Danish Maritime Accident Investigation Board

MARINE ACCIDENT REPORT
June 2014

URD
Fire on 4 March 2014

The Danish Maritime Accident Investigation Board
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This marine accident report is issued on 26 June 2014.

Case no.: 2014006771

Front page: Picture of URD. **Source:** DMAIB.

The marine accident report is available from the webpage of the Danish Maritime Accident Investigation Board www.dmaib.dk.

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The Danish Maritime Accident Investigation Board is an impartial unit which is, organizationally and legally, independent of other parties.

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The purpose of the Danish Maritime Accident Investigation Board is to investigate maritime accidents and to make recommendations for improving safety, and it forms part of a collaboration with similar investigation bodies in other countries. The Danish Maritime Accident Investigation Board investigates maritime accidents and accidents to seafarers on Danish and Greenlandic merchant and fishing ships as well as accidents on foreign merchant ships in Danish and Greenlandic waters.

The investigations of the Danish Maritime Accident Investigation Board procure information about the actual circumstances of accidents and clarify the sequence of events and reasons leading to these accidents.

The investigations are carried out separate from the criminal investigation. The criminal and/or liability aspects of accidents are not considered.

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Contents

1. SUMMARY

On 4 March 2014 at 0320, URD departed from Liepaja, Latvia, with fully loaded car decks and 110 passengers on board, bound for Travemünde, Germany, according to the ship´s regular schedule. At 0740, two crew members, randomly passing the main car deck, discovered a fire on top of a lorry. The bridge was alerted and the car deck sprinkler system was quickly activated. Ten minutes later, the sprinkler system was stopped in order to allow the crew to assess the effect of the extinguishing operation. As the fire was not completely extinguished, the firefighting crew tried to extinguish it by means of a fire hose. Meanwhile, assembly of the passengers was initiated in the ship´s reception area on deck 6.

Approximately 30 minutes after the initial discovery, the fire had been extinguished and normal operation was resumed. A fire watch was established on the car deck for the remainder of the voyage. URD continued towards Travemünde and arrived as scheduled on 5 March 2014 at 0730.

The origin of the fire turned out to be a fluorescent light fixture installed on the car deck.

The report contains information about preventive actions taken and one recommendation.

2. FACTUAL INFORMATION

2.1 Photo of ship

Figure 1: URD
Source: Stena Line

2.2 Ship particulars

Name:	URD
Type of ship:	Passenger/ro-ro ship (vehicles)
Nationality:	Denmark (DIS)
Port of registry:	Kalundborg, Denmark
IMO number:	7826855
Call sign:	OUYL2
DOC company:	Stena Line Baltic A/S
IMO company no. (DOC):	5579685
Year of build:	1981
Shipyard/yard number:	Nuovi Cantieri Apuania Spa/UN 1
Classification society:	Lloyd's Register of Shipping
Length overall:	171.05 m
Breadth overall:	20.82 m
Gross tonnage:	13,144
Deadweight:	4,562 t
Draught max.:	5.19 m
Engine rating:	8,826 kW
Service speed:	17.5 knots
Hull material:	Steel
Hull type:	Single hull

2.3 Voyage particulars

Port of departure:	Liepaja, Latvia
Port of call:	Travemünde, Germany
Type of voyage:	Short international voyage
Cargo information:	Ro-ro cargo, trucks & trailers
Manning:	23
Pilot on board:	No
Number of passengers:	110

2.4 Weather data

Wind – direction and speed:	South-easterly 12 m/s
Wave height:	2 m
Visibility:	Good
Light/dark:	Light

2.5 Marine casualty or incident information

Type of marine casualty/incident:	Fire
IMO classification:	Less serious
Date and time:	4 March 2014 at 0846 LT
Location:	Baltic Sea
Position:	56°13' N – 019°09' E
Ship's operation/voyage segment:	In transit/international
Human factors:	No
Consequences:	Damages to fluorescent light fixture on the main car deck. Damage to tarpaulin on trailer and minor damage to the lorry.

2.6 Shore authority involvement and emergency response

Involved parties:	None
Resources used:	None
Measures taken:	N/A
Results achieved:	N/A

2.7 Information about relevant crew members

Master:	Certificate of competency STCW II/2. 57 years old. Has served on board since 2000. Senior master on board since 2013.
Chief officer:	Certificate of competency STCW II/2. 37 years old. Filling in for the regular chief officer. Has served on board since June 2012. Previously engaged on sister ship ASK.
2nd engineer:	Certificate of competency STCW III/2. 52 years old. Has served on board since 1991. Occasionally serving as chief engineer.
3rd engineer:	Certificate of competency STCW III/2. 51 years old. Has served on board since 1999. Occasionally serving as 2nd engineer.
Chief stewardess:	40 years old. Chief stewardess on board since January 2012.

2.8 Scene of the accident

Figure 2: Position of the ship in the Baltic Sea at the time of the fire
Source: Google Earth

3. NARRATIVE

3.1 Background

At the time of the accident, URD was owned by Stena Line Baltic A/S in Denmark and registered in the Danish International Register of Shipping with its port of registry in Kalundborg, Denmark. URD was operated from Stena Line GmbH in Germany.

The ship was engaged in a regular trading schedule carrying lorries and trailers between Travemünde in Germany and Liepaja in Latvia and the crossing took approx. 26 hours.

The crew was of four different nationalities and the official working language was English.

According to the permit for carriage of passengers issued by the Danish Maritime Authority, URD was allowed to carry a maximum of 186 passengers.

All times are given as the ship's local time.

3.2 Sequence of events

3.2.1 Detection and extinction of fire on the main car deck

On 3 March 2014 at 2320, URD arrived in Liepaja on a regular voyage from Travemünde. The cars and lorries on board were discharged by the 2nd and 3rd officers assisted by seven ratings. The unloading was finished at 0030. Simultaneous with the unloading, 1 trailer, 88 lorries, 12 cars and 2 other units were loaded and stowed for the return voyage to Travemünde. The entire cargo took up 1614 lane metres, leaving the main car deck full.

On 4 March at 0320, URD departed from Liepaja once the loading had been completed.

At approx. 0740, the 2nd and 3rd engineers left the engine control room for breakfast in the crew mess room. On their way, they passed the main car deck to reach the personnel lift leading to the accommodation (figure 3). Entering the car deck, they immediately noticed smoke and a strong smell of electrical burn. The 2nd engineer noticed flames of a height of approx. 5 centimetres and a length of approx. 1 ½ metres on top of a lorry.

The 2nd engineer returned to the engine control room. He called the crew mess room assuming that the master and chief engineer were having breakfast there, but did not reach anybody on the telephone.

Meanwhile, the 3rd engineer made his way from the car deck to the bridge and notified the chief officer who was on duty. The chief officer immediately activated the fire alarm at 0743.

The 3rd engineer made his way back down from the bridge to the main car deck, where he met the 2nd engineer who had returned from the engine control room. They agreed that the 2nd engineer should go to the sprinkler control station in the forward end of the main car deck to start the sprinkler pump, while the 3rd engineer checked that the correct section valve was opened – as they were not sure about which section the fire was in.

At the sprinkler control station the 2nd engineer met an able seaman (AB). The AB informed the 2nd engineer that he was sure that the fire was in section 6 (figure 3). At 0750, the car deck sprinkler system was activated in section 6, where the burning lorry was situated. Subsequently, the 2nd engineer made his way to fire station no. 1 on the bridge deck to muster in accordance with the fire muster list. The 3rd engineer proceeded to the engine control room also to muster according to the fire muster list.

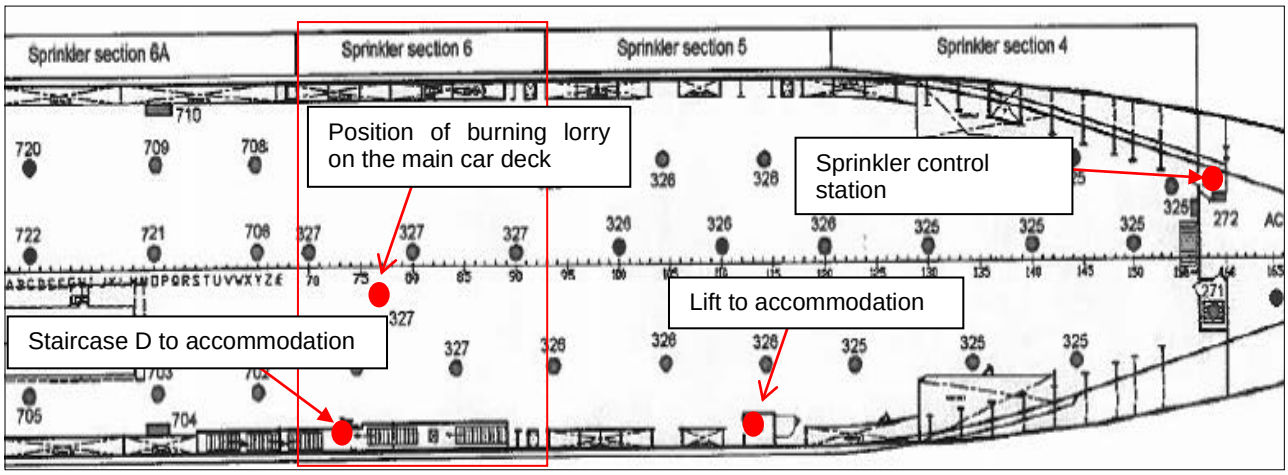

Figure 3: Forward end of main car deck on board URD
Source: Stena Line

At 0746, the master arrived on the bridge, after having been woken by the fire alarm, where he took over the command and ordered the chief officer to go down to attend the scene of the fire and take charge of the firefighting efforts. Simultaneously, the first alarm sounded on the automatic fire detection system.

The master considered an alternative route planning, depending on the development of the situation. Based on information received from the deck crew about the lorry´s license plate, he consulted the cargo documents in order to identify the cargo. He concluded that the lorry carried machinery parts.

The 2nd and 3rd officers mustered on the bridge according to the muster list in order to assist the master.

At 0751, the passengers were informed about the situation over the public address system. The master used the ship´s ballast system to heel the ship and let the water from the car deck sprinkler system drain through the scupper valves on deck.

At 0753, the firefighting team and the smoke diving[1] team had also mustered at fire station no. 1, and started preparing for firefighting.

At 0756, the firefighters were ready to start fighting the fire.

The 2nd engineer informed the master on the bridge that the fire seemed to have been extinguished by the car deck sprinkler system. However, the master did not receive useful feedback from the scene of the fire, and they agreed that the 2nd engineer should accompany the firefighting and smoke diving teams down to the scene of the fire and give feedback on the situation to the master. Furthermore, they agreed to keep their radio communication in Danish as immense radio communication in different languages was ongoing.

The 2nd engineer followed the firefighting- and smoke diving teams down to the main car deck. They stopped at the bottom of the staircase and awaited the extinguishing effect of the sprinkler system.

At 0800, the 2nd engineer asked if the car deck sprinkler could be stopped as it was not possible to make any observations in the heavy water flow from the sprinklers above. It seemed that fire had been extinguished and the car deck was ventilated in order to clear the smoke. However, small

[1] Smoke divers are firefighters wearing self-contained breathing apparatuses.

flames could be observed from the trailer. A fire hose was put into action, but the firefighters experienced difficulties in their efforts due to the densely stowed vehicles on the car deck (figure 4). The chief officer joined them and climbed onto the cabin of the lorry next to the one on fire. A knife was handed to the chief officer so that he could cut open the rest of the burnt tarpaulin on the lorry in order to pour water directly onto the cargo inside the lorry by means of the fire hose.

Figure 4: Main car deck on board URD, fully stowed on the day of the fire. Looking aft
Source: Stena Line

At 0808, the 2nd engineer informed the master that the fire had been extinguished (figure 5). However, it was decided to station a fire watch on the car deck for the rest of the crossing.

At approx. 0815, the master informed the company about the situation.

Figure 5: Burnt lorry. Picture taken after arrival in port
Source: Stena Line

During the discovery and subsequent extinction of the fire, its origin was uncertain. Afterwards, the crew discovered that the fire had originated in a fluorescent light fixture installed on the main car deck (figure 6).

Figure 6: Light fixture where the fire originated on the main car deck
Source: Stena Line

3.2.2 Assembly of the passengers

When the fire alarm sounded, the catering personnel mustered in the reception area on deck 6 (figure 7). The chief stewardess took a handheld radio from the reception and everyone put on yellow caps and jackets awaiting information about the situation that had caused the fire alarm. The catering personnel were informed over the radio that there was a fire on the car deck. The purser went to the bridge and he was ordered by the master to initiate the assembly of the passengers.

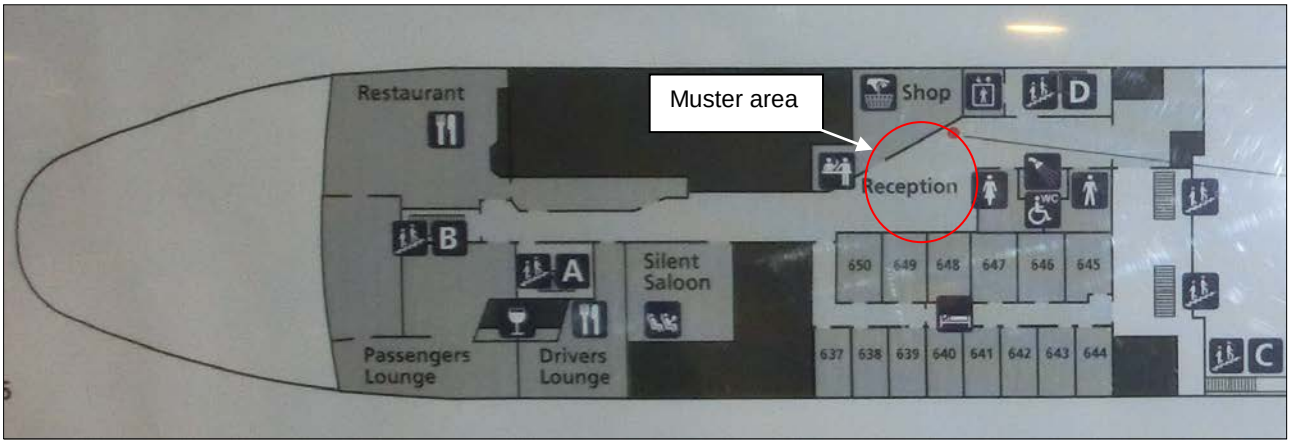

Figure 7: Accommodation, deck 6 on board URD
Source: DMAIB

At 0757, the passengers were instructed to assembly in the reception area and to bring along some warm clothes as the vessel and all cabins were being searched. There was no panic among the passengers as the catering personnel explained the situation. Furthermore, the passengers were instructed where to go and where to find lifejackets in case the ship had to be evacuated.

During the mustering, the catering personnel found it difficult to keep the passengers together. Additionally, the mechanical piece counters intended for census were missing and it was therefore difficult to take census.

At 0810, before the final counting and confirmation was completed, it was reported from the bridge that the situation was under control and the assembly of the passengers was aborted.

URD continued the voyage and arrived alongside in Travemünde as scheduled, on 5 March at 0730.

3.3 Description of the ship

3.3.1 General layout

At the time of the accident, URD was a ro-ro passenger ship normally primarily carrying driver-assisted lorries. The ship had been converted in 1991 and again in 2001.

As shown in figure 8, there were three car decks: the main deck (deck 2), a lower deck (deck 1) and an upper partly unsheltered, open deck (deck 4), giving a total cargo capacity of 1600 lane metres. Access to the upper car deck was by means of a ramp from the aft end of the main deck. Access to the lower car deck was by means of a lift situated amidships on the main car deck.

Passenger cabins were located on decks 4 and 5 and on the saloon deck (deck 6) in the accommodation area. There were a total of 49 cabins providing 120 beds. A common passenger area with restaurant, lounge, bar and shopping facilities was located on the saloon deck. A passenger lift and two staircases connected the main deck and the saloon deck hall.

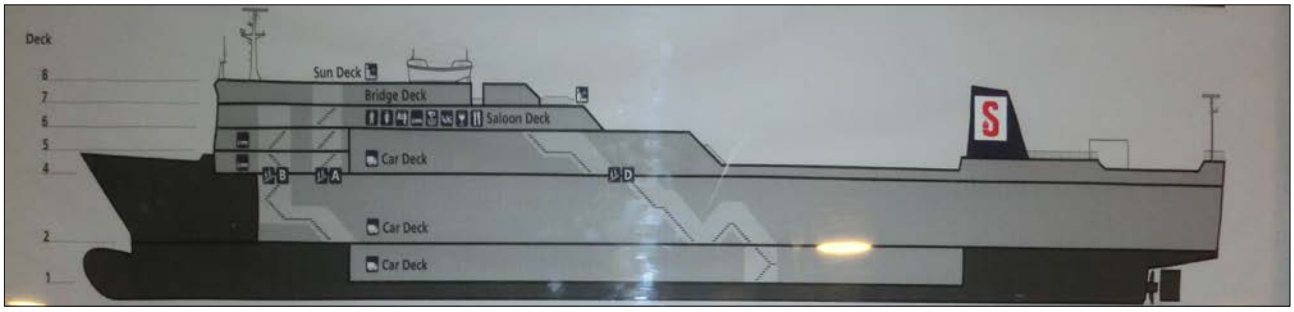

Figure 8: General layout of URD
Source: DMAIB

3.3.2 Cargo handling

In port, cargo operations were carried out by the deck officers assisted by the ratings available. Unloading and loading could be carried out simultaneously as found necessary in consideration of the time schedule. All cargo was loaded and unloaded over the stern ramp and driven into position.

Usually the cargo was driven on board by the drivers of the relevant lorries and cars, and unaccompanied trailers were driven on board by use of a tug master by the harbour stevedores. Cars and lorries were stowed on board continually during the cargo operations according to their line-up position on the quay. No plan was made beforehand, giving the exact on-board position of each individual vehicle. Through good stowage, the capacity could be increased to exceed the rated capacity of 1600 lane metres.

The burnt lorry was situated on the main car deck in the third vehicle lane, counting from the starboard side where the firefighters rigged their fire hose. Between the position of the firefighters and the lorry on fire was a car with a trailer and another lorry in the adjacent vehicle lines.

3.3.3 Car deck ventilation

URD was equipped with a ventilation system on the main deck and the lower car deck, designed for evacuating exhaust gases during loading and unloading of ro-ro cargo. The ventilation system was intended for use only when the stern ramp was open in order to allow a free flow of air from the outside atmosphere. During the fire the system was used for evacuation of smoke on the main car deck with the stern ramp closed. To prevent the creation of a vacuum effect created by the running fans, they were run in alternating directions.

3.3.4 Car deck sprinkler system

The ship´s car decks were covered by a sprinkler system which was divided into ten zones. The valves for the specific zones were placed in the sprinkler control station on the forward part of the main car deck in the port side. The system was supplied with water from the sprinkler pump that could be activated from the sprinkler control station, but it could also be supplied through the fire main – and thereby through the regular and emergency fire pumps – by opening a valve connecting the two systems. The sprinkler head nozzles were placed underneath the deck above throughout the closed and sheltered parts of the car decks.

As smoke developed, it gathered underneath the deck above, limiting the visibility between the deck above and the top of the lorries. This made it difficult to identify the individual sprinkler sections as they were marked with numbers on the frames on the ship´s sides (figures 9 & 10).

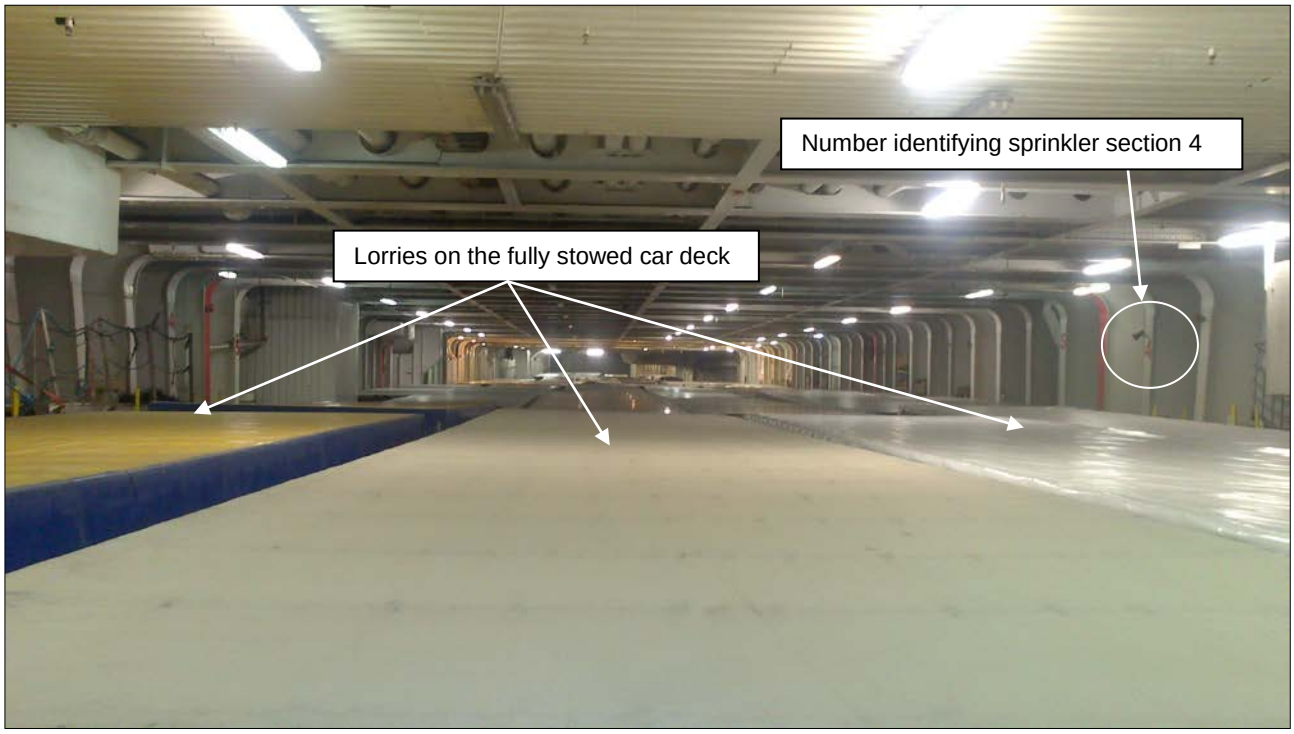

Figure 9: Identification of sprinkler sections on the full main car deck on board URD
Source: Stena Line

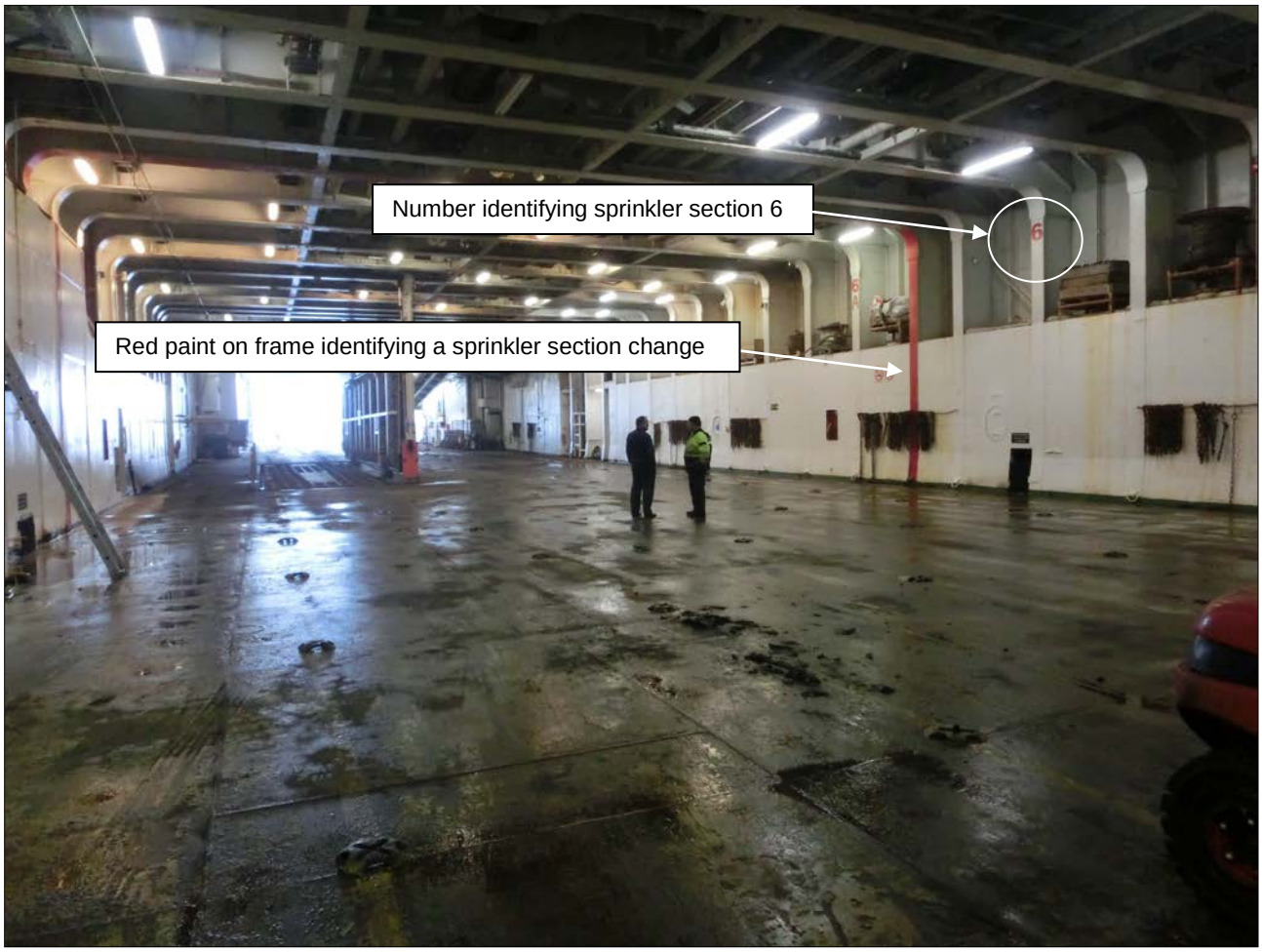

Figure 10: Identification of sprinkler sections on the empty main car deck on board URD
Source: DMAIB

The car deck sprinkler system was tested on a weekly basis in accordance with the vessel´s checklists.

A drawing inside the sprinkler control station described the sprinkler sections on a model of the ship in the *opposite* direction relative to the point of view of the observer. This could cause confusion about the operation of the sprinkler system (figure 11).

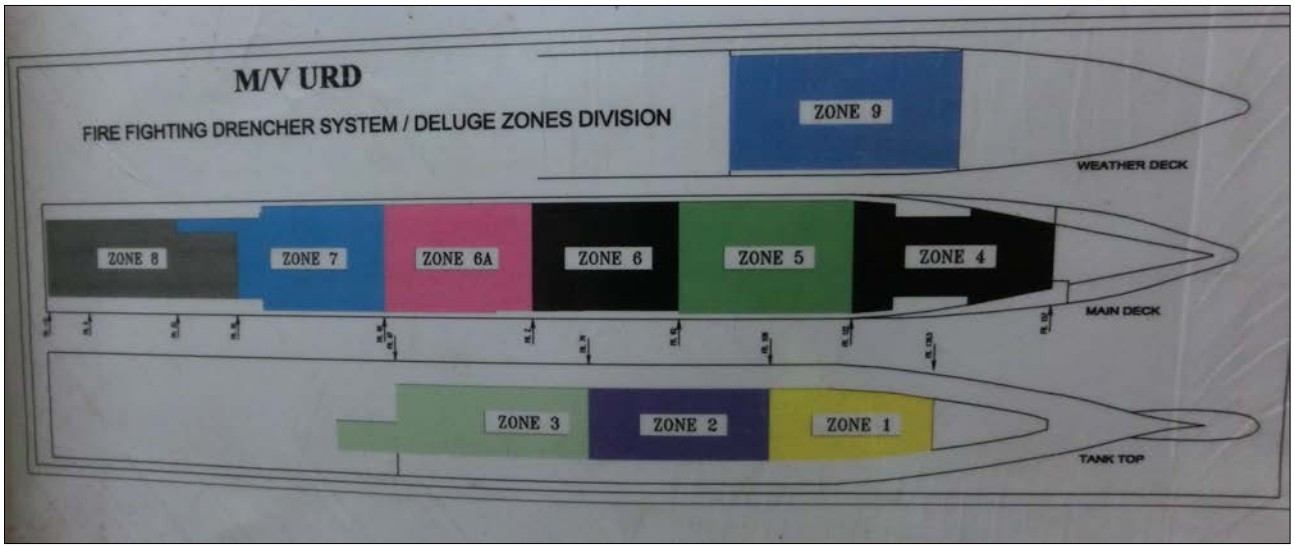

Figure 11: Diagram of the vessel in the reverse direction relative to the viewer
Source: DMAIB

3.3.5 Automatic fire detection system

URD was equipped with an automatic fire detection system. The system consisted of a panel on the bridge where the fire alarms were displayed by visual and audible indication. The panel was connected to the ship´s general alarm system and, if the displayed alarms had not been acknowledged on the panel within a set time of two minutes, the general alarm would automatically sound throughout the vessel. An event log was printed automatically by the bridge fire panel. A mimic relay fire panel was installed in the engine control room.

During the latest conversion of the ship in 2001, a new ship section had been installed amidships to extend the vessel (sprinkler section 6A).

Automatic fire detectors were placed throughout the car deck. In the new section, smoke activated detectors were installed on the main car deck. In the original sections of the ship, at both ends, heat detectors were installed. To activate a smoke detector on the main car deck, smoke would need to develop sufficiently to reach the new section. The burnt lorry was situated in the original forward section approx. 20 metres from the closest smoke detector in section 6A, delaying the automatic fire detection as it did not initially create sufficient heat to activate the heat detectors in sprinkler section 6 (figure 12).

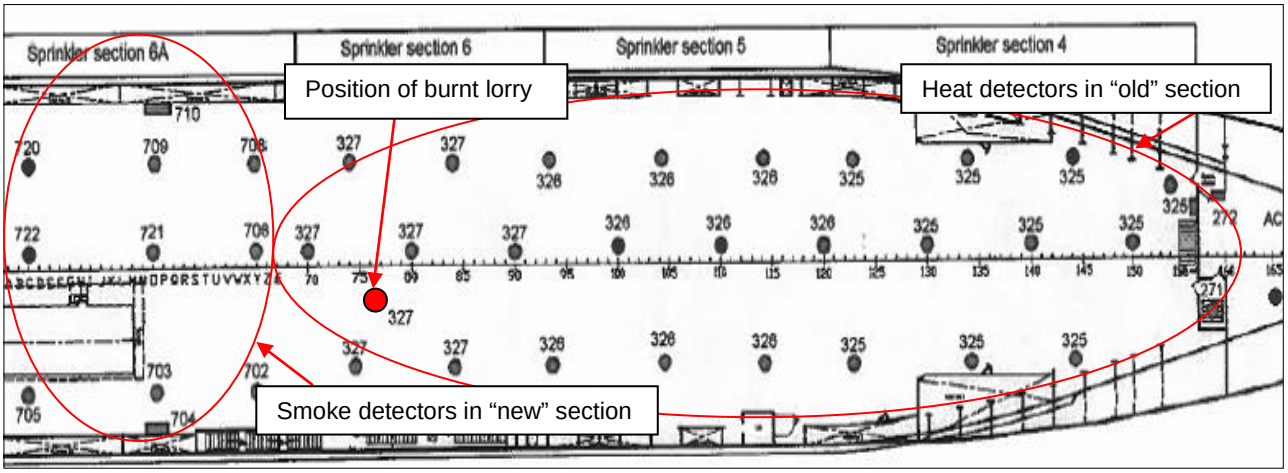

Figure 12: Main car deck automatic fire detectors (numbered dots), forward end
Source: Stena Line

3.4 Vessel fire emergency preparedness

3.4.1 Fire muster list & muster drills

The fire muster list prescribed the master as part of the bridge group and as the senior leader of all emergency operations on board. The master was to muster on the bridge assisted by the 2nd and 3rd officers and an AB.

The chief officer should muster on the scene of the fire and was the firefighting leader in case of fire outside the engine room – coordinating the firefighting efforts together with the 2nd engineer.

The 2nd engineer should muster on the fire station on the bridge deck with the firefighting and smoke diving team. In case of fire in the engine room, the chief officer and 2nd engineer would switch roles.

The chief engineer should muster in the engine control room and was the senior leader in the engine room assisted by the 3rd engineer who was also to muster in the engine control room.

The firefighting team and the smoke diving team should muster on fire station no. 1 on the bridge deck. The two teams consisted of two ABs, and one AB and the motorman respectively.

The chief stewardess was the leader of the guiding group assisted by the cook. Both mustered in the reception hall on deck 6 along with supernumerary catering crew. Their duties assigned by the muster list were to lead passengers away from dangerous areas. No formal guidelines for census were formulated on board URD and this issue was not addressed specifically on the fire muster list. However, the practical approach was to use available catering personnel to take census.

Abandon ship drills and fire muster drills were held every week on board URD. A computer based system was in place to ascertain that every crew member had attended a muster drill every month. Additionally, a number of safety disciplines and emergency scenarios were incorporated and trained during the muster drills.

Though the organisation on board URD had a formal hierarchical structure, there was an informal approach to daily operations. This approach allowed and encouraged input from crew members regardless of their rank. Furthermore, the crew members were familiar with each other as they were part of a regular crew on board.

3.5 Fluorescent lights

3.5.1 Function

Fluorescent lights contain a gas mixture which becomes ionized and thereby conductive. This results in the production of short-wave ultraviolet light that causes a phosphor coating inside the tube to emit visible light.

Fluorescent lights normally used for illumination in large premises work by sending a current through the electrodes at each end of the tube in order to heat up these, whereby electrons are easily released. The ionization occurs by applying a high starting voltage between the two electrodes.

Traditional fluorescent lights like the burnt one on URD has a “starter”, i.e. an automatic starting switch that initially, when the power is switched on, connects the electrodes in series with a “ballast” which is an electromagnetic coil inducing the high voltage needed when starting the fluorescent light and afterwards acting as an impedance to limit the current through the fluorescent light tube.

The light tubes are installed in a fixture by means of sockets at each end, creating the electrical connection between the electrode terminals and the other components in the circuit and fixating the tube. A capacitor may be installed for power factor correction purposes.

Fluorescent light tubes have a limited life expectancy. The electrodes at the ends of the light tube are covered with a substance which releases the electrons when heated and which is continually consumed when the light tube is used. Eventually, the substance will be used up and the tube will no longer be able to turn on, but can be seen flickering. At this stage, if the light tube is not changed, the electronic ballast will repeatedly induce the high voltage needed to start the ionization process, but be unsuccessful when it comes to starting the light tube.

3.5.2 The burnt fluorescent light fixture on board URD

The fixture is likely to have been fitted in 1995. Several of the fixtures, including the burnt one, were placed in close proximity to the car deck sprinkler system; sprinkler heads (figure 13).

Figure 13: Sprinkler head proximity to burnt fluorescent light fixture
Source: DMAIB

Examination of a similar intact reference light fixture (figure 14) from the main car deck on URD showed that the original ingress protection level was badly deteriorated and that water could penetrate through the bolting of the fixture on its back side. The original protection level was estimated to have been equivalent to IP 44, but was not marked on the fixture.

Figure 14: The burnt light fixture next to an intact light fixture from URD
Source: DMAIB

The reference light fixture showed evidence of corrosive impact and salt deposits at the ends of the light tubes (figure 15).

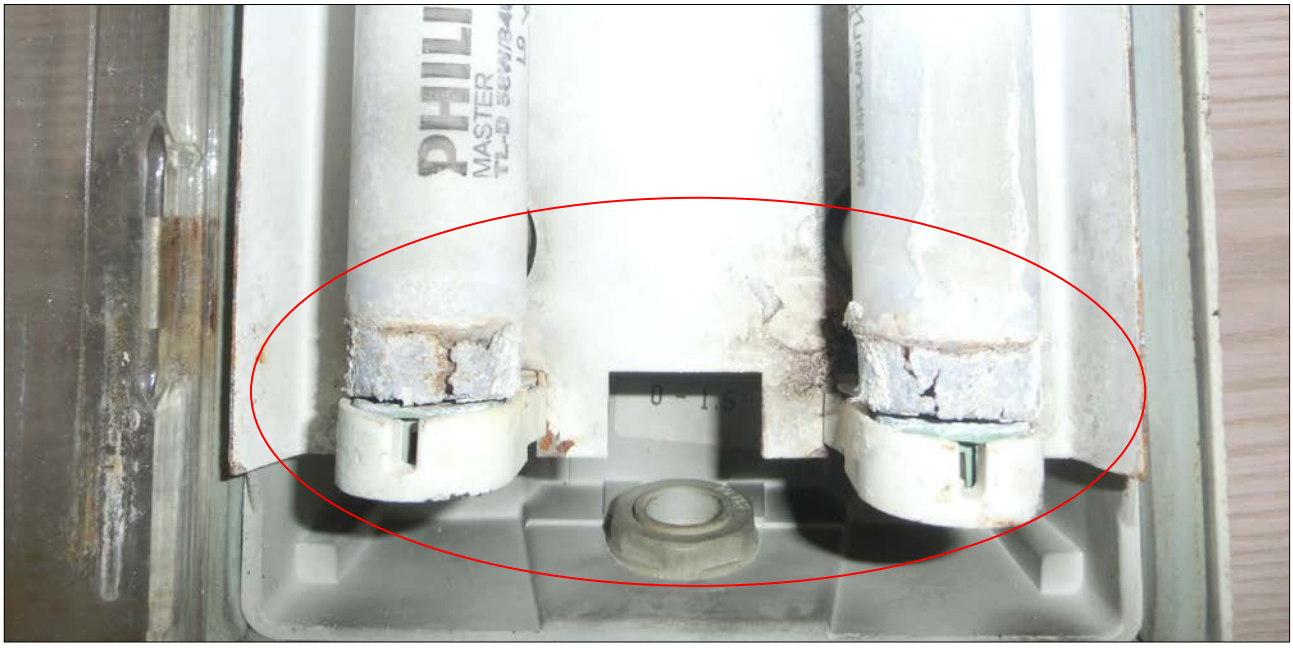

Figure 15: Intact light fixture from URD suffering from heavy corrosive impact
Source: DMAIB

Furthermore, one socket showed clear signs of burning of the plastic shielding (figure 16), which could be determined to be the result of arching between the socket´s electrical connections and the metal mounting plate inside the fixture leading a voltage of 1000-1500 volts induced by the ballast. The metal mounting plate had carbon deposits originating from arching during unsuccessful attempts to start burned out light tubes.

Figure 16: Intact light fixture from URD with burn marks in one socket
Source: DMAIB

4. ANALYSIS

4.1 The cause of the fire

The cause of the fire was a malfunction in a fluorescent light fixture that made the diffuser catch fire. At some point, the diffuser got detached from the light fixture and landed on the tarpaulin of the lorry situated underneath. The tarpaulin caught fire and flames and smoke developed.

A humid and saline atmosphere inside the light fixture is likely to have caused an expedited poor electrical connection resulting in arching, thus igniting the fire. It has not been possible to establish the level of protection against ingress of water into the burnt light fixture due to its condition.

The close proximity of the burnt fixture to a sprinkler head that was tested regularly may have contributed to the existence of the excessive humid and saline atmosphere inside the light fixture.

4.2 Fire extinction

The DMAIB established that key elements in the successful fire extinction were the early discovery of the fire and the organizational flexibility. However, some problems were identified in gaining an overview of the situation and getting access to the fire during the extinction:

4.2.1 Time

The fire was discovered at an early stage as two engineers randomly passed the main car deck and notified the watch-keeping officer on the bridge. They subsequently activated the car deck sprinkler system – irrespective of the plan set out by the fire muster list.

Time is essential for containing and extinguishing fires. Therefore, the early discovery of the fire contributed to the successful outcome of the accident. The crew had knowledge about the fire approx. 6 minutes before the automatic smoke detection system raised the first alarm.

The car deck sprinkler system was activated for ten minutes. When the sprinkler pump was stopped, it could be determined that the fire had not been effectively extinguished despite its limited nature. The sprinkler system had thus only been partially effective in containing and extinguishing the fire.

4.2.2 Overview and accessibility on the car deck

As smoke gathered on the car deck, it was difficult to visually identify in which sprinkler section the burning lorry was situated. It required particular knowledge of the car deck to know what section valve to operate on the sprinkler system as there were no intuitive aids available for crew support in this situation.

The final extinction by the smoke diving and firefighting teams proved difficult for a number of reasons. It was an operational necessity to load as many vehicles as possible and the vehicles were therefore stowed close together. That made it hard for the firefighters to obtain a good overview of the situation. It was also difficult for the firefighters to effectively use the fire hose from their position in the starboard side, just as the stowage of the vehicles made it difficult to approach the fire effectively. The chief officer adapted to these challenges by climbing onto the lorry situated next to the one on fire in order to undertake the final extinction.

There was no vehicle stowage plan. Therefore the vehicles had been stowed randomly during the loading and no detailed plan determined the exact position of each vehicle had been made. This is a common loading procedure on board ro-ro passenger ships. The contents of the cargo inside the vehicles could be identified only by, firstly, visually identifying the lorry by its license plate or similar and, then, consulting the cargo manifest. This meant that, if access to the truck could not be

gained, it would not be possible to establish the flammability of the cargo or any other hazards that it could represent to the crew involved in the firefighting efforts. Furthermore the cargo manifests usually only describe the contents in one or two words

4.2.3 Management and organizational flexibility

The decision-making behind the initiatives taken during the events was, to a great extent, characterized by local action taken by the officers present on the bridge and the officers at the scene of the fire as well as by the master. Despite a hierarchical system, the normally prevailing informal interaction between the crew members is considered to have remained relatively unaffected during the fire incident and was likely to have encouraged local adaptation and decision-making.

The random discovery and presence near the sprinkler station made the engineers adapt to the situation at hand. This form of adaptive behavior required that the crew was well familiar with the operations and features of the ship. On the other hand, unfamiliar crew members would have a stronger need for structure and guidance by procedures and instructions. The ability to adapt to the situation on board URD and early actions may well have given the crew an essential advantage in the firefighting efforts. Training and experience are likely to be key elements to a successful adaptive behavior.

During the firefighting efforts, the master was situated at a relatively great distance from the scene of the events. Therefore, the master would not have first-hand knowledge of every aspect of the firefighting and development of the situation. In consideration of this, his knowledge of the situation was largely dependent on the flow of information from the fire scene to the bridge. Using different languages did not prove problematic during the fire on board URD, but have previously in other cases proven to be a barrier in such context, thus adding to the already challenging task of gaining an overview of the situation. The master was largely dependent on the involved crew members' ability to assess and act according to changing circumstances which are outside the scope of the muster list and other instructions available.

4.3 Assembly of the passengers

The challenges of keeping passengers together and the difficulties experienced in relation to taking census were not problematic during the relatively short duration of the accidental events and its limited consequences.

The catering crew experienced familiarity with their tasks during the fire. Few directions were given as the involved crew members knew what to do as a result of the training received during the frequent muster drills carried out on board.

5. CONCLUSIONS

5.1 *Fire in fluorescent light fixtures*

The fire on board URD originated in a malfunctioning fluorescent light fixture on the main car deck. A combination of age, poor capsuling and a subsequent humid and saline atmosphere inside the fluorescent light fixture is likely to have caused poor electrical connections that resulted in arching. The diffuser caught fire, parted from the fixture and landed on and ignited the tarpaulin on the lorry situated below.

Attention should be drawn to the potential hazards associated with fluorescent lights. The DMAIB has previously experienced that fluorescent light fixtures have been the origin of on-board fires. Tests made during investigations of the serious fires on board HERCULES[2] and UILOQ[3] have proved the possibility of arching in sockets in fluorescent light fixtures due to bad electrical connections (figure 17). The type of electrical circuit found in these light fixtures was, however, different.

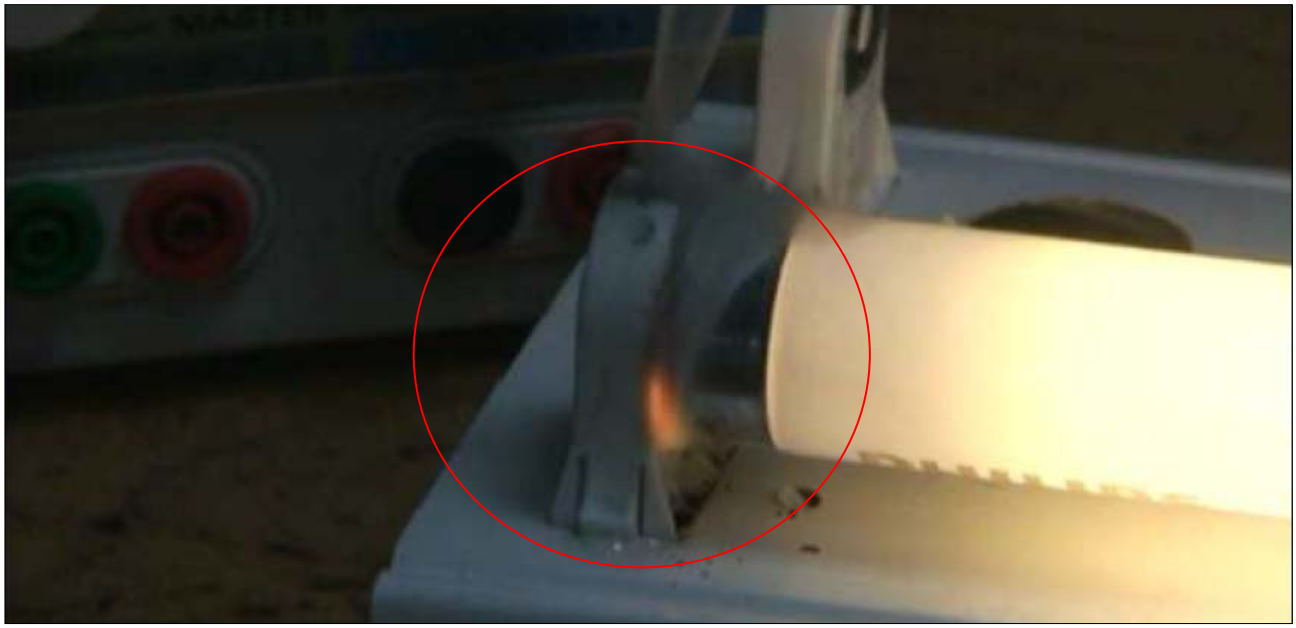

Figure 17: Arching in socket on light fixture from UILOQ during tests made in 2009
Source: Danish Institute of Fire and Security Technology (DBI)

5.2 *Fire on ro-ro decks*

The car deck fire on board URD revealed that a number of previously identified issues had again shown to be relevant; the fixed firefighting equipment installed on the car deck proved to be of limited effect when extinguishing the moderately sized fire.

It proved to be difficult for the firefighters to effectively approach the fire due to densely stowed vehicles on the full main car deck.

The composition of the installed heat and smoke detectors on the main car deck delayed the automatic warning of the bridge.

[2] A marine accident report on the fire on board HERCULES in 2007 can be downloaded here: http://www.dmaib.dk/Ulykkesrapporter/HERCULES-soulykkesrapport.pdf
[3] A marine accident report on the fire on board IULOQ in 2009 can be downloaded here: http://www.dmaib.dk/Ulykkesrapporter/Uiloq-brand-2009.pdf

The hazards imposed on the crew during firefighting efforts on a full car deck are evident as the crew will have only a slight chance of creating an overview of the situation and of foreseeing the development of this. They will have little knowledge of the potential danger associated with the cargo carried on the car deck during a fire and their escape options may be limited.

Some of the above issues have been addressed in 2012, in a paper[4] issued by the IMO following a study of car deck fires on board the ro-ro/passenger ships Al SALAAM BOCCACIO 98, UND ADRYATIC, COMMODORE CLIPPER, LISCO GLORIA and PEARL OF SCANDINAVIA. The risk to existing vessels was identified and summed up in the following extraction:

"The fixed water spray systems and structural protection on vessels constructed before 1 July 2010 may not be able to contain or extinguish a vehicle deck fire. Closely parked vehicles provide ample combustible material and their construction can also shield fires from water sprays preventing them from being extinguished. Prompt crew intervention is required just to contain the fire, and if a full cargo is being carried there is little chance of the crew being able to extinguish anything more than a small fire while the vessel is at sea. Even a moderately sized fire is capable of damaging ship systems, reducing the vessel´s ability to contain the fire and/or reach a port of refuge."

5.3 *Containment of the accident*

The coincidental early discovery of the fire led to the crew´s prompt action and successful extinction of the fire. The efforts were characterized by adaptive behaviour in order to solve the challenges encountered and take the best possible decision based on first-hand knowledge of the situation; partly disregarding formal procedures. This behaviour may have been encouraged by the informal and familiar relationship between crew members irrespective of the formal hierarchical structure. The ability to adapt and act may, furthermore, be ascribed to the positive effect of frequent drills and a substantial level of familiarity with the vessel and its operation.

6. PREVENTIVE MEASURES

Following the fire on board URD, Stena Line have received new piece counters for taking census and implemented a system to prevent them from disappearing again.

Additional UHF radios have been ordered for use by the catering crew assigned to search the ship for passengers.

The car deck sprinkler system piping have been extended so that the nozzles are well below the fluorescent light fixtures in the places where these close together.

Existing markings on the car deck showing the sprinkler sections have been supplemented by additional markings in eye height.

CCTV surveillance on the car decks is being upgraded.

The drawing in the sprinkler control station, showing the car deck sprinkler sections has been updated for easy identification of fire location.

[4] The IMO Sub-Committee on flag State Implementation (FSI) 20/5/3, 8 January 2012.

7. RECOMMENDATIONS

The fire originated in a fluorescent light fixture. The burned fixture and a randomly chosen fixture from the car deck showed clear signs of deterioration caused by ageing and exposure to an unfavourable environment. On this background DMAIB recommends the company that all fixtures installed on the ship´s car decks are subject to an examination to ascertain the need for repair or replacement.