTS, pilot and a shore radio station. When there were

no answers to radio calls, VTS authorities deployed a pilot boat and diverted a navy helicopter to investigate. The pilot boat and the navy helicopter tried to attract attention by sound and horn, but there was no reaction from the ship. The ship was already out of the channel and grounded in shallow waters shortly afterwards. The pilot embarked and found the OOW to be still asleep on the bridge.

### **Why did it happen?**

Fatigue and intoxication by alcohol consumption both by master and OOW is the leading contributing factor. Furthermore, there was no bridge look-out and the bridge watch alarm system was not in use. None of the crew members on board reacted to sounds made to attract attention by the pilot boat and helicopter prior to the grounding.

### **What can we learn?**

- Fatigue is an ever increasing problem which played a heavy role in this accident. Crew, and specially watchkeeping personnel, should be adequately rested and fit prior to their watch.
- Consumption of alcohol increases the effects of fatigue. Company alcohol policies should be followed by all crew at all times.
- All watchkeeping personnel should be well familiarized with and follow bridge resource management procedures closely.
- Bridge watch alarm systems should be regularly checked.

## **19 GROUNDING**

### **Grounding caused by pilot error and failure of bridge team to monitor vessel's progress**

#### **What happened?**

A 72,437 DWT, single screw bulk carrier grounded on the west bank of a wide shallow river. The 225 m vessel was fully laden with iron ore, had a draught of 14 m, and had a river pilot on board.

The vessel was proceeding upriver at eight knots and the pilot agreed to pass an outbound vessel green-to-green. As the vessels were abreast each other, the pilot ordered the helmsman to put the rudder to port. The helmsman complied, and the vessel grounded gently on the west bank a short while later. The water level was rising, and by using the engine and rudder the pilot was able to refloat the vessel one hour later. There being no apparent damage, the vessel was allowed to proceed to anchor where it was inspected. Again, no damage was evident.

#### **Why did it happen?**

An error of judgement on behalf of the pilot caused the grounding, but the bridge team was not monitoring his orders closely enough for them to detect the helm error in time to prevent the accident.

### **What can we learn?**

- Pilots are fallible. Navigational officers must understand the pilot's plan and monitor the vessel's progress against it.
- With the exception of the Panama Canal, the master is ultimately responsible for the safety of his vessel. He should, if necessary, take the con in order to prevent an accident.

## **20 FLOODING**

### **Flooding caused by heavy weather**

#### **What happened?**

The 1972 built bulk carrier was intentionally grounded by its master after the ship took water into cargo holds Nos. 6 and 7 during cyclonic weather and seas. The water could not be removed by either the ship's fixed pumps or portable pumps lowered into the holds. All crew members were safely evacuated from the ship after the grounding.

#### **Why did it happen?**

- The severe weather, and the resultant effect on the ship's structure caused by the ship's movement (pounding, slamming, pitching and rolling), probably resulted in water entering cargo holds Nos. 6 and 7.
- The ship's pumps (both fixed and portable) could not get the water out.
- The hygroscopic<sup>1</sup> nature of the cement cargo led to the water being taken up by the cargo over a period of time. By the time the water was floating on top of the cargo (saturated), it was too late.
- The master did not appreciate the risk the weather posed to his ship when he planned for the passage. Consequently, he sailed the ship into the cyclone, exposing the aging ship to the effects of the severe weather.

#### **What can we learn?**

- The importance of properly identifying the risks of the weather on any passage.
- The importance of following guidance with regard to cargo monitoring during loading and on passage.
- The need to consider the effects of weather on an old ship's structure.

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<sup>1</sup> Absorbing or attracting moisture.

## **21 GROUNDING**

### **Grounding caused by heavy weather**

#### **What happened?**

A ship ran aground while attempting to transit to an area of shelter during an approaching cyclone. The passage took the ship close to the shore and therefore when the ship found it difficult to maintain heading in the weather, it was forced closer and closer to the shore, eventually grounding in severe weather conditions. The engine was not able to generate sufficient power to enable the ship to maintain its heading in the circumstances and the crew found themselves at the mercy of the weather.

#### **Why did it happen?**

- The severe weather caused the ship to not be able to maintain a heading to keep it away from the shore. Consequently, it was pushed onto the shore and it did not have enough engine power to help it maintain a safe distance off the shore.
- The master did not appreciate the risk the weather posed to his ship when he planned for the passage. Consequently he did not allow sufficient distance from the ship to the coast (<5 nm).

#### **What can we learn?**

- The importance of properly identifying the risks of the weather on any passage.
- Although only discussed briefly in the report, the need to ballast down ships if possible.

## **22 INJURY**

### **Burns from boiler flashback**

#### **What happened?**

An engineer was changing the burner on a composite boiler. The ship was steaming slow ahead at the time. There was a flashback and the engineer received burns to his face and hands. Following air purging of the furnace, a second attempt was made to replace the burner. Another flashback occurred causing injury to the chief and second engineers and a fitter who was standing behind the second engineer at the time.

#### **Why did it happen?**

- Three attempts were made to ignite the burner, immediately prior to the first flashback, and on each occasion unburned heavy fuel oil would have been deposited in the furnace.

- When the oil firing unit was shut down, there was no flow of air through the furnace until the maintenance cover was removed. The residual heat in the refractory material, and furnace walls, was probably sufficient to vaporize the lighter fractions of the fuel.
- With the main engine running for less than three hours before the incident, it is possible there were still unburned particles of soot, or lubricating oil or fuel passing through the outlet smoke box. The resulting spark could have been enough to ignite the explosive mixture and cause the flashback.
- While sufficient purging of the boiler furnace prior to opening the oil firing unit is a basic safety precaution, in some instances this alone may not be enough to prevent a flashback. If there have been a number of unsuccessful attempts to ignite the burner, liquid fuel may still be lying in the furnace even after a lengthy purge. At these times, it is essential to allow the furnace to cool sufficiently before it is opened.
- Although all precautions need to be taken to prevent a flashback occurring, matters were made worse in this instance because none of the engine-room staff involved in the incident were wearing appropriate personal protective equipment.
- When the injured seafarers were administered first aid, burns ointment was applied to the burns. This is contrary to current medical advice which advocates cooling the burns with copious amounts of cold, clean, fresh water. See for example *A quick guide to first aid/burns, St John Ambulance, Australia, website – [www.stjohn.org.au](http://www.stjohn.org.au)* – as referenced by the casualty investigation report or the UK's, *The Ship Captain's Medical Guide, website [www.mcga.gov.uk](http://www.mcga.gov.uk)*
- Contributing to the cause of this incident was the absence on board of important safety information notices issued by the boiler manufacturer following flashbacks which had occurred on other installations and the presence on board of a number of conflicting procedures relevant to boiler burner maintenance.

#### **What can we learn?**

- Great care must be taken when working on boiler burner installations – especially, in the case of composite boilers, while the main engine is running. Where instructions have been provided by the manufacturer – either in the way of service bulletins, permanent instruction panels or maintenance manuals – these should be maintained on board the vessel and consulted before maintenance is undertaken.

- The furnace must always be thoroughly purged before any maintenance openings are removed. When no furnace viewing port is provided – as was the case in this instance – an indication that there is unburned fuel present in the furnace can be had by carefully viewing the funnel outlet. Any white smoke would indicate there is still unburned fuel in the furnace or uptakes. A suitable period should be allowed after all signs of smoke have ceased, before opening any maintenance covers.
- Suitable personal protective equipment should be provided by the owner and always worn prior to undertaking maintenance of burner units.
- Guidance on both these aspects can be found in such publications as the UK's Code of Safe Working Practices, which can be downloaded freely from [www.mcga.gov.uk](http://www.mcga.gov.uk). Similar Codes are provided by several Administrations.
- The importance of providing relevant, clear, unambiguous work instructions for all tasks having an element of risk cannot be over-emphasized.

## **23 INJURY**

### **Injury to an eye when an air-flow meter burst**

#### **What happened?**

The chief officer of a Panamax container vessel suffered injuries to his left eye when an air-flow meter burst while he was conducting annual air quality tests on the vessel's breathing apparatus (BA) compressor. The tests involved blowing air through a glass ampoule for a set length of time. The flow of air was regulated manually using a small regulating valve. Four tests had been completed satisfactorily, but during the fifth test the flow meter burst, sending fragments of glass into the chief officer's left eye. A cadet who was witnessing the evolution escaped injury, but the chief officer was hospitalized for treatment.

#### **Why did it happen?**

The accident occurred because the maximum working pressure of the flow meter was exceeded. The working pressure of the BA compressor was 150 bar, but the maximum operating pressure of the flow meter and test device was 10 bar and there was no pressure reduction valve between the compressor and the meter.

There were two types of test device on board, with instructions in different languages, only one of which mentioned using a pressure reduction valve. However, the Chief Officer was unaware of either set of instructions. There were no other instructions or procedures on board for conducting the air test task, and no generic or dynamic risk assessment had been carried out prior to commencing the tests.

#### **What can we learn?**

Where a number of components have to be assembled in order to complete a task, there should be procedures or instructions provided to ensure the assembly is correct and the task conducted correctly.

- Always request full instructions and procedures instead of trying to solve a problem locally.



- Where potential hazards exist, in this case high pressure air, a risk assessment should be completed before the activity starts.
- Set an example, always wear the correct Personal Protective Equipment.

## **24 FATALITY**

### **Man overboard**

#### **What happened?**

The crew of the fishing vessel was deploying a series of ground nets from the vessel. A crew member, who was standing on top of the nets adjacent to the ones being deployed, inadvertently connected the bridle of the net to be deployed to the net on which he was standing. When the mooring gear was deployed, the coiled rope of the bridle attached to the net on which crew member was standing caught his leg, dragging him into the water. Although the net was raised using the winch and the crew member was brought back on board, efforts to revive to him were unsuccessful.

#### **Why did it happen?**

The crew member was inexperienced. There were no means used to identify ends of the ropes of each net and which were to be used to attach to a net or to mooring weights. The area where the nets were stowed was in a small enclosed space, which required crew members to stand on the nets adjacent to those being deployed.

#### **What can we learn?**

- The importance of having new and inexperienced crew members adequately trained for the tasks they are assigned to, recognizing and taking into account the risks associated with the operations.
- The importance of properly supervising new and inexperienced crew members.
- Caution to be exercised at all times when working near or around gear that is to be deployed.

## **25 FATALITY**

### **Fall from height**

#### **What happened?**

The ship was en route to the US Gulf with a riding-gang on board. The riding gang were cleaning the ship's ballast water tanks and on the day of the accident they began cleaning the No.4 starboard water ballast tank. At 0806, after the No.4 starboard ballast tank was declared safe to enter, the riding-gang's foreman and one cleaner entered the tank. The cleaner stayed at the top level of the tank to receive some equipment and the foreman proceeded towards the bottom of the tank. A short time later, two more cleaners entered the tank and made their way towards the bottom of the tank. When they reached the bottom of the tank, they could not find the foreman, so they looked around for him. They then discovered him lying on the platform, one level above the bottom plates. He was unconscious and bleeding from a head wound; and from his ear and nose.

The alarm was raised and an emergency team attended the tank. The foreman was placed on a stretcher and taken to the ship's hospital, where his condition continued to deteriorate. At 1000, the foreman was declared deceased.

#### **Why did it happen?**

- There were no witnesses to the accident. The report therefore assumes that the foreman slipped and fell while passing from one compartment in the No.4 starboard ballast water tank to another and that he hit his head on a metal structure, leading to a skull fracture and/or cerebral haemorrhage.
- It is not believed that lack of breathable air was a contributing factor in this accident. The weather was calm and the ladders and accesses in the tank were in good condition.

#### **What can we learn?**

- Consider the possibility of tripping or falling when carrying out an enclosed space risk analysis
- The importance in keeping a sure footing when working in tanks where there is a danger of falling.
- The importance of wearing and using safety harnesses/fall arresters.

## **26 FATALITY**

### **Injury and death due to heavy seas**

#### **What happened?**

- The chief engineer was killed and the chief officer was injured after they were hit by a large wave which broke over the ship's forecastle during rough weather. The two men were attempting to secure an anchor chain on the forecastle at the time.

#### **Why did it happen?**

- A large wave broke over the forecastle while the two men were tightening the starboard anchor chain, The chief engineer was exposed more than the chief mate and took a large amount of the force from the wave.
- The wave was not seen or felt by those on the bridge, because of the size of the ship.

### **What can we learn?**

- The importance of properly mitigating the risks in going forward during rough weather, to include consideration for adjusting vessel's speed and direction.
- The importance of having appropriate guidance on board to assist with risk identification.

## **27 FATALITY**

### **Two crew members died from asphyxiation**

#### **What happened?**

Two crew members died from asphyxiation when they entered the ship's forward store where the atmosphere was oxygen deficient. The store's atmosphere had been affected by that of the adjoining cargo hold which was loaded with steel turnings which are liable to self-heating and deplete oxygen in the space they are in.

#### **Why did it happen?**

- The cargo hold ventilation ducts passed through the forward store and bellows pieces on the ducts had been cut to drain water and remove cargo residues, which the venting system's design did not allow for. The air in the hold entered the store through the cut ducting.
- The cargo of steel turnings in the hold had depleted the oxygen in the air.
- The forward store was considered a work space and not an enclosed space and the two deceased crew members entered it without informing anyone and were quickly asphyxiated.
- The ship's certification did not allow it to carry that cargo although it could carry other oxygen depleting cargoes. The cargo documentation did not describe the cargo as required by international requirements.
- The hazards of the cargo had increased as it had become wet during loading and had not been compacted because appropriate procedures were not followed.
- The master was provided incomplete and inaccurate information about the cargo but had enough information to try and clarify his doubts about the hazards of the cargo and/or refuse to load it.

#### **What can we learn?**

- Ships' masters and crews should consider the risks associated with modifying a system or equipment on board their ships.
- Masters should consider the implications of loading cargoes that they do not have complete information about.

- Precautions should be taken when entering a trunk or compartment adjacent to an enclosed space. The atmosphere may have been rendered unsafe.
- All involved with shipping hazardous cargoes, including shippers, charterers, brokers and terminals should ensure that it is correctly described as required by international codes and appropriate shipping, loading and carriage procedures are followed.
- Compartments adjacent to enclosed spaces should be considered enclosed spaces unless it can be proved otherwise and appropriate precautions taken.
- More education about the hazards of enclosed spaces is necessary.
- The dangers of cargoes that oxidise and deplete oxygen.

## **28 FATALITY**

### **Crew member being crushed by a heavy object**

#### **What happened?**

During night cargo operations, the body of a crew member was found between the hatch covers. Nobody witnessed the event but his injuries were consistent with being crushed by a heavy object. The ship's cranes were being used to move hatch covers in the vicinity at the time.

#### **Why did it happen?**

The deceased crew member was probably standing on the platform between the hatch covers while they were being moved and was probably struck by a hatch cover as it swung or jerked while being lifted. The crane driver might not have seen the crew member in the dark between the hatch covers.

#### **What can we learn?**

- Crew and stevedores should stand well clear of suspended loads or loads about to be lifted, and should have an adequate escape path.
- Crane drivers should not begin a hoist if they are not able to see all the hazards around the load or are not being directed by someone who can.

## **29 FATALITY**

### **A passenger fell between the vessel and the wharf**

#### **What happened?**

While disembarking passengers after a night cruise, a gap opened between the vessel and the wharf. A passenger stepped into the gap, fell between the vessel and wharf, and drowned.

### **Why did it happen?**

The vessel was left steaming against a single spring mooring while the wheelhouse was unattended. The passengers, who were under the influence of alcohol after the night cruise, were left unsupervised while disembarking as the gap opened between the vessel and wharf. The lighting over the disembarking point was poor.

### **What can we learn?**

- There are additional risks associated with steaming against a single spring mooring that should be mitigated if that practice is to be used.
- The wheelhouse should be manned and someone at the engine controls and helm when the engine is still engaged.
- Adequate lighting should be provided at embarkation and disembarkation points on all vessels at any time they can or are being used.
- Passengers should be supervised at all times when embarking or disembarking vessels.

## **30 FATALITY**

### **Crew member being killed when a hatch opened uncontrolled due to increased pressure in hold**

#### **What happened?**

A cargo hold was being ballasted in preparation for the vessel's maiden ballast voyage and an access hatch to the hold had been inadvertently left closed. A crew member stood on the access hatch in the hold and kicked off the securing cleats. The hatch then flew open under the built-up pressure in the hold and the crew member was propelled up and into the surrounding structures. He died of his injuries.

#### **Why did it happen?**

The access hatch was left closed even though it was listed on the ballast procedure as a critical action because there was no cross checking carried out by the responsible officer before pumping commenced.

The procedure was ambiguous because it inferred that the reason for opening the access hatch was to allow water to overflow on deck rather than release air pressure during the ballasting procedure.

The crew member was probably unaware of the built-up air pressure in the hold.

Being the vessel's maiden voyage, and the crew having been on board for only 2 days, they were not familiar – nor practised in the critical procedure.

### **What can we learn?**

- Care should be taken when opening any access that could be under pressure.
- Procedures and associated checklists should include the reason why tasks have been labelled as critical.
- Procedures and associated checklists should be followed and critical tasks should be verified by more than one person including a responsible officer.
- Crew should be allowed ample time to become familiar with a ship, especially when the complete crew is new or has changed.

## **31 DIVING ACCIDENT**

### **Diver close to be pulled into the propeller during diving**

#### **What happened?**

A diver from a self-propelled crane barge entered the water in order to replace a line marking the position of the wreck. As the diver descended to a depth of about 20 metres, the umbilical cord containing his air supply became entangled in the barge's aft Voith Schneider (VS) propeller, and the diver was dragged towards its rotating blades. The diver's air supply was also pulled from the deck but the diver succeeded in transferring to a bottled air supply. The diver was approximately three metres from the rotating propeller when the propeller was stopped by the vessel's chief engineer. The diver then managed to cut himself free and make his way to the surface from where he was recovered without injury.

#### **Why did it happen?**

- The master and officer of the watch thought the propellers had been stopped but they were still rotating.
- The control system for the propulsion had recently been installed and no procedures for its use had been developed.
- No familiarization training had been provided to the crew so when the officer of the watch thought that he had turned off the propellers, he in fact had not.
- Neither the officer of the watch nor the master verified that the VS propellers were stopped and they did not inform the engine-room that diving operations were about to take place.
- The procedures for diving operations in the vessel's safety management system lacked detail and were not sufficiently robust. They placed an undue reliance on the effectiveness of procedures followed by the embarked diving contractor.
- Diving operations had not been identified as a key shipboard operation by the ship manager or during external audits.

### **What can we learn?**

- The importance of procedures and familiarization training when new systems are installed on board ship. It follows that it is important that new systems are understood before the crew use them.
- The importance of communications between departments when work is being carried out around machinery.
- The importance of having appropriate guidance on board to assist with risk identification.

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## **ANNEX 2**

### **1 ANALYSIS OF THE INVESTIGATION REPORT ON THE FIRE ON THE FISHING FACTORY VESSEL HERCULES, IMO No.8907060 (Incident: C0006872)**

#### **Event and consequences**

At 20:55 hrs on 20 April 2007, a fire broke out in the hold on first deck, where a large amount of plastic and corrugated cardboard packing was stored. Very dense smoke quickly spread throughout the vessel including the bridge. The fire alarm was activated but functioned only for a short while. The crew gathered on the forecastle deck while smoke divers were searching for missing personnel in the accommodation. The search was abandoned after a short while due to lack of breathing gas. There were no compressors on board to recharge the bottles. Fire fighting inside the accommodation had to be abandoned for the same reason. At approximately 22:30 hours the ship was abandoned.

One hundred and five crew members were rescued, while 11 lost their lives. The vessel burned for three weeks. Except for the engine-room, all other parts of the vessel were severely damaged. The vessel was eventually declared a total constructive loss.

#### **Causes and contributing factors**

##### **The basic cause of the accident**

Due to vibration, fluorescent tubes produced sparks in sockets, overheating and melting of plastic. The burning plastic material dropped down and ignited corrugated cardboard, which had been stored close to the tubes.

##### **Contributing factors**

- The light fittings were proven to be unsuitable for installation on board vessels.
- A compartment, originally designed as a processing department and categorized as "other machinery space", had been modified for use as a hold and was being used to store large quantities of corrugated packing, etc. The report indicates no change/update of fire protection of bulkheads and deck as a consequence of the reconstruction.
- A vertical cable duct was not divided into sections. This allowed the smoke and fire to spread rapidly.
- Doors and hatches were wedged open allowing the fire and smoke to spread.
- Cable penetrations through bulkheads were not sealed to prevent smoke and fire from spreading.

##### **Insufficient fire notification and fire fighting**

- The fire alarm and detection system was not installed in all accommodation areas and was insufficient to ensure that all crew members were notified.

- Unprotected cables were damaged by the fire shortly after the fire broke out, resulting in a malfunction of the fire warning system.
- Automatic fire detection was only activated after the fire was already visually detected and then indicated a wrong origin of fire.
- No fixed fire-fighting system or portable fire extinguishers were installed in the holds where large quantities of corrugated cardboard were stored.
- There were insufficient numbers of air breathing apparatuses to deal with the fire fighting. No air compressor was available to recharge the breathing gas bottles.

### **Insufficient emergency training**

- The crew were insufficiently trained in emergency response. Fire drills insufficient to ensure adequate response.
- The crew were unaware of how to activate the fire alarm manually.
- Safety and emergency information was not communicated in all relevant languages and not properly understood by all crew members.
- Muster lists did not correspond to actual crew on board.

### **Issues raised**

#### **General**

- The integrity of the vessel's structural fire protection was considerably reduced due to insufficiencies in several areas, such as open hatches and doors, vertical cable duct not divided into sections and cable penetrations in bulkhead not sealed.
- A fixed fire-extinguishing system (open sprinkler system) in the holds where packing was stored would have enhanced the possibility of fire fighting considerably.
- It remained unclear which structural fire protection method was used when the ship had been built.
- Although only conducted a few weeks before the fire, the initial survey of the ship due to change of flag did not reveal the insufficient structural fire protection.

### **Safety concerns**

- No international regulations prescribe that lamp fixtures should be of a type approved by authorities or by organizations, e.g., classification societies.
- There is a need to look into the requirements for breathing apparatus with regard to identifying sufficient number of apparatuses and breathing air compressors on board any vessel. The SOLAS requirement of such

compressors on any convention ship carrying more than 36 passengers should be considered applicable for all type of vessels including fishing vessels. Key criteria should among others be number of cabins, number of personnel, size of vessel and duration of fire fighting required.

- Casual surveys and approvals of the involved classification society upon the vessel's registration into the Faroese Register.
- Straight, consequent, predictive and timely safety precautions initiated by the vessel management were effective to mitigate the disaster.

Note: The Torremolinos Convention and its 1993 Protocol address requirements to electrical equipment. Neither the Convention nor the Protocol have been ratified by a sufficient number of Member States and, as such, does not apply to fishing vessels. The consequence of this is that there is no mandatory common international safety standard for fishing vessels. Presently, it is up to the Administration to set the requirements.

### **Human factor**

The investigation has revealed the importance of training and drills. The crew consisted of personnel from seven nations, and it has been obvious that not all of the emergency information had been understood by all the crew. Doors and hatches had been left open by use of wooden blocks, strings and the like to improve ventilation in the accommodation area, as well as to ease the processing of the catch. The risk of fire has not been taken into consideration by the crew when keeping doors and hatches open.

There was not a unique working language used and understood by all crew on board. Although the daily routine could be managed with the aid of interpreters and hand signs, the management of emergency situations might be impaired through this.

It has also revealed the importance of maintaining fire and safety plans and emergency muster lists up to date with changes to a vessel's configuration and/or changes in manning.

Note: The Sub-Committee agreed to refer the investigation report to the STW, DE and FP Sub-Committees for consideration (FSI 17/20, paragraph 6.19).

## **2 ANALYSIS OF THE INVESTIGATION REPORT ON THE FIRE ON THE RO-RO CARGO SHIP UND ADRIYATIK, IMO No.9215488 (Incident: C0007200)**

### **Event and consequences**

The ship was on her way from Pendik/Istanbul to Trieste/Italy when the fire occurred. At 05:35 hrs on 6 February 2008, the fire alarm on the bridge indicated a fire on the aft port side of the main deck. The bosun and the watchman were sent to the scene and informed the chief officer from the cargo control room about the situation. But they were unable to correctly assess the extent of fire. The chief officer, initially, was of the opinion that the fire could be extinguished by hoses but on witnessing the extent of the fire realized that this was not possible. The bosun and the watchman left the area because they were not equipped properly with relevant protective equipment.

The general alarm was raised. Approximately 20 minutes after the initial fire alarm, the chief officer and a seaman entered the deck area wearing firemen's outfits and holding a fire hose. Several attempts to start the fire pumps failed, including the emergency fire pump and the fire team had to leave the scene. The fire had by this time spread to the vehicles on the ramp and

aft part of the upper deck. Realizing that the fire could not be controlled by fire hoses, it was decided to activate the sprinklers. The valves were opened and the drencher pump start button pressed, but with no result. This was approximately 27 minutes after the initial fire alarm. At 06:03 a distress call was broadcast.

The fire caused the anti-skid paint on deck to burn with a heavy black smoke as a result. This smoke was sucked into the ventilation system to the engine-room and finally caused the auxiliary engine to stop.

The extremely rapid expanding fire, together with enormous dense smoke development, blocked the escape route to the lifeboat, rescue boat and raft. Based on the master's instruction, the people took flight to the bridge which appeared to be a last safe area to wait for help. Being rapidly fenced in there as well, they decided to further escape to the foredeck from where they later jumped into the sea after being threatened there as well by the approaching smoke and fire. Some of them, partly heavily injured while escaping from the bridge, were able to get a hold on a 6-man raft. The others drifted floating in close vicinity until they all were rescued approximately one hour after leaving the vessel.

At approximately 06:50 hours, the ship was abandoned.

All 22 crew members and 9 passengers were rescued, of which the master and 3 crew were severely injured. The vessel burned for two days and was declared a total constructive loss.

## **Causes and contributing factors**

### **Casualty summary**

It was concluded in the report that the origin of the fire was one of the trucks loaded. Although it has been impossible to provide evidence, the most probable cause of the fire is a malfunction of a truck's electric heating system. The heat from the fire combined with the short distance between the vehicles allowed the fire to spread rapidly.

### **Contributing factors**

The report has raised several issues.

When the fire detecting and alarm system on the bridge first sounded and indicated fire on deck, these signals were underestimated because of experience with various earlier **misleading** alarms. From a human performance perspective, it is important that the crew treat every alarm as a possible indication of a fire and that it is investigated for authenticity immediately.

- There were no remote means mounted on deck which could have confirmed a fire instantly. Triggered by the experience of misleading alarms the OOW did not activate the fixed fire-fighting system instantly but ordered other measures first. Too much time was lost in response to fire. Water was not supplied to the fire hoses because the fire and drencher pumps failed. This was most likely caused by a common fuse connected to the remote starts on the bridge. The fuse may have been activated because of damage to cables caused by the fire. The emergency fire pump also failed to deliver water.
- The integrity of the vessel's structural fire protection was considerably reduced due to no fire protection of space bulkheads and decks which allowed the fire to spread from lower deck to top deck and finally the bridge.

- There was no automatic drencher system covering the ro-ro area. All fire fighting had to be activated manually.
- The report indicates that cables and wiring were damaged early in the fire leading to a common fuse failure or cut-off of electrical supply from generators to fire pumps.
- The location of air intake for the E/R was such that the smoke developing from the fire was sucked into the E/R causing the engines to stop at an early point in time and forcing early abandonment of the E/R crew from the area.

### Rescue equipment

Escape ways and access to lifeboats and rafts were **unprotected and** exposed to the fire on deck and **therefore** impossible to reach.

### Issues raised

- The investigation revealed that no water was supplied by either the drencher or fire hydrant system. The report suggests different explanations for that failure but the real cause could not be identified during the investigation.
- The emergency source of electrical power should be able to support one of the fire pumps for a period of 18 hours. The report concluded that the Emergency Diesel Generator started automatically but, however, none of the pumps supplied water.
- It is clear from the investigation that, due to the rapidly spreading fire, it was impossible to enter the pump-room to manually start the main fire, general service and/or spray water pump, but it does not mention if any attempt was made to enter the bow thruster room to manually start the emergency fire pump.
- Installation of cables and wiring to emergency systems should be assessed to ensure they are installed in a fire-protected manner being able to provide the fire pumps with sufficient power for an appropriate period of time.
- It should be considered to establish a fire protection requirement of A-60 insulation for space bulk heads and decks on ro-ro ships to prevent fire spreading from one deck to the deck above.
- Due to the narrow gap between the vehicles on ro-ro ships, automatic fixed spray extinguishing system should be considered as a requirement.
- Regulations governing flammability of paints and coatings should be extended to include the smoke and flammability of deck or ramp coatings on ro-ro ships. In this accident, it increased the hazard to personnel and caused the auxiliary engine to stop when the smoke was sucked into the ventilation system. SOLAS regulation II-1/35 requires adequate ventilation of machinery spaces, but there are no requirements regarding where to install the air intake.

- Cameras or other detectors on decks would provide the crew on the bridge a possible early warning of any abnormalities such as a fire, and reduce action time.
- Escape ways must be designed such that lifeboats and rafts can be reached safely in any emergency situation.

Consideration should be given to the failure mode of hydraulically-operated ventilation dampers. Some dampers leading to cargo decks stated by the crew to have been closed were found open – possibly due to hydraulic pipes being damaged during the fire and the ventilators opening under spring action.

#### **Human factor**

- When the fire detecting and alarm system on the bridge first sounded and indicated fire on deck, these signals were underestimated because of experience with earlier misleading alarms.
  - Lack of awareness, knowledge and education may have caused underestimation of the extreme difficulty of fighting a fire in the ro-ro area which therefore needs to be responded to expediently.
- The investigation has revealed the importance of training and drills to handle emergencies. In this accident too much time was lost in preparing and dressing for fire fighting. It is well known that training and drills increase the likelihood of efficient and rational action if a real emergency should occur.

Although it has not been identified in this case as a cause, it should be noted that manual activating of emergency equipment in addition to being time consuming, increases the likelihood of a mal-operation in an emergency. A combination of simplification and automation reduces the risk of mal-operation.

Note: The report is referred by Turkey to the DE and FP Sub-Committees for consideration (FSI 17/20, paragraph 6.24).