NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594

March 23, 2018

MATERIALS LABORATORY FIRE FACTUAL REPORT Report No. 17-055

A. ACCIDENT INFORMATION

Place	:	San Juan, Puerto Rico
Date	:	August 17, 2016
Vehicle	:	RO/RO Passenger Vessel *Caribbean Fantasy*
NTSB No.	:	DCA16FM052
Investigator	:	Nancy B. McAtee Fire Group Chairman RE-30

B. VESSEL INFORMATION

1. General

Construction of the *Caribbean Fantasy* was completed in 1989 at Mitsubishi Heavy Industries in Kobe, Japan, as hull number 1174, and originally named the *Victory*. The ship, post-accident, is show in Figure 1. From 1989 to 1998, the vessel sailed with the Higashi Nippon Ferry services in Japan, and, from 1998 to 2008, with the Grandi Navi Veloci services in Italy. The vessel was purchased in early 2008 by Baja Ferries and renamed the *Chihuahua Star*. On October 21, 2011, the company officially changed the name of the vessel to *Caribbean Fantasy* and changed the flag to Panama[1].

[1] For more information on vessel and company operations, see the Port State Control, Flag, Classification, and Mass Rescue Operations Group Chairman's report.

Figure 1. Overall photograph of *Caribbean Fantasy* postaccident.

2. Vessel Particulars

Vessel Name	***Caribbean Fantasy***
Owner/Operator	Baja Ferries, S.A. de C.V.
Port of Registry	Panama City
Flag	Panama
Type	Ro-ro/passenger
Built	1989
Classification society	Registro Italiano Navale (RINA)
Construction	Welded steel
Draft	22.9 feet (7.0 meters)
Length	613.9 feet (187.1 meters)
Beam	88.68 feet (27.03 meters)
Gross tonnage	28,112

3. General Arrangement

Locations and descriptions of various ship spaces are listed below.

Deck 1:

Lower level of the main engine room and auxiliary engine room; Stern tubes room; Water sprinkler system skid; Emergency fire main pump; Stabilizer room; Water mist system skid; Machinery and ventilation equipment rooms; Fresh water tanks (port and starboard); Fuel oil tanks.

Deck 2:

Upper level of main and auxiliary engine rooms including engine storeroom and engine workshop (fire main pumps are located in auxiliary engine room and main engine room); Engine control room (ECR)[2]; Electrical switchboard room; Lower garage (Car Deck A); Stern thruster room; Steering gear room.

Deck 3:

Garage (Car Deck B); Carbon dioxide (CO_2) fixed firefighting system station including pilot boarding doors; Fuel bunker stations (port and starboard); main loading ramps.

Deck 4:

Garage (Car Deck C); Emergency fuel and fuel pump shutoff valves and ventilation shutoff (located in Stairwell #5 between Decks 3 and 4); forward and aft mooring deck.

Deck 5:

Garage water drencher system station; Crew and passenger accommodation and office areas; Galley, restaurant and crew mess; Main passenger reception; Firefighting stations #3, #4, and #5; marine evacuation system (MES) embarkation stations.

Deck 6:

Passenger areas and accommodation; Firefighting station #2; Muster station C.

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[2] The vessel's engine room machinery and systems were controlled from the Engine Control Room (ECR). This space contained the remote operating controls for the engine room machinery, engine data recorders, emergency shutdowns for the generator engines and ventilation fans, and the remote controls for the Nebula® local application water mist system.

Deck 7:

Passenger areas and accommodation; Crew accommodation; Emergency Diesel Generator (EDG) room; Firefighting station #1; muster stations A and B; lifeboats and liferafts; kennel; medical facility.

Deck 8:

Bridge; Battery room; Emergency switchboard room; helicopter winch deck.

4. Fire Protection Systems

The *Caribbean Fantasy* had structural fire protection throughout the ship. The ship had several fixed firefighting systems including an automatic fire detection system; a fixed carbon dioxide extinguishment system; a local application water mist system, a sprinkler system in passenger and crew areas and a water drencher/deluge system on the garage decks.

a. Structural Fire Protection.

The *Caribbean Fantasy* was divided into five main vertical zones (MVZs) that provided both watertight integrity and thermal/fire containment[3]. The ship also had two main horizontal zones (MHZs) subdividing the garage decks with A-60 boundaries.[4] The arrangement of these structural fire protections zones is shown in Figure 2.

[3] Per SOLAS II-2 Reg 24.1.1 (in force at the time the ship was constructed)/ SOLAS II-2 Reg 9.2.2.1.1.1 (current regulation), in ships carrying more than 36 passengers, the hull, superstructure, and deckhouses shall be subdivided into main vertical zones by "A-60" class divisions. According to SOLAS II-2 Regulation 3.2, A-60 divisions are to be constructed of steel of equivalent material suitably stiffened. These boundaries are to be insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140°C above the normal temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature within 60 minutes. The construction must be capable to prevent the passage of smoke and flame.

[4] As per SOLAS II-2 SOLAS II-2 Regulation 24.5.1 (at time of construction)/SOLAS II-2/9.2.2.1.5.1 (current), automobile car ferries where the provision of main vertical zone bulkheads would defeat the purpose for which the ship is intended, equivalent means for controlling and limiting a fire shall be substituted with approval. This was accomplished using MHZ to provide separation of the garage decks.

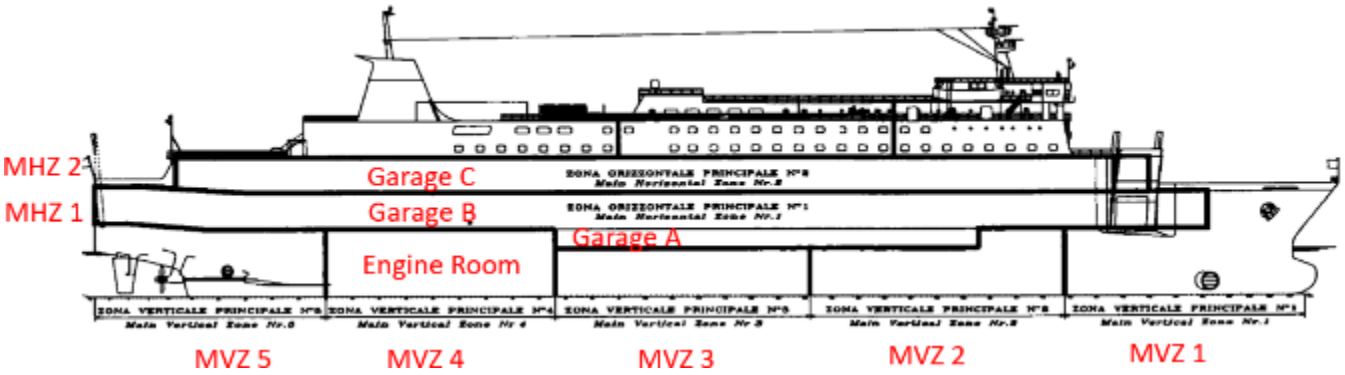


Figure 2. Line drawing of main vertical and horizontal zones.

The engine rooms (main and auxiliary) were in main vertical zone 4. According to the structural fire protection plan (approved on November 2012), the vertical A60 bulkheads separating the space were at the forward end of the main engine room (frame 83) and at the aft end of the auxiliary engine room (frame 40). Between the main engine room and auxiliary engine room was an A0 subdivision (frame 54). The deck separating the engineering spaces from garage B were to be of A60 fire integrity. The engine control room (ECR) was located within the main engine room on the port side on deck 2. According to the structural fire protection plan, there was A0 integrity between the machinery spaces and the ship side shell plating. Investigators could not find record of any inspection or repairs of the horizontal boundary between the machinery spaces and garage B. The last port state control inspection conducted by the Coast Guard on August 9 documented missing A60 insulation in garage B middle deck overhead at frame 22, which was replaced by the ship's crew.

The ship had six watertight doors, four of which were either in or adjoining the machinery spaces (WTD 3, 4, 5 and 6). The other two watertight doors were in garage A (WTD 1 and 2). All were on deck 2, except for one which was on deck 1 (WTD 5). Because the *Caribbean Fantasy* was arriving in the port of San Juan at the time the fire occurred, all watertight doors were required to be closed in accordance with Panamanian and company requirements.

A total of 83 A-60 fire doors were located throughout the ship which consisted of 29 remote or locally released magnetic holdback doors, found mostly in the accommodation spaces, with the remaining 54 as self-closing doors. The remote closing location for the doors was located on the bridge which also provided an indication of all the doors status (open or closed). Investigators recovered drawings for the fire doors on board, but it was found to be not updated to the existing ship arrangement and was in Italian (Nr. 6000366 RINA approval date March 11, 1999). Updated drawings were provided by Baja Ferries (Bureau Veritas approval date June 12, 2012). There were no reports of any problems with the fire doors on board at the time of the accident. From CCTV footage from the duty-free shop on deck 6 recovered by investigators, fire doors held open by magnet closed from being activated remotely at about 0738 local time.

The CCTV recording from the duty-free shop showed movements of both passengers and crew moving from aft to forward through the shops. Passengers could be seen moving through the

space with luggage and personal effects but wearing no lifejackets. Some crew were moving aft through fire door 619 and then passing back through that door moving forward with multiple lifejackets in hand. Aft of this space was muster station C, where passengers were to muster and gather lifejackets. However, there was smoke at that muster station. The CCTV video captured crew members moving through the space and as the doors were opened, grey smoke would enter the space in view of the camera. This can be seen in figure 4 where fire door 619 is in the left and a crew member can be seen emerging from the smoke with lifejackets in hand. In the foreground, crew members are moving dogs in their kennels forward as well to escape the smoke-filled area aft.

Figure 3. Frame taken at 0810 from a CCTV camera in the duty-free shop looking aft. The grey box in the upper left corner shows a crew member passing through fire door 619 from a smoke-filled space aft with lifejackets in hand.

b. ***Automatic Fire Detection***

The *Caribbean Fantasy* was equipped with a fire detection system as was required by SOLAS II-2 Regulation 7.4 at the time of the ship's constructions[5]. The Consilium Salwico CS4000 fire detection system was a conventional addressable fire detection system.[6] Various types of loop units (smoke and heat detectors and manual call points) were installed throughout the ship. The main alarm control panels were located on the ship's bridge. These panels are shown in Figure 4. The panels provided alarm information as well as the ability to control the system. The M 4.3 (upper) panel provided information on the shipboard fire detection system. The CS4000 (lower) panel provided alarm information for the engine room water mist system specifically. The middle panel shown in Figure 4 could not be identified by Consilium representatives. It appeared to be an indication panel for the sprinkler system section valves based on data recovered from the voyage data recorder (VDR).

[5] The current regulation is SOLAS II-2 Reg. 7.4.

[6] A conventional system only gives alarm information for specific circuits, loops or zones. This differs from analog addressable fire detection systems which give alarm details on individual loop units. Product information for this system states that the CS4000 can operate as either type depending on how it is configured.

Figure 4. Photograph of fire detection system panels on the bridge.

A repeater panel, located in the ECR, had a display listing the location of the alarm.[7] This panel is shown in Figure 5.

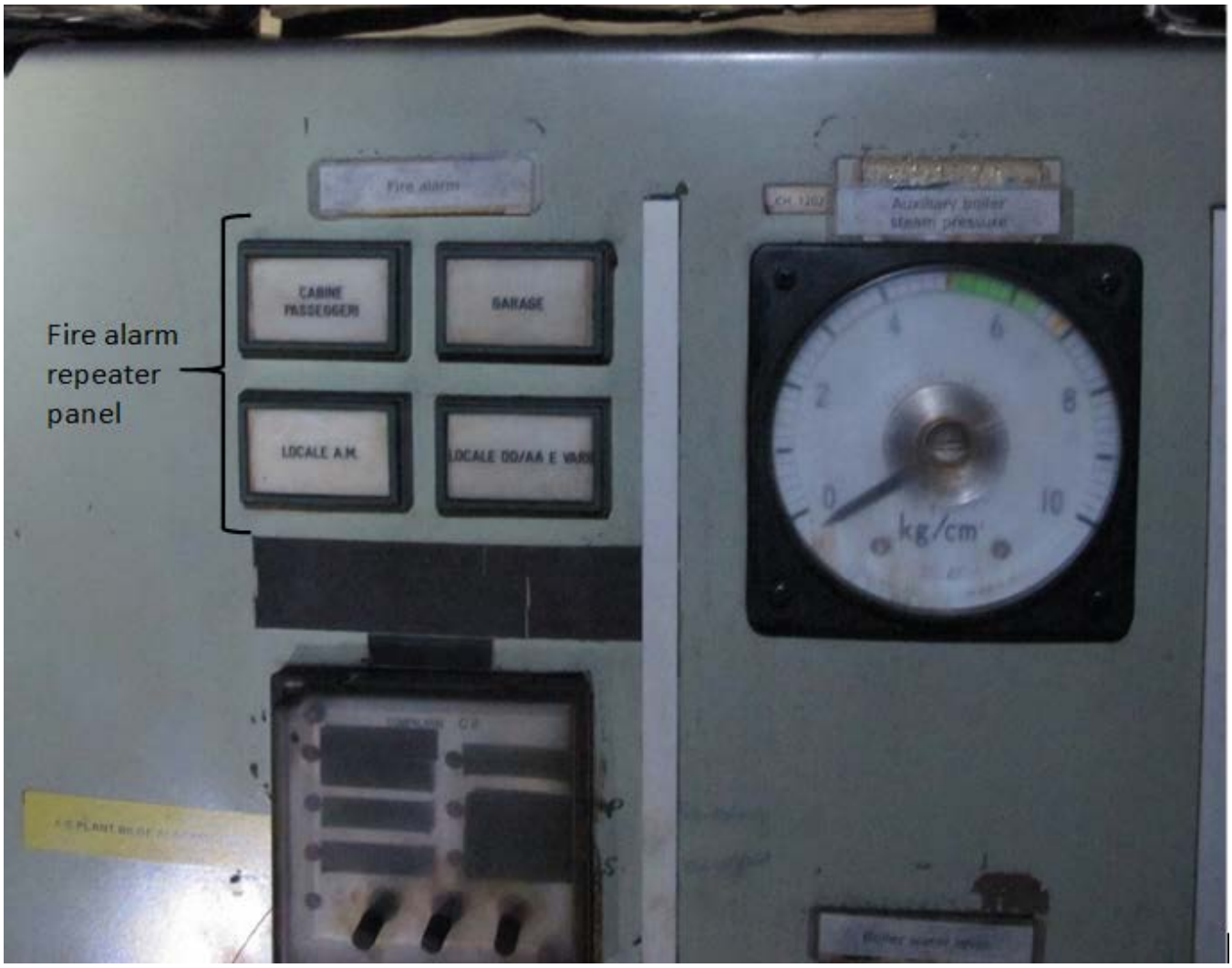


Figure 5. Photograph of fire alarm repeater panel in engine control room. Note the fire alarm repeater indicator text is in Italian.

This system replaced a Consilium Salwico C300 system. The system retrofit occurred in June 2013. At the time of the retrofit, the Consilium technicians noted in the installation service report that very few drawings were provided, no loop drawings or no external connection drawings were available, and the few system drawings available were mostly in Japanese. The service

[7] No system drawings or detector lists were provided by the operator. Drawings of detector loops for the accommodation spaces were provided by the ship's classification society, RINA Services; however, no drawings for the lower decks were provided.

report further stated that modifications to the system had been made but had not been documented.[8] Several wires were found missing and three detector loops were found that were not listed on the main bridge panel and did not appear on any available drawings. Figure 6 shows the listing of loop identification addresses generated by the Consilium technicians during the installation of the new system. Zones 1, 3, and 11, while fully functional, could not be identified by Consilium and were left unaddressed.

[8] No retrofit drawings or other approval documents were provided by RINA.

I/O M 70 ADDRESS: 53					
8	ZONE 54 GARAGE "B" PORT	24V 70mA	8–		
			8+		
7	ZONE 53 GARAGE "B" STBD	24V 70mA	7–		
			7+		
6	ZONE 52 GARAGE "B" PORT	24V 70mA	6–		
			6+		
5	ZONE 51 GARAGE "B" STBD	24V 70mA	5–		
			5+		
4	ZONE 50 GARAGE "B" PORT	24V 70mA	4–		
			4+		
3	ZONE 49 GARAGE "B" STBD	24V 70mA	3–		
			3+		
2	ZONE 48 GARAGE "B" PORT	24V 70mA	2–		
			2+		
1	ZONE 47 GARAGE "B" STBD	24V 70mA	1–		
			1+		

I/O M 70 ADDRESS: 52					
8	ZONE 46 GARAGE "B" PORT	24V 70mA	8–		
			8+		
7	ZONE 45 GARAGE "B" STBD	24V 70mA	7–		
			7+		
6	ZONE 44 GARAGE "B" PORT	24V 70mA	6–		
			6+		
5	ZONE 43 GARAGE "C" PORT	24V 70mA	5–		
			5+		
4	ZONE 42 GARAGE "C" STBD	24V 70mA	4–		
			4+		
3	ZONE 41 GARAGE "C" PORT	24V 70mA	3–		
			3+		
2	ZONE 40 GARAGE "C" STBD	24V 70mA	2–		
			2+		
1	ZONE 39 GARAGE "C" PORT	24V 70mA	1–		
			1+		

I/O M 70 ADDRESS: 51					
8	ZONE 38 GARAGE "C" STBD	24V 70mA	8–		
			8+		
7	ZONE 37 GARAGE "C" PORT	24V 70mA	7–		
			7+		
6	ZONE 11 ZONE 11	24V 70mA	6–		
			6+		
5	ZONE 35 GARAGE "C" PORT	24V 70mA	5–		
			5+		
4	ZONE 34 GARAGE "C" STBD	24V 70mA	4–		
			4+		
3	ZONE 36 GARAGE "C" STBD	24V 70mA	3–		
			3+		
2	ZONE 32 GARAGE "C" STBD	24V 70mA	2–		
			2+		
1	ZONE 31 GARAGE "C" PORT	24V 70mA	1–		
			1+		

I/O M 70 ADDRESS: 50					
8	ZONE 30 GARAGE "C" STBD	24V 70mA	8–		
			8+		
7	ZONE 29 STAIRCASE 13	24V 70mA	7–		
			7+		
6	ZONE 28 STAIRCASE 12	24V 70mA	6–		
			6+		
5	ZONE 27 STAIRCASE 9	24V 70mA	5–		
			5+		
4	ZONE 26 VENTS ROOM	24V 70mA	4–		
			4+		
3	ZONE 25 ELECTRICAL STAIRCASE	24V 70mA	3–		
			3+		
2	ZONE 24 STAIRCASE 7	24V 70mA	2–		
			2+		
1	ZONE 23 STAIRCASE 8	24V 70mA	1–		
			1+		

I/O M 70 ADDRESS: 57					
8		24V 70mA	8–		
			8+		
7	ZONE 3 ZONE 3	24V 70mA	7–		
			7+		
6	ZONE 1 ZONE 1	24V 70mA	6–		
			6+		
5	ZONE 83 SHAFT AFT	24V 70mA	5–		
			5+		
4	ZONE 82 SHAFT FWD	24V 70mA	4–		
			4+		
3	ZONE 81 GENERATOR STBD	24V 70mA	3–		
			3+		
2	ZONE 80 GENERATOR PORT	24V 70mA	2–		
			2+		
1	ZONE 79 ENGINE PORT INFERIOR	24V 70mA	1–		
			1+		

I/O M 70 ADDRESS: 56					
8	ZONE 78 ENGINE STBD INFERIOR	24V 70mA	8–		
			8+		
7	ZONE 77 ENGINE PORT SUPERIOR	24V 70mA	7–		
			7+		
6	ZONE 76 ENGINE STBD SUPERIOR	24V 70mA	6–		
			6+		
5	ZONE 75 CONTROL ROOM	24V 70mA	5–		
			5+		
4	ZONE 74 FUNNEL PORT	24V 70mA	4–		
			4+		
3	ZONE 73 FUNNEL STBD	24V 70mA	3–		
			3+		
2	ZONE 72 STAIRCASE AFT STBD	24V 70mA	2–		
			2+		
1	ZONE 71 THRUSTER BOW	24V 70mA	1–		
			1+		

I/O M 70 ADDRESS: 55					
8	ZONE 70 STABILIZER PORT	24V 70mA	8–		
			8+		
7	ZONE 69 STABILIZER STBD	24V 70mA	7–		
			7+		
6	ZONE 68 SEPTIC PORT	24V 70mA	6–		
			6+		
5	ZONE 67 SEPTIC STBD	24V 70mA	5–		
			5+		
4	ZONE 66 STEERING GEAR ROOM	24V 70mA	4–		
			4+		
3	ZONE 65 THRUSTER AFT	24V 70mA	3–		
			3+		
2	ZONE 64 GARAGE "A" AFT	24V 70mA	2–		
			2+		
1	ZONE 63 GARAGE "A" CENTER	24V 70mA	1–		
			1+		

I/O M 70 ADDRESS: 54					
8	ZONE 62 GARAGE "A" BOW	24V 70mA	8–		
			8+		
7	ZONE 61 BOSUN LOCKER	24V 70mA	7–		
			7+		
6	ZONE 60 ROOM CO2	24V 70mA	6–		
			6+		
5	ZONE 59 GARAGE "B" THRUSTER	24V 70mA	5–		
			5+		
4	ZONE 58 GARAGE "B" PORT	24V 70mA	4–		
			4+		
3	ZONE 57 GARAGE "B" STBD	24V 70mA	3–		
			3+		
2	ZONE 56 GARAGE "B" PORT	24V 70mA	2–		
			2+		
1	ZONE 55 GARAGE "B" STBD	24V 70mA	1–		
			1+		

Figure 6. Listing of fire detection zones.

During the post-installation testing, technicians found a few loop cable breaks and one earth fault. According to the system manual, these are considered minor faults and the system is

considered fully functional. The technicians left instructions for the ship's crew to correct these faults. The crew was told that, if any loop units were too damaged or too old to work, conventional Consilium detectors could be used as replacements without issue.[9] The Consilium technicians also provided training on the system upgrade to the crew. There is no record of the system faults being rectified by the crew.

In addition to the Consilium system, there was a third panel located on the port side aft wall of the bridge as shown in Figure 7. This panel was a Sira Area 54 panel and it was labeled "SMOKE DETECTORS" with an adhesive label located above the panel. According to layout drawings for this panel, it provided alarm information for detectors located in the passenger/accommodation areas (decks 5–7).

[9] According to Consilium, conventional, non-addressable detectors could be used due to the presence of monitoring circuits within the individual loops that would provide the alarms location to the monitoring panels.

Figure 7. Photograph of SIRA panel located on the bridge.

According to the ship's operator, the fire detection system was tested on a regular basis by the Chief Electrician. No inspection logs or other inspection reports were provided or found onboard the ship.

c. ***Fixed Carbon Dioxide Extinguishment System***

The carbon dioxide (CO_2) fixed firefighting system for the main engine room and auxiliary engine room (MVZ4) was designed by Minimax. This system was required by SOLAS II-2 Regulation 7.1.1.1[10]. The CO_2 room was located on the port aft corner of deck 3 (Garage B) with an escape ladder to the mooring deck on deck 4. This hatch was inoperable from deck 4 and was found strapped closed from the inside of the CO_2 room as shown in Figure 8. The strap was to secure the space from inside to prevent unauthorized entry into the CO_2 room from the mooring deck.

Figure 8. Photograph of upper hatch of CO_2 room to the deck 4 aft mooring deck with strap securing hatch from inside the space.

[10] SOLAS II-2 Regulation 7.1.1.1 was the regulation required at the time of the ship's construction. The current regulation is SOLAS II-@ Reg. 10.4.1.1.1.

The room was divided into an upper and lower levels separated by a hatch. The system contained a total of 110 60-liter (45 kilogram) cylinders. A line drawing of the system is shown in Figure 9. The cylinder bank on the upper level contained 54 bottles. A photograph of the upper level is shown in Figure 10. The lower level contained 56 cylinders. A photograph of the lower level is shown in Figure 11.

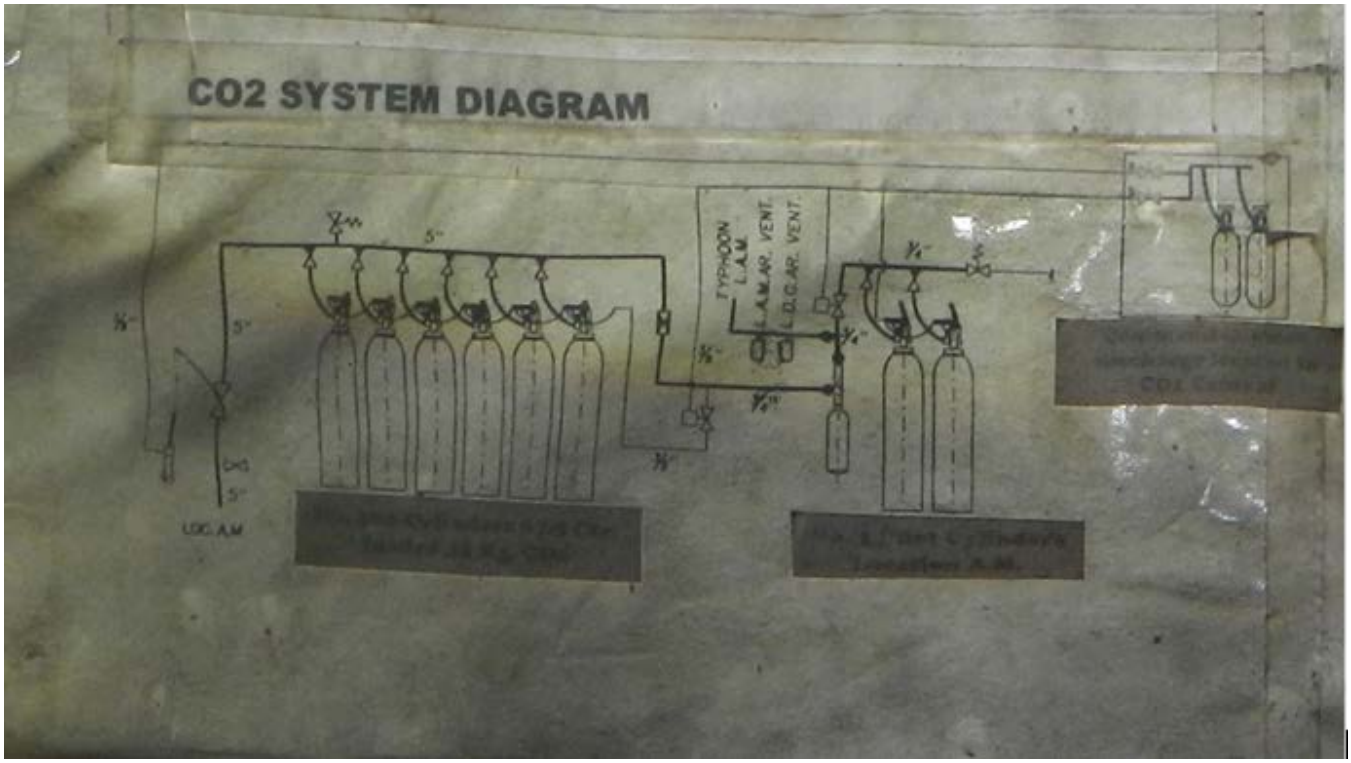


Figure 9. Photograph of CO_2 system drawing in CO_2 room.

Figure 10. Photograph of upper deck of CO_2 room.

Figure 11. Photograph of lower level of CO_2 room.

The following instructions were posted on the wall of the lower level of the room to the right of the entry door (a photograph of these instruction is shown in Figure 12):

> Impact protected zone fixed firefighting CO2 system MINIMAX given by the responsibility of the Genova Limited Company. Extinction is affected by the saturation of the atmosphere carbon dioxide, a gas non-toxic, non-corrosive. For greater efficiency need to download the gas in the bottle number corresponding to that indicated in the diagram.
> When operating the gas will have 30 seconds to sound the alarm with a siren pneumatic working with the same system of automatic bottle drives.
>
> In case of fire in the local area, protect, operate as follows.
> Be sure all personal have left the disaster area, stop all ventilation, close all doors that do directly to the fire zone.
>
> 1. Locate the picture of the drive system

2. Open the front door of the box MINORS
3. Make sure all valves are in CO2 normally closed position
4. Open the bottle valve actuation CO2
5. Check valve to intercept the fire area
6. Open the valve actuator to intercept the alarm zone
7. Open the valve of the CO2 communication to the department of machine (fire zone)

After turning off the fire, close the valve interception going to the fire area on the fourth of CO2 machines keep the area as long as possible without ventilation.

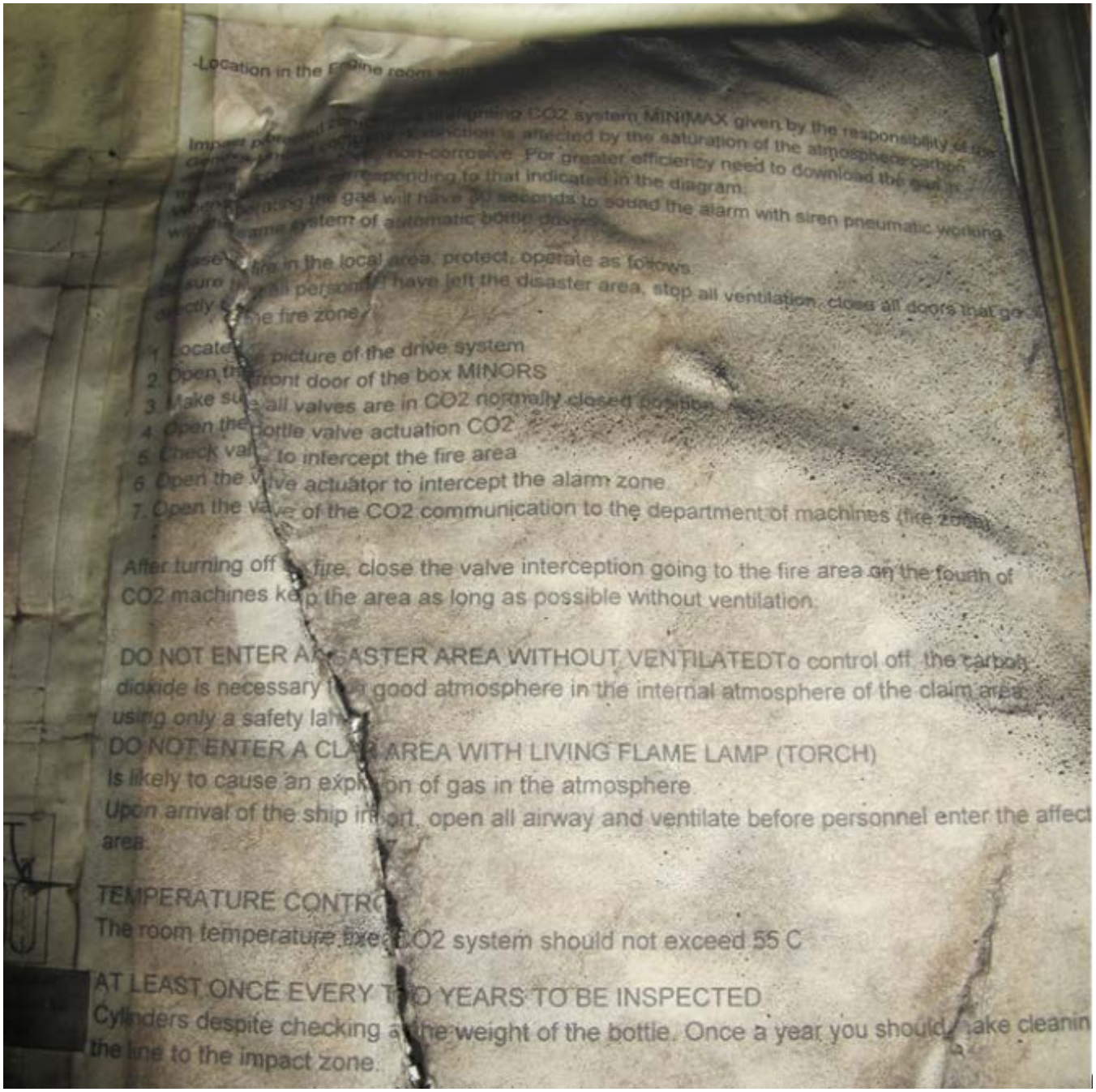


Figure 12. Photograph of CO_2 operating instructions on wall of CO_2 room.

The pilot cabinet was located on the bulkhead to the left of the entry door into the CO_2 room as shown in Figure 14. The cabinet consisted of two smaller pilot cylinder bottles and the actuating lever for the system as shown in Figure 14. There were no markings identifying this box as the pilot cabinet. Next to the pilot cabinet was another box mounted on the bulkhead as shown in figure 13 with a sticker in Italian which read “avviatore estrattore locale CO2,” which translated

means, “local CO_2 extractor starter.” This system is for the removal of CO_2 from the space after actuation of the firefighting system to allow crew safe access to evaluate the space.

Figure 13. Photograph of carbon dioxide extraction unit cabinet exterior.

Figure 14. Photograph of interior of pilot cabinet. Both valves are in the open position.

The following instructions were posted on the inside of the cabinet door. A photograph of these instructions is shown in Figure 15.

INSTRUCTIONS TO RELEASE CO2 IN THE ENGINE SPACES

IN CASE OF FIRE FOLLOW THE INSTRUCTIONS BELOW

1. MAKE SURE ALL PERSONNEL ARE CLEAR FROM THE ENGINE SPACES
2. OPEN THE RELEASING DOOR BOX. MAKE SURE VALVE ARE IN CLOSE POSITION
3. OPEN CYLINDER VALVE
4. OPEN VALVE “A” TO SOUND THE CO2 ALARM
5. OPEN VALVE “B” TO RELEASE CO2 IN THE ENGINE SPACE

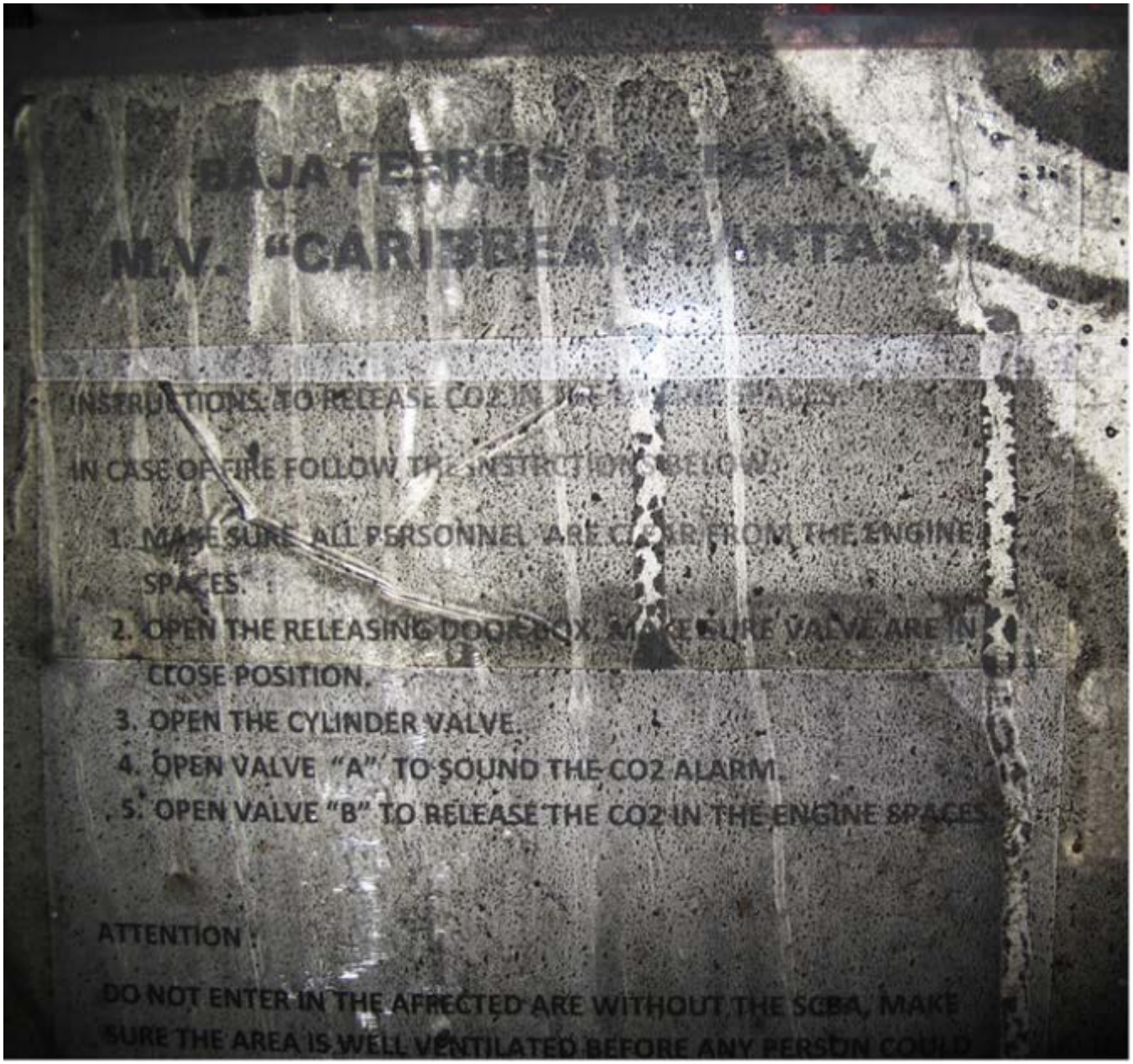


Figure 15. Photograph of second set of CO_2 system instructions.

As stated in the instructions above, opening "valve A" would initiate the alarm. Opening valve B would initiate the pilot bottles to open the space selection valve and release the gas into the space. There was also an empty cylinder installed downstream in line with the cabinet that provides a 30 second delay in the release of the bottle banks to provide time to egress from the affected space. These valves would also activate two solenoids that had "ventilaz" written on them. The solenoids, which appeared to be responsible for shutting down ventilation for the main and auxiliary engine rooms, are shown in Figure 16.

Figure 16. Photograph of ventilation control solenoids.

There was also a dedicated CO_2 system for the galley duct (a 5-kilogram cylinder located on Deck 5).

Ship's records show a May 2011 requisition for service testing of the system and a July 2011 requisition for hydrotesting of 42 CO_2 cylinders. The last inspection was done May 20, 2016 by Tunisia Ship Repairs. No anomalies were reported.

d. Water Mist System

A fixed local application firefighting system was installed as required by SOLAS II-2 Regulation 10 and in conformance with IMO Circular 913(1999) regulations. The Ciodue Acqua HPN Nebula system was installed in various machinery spaces on the ship in 2005. Local application nozzles were installed in the following areas: main engines (4 nozzles over each engine), auxiliary generators (2 nozzles over each generator), fuel purifiers and boilers (3 nozzles), and fuel

booster pumps (1 nozzles over each pump). A photograph of one of the main engine room water mist nozzles, after the fire, is shown in Figure 17.

Figure 17. Photograph of water mist system nozzle after the fire. The nozzle is circled.

The HPN Nebula system was an open nozzle, dry pipe (supply pipes normally empty when not in operation) system. The system was activated either manually or automatically. For manual activation, personnel activated the system by pressing the activation button for the affected space on the water mist system panel in either the ECR, at the system skid in the air conditioning machinery room forward of the engine room on deck 1 (as shown in Figure 18) or at one of three remote activation panels located outside the engine workshop on deck 2, in the auxiliary engine room near watertight door no. 4 on deck 2, and forward of the main engine room on deck 2 at the entrance to the engine room from garage A near watertight door no. 3 (as shown in Figure 19). For automatic activation, when the water mist control panel received a fire alarm (either smoke or heat in an area protected by water mist), the control panel activated the system pump and actuated the section valve for the affected areas. The control panel also activated both visual and audible alarms to indicate the system had been activated.

Figure 18. Photograph of water mist control panel in engine control room.

Figure 19. Photograph of water mist remote activation panel in the AC machinery room.

During operation, the nozzles introduced water into the localized area as a high-speed mist containing small droplets with a very large total water surface area, providing, efficient cooling of the fire and associated combustion related gases. The high speed of the small droplets enabled the mist to penetrate combustion-related gases and reach the source of the fire and heat. The water mist system used fresh water from the ship's fresh water tanks, but a salt water connection was also provided. A manual valve that changed the water source from the fresh water tanks to salt water was located on the system skid in AC machinery room.

The system was tested weekly by the crew according to testing logs found in the ship's records. No other service or inspection records were provided or found onboard the ship.

e. Water Deluge/Drencher System

A water drencher system (also known as a deluge system) was installed on all three garage decks of the ship with a total of 1165 removable nozzles. The system was required by SOLAS II-2 Regulation 54.2.9. Deluge systems are systems in which all sprinklers connected to the water piping system are open and dry. Water is not present in the piping until the system operates. These systems are used for special hazards where rapid fire spread is a concern, as they provide a simultaneous application of water over the entire hazard area.

The system on board the Caribbean Fantasy was activated at the drencher system station located on Deck 5 near the engine casing port side[11]. A photograph of this space is shown in Figure 20. Fresh water was provided from fresh water tanks 8 port and 8 starboard.[12] The drencher system was also attached to the fire main, which could supply sea water to the system. The system required manual activation. An audible alarm activated when the system was actuated.

[11] The *engine casings* were the main exhaust ventilation ducts for the engines and were located between frames 45 and 65 on the port and starboard side. The casings started on deck 2 in the upper portion of the engine room and rose the entire height of the ship up through the exhaust stacks.

[12] The drencher system was originally designed to use salt water. However, during a U.S. Coast Guard inspection in 2013, a recommendation was made to switch the water source from salt water to fresh water to mitigate wide spread corrosion and blockages in piping and nozzles that lead to activation issues. No records or drawings from either the ship operator or class society of the changeover and necessary retrofitting required for this change were found.

Figure 20. Overall photograph of water drencher system control station.

The three garage decks were separated into multiple specific zones. Each zone had a dedicated valve that had to be manually opened to start the flow of water to that zone. The drench zone layout and the protected areas are listed below.

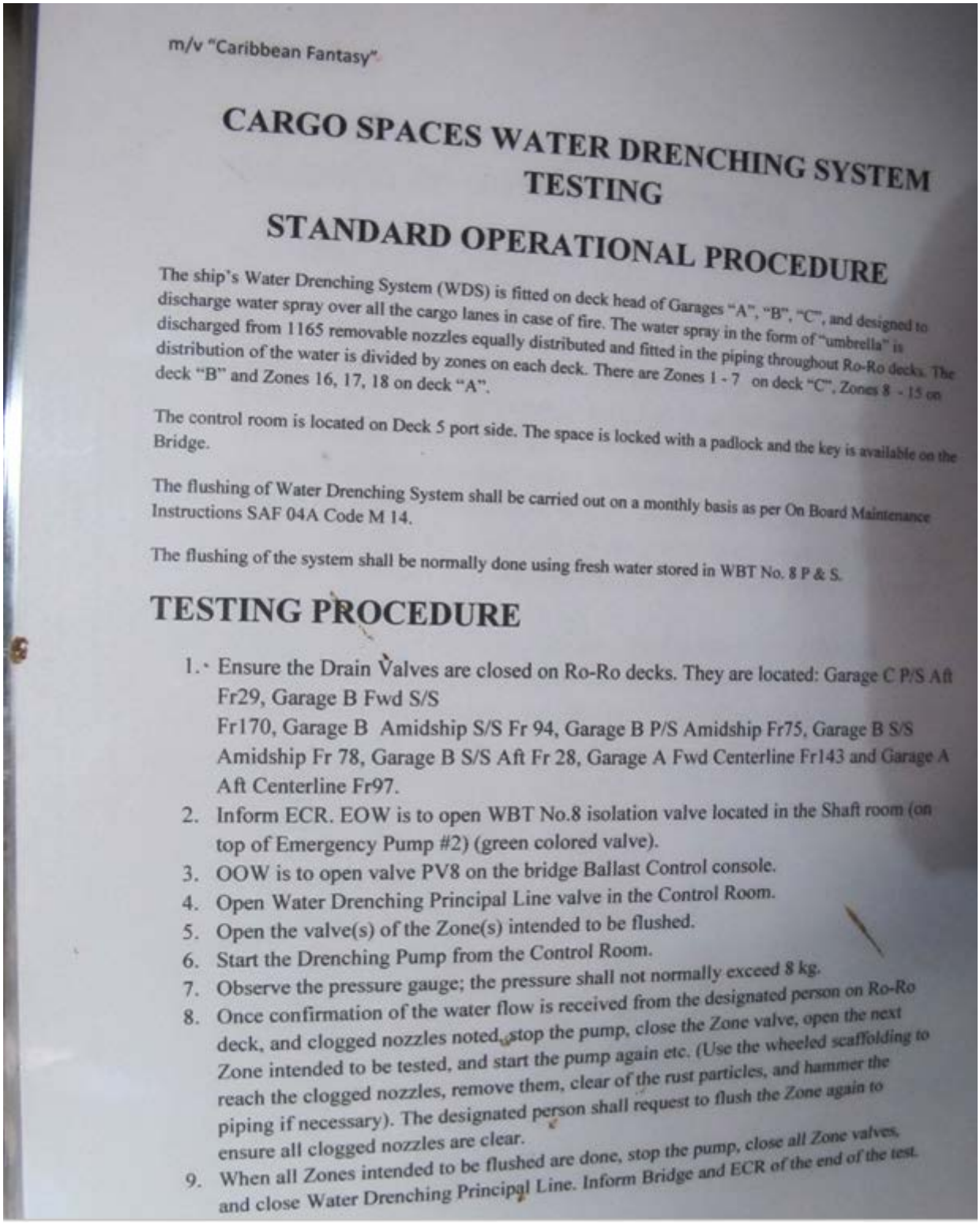
Garage C:
Zone 1 (Frames 166–185)
Zone 2 (Frames 141–166)
Zone 3 (Frames 116–141)
Zone 4 (Frames 91–116)
Zone 5 (Frames 66-91)
Zone 6 (Frames 41–66)
Zone 7 (Frames 12–41)

Garage B:

Zone 8 (Frames 175–206)
Zone 9 (Frames 150–175)
Zone 10 (Frames 125–150)
Zone 11 (Frames 100–125)
Zone 12 (Frames 74–100)
Zone 13 (Frames 49–74)
Zone 14 (Frames 24–49)
Zone 15 (Frames AD–24)

Garage A:
Zone 16 (Frames 137–163)
Zone 17 (Frames 110–137)
Zone 18 (Frames 83–110)

Testing procedure and instructions were posted in the drencher activation station (as shown in Figure 21); emergency operation instructions were the same as the testing procedure/instructions. The instructions were specifically for a testing procedure designed to keep the piping and nozzles free from debris. The system was tested weekly while dockside during the overnight stay in Santo Domingo, Dominican Republic. The drencher system on board the Caribbean Fantasy was known to have problems with corrosion and blockages in pipes from its sea water suction design which warranted inspection and flushing of the system on a weekly interval.



m/v "Caribbean Fantasy"

CARGO SPACES WATER DRENCHING SYSTEM TESTING

STANDARD OPERATIONAL PROCEDURE

The ship's Water Drenching System (WDS) is fitted on deck head of Garages "A", "B", "C", and designed to discharge water spray over all the cargo lanes in case of fire. The water spray in the form of "umbrella" is discharged from 1165 removable nozzles equally distributed and fitted in the piping throughout Ro-Ro decks. The distribution of the water is divided by zones on each deck. There are Zones 1 - 7 on deck "C", Zones 8 - 15 on deck "B" and Zones 16, 17, 18 on deck "A".

The control room is located on Deck 5 port side. The space is locked with a padlock and the key is available on the Bridge.

The flushing of Water Drenching System shall be carried out on a monthly basis as per On Board Maintenance Instructions SAF 04A Code M 14.

The flushing of the system shall be normally done using fresh water stored in WBT No. 8 P & S.

TESTING PROCEDURE

1. Ensure the Drain Valves are closed on Ro-Ro decks. They are located: Garage C P/S Aft Fr29, Garage B Fwd S/S Fr170, Garage B Amidship S/S Fr 94, Garage B P/S Amidship Fr75, Garage B S/S Amidship Fr 78, Garage B S/S Aft Fr 28, Garage A Fwd Centerline Fr143 and Garage A Aft Centerline Fr97.
2. Inform ECR. EOW is to open WBT No.8 isolation valve located in the Shaft room (on top of Emergency Pump #2) (green colored valve).
3. OOW is to open valve PV8 on the bridge Ballast Control console.
4. Open Water Drenching Principal Line valve in the Control Room.
5. Open the valve(s) of the Zone(s) intended to be flushed.
6. Start the Drenching Pump from the Control Room.
7. Observe the pressure gauge; the pressure shall not normally exceed 8 kg.
8. Once confirmation of the water flow is received from the designated person on Ro-Ro deck, and clogged nozzles noted, stop the pump, close the Zone valve, open the next Zone intended to be tested, and start the pump again etc. (Use the wheeled scaffolding to reach the clogged nozzles, remove them, clear of the rust particles, and hammer the piping if necessary). The designated person shall request to flush the Zone again to ensure all clogged nozzles are clear.
9. When all Zones intended to be flushed are done, stop the pump, close all Zone valves, and close Water Drenching Principal Line. Inform Bridge and ECR of the end of the test.

Figure 21. Photograph of water drencher system testing/operating procedure.

This system was tested August 9, 2016, during a US Coast Guard Port State Control inspection. Thirteen nozzles were found to be missing, but replacement nozzles were found and installed while inspectors were still on board. No other issues were found during this inspection.[13] Investigators were informed that many of the brass replacement nozzles were stolen during a shipyard period at CMR Tunisia ship repairs shipyard in Menzel Bourguiba/Bizerte, Tunisia from March 26 to July 3, 2016.

f. Fire Main System

Two main fire pumps were located on deck 2 in the auxiliary engine room. The emergency fire pump was located on deck 2 in the A/C compressor room and was electrically connected to both the main and emergency generators. The fire mains were located on deck 5. Fire hydrant and hose stations were located throughout the ship.

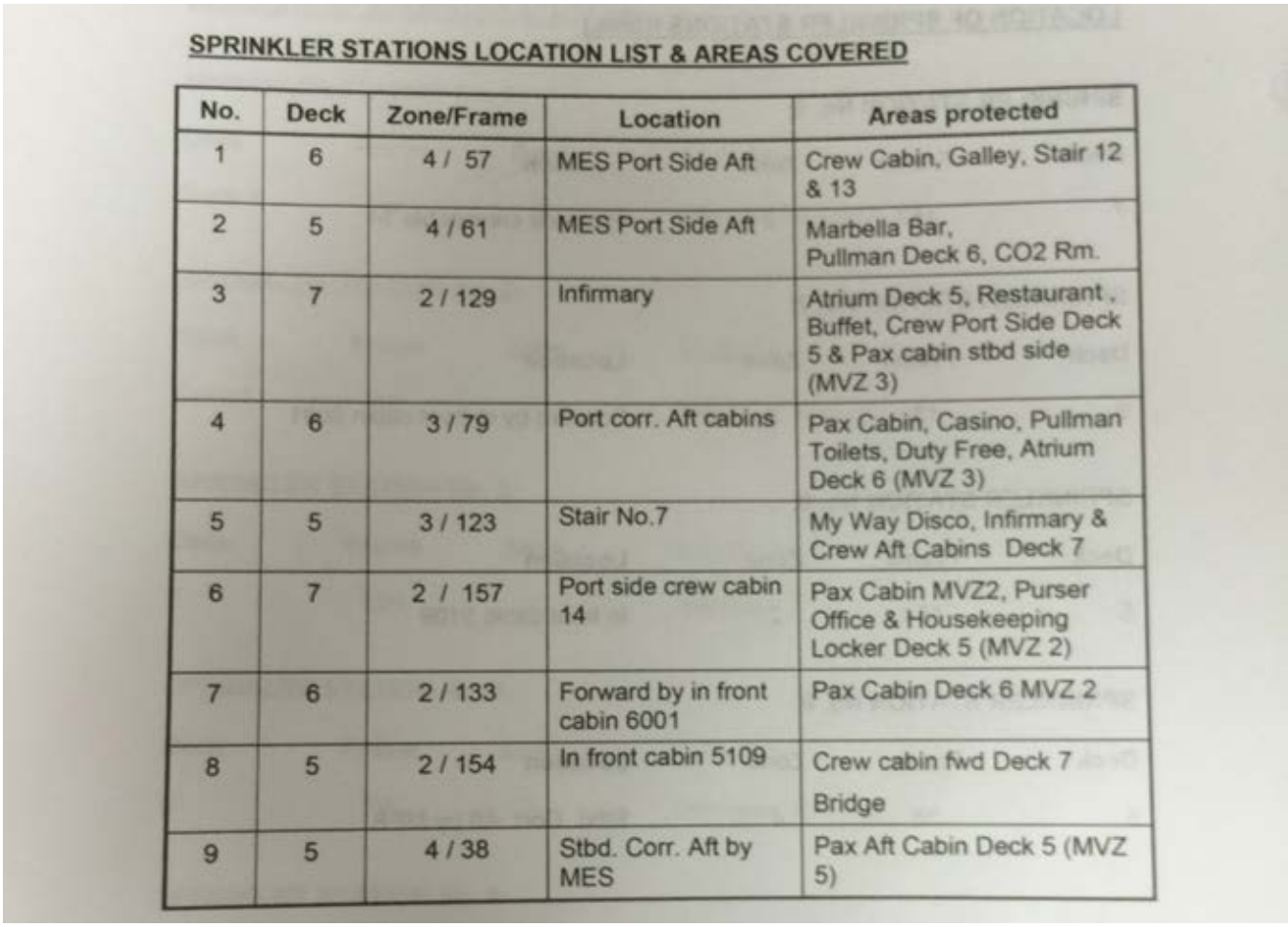
In July 2016, when the ship was docked in Cadiz, Spain, for repairs, surveyors from the vessel's classification society, RINA Services, found during an inspection that the fire main was not permanently pressurized as required by SOLAS II-2 Regulation 10.2.1.2.1.1. due to the absence of a relevant jockey pump. According to Baja Ferries, the jockey pump was installed during the repair stop in Cadiz.

g. Sprinkler System

A Minimax water sprinkler system was installed in all accommodation areas (corridors, cabins, offices, store, paint locker, and public areas), the CO_2 station, and in all the stairwells. The system was not originally required when the ship was built because it was constructed in accordance to SOLAS 1974 requirements. According to the system drawings posted on the sprinkler skid, the system was installed in 1999, as required by the SOLAS Retroactive Fire Safety Amendments (RFSA).

The sprinkler system skid was located on deck 1 in the forward machinery and equipment room. The skid included the riser and pump as well as a fresh water tank. Additional water was supplied by the main fresh water tanks. The sprinkler activation alarm panel was located on the bridge. There were 9 sprinkler station/zones as shown in Figure 21. Each zone had a physical station where sectional valves for that zone were located.

[13] During past inspections, there had been a consistent problem with clogged nozzles. This continued even after the system was reportedly changed over to fresh water as shown in the weekly testing log.



SPRINKLER STATIONS LOCATION LIST & AREAS COVERED

No.	Deck	Zone/Frame	Location	Areas protected
1	6	4 / 57	MES Port Side Aft	Crew Cabin, Galley, Stair 12 & 13
2	5	4 / 61	MES Port Side Aft	Marbella Bar, Pullman Deck 6, CO2 Rm.
3	7	2 / 129	Infirmary	Atrium Deck 5, Restaurant , Buffet, Crew Port Side Deck 5 & Pax cabin stbd side (MVZ 3)
4	6	3 / 79	Port corr. Aft cabins	Pax Cabin, Casino, Pullman Toilets, Duty Free, Atrium Deck 6 (MVZ 3)
5	5	3 / 123	Stair No.7	My Way Disco, Infirmary & Crew Aft Cabins Deck 7
6	7	2 / 157	Port side crew cabin 14	Pax Cabin MVZ2, Purser Office & Housekeeping Locker Deck 5 (MVZ 2)
7	6	2 / 133	Forward by in front cabin 6001	Pax Cabin Deck 6 MVZ 2
8	5	2 / 154	In front cabin 5109	Crew cabin fwd Deck 7 Bridge
9	5	4 / 38	Stbd. Corr. Aft by MES	Pax Aft Cabin Deck 5 (MVZ 5)

Figure 3. Photograph of sprinkler station locations and descriptions.

5. Fuel and Fuel System Information

The emergency shutoff panel was located in stairwell no. 5 between decks 3 and 4. The panel contained the pneumatic valve that shuts down ventilation to the engine room, and the spring-driven quick-closing valves (QVCs) that initiate the remote shutdown for the fuel and lubrication oil supply.

The fuel bunker stations were located on deck 3 (garage B) on both port and starboard sides at frames 70 and 69, respectively.

Due to the ship's location within an emission control area (ECA), the main engines were using marine diesel fuel at the time of the fire. This was confirmed in interviews with the engineering crew members.

The most recent leak occurred a week prior to the accident on the fuel supply line to the starboard main engine.[14]

6. Firefighting Equipment

There were five firefighting lockers. Firefighting station no. 1 was located on deck 7. Firefighting station no. 2 was located on deck 6. Firefighting stations nos. 3, 4, and 5 were located on deck 5. Each locker contained a variety of firefighting equipment. A complete listing of the equipment in each locker is provided in Appendix A. According to the ship's emergency plan and station bill, there were two main fire squads on the ship. Fire squad no. 1 was a seven-person team, four of which had self-contained breathing apparatuses (SCBAs) and was led by a second officer. This team was responsible for firefighting in accommodation spaces. Fire squad no. 2 was a six-person team, three of which had SCBAs, and was led by a second engineer. This team was responsible for firefighting in engineering spaces. Fire squad no. 1 got their equipment from fire station no. 3, while fire squad no. 2 got their equipment from fire station no. 2.

C. FIRE EVENT TIMELINE

On the morning of August 17, the *Caribbean Fantasy* was approaching the pilot station at the entrance of the port of San Juan for a scheduled 0730 local time pick up of the harbor pilot. Below in the main engine room, the watch third engineer, motorman, and wiper were on duty. Both the motorman and wiper were carrying out normal rounds and tasks in the engine room, and the third engineer was in the ECR preparing for the arrival into San Juan. The chief engineer stated that he arrived in the ECR just before 0700 in advance of the arrival.

Between 0715 and 0720, the motorman and the wiper discovered a fuel leak coming from the port main engine near cylinder no. 8 and the engine's turbo charger. The motorman ran to the ECR and informed the chief engineer of the leak. The chief engineer went with the motorman and, upon observing the leak, went back to the ECR to inform the bridge that there was a fuel leak and that the port engine needed to be stopped. The master informed the chief engineer that they were five minutes away from the pilot station. After hanging up, the master stated, "reduce the speed." The chief engineer took local control of the propulsion and reduced the pitch on the port main engine. He then left the ECR to return to the location where the source of the leak was discovered. The leak turned into a fuel spray. Once there, he observed the fuel spray ignite from contact with a hot surface starting a fire. Both the chief engineer and motorman, who were on the port side of the engine, ran back to the ECR, while the wiper, who was on the starboard side of the engine, evacuated the space via watertight door number 5 (Frame 54 centerline) which led into the auxiliary engine room aft. From there, he exited via stairs to the deck above, garage B, two decks above. According to the chief engineer, when he got to the ECR, he manually activated the water-mist firefighting system. The third engineer called the bridge to inform them

[14] The gaskets removed from the fuel flange blinds were tested at the NTSB Materials Laboratory. The results of that testing are found in Materials Laboratory Report 17-053.

of the fire, while at the same time he stopped the fuel oil supply and boost pumps. The third engineer then pulled both propulsion levers to zero pitch from the console in the ECR.

At 0725, the deck cadet on the bridge answered the call from ECR. The cadet informed the bridge team that there was a fire in the engine room. Immediately after, numerous audible alarms sounded on the bridge. The master stated he asked the staff captain to go below to check on the situation. Both the staff captain and the safety officer departed the bridge.

At 0727, the master gave the order to announce, "Mr. Skylight" and stop the engines. "Mr. Skylight" was an announcement that was made to the crew via the ship's public address (PA) system that activated the ship's firefighting and response teams. The announcement for Mr. Skylight included the instruction "staging area garage A." meaning that all fire response teams should stage themselves in garage A (deck 2) to await further instructions from the ship's safety officer. Numerous alarms continued to sound on the bridge.

At 0729, the master was informed by phone that the engine room was being evacuated. In response, the master ordered that the ECR activate "hi-fog."[15] Right after the call, the master informed the San Juan pilot station via VHF radio of the fire in the engine room and that he was preparing to evacuate the passengers. While the master was on the radio requesting assistance from the pilot station, the second officer used the ship's internal radio to inform the safety officer they needed to know when all persons were evacuated from the engine in order to release the CO_2 system.

Meanwhile, the smoke, heat, and flames were increasing in the main engine room. In the ECR, the chief engineer, third engineer, and motorman were unable to account for the wiper, not knowing he had exited via the aft auxiliary engine room. The chief engineer took an emergency escape breathing device (EEBD) and tried to enter the engine room from the ECR, but was unable to enter the space because of the heat and smoke. The third engineer recalled seeing the water mist system panel had power to it, but, because of the lack of visibility due to the heavy smoke, he was unable to see any water mist through the engine room window in the ECR.

The staff captain arrived in the ECR, where he witnessed the fire on top of the port main engine through the ECR window. During his interview, he stated that he saw that the flames were touching the ceiling of the engine room and that the smoke and heat was "violent." The staff captain said that he informed the master by radio that there was a "big fire" in the engine room and he recommended that CO_2 be released, however because the chief engineer was still unable to account for the wiper, he recommended not to release CO_2 until confirmation could be made. The staff captain departed the ECR and went to the CO_2 station in garage B (deck 3) aft on the port side to await further instructions.

[15] Hi-Fog® is the name of a high-pressure water-mist fixed fire-protection system manufactured by Marioff Oy. The crew of the *Caribbean Fantasy* referred to their water mist system as "hi-fog" even though the system onboard was built by another manufacturer.

Fire response team members began to arrive at the staging area in garage A, where they met the safety officer. The safety officer stated that she had fire squad no. 1 open water tight door (WTD) no. 3, which separated the garage from the main engine room. Upon opening the door, they observed a significant amount of smoke inside the engine room. The smoke began to enter garage A, so she ordered the fire squad to close the door and pull back. Recognizing that it was not possible to fight the fire from garage A (deck 2), she ordered the fire response teams to the main stairway on the starboard side and onto garage B (deck 3) directly above. Garage B was also beginning to fill with smoke, so the safety officer established garage C (deck 4) forward as the staging area for the fire teams.

From garage C, the safety officer directed fire squad no. 2 to conduct boundary cooling one deck below in garage B. However, according to fire team member interviews, the hoses were never charged. The SO tried to call the chief engineer on the radio to confirm that the engine room was evacuated but could not get a response. Concerned about this, she donned a self-contained breathing apparatus (SCBA) and together with fire squad no. 1 proceeded aft toward the port side stairs in garage C that led to the engine room. She recalled that they were not able to make it to the engine room because of the smoke and heat.

The chief engineer, motorman, and third engineer evacuated the ECR by way of the port side stairway adjacent to and forward of the ECR. All noted the smoke and heat was intense. At the top of the stairway, on a platform which led out to Garage B (the vehicle deck above the engine room), the chief engineer went to the emergency shutdown panel and opened the pneumatic valve on the panel. This action should have shut down ventilation to the engine room and closed eight spring-driven quick-closing valves (QVCs) for the fuel and lubrication oil supply. After activating the pneumatic valve, the chief engineer continued up the stairs and escaped to garage C (deck 4). The third engineer stated that he was the last person to evacuate and that he was overcome by the smoke and heat that he had inhaled. At 0732, the chief engineer announced on the ship's internal radio to the command center on the bridge that everyone was out of the ECR. The second officer on the bridge responded that they needed to be sure that everyone was out.

Once in garage C, the chief engineer was able to obtain an SCBA from fire squad no. 1. After donning the SCBA, he tried to re-enter the engine room, by way of the same stairway, to confirm everyone was out of the space, including the wiper, who he did not see evacuate. He was not able to make it down the stairs because of the intense smoke and heat. While on the stairway, he opened the refilling valve for the air reservoir for the QCV and ventilation shut downs as an assurance that there would be adequate air supply for everything to close. He then exited to garage B.

While on garage B, he met some members of the fire team and was informed that the wiper was out of the engine space. For about 2 minutes, communications continued with both the safety officer and the staff captain regarding confirmation of the engine room evacuation and the closing of fire dampers. The safety officer requested all fire doors for the MVZ4 and MVZ5 be closed to

prevent smoke. The bridge responded that they would close all vertical zones and sound the general alarm. At 0733, the staff captain reported that he was at the CO_2 station.

At approximately 0736, the chief engineer confirmed to the bridge that all persons were out of the engine room. Upon hearing that, the master gave the order to release CO_2. The staff captain, who was at the CO_2 station in garage B, complied by operating the two valves needed to activate the alarm and the system. At 0737, the staff captain informed the bridge by radio that CO_2 had been released. The staff captain remained at the CO_2 station and was joined by the chief engineer shortly thereafter. The staff captain verified that he heard the CO_2 bottles discharge, and he and the chief engineer noted frost on the valves and piping (a common indicator of movement of gas through discharge lines). Both then departed the CO_2 station. Both the safety officer and staff captain communicated to the bridge that there was a high concentration of smoke present in both garages B and C (decks 3 and 4, respectively). The safety officer announced to the command center that she had relocated the staging area to Garage C forward due to the smoke at 0738 and directed fire no. 1, fire squad no. 2, and the boundary cooling team to that location.

At 0740, the bridge command center requested that the boundary cooling be conducted in garage B directly above the engine room. The staff captain replied that there was “too much smoke in garage B and C” and requested to open the forward main ramp/door to clear the smoke out. The master denied this request as he did not want to add wind and air to the car deck. None of the boundary cooling teams had SCBAs or fire protective equipment, and thus they were unable to access the area in garage B above the engine room.

At 0741, Coast Guard Sector San Juan contacted the *Caribbean Fantasy* on VHF channel 16 and requested that they change frequency to channel 22A. Before switching stations, the second officer on the bridge reported to the Coast Guard that there was fire in the engine room, that CO_2 had been released, and that the vessel was not under command just north of the entrance to San Juan harbor.

At 0742, the master, concerned about the smoke in the garages, asked the staff captain if he thought activating the garage drencher system would help, to which the staff captain replied the “drencher was empty; almost finished.” The master requested the drencher for garage B be activated. The staff captain went to the drencher room on deck 5 port side aft, near the crew mess, where he was met by the third officer who had been directed by the safety officer to that station. About a minute later, a security guard, who had been standing by at the starboard side pilot door ready to embark the pilot, called the bridge and informed them there was a fire near the starboard side pilot door located in garage B midship.

For about four minutes, between 0744 and 0748, there were multiple radio calls to the command center on the bridge from various personnel and teams throughout the ship. During that time, none of the calls were answered or acknowledged. At 0745, one of the second officers radioed the bridge in a second attempt to report heavy smoke on the port and starboard sides of deck 5 aft, which were the crew accommodation and one of the main passenger areas. At 0746, the

master began announcements to passengers informing them of the fire and to directing them to following the instructions of the crew and report to muster stations.
At 0747, the safety officer relayed information that there was smoke in garage B and that there was oil coming from the port side bunker station on that same deck, again with no response from the bridge. The medical team also checked in, but the call was unanswered. At the time the radio calls went unanswered, the master, second officer, and cadet were occupied with communications with the Coast Guard and announcements to the passengers.

At 0750, the safety officer, speaking through an SCBA, reported to the bridge command center that there was a “big explosion” in garage B. The master requested to know if the drencher was working. The staff captain replied that he had started the pump but could not verify that it was working. The safety officer then reported that there was “nothing coming in garage B”. About two minutes later, the chief engineer called the master on the radio and confirmed the drencher system was working. The staff captain told investigators that he opened the valves for all of garage A and garage B.

Following a radio exchange with the CG, the master asked the safety officer if the fire was under control. She replied there were three big explosions and oil in garage B. The master then asked to continue with the drencher system.

At approximately 0801, the master announced, “Stop the drencher.” This was passed to the safety officer, who stated she would stop it. When later asked by investigators why he had ordered the drencher to be stopped, he recalled that the vessel was starting to list to port. He said he was concerned with the amount of water on the car decks and its effect on the ships stability. The wind at the time was on the starboard beam of the ship which induced a list to port. As a result, the water from the drencher pooled at the listed port side of the garages.

The chief engineer arrived on the bridge at 0814 and began to brief the master about the status of the fire in the engine room. The master asked if the fire was out. The chief engineer told him that he stopped everything and the engine was stopped, but he could not confirm if the fire was out. The chief engineer told the master he saw the leak. The master, who had been busy with managing the evacuation, told the chief engineer to stop talking and then redirected his attention back to ordering the launching of liferafts and the preparation of lifeboat no. 3.

At 0817, a power interruption, due to the transition from main to emergency power, on the bridge triggered the activation of numerous alarms.

At 0822, the master was informed that the garages were still full of smoke. After receiving the report, he called the Coast Guard Sector San Juan on VHF channel 16 to inform them that his crew was unable to control the fire and that he was sending the passengers off the ship. The pilot boat, still next to the ship, relayed the message to the Coast Guard small boats in the area.

By 0842, other response vessels and aviation assets arrived on scene. These included a boat from Customs and Border Protection (CBP), two police boats, five tugboats, a boat from the fire department, a Marine Spill Response Corporation (MSRC) boat, a second pilot boat, and good Samaritan vessels. In addition to the Coast Guard small response boats, a 55-foot aids to navigation (ATON) boat (CG 55115) arrived on scene. Two Coast Guard MH-65 Dolphin helicopters from Air Station Borinquen, Puerto Rico, and a Fuerzas Unidas de Rapida Acción (United Forces of Rapid Action—FURA) Bell 429 from Isla Grande airport in San Juan were also on scene. Between 0840 to 0925, a total 14 persons boarded the vessel with SCBAs and personnel protective equipment including shore-based firefighters, a Puerto Rico police rescue unit, and Puerto Rico Emergency Management Agency (PREMA) personnel.

Once on board, the firefighters and shore-based personnel staged themselves near the emergency diesel generator room on the starboard side of the ship on deck 7 forward. According to one of the firefighters interviewed, on at least two occasions, firefighters made attempts to gain access to the engine room. The chief engineer was asked to accompany the firefighters since he was most familiar with the location of the fire and how to get around the ship. On the first access attempt, a firefighter reported seeing fire when on the way down to the engine room. Given the conditions of visibility, there was no confirmation as to where exactly the fire was sighted though. During the second access attempt, the firefighter explained that they were able to make it down about two decks via a stairway near the galley on deck 5 but were then forced back because of the smoke and heat. The firefighter also noted that smoke conditions in the accommodation spaces required them to wear SCBA during the second attempt. The smoke in the accommodation spaces was black in color but was not so dense as to affect visibility. The master informed investigators that he did not authorize, nor was he aware of, the landing of shore-based firefighters and first responders on board. Coast Guard command center personnel were also unaware of the placement of the shore-based three fire teams on board. According to the captain of the port (COTP) for sector San Juan, he learned of this only after speaking to the fire chief when they were at the pier 6, the site that was determined to be the location to receive passengers and crew from the ship.

The Coast Guard fast response cutter (FRC) *Joseph Tezanos* (CG1118) was dispatched from Sector San Juan with orders for the commanding officer to act as search and rescue on-scene coordinator (OSC).[16] The vessel got under way at 0830 and arrived on scene at 0850 (according to the vessel's log). Although the crew logged that the cutter's commanding officer assumed duties as OSC, no one from the cutter or Sector San Juan announced this to the *Caribbean Fantasy*'s master or other vessels in the area. The *Joseph Tezanos* was equipped with a pan, tilt, and zoom camera that was manned by a cutter crewmember during the vessel's time on scene. At 0858, the camera captured thick black smoke coming from the stacks of the ship.

[16] The *OSC* is a person designated to coordinate search and rescue operations within a specified area. The OSC should be the most capable person available, taking into consideration SAR training, communications capabilities, and the length of time that the unit the OSC is aboard can stay in the search area. Source: International Maritime Organization (IMO), *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual*, Resolution A.894(2), 29 November, 1999.

During the vessel's time on scene, the camera recorded other events that helped investigators determine the facts and timeline of on-scene activities. [17].

The fire continued to burn on the *Caribbean Fantasy* throughout the evacuation of the ship. The intense heat generated by the fire caused paint on the both sides of the ship to blister and eventually burn off. On the starboard side of the ship, above the waterline and forward of the MES, large pieces of paint burned and fell from the ship and into the water. The engine casings extending from the engine room to the stacks were also subject to this intense heat from the fire and paint began to burn, blister and fall away. Although close to the MES, none of the pieces of paint that fell touched the slide, platform, or any of the liferafts.

About 1030, the master informed the *Joseph Tezanos* that the last of the passengers had been evacuated from the ship. He then coordinated with the safety officer and staff captain to release the crew from their stations. Video from the cutter showed the last person coming down the slide at 1104. The remaining persons arriving at the MES platform were recovered directly by Coast Guard, CBP, and good Samaritan vessels and brought to pier 6. Once the starboard MES was no longer manned, the platform and slide drifted away from the ship, which allowed a tugboat and firefighting vessel to spray the ship's side to cool the burning areas.

Five crewmembers remained on board the *Caribbean Fantasy*: the master, the staff captain, the safety officer, the chief engineer, and the chief electrician after everyone else was evacuated. The *Joseph Tezanos* requested that all remaining persons leave the ship, but the master responded that the shore-based firefighters were still on board and they had requested that the chief engineer and chief electrician remain behind to help with firefighting efforts. He stated it was his wish to remain on board with the shore-based firefighters and his crew accompanying them. He was told by the *Joseph Tezanos* that everybody needed to be off the ship and the cutter did not have any means to get in contact with the shore-based firefighters. At 1150, the master replied that he would try to reach the firefighters, but they were down in the engine room. The master was able to contact the chief engineer and firefighters, and he ordered them to the helicopter deck. The captain also proceeded to the helicopter deck, and once there he reported to the *Joseph Tezanos* that he had all remaining crew and they were ready for evacuation. At about 1224, a police helicopter landed on deck and picked up the remaining five crew, leaving the shore-based firefighters behind. The master stated that he did not want to leave the ship considering there were about 10 firefighters were still on board but said that he understood from the cutter that he had to disembark. After transporting the crew to the airport, the police helicopter returned to the *Caribbean Fantasy* to pick up the shore-based firefighters, making two separate trips. All persons were off the ship just before 1300.

From approximately 1300 on August 17 through 1512 on August 18, the damage to the port side hull in the area near the bunker station door, as shown in Figure 23-25, progressed as follows[18]:

[17] For more information on the evacuation of the vessel, see the Operation Group Chairman's factual report.
[18] These times were based on time-stamped photographs taken during the towing operation.

- 1308 8/17/2016-Port bunker station shell door shows no signs of damage (Figure 23).
- 2119 8/17/2016-Flames visible through shell of bunker door station (Figure 24).
- 1512 8/18/2016-Bunker station door paint missing, penetration through hull; soot around bunker station door (Figure 25).

Figure 23. Photograph of port side of ship at 1308 on 8/17/16. No hull damage shown. Paint starting to discolor forward of bunker stations door.

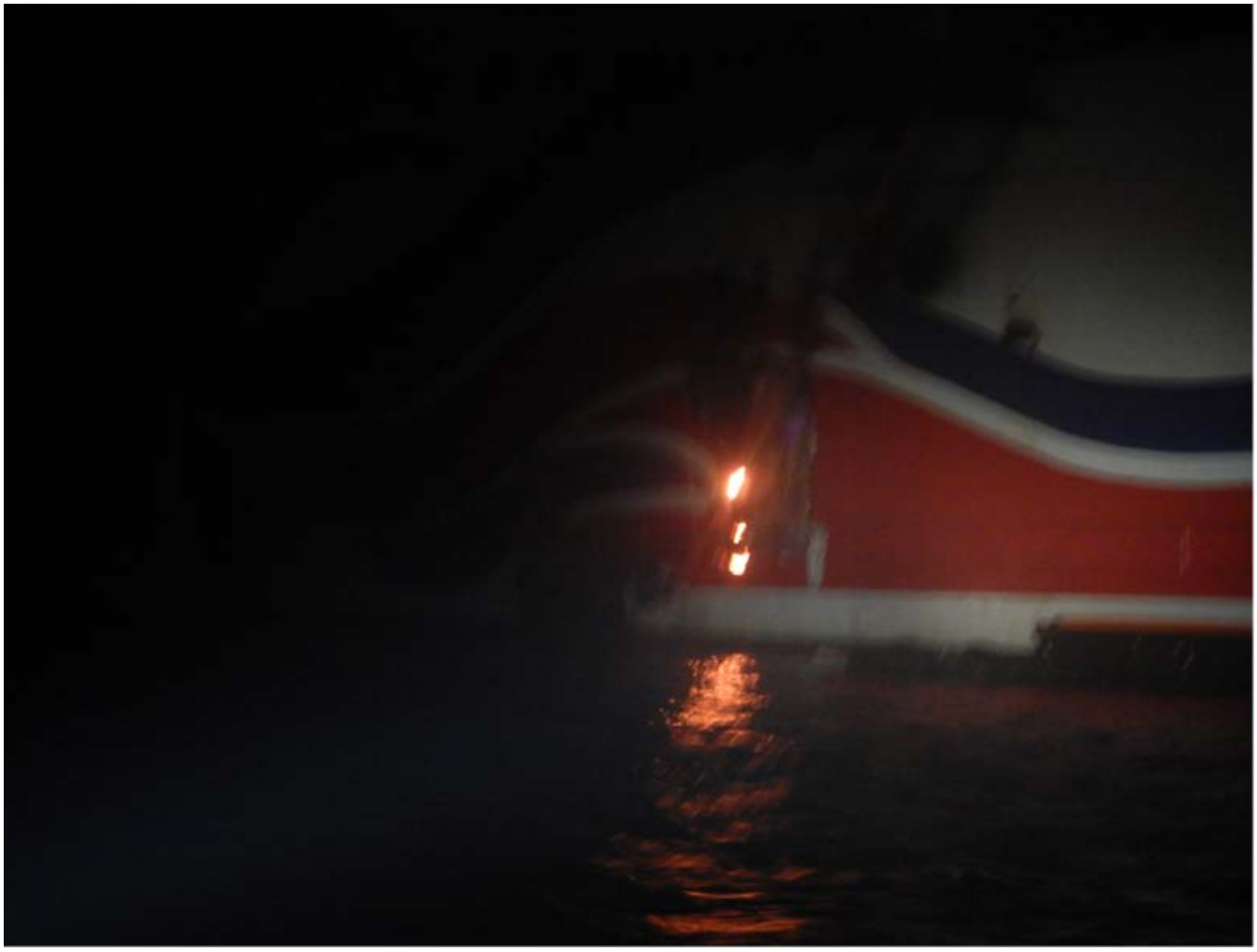


Figure 24. Photograph of port side of ship at 2119 on 8/16/17. Flames are visible through the shell of the bunker station door.

Figure 4. Photograph of port side of ship at 1512 on 8/18/16. Paint on bunker station door has burned away.

The Caribbean Fantasy remained aground, still on fire, until August 20 when it was towed into port and moored alongside pier 15 in San Juan Harbor. Once the ship was alongside the pier at 1600, the Coast Guard captain of the port (COTP) granted permission for the salvage company fire team to enter the main engine room to extinguish the fire. At 1700, the first fire team entered the main engine room to attack the fire. The first team made an initial assessment of the scene and found the only open flame remaining involved the port side lube oil tank. Between 1720 and 1730, a second team of fire fighters were exchanged for the first team. The teams extinguished the port side lube oil tank by utilizing water fog provided by a hand-held 1½ inch fire hose and Vari-nozzle.

The water was supplied from the harbor by the local San Juan Engine/Pump Truck, which was prepositioned on pier 15 at the request of the salvage team prior to arrival of the ship. At 1800, the fire was declared fully extinguished.

D. WRECKAGE/FIRE DAMAGE

1. Exterior hull

The exterior hull exhibited thermal related damage in areas adjacent to the engine casings (both port and starboard) and the main engine room. These areas exhibited blistered and burned paint with large areas of missing paint[19]. The damage extended from the level of the upper engine room up the entire height of the engine casing/exhaust stack. The damage to the exterior both port and starboard is shown in Figures 26 and 27. There was also exterior hull damage around frame 70 in the area of the port fuel bunker station.

Figure 26. Photograph of starboard side of ship on August 19. Smoke can be seen coming from the exhaust stacks on the upper deck.

[19] Paint discolors approximately 250-400°F and begins to blister (bubble and peel) around 350-400 °F. These ranges are dependent on many factors including exposure time, flame vs radiant heat, paint type and layers of paint present. (*Engineering Analysis of Fires and Explosions*. Randall K. Noon, CRC Press, 1995).

Figure 27. Photograph of port side of ship while being towed into San Juan harbor on August 20. Smoke can be seen coming from the exhaust stacks on the upper deck.

According to a class survey completed after the fire, the following damage was found:

- The starboard side shell plating had slight deformations/indentation between frames 68–79, and from 500 mm up to 2.5m above the water-line. The deformations/indentations measured approximately 25–50 mm at the deepest part. The frames appeared to be intact and with no visible fractures in the plating, when inspected from outboard side.
- Port side shell plating showed some deformations 25–30 mm maximum, between frames. 65–69 around 500 mm, above the water line.
- Additional side shell plating deformations were found between frames 65–70 above port bunker station door. There was deformation in plating around 25–30 mm.
- On the bottom plate, divers found a fracture near a longitudinal weld seam at the Keel plate between frames 60–61. The fracture was within the ring cofferdam that surrounded the main engines. The fracture measured approximately 584 mm long with 25 mm opening in the middle.

2. Main Engine Room

The upper main engine room sustained heavy fire damage. All exposed surfaces exhibited charring of paint and heavy sooting. The upper surface of both engines exhibited missing paint and thermal related oxidation of the metal underneath. An area of clean burn was evident on the port engine exhaust manifold. A photograph of the upper level of the engine room is shown in Figure 28.

Figure 28. Overall photograph of upper deck of main engine room looking from forward to aft. The port main engine is on the right of the photograph. The starboard main engine is on the left.

According to the class survey report, the upper deck longitudinals, located over the aft portion of the port main engine, were deformed but intact. The transverse deck girders 6–8 (counting from aft watertight bulkhead at frame 54) were deformed but intact. The upper portion of the forward transverse watertight bulkhead (port side) at frame 83 was deformed from deck 2 to deck 10 longitudinally. This damage was approximately 2 meters long with a maximum depth of deformation approximately 35–40 mm.

The aft bulkhead of the portside lube oil storage tank, which was integral with the watertight bulkhead at frame 83, was thermally deformed. Deformations continued along the aft bulkhead (approximately 2.5 meters).

There was evidence of charred material on several large electrical cables located overhead in the main engine room. The material appearance was similar to intumescent coating.[20] There were no records of this coating being placed on the overhead cables.

The lower main engine room exhibited heavy sooting with some burned areas due to drop down debris burning. Otherwise, the lower level was relatively undamaged. A photograph of the lower engine room is shown in Figure 29.

Figure 29. Photograph of portion of lower engine room.

Watertight door no. 6 (aft engine room to auxiliary engine room) door was found open during the initial on scene examination. The door was sooted and the sooting pattern extended on to the

[20] Intumescent coating is a passive thermal protective substance that is either painted or sprayed on surfaces such as electrical cables. The coating expands and chars in the presence of heat. The char is a poor conductor of heat and slows the transfer of heat to the surface underneath, providing limited thermal protection.

frame on the door frame interior on the auxiliary engine room side. The fire patterns on the door and doorframe, as shown in Figure 30, were consistent with the door being left opened at some point during the fire.

Figure 30. Photograph of watertight door 6 (facing aft into auxiliary engine room).

a. Fuel Supply Pipe End Flange and Blanking Plate

According to the engineering crewmembers present at the time of the fire's ignition, the port main engine fuel oil supply pipe was leaking at the end flange that was capped with a blanking plate. The end flange, located on the aft end of the engine near the exhaust manifold, was heavily sooted and was still covered with fuel after the fire was extinguished. A photograph of this flange and blanking plate is shown in Figure 31. The end flange, blanking plate, and a section of fuel supply pipe were removed and sent to the NTSB Materials Laboratory for further examination.[21]

Figure 31. Photograph of flange on fuel supply line for portside main engine.

[21] For further information, refer to NTSB Materials Laboratory Report 17-008 (fuel flange examination), NTSB Materials Laboratory Report 17-053 (Gasket examination), and Group Chairman's Factual Report - Engineering for more information.

3. Auxiliary Engine Room (Generator Room)

The auxiliary engine room, also called the generator room, was relatively undamaged. The generator equipment was undamaged and covered with a layer of soot. The bulkhead between the main engine room and the auxiliary engine room sustained heavy thermal damage. Large sections of paint were missing on the auxiliary engine room side, particularly around watertight door no. 6. The remaining paint was bubbled off the bulkhead or was hanging in large sections from the bulkhead. A photograph of the paint damage on the bulkhead is shown in Figure 32.

Figure 32. Photograph of bulkhead between main engine room and auxiliary engine room (auxiliary engine room side).

4. Garage Deck A (Deck 2 Forward of Engine Room)

There was no evidence of thermal damage on Garage Deck A. There was no sooting or evidence of smoke. There were several inches of standing water on the port side during the initial on-scene examination. The collection of water on the port side was due to the ship listing to port.

There was no evidence of broken fire main piping or hoses left open; the water appeared to be water from the drencher system. A photograph of garage A is shown in Figure 33.

Figure 33. Overall photograph of Garage Deck A (Deck 2) facing forward. Water can be seen on deck on the left side of the image.

5. Garage Deck B (Deck 3)

Garage deck B was heavily sooted over the entire length of the deck. The port side sustained more sooting and thermal damage than the starboard side. In the area located directly over the engine room, the bulkheads and decking had significant thermal damage. The decking was warped. Upper deck plating and internal structures at frame 84 were warped/pushed up approximately 150 mm. The warpage ran from the port side to the center line. Additional deformations in deck plating began on the portside near bunker station at frame 68 to about center line. A low burn pattern was located on the port bulkhead between frames 44 and 87 as shown in Figures 34 and 35.

Figure 34. Photograph of forward section of damage (approximately frames 44–55) on the port side of Garage Deck B. The left side of the photograph is aft, and the right side is forward. Frame 51 and drencher zones 13 and 14 are painted on the bulkhead.

Figure 35. Photograph of bulkhead damage on port side of Garage Deck B taken after the cargo was removed. The left of the photograph is aft and the right is forward.

There was severe fire damage in the area of the port side bunker station. Inside the garage, the station door at frame 70 was pushed out and torn off the hinges. The corresponding longitudinal bulkhead of the bunker station was outwardly deformed from frames 72 to 83. The interior had heavy thermal damage. Most of the paint was missing. The paint that remained was thermally discolored black. Aluminum components present in the locker melted. The end cap on the fuel fill pipe in the station was found missing. The damage to the interior of the station is shown in Figure 36. The shell door in the port side bunker station had its door seals burned away. The paint was burned away from the exterior of the bunker station shell door and the area above it.

Figure 36. Photograph of the interior of the port fuel bunker station. The side shell door can be seen at the left of the photograph.

Forty-three trucks and/or truck trailers were located in garage B. The cargo contained in those trailers consisted mainly of produce, plastic materials, and consumer goods. In the area over the engine room, several trailers had significant fire damage including damaged and missing tires, missing floors and warping and thermal discoloration to the containers and trailer body. According to the cargo manifest, there was no hazardous material in any of the trailers at the time of the fire.

6. Garage Deck C (Deck 4)

There was no structural deformation. There was no thermal damage other than some plastic pipes located in the overhead that melted. The entire deck and the vehicles parked on this deck were covered with soot.

7. Ventilation System

As stated above, the engine casings were located between Frames 45 and 65 on the port and starboard side. The casings started on deck 2 and rose the entire height of the ship up through the exhaust stacks. In addition to the exterior hull damage mentioned above, the stacks exhibited heavy sooting on the interior where visible. The stacks also exhibited thermal damage to the exterior paint at the top. A large portion of the paint was missing on the aft side, and the metal underneath was oxidized as shown in Figure 38.

Figure 38. Photograph of the port aft side of the exhaust stack casing.

The engine room ventilation dampers were located in the funnel. The remote shutoff for the engine room dampers was at the same location as the remote fuel pump shutoff station as mentioned above. The same pneumatic system operated both the fuel and ventilation shutoffs.

The dampers were tested during the CG inspection on August 9, 2016. Two fire dampers for Garage C (Aft D17B) would not close. According to Baja Ferries, these deficiencies was corrected.

During interviews with several members of the engineering crew, conflicting information was provided as to how the dampers closed and whose responsibility it was to secure ventilation during a fire event. Upon review of the emergency plan and station bill, investigators found that it was the responsibility of the air conditioning (AC) engineer to “cut ventilation in emergency compartment(s) when ordered to do so by the bridge.”

According to salvage workers who boarded the ship prior to investigators, several dampers were open or partially open. Several of the dampers were sooted with indication of pressurization patterns consistent with them being closed during the fire with heat and smoke escaping from the closure of the dampers. Several dampers had little or no soot. A complete description for the deck 4 dampers is found in the table below.

Damper Location	Damper/Fan Number	Fan Type	Service Zone	Post fire Damper Status	Condition
Deck 4, Frames 187–193, Port side	None shown	No fan shown	Garage B (Deck 3)	N/A	Unknown
Deck 4, Frames 163–168, Port side	D15C	Exhaust	Garage B (Deck 3)	2 dampers, both shut	No soot
Deck 4, Frames 136–141, Port side	D17C (mislabeled on FCP as D15C)	Exhaust	Garage C (Deck 4)	2 dampers, both shut	No soot
Deck 4, Frames 110–119	D15B	Exhaust	Garage B (Deck 3)	4 dampers: 1 shut, 3 ajar ~1–6 inches (FWD 2 and aft 1)	No soot
Deck 4, Frames 101–111, Port side	D17B	Exhaust	Garage C (Deck 4)	4 dampers, all shut	No soot
Deck 4, Frames 91–95, Port side	D19	Exhaust	Garage A (Deck 2)	2 dampers, all shut	No soot
Deck 4, Frames 90, Port side	D5	Exhaust	A/C Room (Deck 1, Centerline)	No Damper, Fan only	No soot
Deck 4, Frames 68–75, Port side	D17A	Exhaust	Garage C (Deck 4)	2 dampers–both closed	No soot
Deck 4, Frames 63–68, Port side	D15A	Exhaust	Garage B (Deck 3)	2 dampers both closed	Sooted
Deck 4, Frame 12, Port side (Stern/Mooring Deck)	D13	Supply	Garage C (Deck 4)	Vent cover open	No soot (exterior)

Damper Location	Damper/Fan Number	Fan Type	Service Zone	Post fire Damper Status	Condition
Deck 4, Frames 9–11, Port side (Stern/Mooring Deck)	D9 & D10	Supply	Garage B (Deck 3)	Fan status unknown	Unknown
Deck 4, Frames 12, Starboard side	D6 (mislabeled on FCP as D15C)	Supply	Garage C (Deck 4)	Fan status unknown	Exterior sooted
Deck 4, Frames 63–68, Starboard side	D14A	Supply	Garage B (Deck 3)	Fan status unknown	Exterior sooted
Deck 4, Frames 68–75, Starboard side	D16A	Supply	Garage C (Deck 4)	3 dampers, all shut	No soot
Deck 4, Frames 83–93, Starboard side	D14B	Supply	Garage B (Deck 3)	3 dampers, all shut	No soot
Deck 4, Frames 129–136, Starboard side	D16B	Supply	Garage C (Deck 4)	Unknown	Exterior of vents sooted (high exhaust louvers over D14C)
Deck 4, Frames 143–150, Starboard side	D14C	Supply	Garage B (Deck 3)	3 Dampers, all shut	No soot
Deck 4, Frames 153–155, Starboard side	No symbol, no damper, fan only	Undetermined	Aux. Machinery Space (Deck 1, centerline)	No damper, fan only	N/A
Deck 4, Frames 158–163, Starboard side	D18	Supply	Garage A (Deck 2)	2 dampers, both shut	No soot
Deck 4, Frames 163–168, Starboard side	D16C	Exhaust	Garage C (Deck 4)	2 dampers, both shut	No soot

Damper Location	Damper/Fan Number	Fan Type	Service Zone	Post fire Damper Status	Condition
Deck 4, Frames 197, Starboard side, FWD Mooring Deck	D4	Supply	Bow Thruster Room (Deck 2)	Unknown	Unknown
Deck 4, Frames 196, Starboard/ Centerline, FWD Mooring Deck	D7	Exhaust	Garage B/C (Deck 3/4)		
Deck 4, Frames 196, Port/Centerline, FWD Mooring Deck	D8	Exhaust	Garage B/C (Deck 3/4)		
Deck 4, Frames 196, Port side, FWD Mooring Deck	D12	Exhaust	Garage B/C (Deck 3/4)		

8. Carbon Dioxide (CO_2) Fire Suppression System Station

The outer door to the CO_2 station was heavily sooted on the exterior surface that faced the garage area. The interior surface that faced into the space was sooted as well. There was a little soot in the doorframe, but the level indicated that the door had been closed for almost the entire fire event.

The space was sooted but there was no other thermal damage to the space. The hatch between the upper and lower level was heavily sooted on the underside but the upper side was only lightly coated indicative of the hatch being open during the fire. There was a waxy residue present on several of the bottles and hoses on this level. Laboratory examination determined this material was some type of anti-corrosion product.[22]

The lower level was heavily sooted and there was little evidence of thermal damage. However, three of the four sprinkler heads in this space were missing their glass bulbs. Standing water on the floor of the lower level indicates that these sprinklers activated at some point during the event. The light fixtures at ceiling level were intact and sooted but showed no evidence of thermal damage. Several of the cylinders and hoses in this space were covered in the waxy

[22]See NTSB Materials Laboratory Report 17-054 for more information.

residue similar to that observed on the upper level cylinders. A random sampling of connections was tested by hand to assess connection tightness. No loose connections were found. The actuating sectional valve had been found in the open position by the salvage employees. The pilot actuating valve (Valve “B”) was also found open by the salvage workers. The solenoids responsible for isolating the engine rooms and generator room ventilation had actuated.

9. CO_2 Actuation

During his interview, the Staff Captain stated that he entered the CO_2 room from Garage B and actuated the firefighting system by following the directions in the pilot cabinet.

All the bottles in the main CO_2 room were weighed to determine if they were empty. All the bottle weights indicated that the cylinders were empty of gas. This is indicative that the system fully actuated during the event.

10. Water Mist System Actuation

The Chief Engineer stated during his interview that he actuated the water mist system by pushing the actuation button located on the control panel in the ECR. In addition, several smoke detectors alarmed during the event which also would have activated the system.

According to the pressure gauges on the system skid, the water mist system also activated in the following areas: Main Engine #2, Main Engine #1, Fuel Booster #1, Generator #3, and Generator #2. These activations were verified on the alarm activations on the VDR.

The Chief Engineer stated in his interview that the panel in the ECR was in “MANUAL” before the fire. This could not be confirmed as the switch position was unmarked on the panel.

VDR data plots show that the smoke detector labeled ALARM ZONE 007 ENGINE PORT SUPERIOR was in a “fault” status and was likely not functional at the time of the fire.

11. Water Deluge System

According to the First Engineer, he was tasked with actuating the drencher system on deck 3 (Garage Deck B).

The post-event status for each zone is listed below.

Garage C:
Zone 1 Closed
Zone 2 Open
Zone 3 Closed
Zone 4 Closed
Zone 5 Closed

Zone 6 Closed
Zone 7 Closed

Garage B:
Zone 8 Open
Zone 9 Open
Zone 10 Open
Zone 11 Open
Zone 12 Open
Zone 13 Open
Zone 14 Open
Zone 15 Open

Garage A:
Zone 16 Open
Zone 17 Open
Zone 18 Open

12. Water Sprinkler Actuation

In addition to the sprinkler actuation in the CO_2 room, several other sprinklers heads were found actuated in various areas of the ship. Sprinklers heads in stairwell no. 5 were missing the bulb indicating that these sprinkler heads had activated.

13. Fresh Water Tank

The designated fresh water tanks, tanks 8 starboard and port, were sounded post-accident and were found to be nearly empty. Water had been bunkered when the ship was last in port at San Juan.

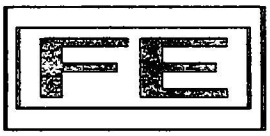
14. Firefighting Equipment

Fireman's outfits and SCBAs were found scattered throughout various parts of the ship. Several firefighting hoses were found deployed but showed no signs that the hoses had been charged and there was no evidence of a firefighting effort. This was confirmed by the Safety Officer (the on-scene commander), who stated that she ordered both fire squads to boundary cool in garage B but had them evacuate to garage C because of the high concentration of smoke in garage B. The abandon ship order came before any further firefighting or boundary cooling efforts were able to commence.

Nancy B. McAtee
Fire and Explosion Specialist

Appendix A

Fire Station Equipment Inventories



#1

FIRE STATION EQUIPMENT INVENTORY

ON BOARD	QTY	FIRE PLAN	QTY
Fireman Laminated Outfit (coverall & Pants & Jacket, helmet & gloves)	4	Fireman outfit	4
Rubber Boots	15	Rubber boots	16
Rubber Gloves	15	Rubber gloves	14
Safety Helmets	18	Safety helmets	26
Safety Flashlight	0	Safety flashlight	3
Axes (Large)	12	Fireman axes	16
BA Sets	3	B.A.	3
Dry Powder Fire Extinguishers	24	Portable powder extinguisher	23
CO2 Fire Extinguishers	10	CO2 extinguisher	11
Emergency bags with tools, torch, el. rubber gloves & safety belt,high visible vests	11	Emergency bag (tools, torch, rubber gloves, safety belt, highly visible vest)	11
Electrical tool boxes , gloves, torch,safety belts,wedges	2	Electrical tools box	2
Life Line (20 m) w/Fast Release Hook (4 manila & 1 Henequen)	5	Life line	5
Water Fog applicator	9	Water fog applicator	10
Mask Spasciani	9	Breathing mask	7
EEBD spare boxes and safe crash glass	2	EEBD (spare boxes/safe crash glass)	2
Gas Mask 3M with spare filters	3	Gas mask 3M with spare filters	3
Spare BA Cylinders for Spaciani sets	8	Spare B.A. cylinders sets	7
Crawbar	7	Crowbar	7
Hoods neck	2	Hoods necks	2
Hoods overhead	2	Hoods overhead	3
Fire blankets	2	Fire blankets	2
Shields for fireman's helmet spare	7	Spare shields for fireman's helmet	8
Various fireman's helmets	7	Fireman helmets	6
Various fireman's outfit gloves	10	Fireman outfit gloves	7
EEBD (4-2017 / 5-2027)	3	EEBD	3
chemical absorbent pads (2boxes 50padsx2)	79	Chemical absorbent pads (2 boxes 50 pads*2)	2
metal cutter	1	Metal cutter	1
Fire Helmet	12		

#2

FIRE STATION EQUIPMENT INVENTORY

ON BOARD	QTY	FIRE PLAN	QTY
Protective clothing (4 Orange & 1 Laminated Pants&Jacket)	5	Protective clothing	5
Pair of rubber boots	5	Pair of rubber boots	5
Pair of rubber gloves	5	Pair of rubber gloves	5
Rigit helmets	6	Rigit helmets	5
Electric safety lamps	4	Electric safety lamps	4
Fireman's axes (small)	4	Fireman's axes	4
Breathing apparatus of aproved type	4	Breathing apparatus of aproved type	4
Spare cylinders	8	Spare cylinders	8
Life Line (20 m)	4	Safety ropes with breathing apparatus connection	4
Water Fog	4	Water fog applicator	4
Fire extinguishers dry powder (6kg)	7	Fire extinguishers dry powder (6kg)	7
Fire extinguisher CO2 5kg	1	Fire extinguisher CO2 5kg	1

#3

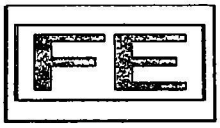
FIRE STATION EQUIPMENT INVENTORY

ON BOARD	QTY	FIRE PLAN	QTY
Protective clothing	6	Protective clothing	6
Pair of boots (4 rubber + 2 laminated)	4	Pair of rubber boots	6
Pair of gloves(4 rubber + 2 laminated)	6	Pair of rubber gloves	6
Rigit helmets	10	Rigit helmets	7
Electric safety lamps	4	Electric safety lamps	4
Fireman's axes (small)	4	Fireman's axes	4
Breathing apparatus of aproved type	4	Breathing apparatus of aproved type	4
Spare cylinders	16	Spare cylinders	16
Life Line (20 m)	5	Life Line (20 m)	4
Water Fog	2	Water fog applicator	2
Fire Extinguishers dry powder 6 kg	13	Fire Extinguishers dry powder 6 kg	14
Fire Extinguishers CO2 5 kg	2	Fire Extinguishers CO2 5 kg	2

4

FIRE STATION EQUIPMENT INVENTORY

ON BOARD	QTY	FIRE PLAN	QTY
Protective clothing	4	Protective clothing	4
Pair of boots	4	Pair of rubber boots	4
Pair of gloves	4	Pair of rubber gloves	4
Fire Protective helmets	4	Rigit helmets	4
Electric safety lamps	3	Electric safety lamps	3
Fireman's axes	3	Fireman's axes	3
Breathing apparatus of aproved type	3	Breathing apparatus of aproved type	3
Spare cylinders	7	Spare cylinders	7
Life Line (20 m) manila	3	Life Line (20 m) manila	3
Water fog applicator	1	Water fog applicator	1
Fire extinguisher Dry powder	2	Fire extinguisher Dry powder	8
Fire extinguisher CO2	3	Fire extinguisher CO2	3
Spare Fire Hose	1	Spare Fire Hose	1



5

FIRE STATION EQUIPMENT INVENTORY

ON BOARD	QTY	FIRE PLAN	QTY
Fireman Laminated Oufit (Pants&Jacket)	3	Protective clothing	3
Pair of boots(2 laminated+1 rubber)	3	Pair of rubber boots	3
Pair of gloves(Fire protective)	3	Pair of rubber gloves	3
Fire Protective helmets	3	Rigit helmets	3
Electric safety lamps with belts	2	Electric safety lamps	2
Fireman's axes	2	Fireman's axes	2
Breathing apparatus of aproved type	2	Breathing apparatus of aproved type	2
Spare cylinders	4	Spare cylinders	4
Life Line (20 m) manila	2	Safety ropes with breathing apparatus connection	2
Water Fog	1	Water fog applicator	1
Safety Helmet	3		