National Transportation Safety Board

Office of Marine Safety

Washington, D.C. 20594

Group Chairman's Factual Report

Survival Factors

Caribbean Fantasy

DCA16FM052

March 20, 2018

1 Accident Information

Vessel: *Caribbean Fantasy*
Accident Number: DCA16FM052
Date: August 17, 2016
Time: 0725 Atlantic standard time (coordinated universal time – 4)
Location: Atlantic Ocean, 3 miles north of San Juan, Puerto Rico
18°30.1N, 66°8.0' W
Accident type: Fire
Injuries: 23

2 Survival Factors Group

Chairman: Michael B. Karr, Survival Factors Group Chairman
Office of Marine Safety
National Transportation Safety Board
Member: LT [redacted], District 7,
US Coast Guard

3 Accident Summary

See the Operations Group Factual Report for the Accident Summary.

4 Investigation

See the Operations Group Factual Report for the description of the investigation.

5 Vessel Information

See the Operations Group Factual Report for vessel information.

6 General Description of *Caribbean Fantasy* Lifesaving Appliances and Systems

The *Caribbean Fantasy*'s classification society, RINA Services, approved the vessel's Life Saving Appliances Plan on August 1, 2016, attesting that the listed equipment requirements satisfied compliance with Chapter III of SOLAS74, as amended. The vessel could carry up to 1,150 people (passengers and crew) on short international voyages and 400 people on long international voyages. Lifesaving equipment requirements included:

50-person liferafts: 23
Lifejackets on board: 1485 adult; 30 oversized lifejackets; 153 child; and 29 infant
Totally enclosed lifeboats: 1 for 70-persons (also listed on the plan as a rescue boat)
Partially enclosed lifeboats: 2 (150 persons each)
Fast rescue boat: 1

At the time of the accident, Baja Ferries operated the *Caribbean Fantasy* on short international voyages between San Juan and Santo Domingo. SOLAS defines a short international voyage as that in which a ship will not be more than 200 miles from a port or place in which the passengers and crew could be placed in safety. Neither the distance between the last port of call in the country in which the voyage begins and the final port of destination nor the return voyage shall exceed 600 miles. The final port of destination is the last port of call in the scheduled voyage at which the ship commences its return voyage to the country in which the voyage began.

7 Emergency Systems and Survival Equipment

7.1 Lifeboats

Figure 1. *Caribbean Fantasy* lifeboat no. 2 on the pier in San Juan after the accident. Canvas tarps hinged on the top of the lifeboat were designed to cover the entrances on each side of the boat.

Schat-Harding AS designed and manufactured the lifeboats and davits supplied to the *Caribbean Fantasy*. Lifeboats no. 1 and no. 2, located on the starboard and port side of the vessel, respectively, were a partially-enclosed lifeboat design, model number MPC 36 SV, constructed of glass-fiber-reinforced plastic (GRP). They were built in 1998, had a capacity of 150 persons, an overall length of 35.1 feet (10.7 m), and a beam of 14.1 feet (4.3 m). Lifeboat no. 3, located on the starboard side of the *Caribbean Fantasy*, was a fully-enclosed lifeboat design, model number KISS800C, constructed of GRP. It was built in 2003, had a capacity of 70 persons, an overall length of 27.9 feet (8.5 m), and a beam of 9.0 feet (2.75 m).

Figure 2. *Caribbean Fantasy* lifeboat no. 3. Workers prepare the lifeboat so that investigators can exercise the hook release mechanism.

Each of the *Caribbean Fantasy* lifeboats was stowed in and launched using a davit. Lifeboats no. 1 and no. 2 used Schat-Harding VIP 18 davits and lifeboat no. 3 used a VIP 1000 davit. These were gravity davits that were also fitted with winches for raising and lowering the davit arms and the lifeboats.

All lifeboat release hooks had been replaced with new "U-Hook release systems" on May 20, 2016, during a shipyard maintenance period in Tunisia. The installations were approved, witnessed, and tested by RINA. The hooks were replaced to comply SOLAS Regulation III/1.5. In May 2011, the IMO amended the SOLAS regulations for life boat release and retrieval systems based on a review of casualties that occurred during drills and inspections. Deaths and injuries had

occurred when lifeboat hooks accidentally released, during raising and lowering operations, dropping the boats with crewmembers embarked. The new hooks included a "recovery pin" for each hook at the end of each lifeboat, which prevented the hooks from inadvertently releasing when the boat was hoisted after inspections and drills. The previous hook arrangements did not include this design feature (See Attachment 3).

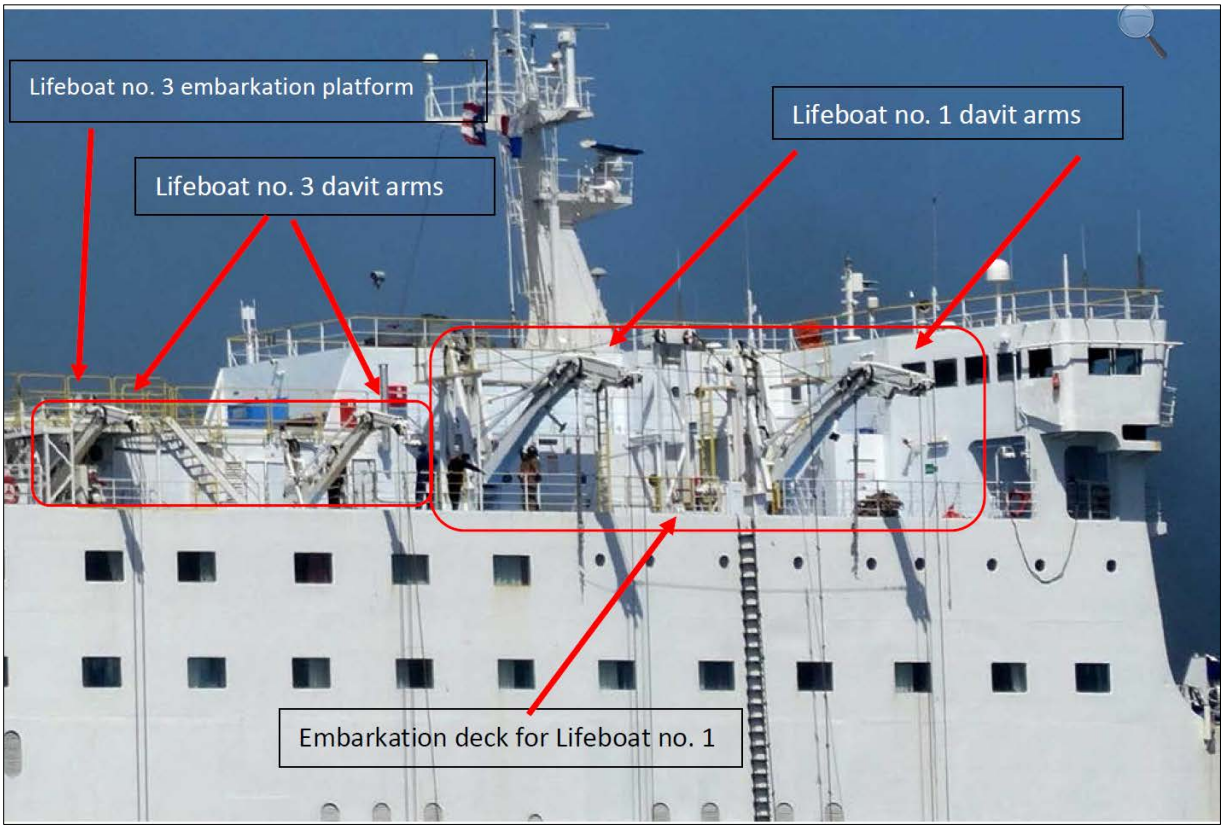

Figure 3. *Caribbean Fantasy* starboard side (Photo by Coast Guard)

All three life boats were close to accommodation and service spaces and just aft of the navigation bridge. Lifeboats no. 1 and no. 3, stowed in their davits on deck 7, were both located within muster station A. Lifeboat no. 2, also stowed on deck 7, was located within muster station B.

7.2 Liferafts and Marine Evacuation System (MES)

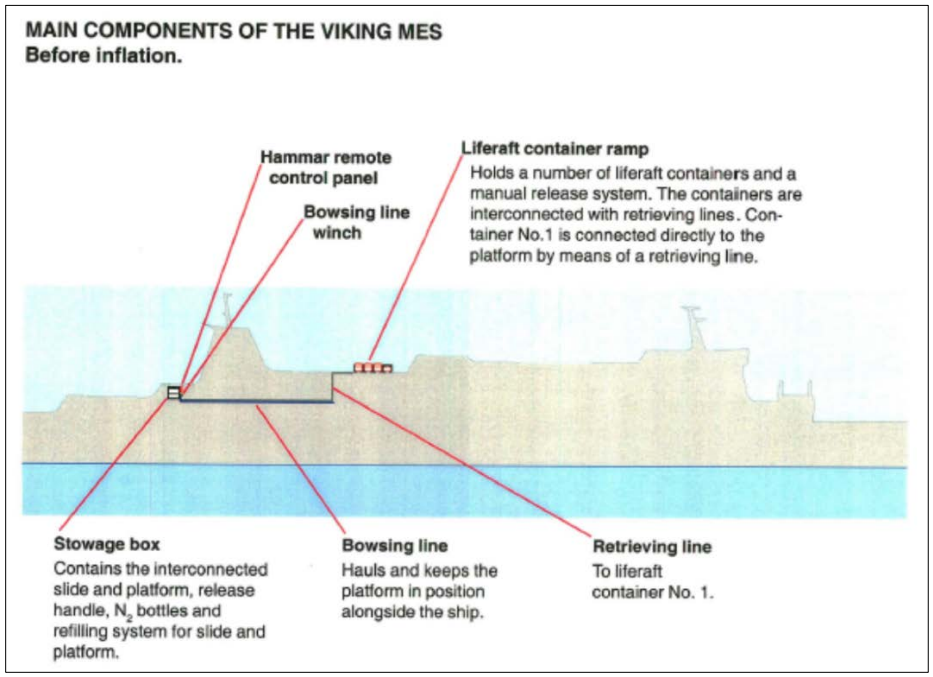

Figure 4. Main Components of the VIKING MES before inflation (Caribbean Fantasy *MES Training and Operations Manual*)

VIKING LIFE-SAVING EQUIPMENT A/S designed and manufactured the liferafts supplied to the *Caribbean Fantasy*. All were enclosed rafts, model number 50 DKS, with a capacity of 51 persons. The liferafts were integrated with VIKING marine evacuation systems (MESs; model number VES DD 25.5m 83.7-ft). The rafts, in their containers, were installed on the port and starboard sides of the vessel in reclining racks on deck 7, one deck above the MESs, with 12 associated liferafts on the port side and 11 on the starboard side (see figures 4 and 5).

Figure 5. Recovered *Caribbean Fantasy* liferafts.

As designed, an MES and associated liferaft containers were to be deployed in an emergency, with passengers and crew sliding down the MES's 83.7-foot-long (25.5-meter-long) inflatable slide to an inflated platform on the water. The rafts could be released remotely by a crew member activating a release pump mechanism from a box adjacent to the MES platform on deck 6. They were designed to be released individually starting with no.1 and upward. Should the remote release mechanism not work, there was another remote release pump mechanism at the liferaft rack, along with manual methods including a release bar at the rack or by individually releasing each raft at the securing link. The International Life-Saving Appliance Code (LSA code) requires that an MES function from the ship with a trim of up to 10° and list of up to 20°. The angle of the slide to the horizontal was to be between 30° and 35° when the ship was upright.

All liferaft containers were designed to be connected sequentially by retrieving lines, with the first raft connected to the MES platform by a retrieving line. Crewmembers assigned to the platform were to use the retrieving line to pull the first liferaft container alongside the platform, secure the container to the platform, and inflate the raft. The MES installed on the *Caribbean Fantasy* was designed to have at least two inflated liferafts alongside the platform at a time to allow for simultaneous boarding. Passengers were to board the liferafts until at capacity,

after which the liferaft was to be cut away before a crewmember pulled another raft container next to the platform. The boarding process was to continue until the evacuation was complete.[1] MES illustrations from the operator's manual are included as attachment 1. The system was designed for all people to be transferred from the ship to inflated liferafts within 30 minutes of the abandon order being given.

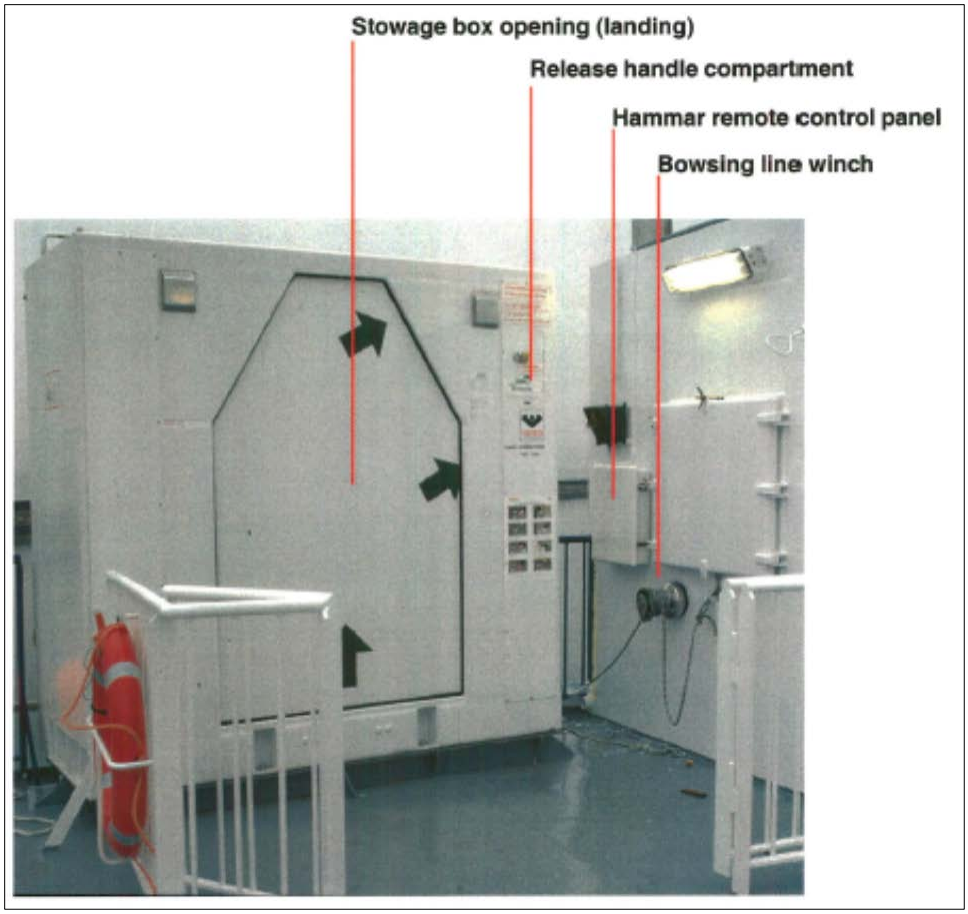

Figure 6. MES stowage box components similar to those on board the *Caribbean Fantasy*. (Caribbean Fantasy *MES Training and Operations Manual*)

[1] VIKING LIFE-SAVING EQUIPMENT A/S, *Manual, VIKING Marine Evacuation System, M/V Caribbean Fantasy*, 1999.

Figure 7. Postaccident photo of the life raft containers and storage racks for the *Caribbean Fantasy's* port side marine evacuation system.

7.3 Rescue Boat

The *Caribbean Fantasy* had one rescue boat, designed and manufactured by WaterCraft Hellas S.A., stowed on the port side of the ship. The boat, model number HELLAS FRB 6.50, was constructed of GRP and had a capacity of six persons, an overall length 20.8 feet (6.4 m), and a beam of 8.0 feet (2.4 m).

The manual for the MES described using the rescue boat to keep the MES launching area clear of any obstructions or obstacles and for hauling life rafts and/or containers to the MES platform. According to VIKING, use of the rescue boat was recommended and not mandatory. During type approval certification, a rescue boat was used to achieve the certification. VIKING noted that it was up to each company to define the use of the rescue boat within their emergency plan.

The emergency plan and station bill approved by RINA on July 3, 2016, and used by the crew during the evacuation called for the crew assigned to lifeboat no. 3 to marshal the MES liferafts. The plan did not assign anyone to the rescue boat for abandoning ship (The man-overboard section of the emergency plan included rescue boat assignments). The emergency plan

approved by RINA on February 2, 2016, included abandon ship rescue boat assignments, but the plan was not in use at the time of the accident. During the accident, the master chose to not launch the rescue boat, deciding to rely on Coast Guard small boats to assist with MES operations.

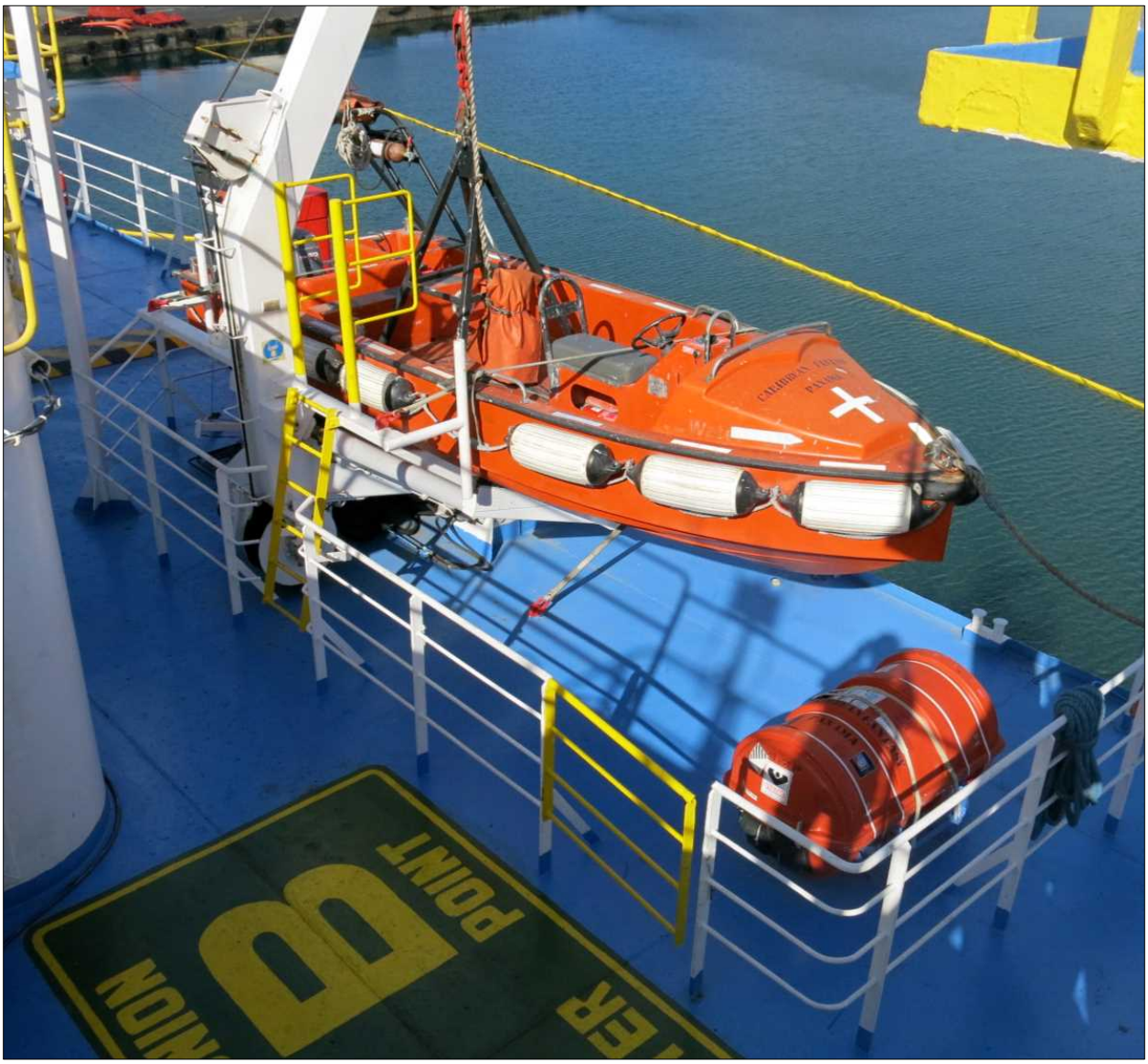

Figure 8. *Caribbean Fantasy* fast rescue boat stowed in its davit.

SOLAS regulation 21.3.2 requires passenger ships engaged on short international voyages to carry enough lifeboats and rescue boats so each can marshal no more than nine rafts. The Caribbean Fantasy had a fast rescue boat and three lifeboats for its 23 liferafts.

8 Launching Lifeboats

According to the Shipboard Emergency Organization manual, upon the announcement from the bridge of the codeword, “Mr. Skylight” from the public address system, members of the lifeboat preparation team were to immediately proceed to Deck 7 starboard side by lifeboat no.1 and to remain ready to react to orders from the bridge. The captain was to order the general alarm signal of seven short and one long blasts and then direct the lifeboat preparation team to lower the boats to the embarkation deck.

Lifeboats no. 1 and no. 2 had to be lowered to the embarkation deck from their stowed positions before passengers could enter the lifeboats. Two ordinary seaman (OS) were assigned to each lifeboat. One was responsible for seeing that the plug for the drain in the bottom of the boat was installed and that the safety pin designed to prevent the accidental release of the lifeboat was removed so that the hooks could release. The second OS was responsible for removing the lashings, preparing the lifeboat winch, and operating the winch, if necessary. After releasing the lashings, the second OS was to lower the lifeboat to the embarkation deck using the winch brake. The weight of the lifeboat and davits would cause the davit arms to descend by gravity, moving out over the side of the ship to the lowering position, and coming to rest when the upper davit arm was locked to the main davit arm. As the lifeboat was lowered to the embarkation deck, tricing/bowsing gear fitted between the main davit arm and the floating block would swing the boat into the boarding position next to the ship.

The bowsing gear also enabled the lifeboats to be loaded and launched with a severe heel or list. The International Life-Saving Appliance (LSA) code resolution MSC.48(66) regulation 4.4.1.1 requires lifeboats to be able to be launched with a heel of up to 20 degrees. SOLAS chapter III/part B/section I regulation 11.8 states, “Where necessary, means shall be provided for bringing the davit-launched survival craft against the ship’s side and holding them alongside so that persons can be safely embarked.” The bowsing gear, also known as bowsing tackle, serves to pull the lifeboat into the ship’s side at the embarkation deck from both the forward and aft davit arms and floating blocks. The pre-adjusted web straps, which are aligned by the ship’s crew and maintained in an operationally ready position, are held tight by a roller that is connected to a screw with a handle on it. If the bowsing gear is set correctly, it should hold the boat in at the ship’s side during embarkation even if there is a list of up to 20 degrees or the vessel is moving from the sea

conditions. Once alongside the ship, secured in place by the tricing/bowsing gear on each davit arm, passengers board.

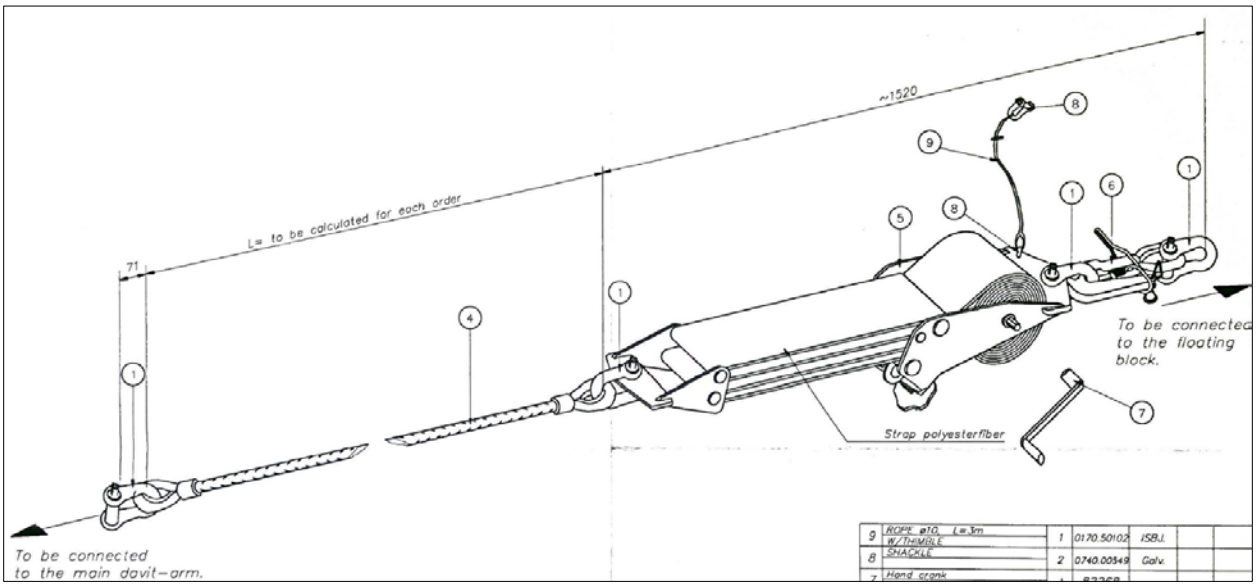

Figure 9. Tricing/Bowsing Gear. The tricing/bowsing gear limits the swing of the lifeboat as it is lowered into position (tricing) and the bowsing gear allows the apparatus to shorten, pulling the lifeboat into the side of the ship. (Schat-Harding drawing).

Once the lifeboat was at the embarkation deck, the two OSs were required to open the entrances to the boat and check the engine by operating it ahead and astern.

Two quartermasters (QM) were assigned to prepare and launch lifeboat no. 3. The first was to open the entrance to the lifeboat, make sure the lifeboat drain plugs were in place, test the engine operation ahead and astern, and to remove the lashings when it was time to launch the loaded lifeboat. The second QM prepared and operated the winch, if necessary.

Each lifeboat was fitted with mechanisms for lowering, including steel wire connected directly to the winch brake, which could be operated by pulling a handle at the stern of the boat.

Investigators noted that the procedure used by the lifeboat preparation team found in the Shipboard Emergency Organization manual and in the vessel's SOLAS Training Manual did not contain a procedure to ensure the recovery pins for the lifeboat hooks were in their stored position. However, the hook manual provided by the manufacturer to the ship included guidance to visually check to see that the recovery pins were in their stored position when preparing to lower the lifeboat.

Lifeboat no. 3 was designed to be loaded when it was in its stowed position. Occupants entered the lifeboat from a platform at the aft end of the boat through two doors (see Figure 3 and 22). Once loaded, the crew would remove the lashings and allow gravity to lower the davit arms and the boat, using the winch brake to control the speed of descent. The davit arms would move out to the lowering position and come to rest when the upper davit arm locked to the main arm. The floating blocks, with the link connected to the life boat hooks, would then release from the davit arm and lower the lifeboat. Because occupants boarded lifeboat no. 3 in its stowed position, the design of this lifeboat arrangement did not include tricing/bowsing gear.

Per the Shipboard Emergency manual, when the abandon ship signal of one long blast sounded, crew and passengers were to board the lifeboats and await the captain's orders to lower the lifeboats.

Each lifeboat was to be manned by four crewmembers serving in positions as boat commander, second commander, aft hook operator, and forward hook operator. (Additional crewmembers were assigned to the lifeboats, but not in designated positions, including the third engineer in lifeboat no. 3). Each of the lifeboat commanders were deck officers. The second commanders for lifeboats no. 1 and no. 2 were the second engineer and the first engineer, respectively and for lifeboat no. 3, the Bosun. Each of the hook operators were ratings from the deck and engine department.

Once the captain gave the order to lower the lifeboats, the crew were to slacken and then remove the tricing/bowsing gear from lifeboats no. 1 and no. 2, release the lashings from lifeboat no. 3, and lower each lifeboat to the water by operating the handle on the winch brake or from the self-lowering handle in the lifeboat. The lifeboat was connected to the davits by wire falls. At the end of the falls was a floating block with a link connected to hooks at each end of the lifeboats.

When the boat entered the water, the commander was to release the hooks, disconnecting them simultaneously from the fore and aft floating blocks. Once released, the lifeboat could move away from the side of the ship.

The manual provided by the hook manufacturer described three methods for releasing the hooks:[2]

[2] BC Service Group, *U-Hook 3 – 6 – 10 – 15 ton Operation and Maintenance Manual*, rev. 4, February 2016.

- **Normal Procedure.** As the lifeboat "touches down and becomes waterborne," a hydrostatic interlock on each hook opens. The lifeboat commander then removes the safety pin from the control unit and lifts and rotates the release handle until it stops in the open position, releasing the hooks.

- **Hydrostatic Interlock Manual Override Procedure.** If the normal procedure does not work and the lifeboat is in the water, the crew breaks a plastic glass with the safety pin and then uses it to move the hydrostatic interlock indicator from the green (closed) to the red (open) position to open the hydrostatic interlock. While holding the indicator in the red position, the lifeboat commander then lifts and rotates the release handle until it stops in the open position, releasing the hooks. This operation requires two trained crew members. One to operate the release handle and another to hold the interlock in the red position.

- **Emergency Manual Release Procedure.** If the hydrostatic interlock override procedure does not release the hooks, with the release handle in the open position crewmembers position themselves at each hook and wait for the lifeboat commander's order to use a wrench to open the hooks. A wrench, which should be located at the forward and aft hatch of the boat, is then used by a trained crew member to rotate the manual release stud on the hook mechanism. This must be done simultaneously.

If the procedures in the manual did not work, the crew could lift the gate, designed to keep the hook from releasing prematurely when the falls become slack, and then manually maneuver the falls out from under the hook. This process was dangerous and a last resort as it involved risk of injury to the operators.

9 Deploying the Marine Evacuation System

Per the Shipboard Emergency Organization manual, the MES deployment teams for the port and starboard sides were to muster on deck 5 by the MES stowage box when they heard the abandon ship signal of one long blast. They then waited for the captain's order to deploy the MES. The two teams each consisted of a slide controller, slide controller assistant, life raft operator, and three platform crew members. Five members of the MES deployment teams, assigned lifeboat launching duties, were to join their teammates once the lifeboats launched and moved away from the ship. These crew served as the port side MES slide controller, the two slide controller assistants, and a member of each platform crew.

Once the captain ordered the MES deployed, the slide controller was to pull the release handle to inflate the slide and the platform. After the MES inflated, the slide controller assistant is to take up slack and tighten the bowsing line, using the bowsing line winch, to properly position the MES as shown in figure 10. The bowsing line was a line running from the ship to the MES loading platform on the water designed to keep the MES slide and platform in position when deployed. By adjusting the line, a crewmember could place the platform and connected slide in the best position and angle to expedite evacuation. The MES *Training and Operational Manual* stated, "the slide should follow a straight line from the stowage box landing to the platform," which results in "leaving a gap of several meters between the platform and the side of the ship." The winch operator was to haul in until the slack disappeared without tightening the bowsing line "too much." No other lines were used to position the slide. The VIKING representative told investigators that the crew should have hauled in the bowsing line "immediately after launching."

With the MES slide and platform properly positioned, the slide controller was to order the platform crew down the slide. When the captain ordered the launching of the liferafts, the slide controller was to order the liferaft operator to use the Hammar remote release system, with controls located adjacent to the MES platform, to release them. If the remote release failed, the slide controller was to order the life raft operator to release the liferaft containers from the Hammar release controls adjacent to the liferafts or manually from the liferaft container ramp, one-by-one.

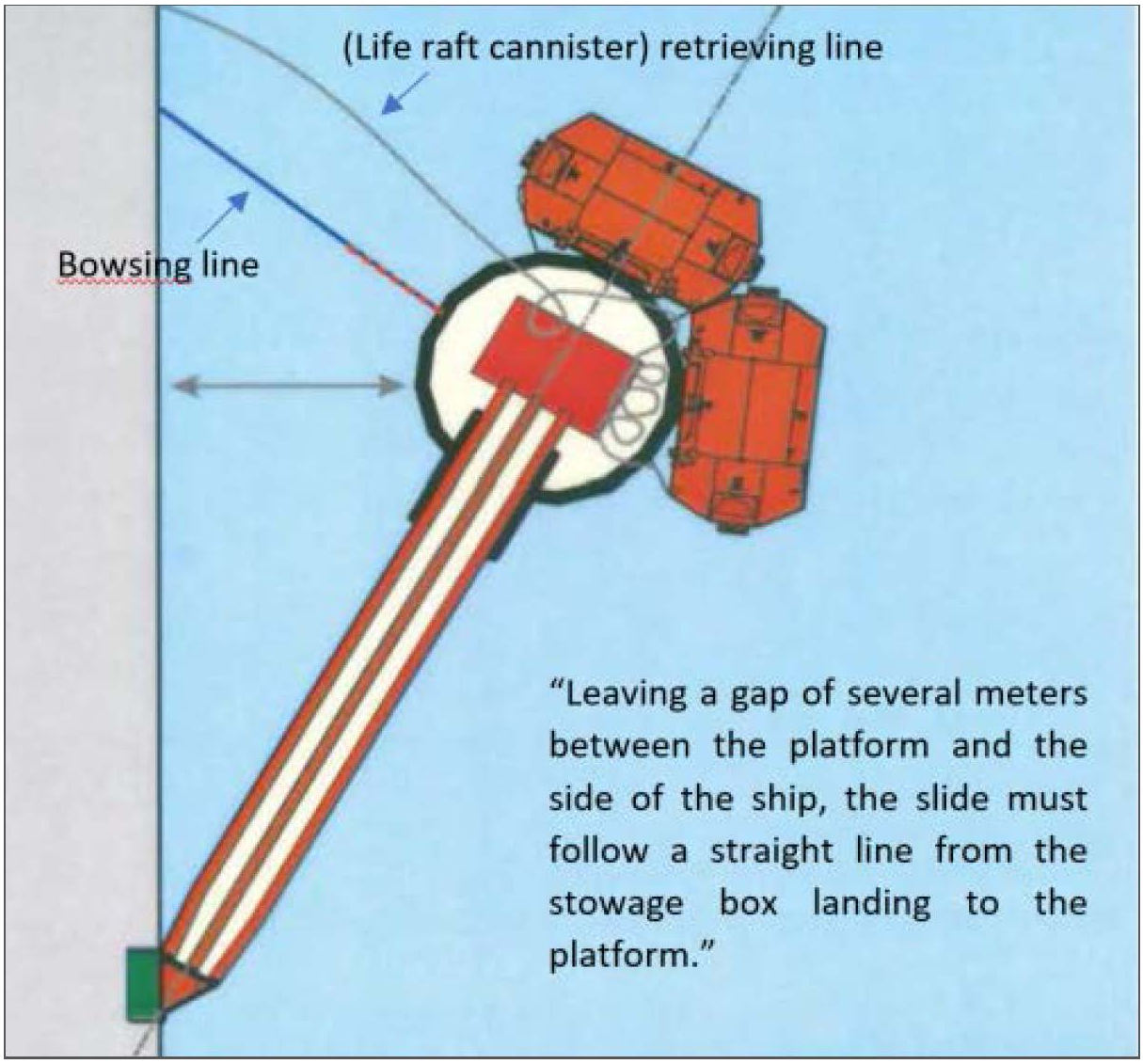

Figure 10. Correct positioning of slide and platform by means of the bowsing line winch (*Caribbean Fantasy* MES *Training and Operations Manual*)

When the first liferaft container was released, the platform crew was to use the retrieving line connected between it and the platform to haul the container to the platform, pull out lines with clips from each end of the container, clip the lines to the platform to prevent the raft from floating away, and then inflate the raft by pulling on the red quick release handle found in a holder behind a pocket on the right side of the life raft container. The platform crew was to then use the retrieving line connecting the first liferaft to the second liferaft, to haul it alongside the platform and repeat the process.

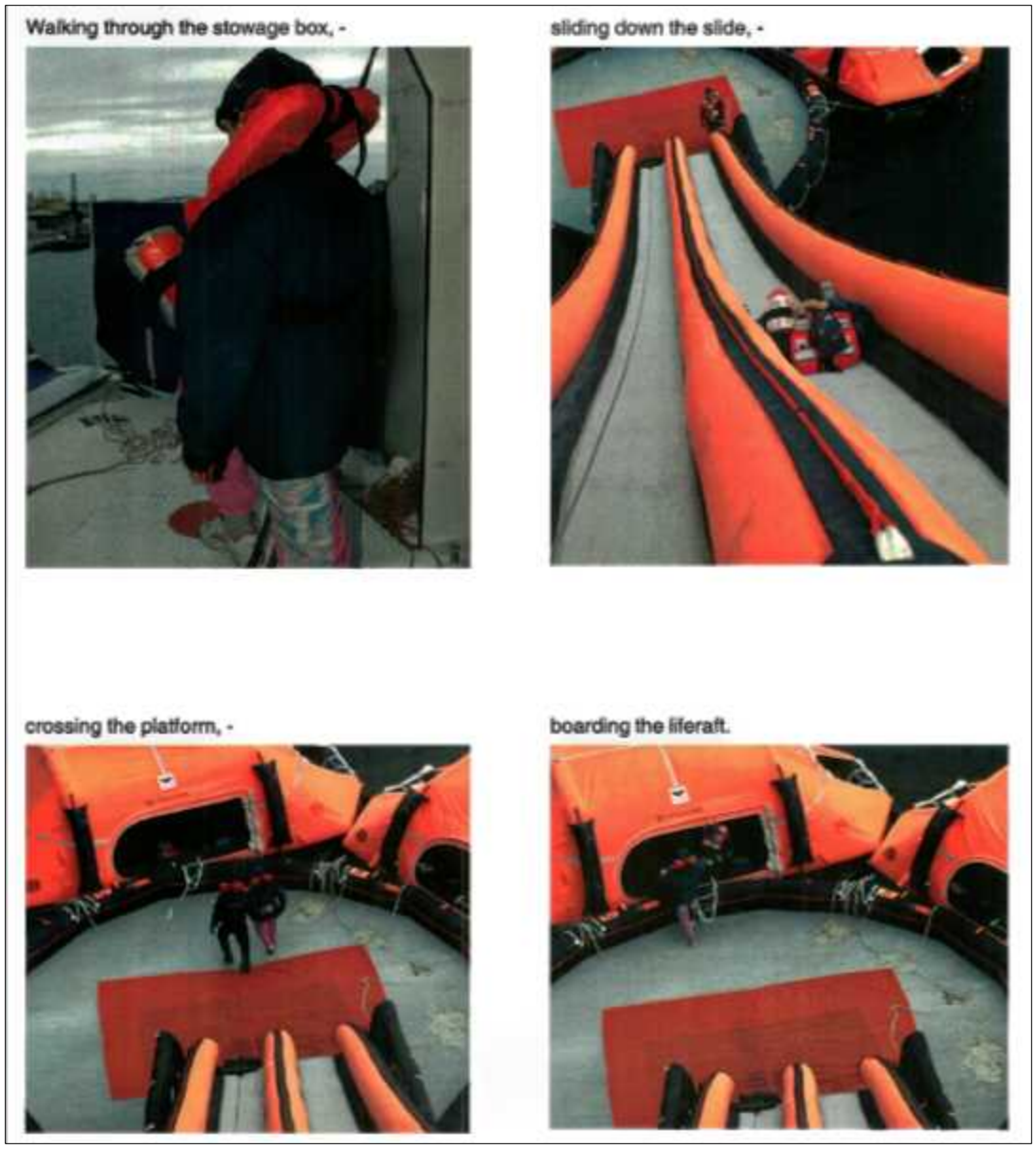

Figure 11. Photos and text from the MES *Training and Operations Manual*. Rafts pictured are the same models carried by the *Caribbean Fantasy*.

With the two rafts inflated, the slide controller was to direct people down the slide. He and the assistant slide controller were to instruct, guide, and control the passengers and crew lining up to use the slide. Passengers using the left track of the slide would use the liferaft on the left side of the platform, and passengers using the right track would use the liferaft on the right. When the passengers and crew reached the platform, the platform crew were to guide them from the end of the slide, across the platform, and into the raft. Once the raft was loaded, the platform crew was to use a knife from a sheath on the platform to cut the two lines attached to the clips that held the raft to the platform so that the raft could float away or be hauled away by lifeboat no. 3. As the loaded

raft drifted away, the platform crew was to use the second line attached to one of the two clips—the retrieving line—to haul in the next life raft container and repeat the process described above.

Once all rafts were loaded, the captain could order the slide controller to disconnect the slide from the side of the ship so that the slide and platform could serve as an over capacity floating device.

If the slide or platform lost pressure, leaked, or did not inflate fully during the evacuation, the slide controller had access to a pressure refilling control valve at the top of the slide. When actuated, the valve provided additional air pressure to individual or all components of the MES.

10 Problems Experienced with Lifeboats

During the evacuation of the Caribbean Fantasy on the accident date, the captain first wanted to launch lifeboat no. 2, but when he saw that the 2 to 4-degree port list put lifeboat no. 2 about two feet from the side of the ship at the embarkation deck, he decided not to load the lifeboat at that time. Later, the launching crew hoisted lifeboat no. 2 up and adjusted and tensioned the bowsing straps and then lowered the boat back to the embarkation deck where the gap was then reduced so the boat could be safely embarked.

When in the water, lifeboats no. 1 and no. 2 did not release from their falls as designed. Each commander resorted to the last option for releasing the hooks. That is, each hook operator lifted the gate on the hook when the falls became slack and then manually maneuvered the link attached to the block at the end of the falls out from under the hook.

Lifeboat no. 1 commander told investigators that the engine was never able to start, and seawater entered from a crack that opened on its port side from hitting the ships side when it was unable to be released from the falls. The lifeboat commander said he tried to use the hand bilge pump to remove the water from the boat, without success.

The captain ordered lifeboat no. 3 lowered to the water without its second commander (the bosun) and its engineer (the third engineer). The commander, one of two second officers on board the ship, said the hooks did not release when the lifeboat became waterborne. He and the crew members assigned to each hook could not manually release either hook as the crew did in lifeboats no. 1 and no. 2. The commander told investigators that, as they struggled to release the hooks, the waves smashed the lifeboat into the ship's side, opening cracks in the lifeboat hull. Lifeboats no.

1 and 3 were on the windward side of the ship and thus exposed to waves. Failing to release the hook, the captain ordered the lifeboat returned to the embarkation deck. However, the winch used to raise the lifeboat stopped working when the boat was about 10 feet above the sea. According to the Schat-Harding winch manual, the winch was only designed to lift a lifeboat back to the embarkation deck with a maximum of six persons inside. The lifeboat was nearly at its maximum 70-person capacity when the winch failed.

11 Problems Experienced with Port Side MES

The safety officer deployed the port side MES with assistance of the able-bodied seaman (AB) assigned as the starboard side MES slide controller when the captain ordered the MES deployed. The safety officer was not assigned to the MES team, but she later told investigators that she was near the port side MES and knew the AB and OS assigned as the port side MES slide controller and assistant slide controller were still engaged in lifeboat launching operations. Once she began the inflation, she and the AB left for the starboard side MES.

The staff captain told investigators he arrived at the port side MES as it inflated. Seeing that it did not adequately deploy, he added additional nitrogen to the slide and platform using the MES spare refill valve. The slide alignment did not improve, remaining at an angle too steep for evacuating passengers. The staff captain told investigators that he did not use the bowsing line to attempt to position the MES properly. He said using the bowsing line to stretch out the slide and bring it along the side of the ship may have corrected the slide's vertical angle. The captain then decided that the slide angle was too steep for safe use. Additionally, the captain and staff captain told investigators that they did not use the port side MES due to the risk to passengers from smoke emanating from the pilot door/bunker station on the port side of the ship in between the port side liferaft container storage racks and the MES platform. As he explained, the raft containers would have been pulled to the platform, close to the fire, and they were concerned about loading passengers into liferafts and then releasing the loaded rafts in proximity of the flames and smoke. The housekeeper, serving as one of two port side MES assistant slide controllers, arrived at the port side MES platform at the same time as the staff captain. The housekeeper told investigators he released one of the port side raft cannisters into the water.

12 Problems Experienced with Starboard Side MES

The staff captain told investigators the starboard side MES deployed well but the crew could not use the bowsing line because it was "cut." One of the ABs assisting with the starboard side MES also noted that "the line where to keep it on the ship was broken." A Coast Guard photograph of the MES taken during the evacuation show the bowsing line in two pieces, with a slack bowsing line on the starboard side of the ship (see figure 12).

Figure 12. From left to right: A piece of the bowsing line attached to the starboard side MES platform; and the rest of the bowsing line, hanging slack on the side of the *Caribbean Fantasy* (Photo by Coast Guard)

The staff captain said that they added nitrogen from the spare pressure refilling valve to overcome the effects of the wind, which was causing the slide to collapse, and sent passengers down the slide even though the side deployed with a steep angle (See figure 13). Eventually, when about 70 passengers and crew remained on board, a Coast Guard small boat crew, at the *Caribbean Fantasy* captain's request, used a line attached from the MES platform to the bow of the small boat to pull the platform forward and improve the alignment of the slide (See *Group Chairman's Factual Report - Operations* figures 14 and 16).

Figure 13. *Caribbean Fantasy* starboard side MES deployed with steep angle. Note the large opening of the lifefraft is turned away from the MES platform. (Photo by US Coast Guard)

As previously noted, all liferaft containers were designed to be released one-by-one from their storage racks on either side of the ship via the Hammar remote control panel at the MES platform. However, the housekeeper assigned as an assistant slide controller for the port side MES told investigators that the automatic release did not work on the starboard side. The housekeeper stated he released the first two containers using the Hammar release pumps located near the storage rack and the staff captain released the rest shortly thereafter, one after the other. The staff captain told investigators he manually released the containers.

Also noted previously, the liferafts were designed to be inflated by crewmembers once they were pulled alongside the MES platform. But some of the starboard side liferafts inflated early. The housekeeper said he saw four rafts inflate before being pulled to the platform, the captain and staff captain also referred to more than one raft inflating early, and a passenger took a photograph showing four empty liferafts with lines still connected to the ship (see figure 14). In addition to being manually deployed and inflated in conjunction with an MES deployment, the liferafts were also designed to automatically deploy and inflate if the vessel sank. If the vessel sank, the liferaft

container, connected to the ship by lashing straps, would be cut free by a hydrostatic release unit (HRU) and float to the surface. When the painter line, with one end connected to the sinking ship and the other connected to a CO_2 bottle valve inside the container became taut, the tension opens the CO_2 valve, inflating the raft. Shortly thereafter, the weak link connecting the raft to the rack would break so that the raft would remain on the surface.

The Hammar remote release operation at the rack cut a line to free the container and at the same time disconnected the painter from the container rack. When released manually, by using either the release bar or securing link as was done on all but two of the starboard side rafts, the painter remained attached to the rack and payed out. To prevent early inflation, the platform crew must pull the container to the platform before the raft container drifts far enough away to put tension on the painter line and prematurely inflate the raft.

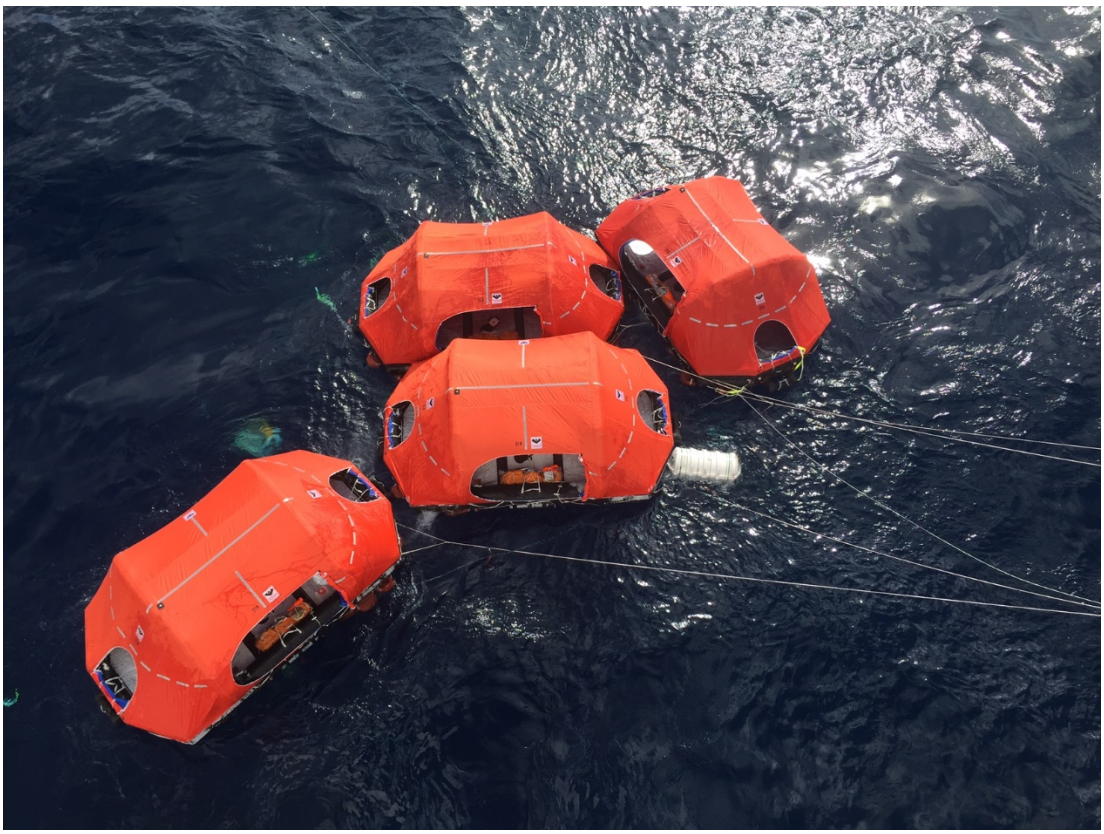

Figure 14. Inflated liferafts without passengers and a liferaft container that had not deployed. (*Caribbean Fantasy* passenger photo provided by Coast Guard)

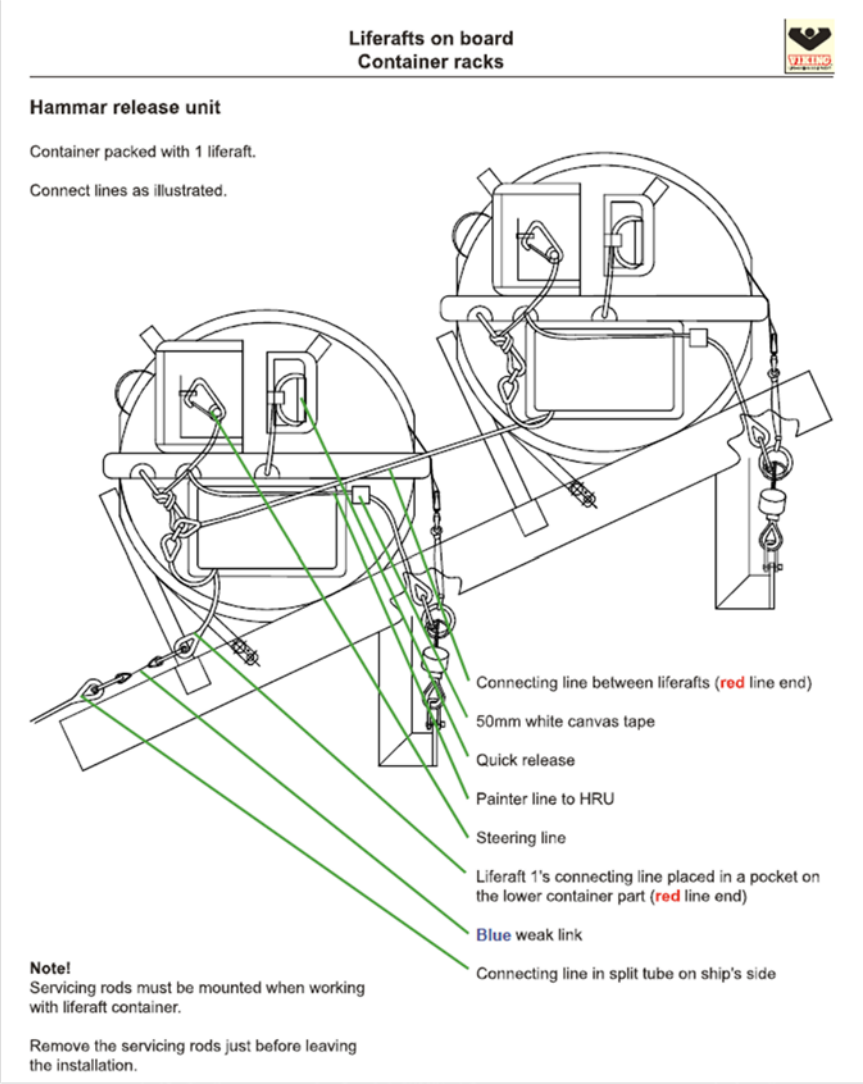

Figure 15. Excerpt from MES liferaft installation manual

After releasing two of the liferaft containers, the housekeeper went to the MES platform area. The staff captain and safety officer asked him to work as platform crew on the starboard side because the assigned platform crew had not arrived. He did so, saying he was on the platform by himself until another crewmember joined him to serve as a platform crew member. The second crewman, sent to assist the housekeeper as a platform crewman, broke his ankle using the slide on his way down to the platform. The housekeeper said pulling the inflated liferafts to the platform was significantly more difficult in the winds and seas. He and the other platform crewmember were exhausted from hauling inflated liferafts. At the request of the *Caribbean Fantasy* captain, a Coast Guard small boat assisted by pushing the inflated rafts to the platform.

The safety officer located at the MES platform, used a portable VHF radio to direct the housekeeper to serve as commander of the first raft launched from the starboard MES. People in that liferaft included the crewman with the broken ankle and 12 to 14 children. The staff captain told investigators that other crewmembers were sent to the platform to assist passengers into rafts.

Figure 16. Muster station, MES, and lifeboat locations on board the *Caribbean Fantasy.* (Photo by Coast Guard)

One of the first crewmembers down the slide ended up in the water. Another crewmember told investigators he apparently jumped in the water to avoid hitting a person on the slide in front of him.

13 Maintenance and Inspection of Lifesaving Appliances

13.1 Lifeboats

The operating company had a system in place for tracking lifesaving appliance maintenance and examinations. The system listed equipment and accompanying SOLAS examination and maintenance requirements in a table. As tasks were completed, dates would be

entered in columns in the table. The last recorded entries found by investigators were in March 2016.

The following tests and inspections were to be carried out weekly, and a SOLAS regulation required a report of the inspection to be entered in the log-book:

- All survival craft, rescue boats and launching appliances shall be visually inspected to ensure that they are ready for use. The inspection shall include, but is not limited to, the condition of hooks, their attachment to the lifeboat and the on-load release gear being properly and completely reset;
- All engines in lifeboats and rescue boats shall be run for a total period of not less than 3 minutes, provided the ambient temperature is above the minimum temperature required for starting and running the engine. During this period of time it should be demonstrated that the gear box and gear box train are engaging satisfactorily; and
- Lifeboats shall be moved from their stowed position, without any persons on board, to the extent necessary to demonstrate satisfactory operation of launching appliances, if weather and sea conditions so allow.

According to deck officers interviewed, it was the responsibility of the engine department to run the lifeboat and fast rescue boat engines on a weekly basis. Planned maintenance records from the engine department did not show any evidence of a weekly testing of lifeboat engines. Further, no record of engine checks could be found in any deck or official logbook.

On June 22, 2016, while the vessel was still at the shipyard in Tunisia, the three lifeboats and the lifeboat release hooks installed only a few days earlier were examined and tested for compliance with the SOLAS regulations by shipyard employees authorized to carry out the lifeboat statutory examinations on behalf of Panama and RINA. The Campagnie Mediterraneenne De Rearation Tunisie S. A (C.M.R. Tunisie) employees documented their findings for each lifeboat and davit in an inspection report. The report noted that the examinations and operational tests were conducted in compliance with SOLAS, specifically citing SOLAS Chapter III regulation 20.3 and 20.11 and IMO Marine Safety Committee (MSC) circular 1206, Annex 1, Appendix, Regulation 2.4. The report also included a statement, “This is to confirm that the lifeboat and lifeboat release

gear has been inspected and is ‘fit for purpose’ until the next inspection.” The report made no mention of SOLAS regulation 19, lifeboat drills.

13.2 MES and Liferafts

SOLAS regulation 20.8 required the MESs and inflatable liferafts to be serviced every 12 months and that each MES be deployed every six years. The port and starboard MESs had been serviced on October 4, 2015, and August 23, 2015, respectively. The VIKING examination report for the port MES annual service recorded a last deployment in April 2012. The report for the starboard MES recorded a last deployment of the system in April 2011. The RINA ship status report, a data base of vessel information, listed next deployment dates of April 2017 for the starboard MES and April 2018 for the port MES.

The Hammar hydrostatic release units for the liferafts were required to be serviced every 12 months in accordance with SOLAS regulation 20.9. Records showed that the units were serviced by VIKING technicians in October 2015 on board the vessel while it was in port San Juan.

The *Caribbean Fantasy* received 14 new liferafts while in the shipyard in Tunisia. All starboard side life rafts were replaced with rafts inspected for service in June 2016, except for life raft no. 21 inspected in May 2016. Port side rafts 2, 4, and 6 were replaced with new rafts inspected in June 2016. The other port side rafts were due for inspection in August 2016. On August 10, 2016, the Panama Maritime Authority issued a letter authorizing a 3-month extension of the inspection deadline for those rafts on the port side until November 18, 2016.

Because of travel warnings for Tunisia, authorized VIKING technicians did not travel to the shipyard in Tunisia to install the new rafts and integrate them into the MES system. Instead, shipyard employees who were authorized to carry out the work by the classification society installed the raft containers on the life raft racks. VIKING was not consulted in this arrangement.

14 Training

14.1 Lifeboat and MES

Each of the three lifeboat commanders had successfully completed a course of training in the Proficiency in Survival Craft and Rescue Boats specified in Regulation VI/2 of the STCW convention.

SOLAS Chapter III/Part B/Section I Regulation 19.3.4.8 requires crew involved in deploying the MES to have participated in the actual deployment of the MES every two years; however, none of the *Caribbean Fantasy* crew had ever deployed an MES. The staff captain's training record included a document signed by a VIKING service manager attesting to receiving "instruction in handling and deployment of a VIKING Evacuation Slide" with rafts on June 5, 2014. The safety officer, who deployed the port MES and was responsible for training the crew on the system, said she had never seen one deploy until the day of the accident. Her only MES training had been to view an instructional video shown to members of the *Caribbean Fantasy* crew during recurrent MES training. The third officer, who launched the starboard side MES, did not have any information in his company training record to document a previous deployment of an MES. The AB who released the first two liferafts from the starboard side told investigators he had never seen an MES deploy.

On October 21, 2015 the *Caribbean Fantasy* was detained by the US Coast Guard in San Juan for failing to meet minimum safety standards. One of the deficiencies listed on the Port State Control Report of Inspection was "The ship's crew could not provide documentation that any crew members were participating in MES deployments, and when questioned during drills, crew reported never having participated in a deployment." Coast Guard Sector San Juan cleared this deficiency on November 23, 2015, when RINA informed inspectors that, "Training for MES party member has been carried out with means of audio video aids."

The safety officer explained that she was responsible for training all crewmembers in their emergency roles and verifying training required by STCW code had been completed when they reported on board. For MES training she used the instructional video shown on board the ship to instruct the crew in how to deploy and use the system. The training video was not filmed on board the *Caribbean Fantasy* and did not include narration explaining each aspect of the operation of the MES and liferafts. The video included short segments covering the entire MES evolution, beginning with the MES deployment and continuing through each stage up to and including to a boat towing inflated liferafts filled with people. Users or presenters could click on specific segments of video showing the MES in use. The video showed close-up views of the bowsing line winch in operation and a view of the MES, but did not include a segment demonstrating how to use the winch to position the MES platform with the bowsing line. The training video, guided by the safety officer, was last shown to the crew on August 4, 2016.

The safety officer told investigators that she instructed the officers in charge of the lifeboats on how to carry out their roles and provided them with the lifeboat manual for their lifeboat. The second officer who commanded lifeboat no. 1 during the accident and had reported aboard the ship four days before the accident had not received lifeboat training or the manual before the accident. He had only received 40 minutes of orientation training, training all crew members receive, when he first reported to the ship. This consisted of the safety officer escorting the second officer around the vessel, including a walk by the lifeboats and general overview of his role in each evolution contained in the emergency plan and station bill.

14.2 Crew and Passenger Drills

SOLAS regulation 30 required a weekly abandon ship drill and fire drill. The entire crew did not have to be involved in every drill, but according to Baja Ferries company policy each crew member was required to attend an abandon ship drill and a fire drill twice per month. Investigators reviewed "drill and training return" schedules that were maintained by the safety officer. According to the schedule, the weekly fire and abandon ship drills were scheduled to take place every Sunday.

The last combined fire and abandon ship drill was completed during the Coast Guard port state control inspection on August 9. The Coast Guard examination record did not contain any remarks or details describing the drill. One of the two second officers said that during the drill lifeboat no. 2 was launched and he was in command. When asked if lifeboat no. 2's release hooks were operated during the drill, he told investigators that the hooks were released "manually" and not by operating the release gear as per the hook manual. The second officer was the commander for lifeboat no. 3 during the accident.

The August 9 fire and abandon ship drill was not recorded in the official logbook. The last general drill recorded in the official logbook took place on July 16. The ship's record of the drill noted, "General Drill (Bomb search, followed by fire and abandon) carried out with satisfactory results." It also noted that all lifesaving appliances were ready for immediate use. Prior to that, a general fire and abandon drill was held on July 2. Preceding that, the last crew drill took place on March 16 which was before the shipyard period.

SOLAS emphasizes the importance of the weekly drill by requiring operators to explain in the ship's logbook why a drill was not held at its appointed time or did not meet the drill criteria

as described in the SOLAS regulations (regulations 3.4 and 3.5 contain detailed requirements for the abandon ship drill and fire drill). Investigators did not find any such logbook entries required by SOLAS regulation 19.5.

During the shipyard period, only a small complement of officers and crew (about 14) stayed with the vessel. Most of the ship's hotel crew were sent on vacation for that time and returned to the *Caribbean Fantasy* on August 5 and 6 in Santo Domingo, about 3–4 days before the Coast Guard port state control inspection. SOLAS requires a drill after changing out 25 percent or more of the crew. The safety officer told investigators that a drill was carried out in accordance with this requirement but there were no logbook entries showing the drills were carried out.

Investigators did not find a work instruction or procedure containing guidance for recording attendance at drills.

Sección 4a: REGISTROS DE EJERCICIOS DE ZAFARRANCHO, REVISTAS E INSPECCIONES + DISPOSITIVOS DE SALVAMENTO Y EQUIPO CONTRA INCENDIO. 4a

Nota: Los requisitos para ejecutar los ejercicios de práctica de zafarrancho, revistas de la tripulación e inspecciones en los diferentes tipos de buques están contenidos en el Capítulo III del Convenio Internacional para la seguridad de la Vida Humana en el Mar (SOLAS) 1974.

Section 4a: RECORD OF DRILLS, MUSTERS AND INSPECTIONS / LIFESAVING AND FIREFIGHTING

Note: The requirements for holding boat and fire drills, crew musters and inspections in the various classes of vessel are laid down in Chapter III of the International Convention for the Safety of Life at Sea (SOLAS) 1974.

Fecha de los ejercicios de práctica de zafarrancho, revistas e inspecciones Date of drill or muster & inspections	Naturaleza de los ejercicios o revistas Nature of drill or muster	Naturaleza de la inspección de los dispositivos de salvamento y equipo contra incendio y condiciones en que se encontraron. Nature of the inspection of the lifesaving and firefighting appliances and the condition in which they were found.	Fecha del Asiento Date of entry	Firmas del Capitán y Primer Oficial Signature of Master and First Mate
19th June 2016	Individual life raft training drill with satisfactory result	How to operate and equip can found inside liferaft Explained with satisfactory result	19th June 2016	Master: [redacted]
02 July 2016	General Drill (Emergency Drill FIRE and Abandon) carried out with satisfactory Result	All LSA and FFE are in Good Condition and Ready for use.	02 July 2016	SAFO: [redacted]
16 July 2016	General Drill (Bomb Search follow by Fire and abandon) carried out with satisfactory results	LSA and FFE are in Good condition and ready for use immediately	16 July 2016	SAFO: [redacted]
04 Aug. 2016	HES Video Showed to the crew with result satisfactory	Showed how to operated HES system	04 Aug. 2016	[redacted]
07 Aug. 2016	Life raft training drill carried out with satisfactory result	Liferaft Demo inflated for the crew how to operate	07 Aug. 2016	SAFO: [redacted]

Figure 17. Except from *Caribbean Fantasy* official logbook record of drills, musters, and inspections.

The second officer who had joined the vessel 4 days before the accident, on August 13, did not attend any crew muster or fire drill. Furthermore, he had no opportunity to familiarize himself with the features of any of the lifeboats. When asked if he attended a crew drill, he declined to comment. The second officer told investigators that his emergency duty was to be the leader for "fire group no. 3" and the commander for lifeboat no. 3. However, the emergency plan and station bill stated that his duty was to relieve the officer of the watch on the bridge, operate GMDSS equipment, and communicate with emergency teams. The emergency plan and station bill had no "fire group no. 3."

5	2nd Officer 2do Oficial	Bridge Puente de Mando	Relieves OOW. Operates GMDSS. Assists with communication to Emergency Teams. Carries VHF Radio. When LB No. 3 is waterborne, position it in the vicinity of MES to assist in marshalling Liferafts. Relevar Oficial de guardia. Operador de GMDSS. Asistir con las comunicaciones con los Equipos de Emergencia. Llevar el Radio VHF. Cuando Bote No. 3 esta en el agua posicionarlo acerca de MES para asistir con manejo de las balsas.	LB 3 Bote 3	Commander, VHF, AM Airband Comandante

Figure 18. Excerpt from *Caribbean Fantasy* emergency plan and station bill

During the fire, the second officer reported to the locker for fire station no. 3 where fire squad no. 1 had gathered their equipment before proceeding to garage C. The third officer, who was assigned as leader for fire squad no. 1 in accordance with the emergency plan stated that he saw the second officer there.

According to the safety officer, a typical fire and abandon ship drill would be carried out while in port in the following manner:

- Announcement of codeword "Mr. Skylight" with the location of the fire.
- Fire squads and response teams assemble in a staging area where they receive instruction and orders from the safety officer who is the on-scene commander.
- Upon order from the command and control team on the bridge, firefighting efforts carried out in and/or around the affected space.
- General alarm sounded (seven short and one long signals on ship's alarm bell accompanied by the ship's whistle).
- All crew go to their emergency stations.
- Announcement of fire not under control.
- Evacuation control teams check all areas to ensure they are evacuated.
- Alarm sounded for prepare for abandon ship (one long signal on ship's alarm bell accompanied by ship's whistle).
- All crew go to their assigned survival craft.

- Fire teams leave and go to their abandon ship stations upon dismissal from the on-scene commander.
- Throughout the drill, officers walk around ship and ask crew questions to make sure they were familiar with their emergency duties – sometimes they would show the lifeboats and how to start them.
- Announcement from captain that the drill is complete and crew is dismissed from their stations.
- Officers and department heads meet for a short post-drill briefing.

Flag administrations, under the authority of SOLAS regulation 19.3.4.5, could allow ships operating on short international voyages not to launch the lifeboats on one side if their berthing arrangements in port and their trading patterns did not permit launching of lifeboats on that side. However, all such lifeboats were to be lowered at least once every three months and launched at least annually. Neither the drill schedule nor the official logbook recorded the lowering and/or launching of lifeboats in accordance with the requirements of a vessel on a short international voyage. Further, investigators recovered deck maintenance records from January 31, 2016, to April 28, 2016, which were sent to the company and signed by the master, chief engineer, and safety officer. The records indicated that the starboard side lifeboats were last lowered in October 2015. The April 28, 2016, report entry read, "LB1, 2 & LB3 lowered to the water during Dry Dock, when is going to be performed the annual inspection of L/B appliances." As noted, the annual inspection of the lifeboats was conducted during the ship yard period, but the report made no mention to the lifeboat drill requirements found in SOLAS regulation 19. The vessel's logbook did not contain any entries for lifeboat drills on April 28 or June 22, 2016. No other evidence was found to show lifeboat drills involving lifeboats no. 1 and 3 were held or that the lifeboats were operated by their assigned crew. Although it was Baja Ferries policy that the lifeboats be lowered to the water and operated by the assigned crew on a quarterly basis, there was no evidence that the company identified the failure to follow this policy onboard the *Caribbean Fantasy* as a non-conformity or implemented corrective actions.

15 Accountability of Passengers and Crew

There is no international or Panamanian requirement to take passenger attendance when abandoning ship. IMO MSC Circular 699, *Revised Guidelines for Passenger Safety Instructions*,

provides recommendations for operators to facilitate assembling passengers at their assigned muster station, but no guidance or direction is offered for conducting a roll call. Following the loss of the Italian cruise ship *Costa Concordia* in 2012, the IMO published MSC Circular 1446 Revision 2, which recommended that elements of musters and emergency instructions include a "method of accounting for passenger attendance at musters both for training and in the event of an actual emergency." However, these measures were voluntary.

The *Caribbean Fantas*y operators included a passenger muster process in its Shipboard Emergency Organization manual. Further, the emergency plan and station bill required a roll call to be conducted at each of the muster stations.

When the captain called the hotel director and told him to begin evacuation, the hotel director activated the ship's evacuation control team. He and the chief purser—the deputy evacuation control leader—reported to their station at the reception area. He then passed the word to other members of his team. Stairway guides went to their assigned locations to direct passengers to their muster stations, and other members of the crew checked ship spaces to ensure no passengers were left behind. Specifically,

- the chief housekeeper and staff checked guest cabins;
- the head bartender and staff checked public spaces;
- the head dining room manager and staff checked guest dining areas; and
- the executive chef and staff checked crew public areas and the galley.

The staff captain told investigators that the evacuation control efforts included checking for passengers in public spaces and in their cabins including toilet areas, showers, and under beds. Each evacuation team leader had a checklist to keep track of spaces that were reported clear and was responsible for reporting the evacuation progress to the hotel director, stationed at the main reception area. The hotel director, in turn, communicated this progress to the command center on the bridge.

Figure 19. *Caribbean Fantasy* passenger cabin door. Door handle marked with toilet paper.

The chief housekeeper said he knocked on cabin doors to tell passengers to evacuate to their muster stations. As passenger cabins were searched by the crew and confirmed clear, a piece of toilet paper was placed around the door handle to indicate that the cabin was checked.

While evacuating passengers, the chief housekeeper received a call from the hotel director telling him to guide passengers assigned to muster station C on deck 6 aft, near the stern of the ship, away from smoke at the stern. The hotel director told the chief housekeeper to move the passengers forward and up to deck 7, between the liferaft racks and muster stations A and B.

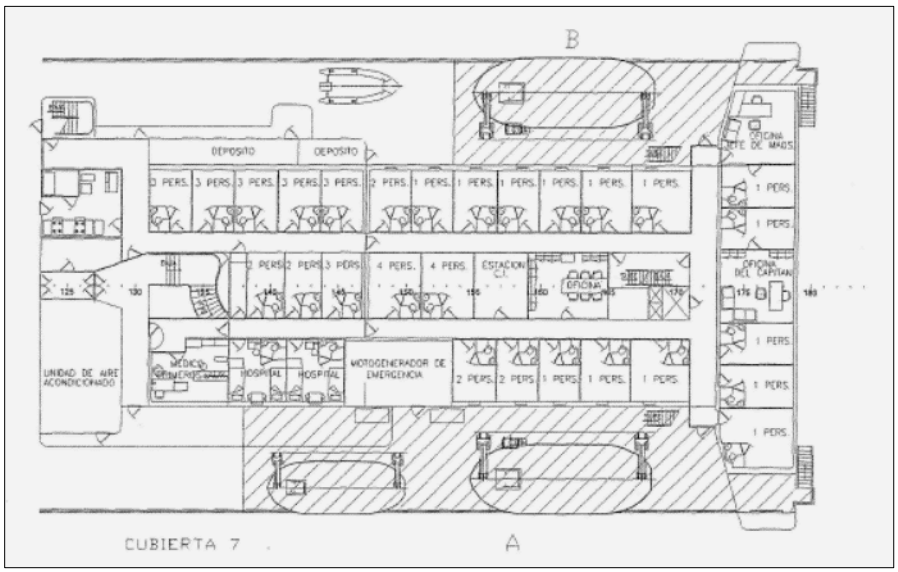

Figure 20. Drawing of *Caribbean Fantasy* deck 7 showing muster stations A (150 persons) and B (220 persons) located under the lifeboats.

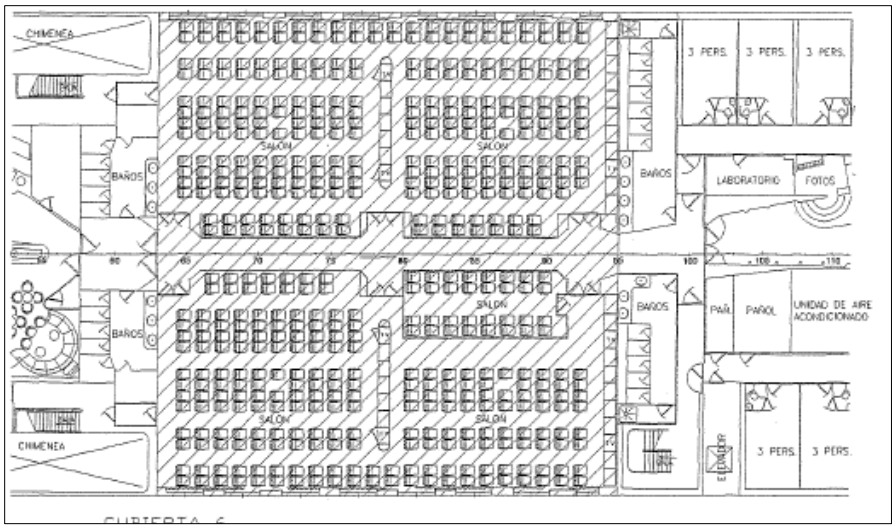

Figure 21. Muster Station C, located in the Salon on Deck 6 on board the *Caribbean Fantasy*. 830 persons.

At 0757, the hotel director called the bridge and informed the command center that all passengers and crew had been evacuated from the ship's internal spaces. However, one minute later, the safety officer called the bridge by radio and requested that one long signal be sounded because there were still people on deck 5. This signal, according to the ship's emergency plan, was the prepare for abandon ship signal, and signaled that all persons on board were to go from their muster stations to their survival craft embarkation stations where, upon verbal command from the master, the evacuation of the ship would take place. The second officer directed the deck cadet to sound the signal. At 0758, the vessel's voyage data recorder (VDR) microphones captured the signal.

The hotel director estimated that 80% of the passengers were "regulars" — those who routinely used the ferry to go back and forth between the Dominican Republic and Puerto Rico. He added that these passengers were familiar with the ship and announcements. The safety officer added that because many of the passengers regularly traveled with the ship, communicating during the evacuation was facilitated by the crew and passenger familiarity. The staff captain recalled that during the accident many people were already awake and dressed because the vessel was close to arriving in port.

The evacuation control team also consisted of leaders and staff assigned to muster stations A, B, and C and the mobile guest assistance team. The evacuation team leader would keep in

contact with each team and make final reports to the bridge. Prior to the abandon ship order, the evacuation control team leader had not received a final report from the team leaders for Muster station A, Muster station B and Muster station C. The muster station team leaders' reports would have included the results of their mustering – accounting for passengers and crew.

Figure 22. Lifejackets being distributed to passengers on deck 7 behind lifeboat no. 3. The davit for lifeboat no. 1, which has been lowered to the embarkation deck, can be seen ahead of lifeboat no. 3. (Frame from *Caribbean Fantasy* passenger video provided by Coast Guard)

The emergency plan approved by RINA on July 3, 2016, called for pursers and assistant pursers assigned to each muster station as team leaders to retrieve a guest manifest from "evacuation control" located at the ship's reception desk and take a roll-call at the muster station. But a roll call did not take place during the accident because, according to the hotel director, passengers were ordered to embark survival craft shortly after receiving the order to proceed to their muster stations. The muster station Team C leader, who was in her third contract on board the *Caribbean Fantasy*, told investigators that she went to the bridge to retrieve the muster list, as she had done in drills, but the list was not in or near the box that she expected it to be in. After a few moments of looking for the list, she proceeded to her muster station. The muster station team leader, who had been on board for less than two weeks, said she went to the bridge looking for the muster list and was told by an officer, "there is no list on the bridge." The chief purser/the deputy

evacuation control leader, according to the emergency plan and station bill, was to have been at the reception area to hand out the guest muster list to the muster station team leaders. But during her interview with investigators, she made no mention of her responsibility to distribute the lists to the muster station leaders. (She did tell investigators about her emergency plan and station bill abandon ship assignment that involved safeguarding guest and crew documents.) As she described the sequence of events to investigators, the chief purser mentioned that when she was waiting to evacuate on Deck 7, the safety officer called her by the ship's internal radio asking her where she was and if she had the passenger lists. The chief purser told the safety officer that someone came to her and took the passenger lists.

The evacuation control teams assigned to muster stations A and B had consisted of 6 crewmembers, while the team assigned to muster station C had 19 crewmembers. The team's role was to conduct a roll call of persons at the muster station and see that all passengers properly donned life jackets. When it came time to abandon ship, teams A and B were to assist passengers into lifeboats. Given that muster station C was on deck 6 and that all personnel assembled at muster station C were to go to the MES, the control team leaders were also responsible for briefing passengers on how to use the slide and guiding passengers to the port and starboard MES embarkation stations on deck 5.

SOLAS Chapter III/Part B/Section III/Regulation 27.1 requires that "all persons on board all passenger ships shall be counted prior to departure." Regulation 27.4 requires that, once passengers are counted, the list must be kept ashore and made readily available to search and rescue services. During the accident, the Coast Guard contacted the vessel operator shoreside personnel for the final count of 511 passengers and crew. During the initial search and rescue information gathering process, the ship told the Coast Guard by radio that 512 persons were on board. A passenger had departed the ship the previous evening for medical reasons, and the passenger numbers kept on the ship had not been updated.

Because the *Caribbean Fantasy* was to arrive in the port of San Juan on the morning of the accident, many of the passengers were waiting in public spaces with their personal effects. When the announcement was made to abandon the ship, many passengers brought their personnel effects with them to the muster stations. Some crew members also did the same. When at the muster stations, crewmembers managing those stations and the embarkation of survival craft and the MES had to instruct the passengers leave their effects behind.

Figure 23. Some personal effects left behind at muster station A, near lifeboat no. 3.

16 Emergency Instructions for Passengers

SOLAS Chapter III/Part B/Section I/Regulation 19.2.3 requires that a passenger safety briefing be conducted whenever new passengers embark a vessel, either immediately before or immediately after departure. The briefing shall include the instructions to follow in the event of an emergency and shall be made by means of an announcement in one or more languages likely to be understood by the passengers. The announcement shall be made on the ship's public-address system or by other equivalent means. Information cards, posters, or video programs may be used to supplement the briefing but may not be used to replace the announcement. Crewmembers and passengers told investigators that a safety briefing was made before the ship departed Santo Domingo. According to the safety officer, a crew member was present in the reception area on deck 5 to demonstrate how to don a lifejacket.

Throughout the ship were signs instructing how to don a lifejacket. Signs were posted on the back of passenger cabin doors instructing passengers what to do and where to go during an emergency. The signs were also posted in the main salon on deck 6 primarily used by passengers who did not purchase a cabin. Some of these instructions were for lifejackets that were not carried on the vessel, while others were in Italian and English with emergency procedures that differed from the *Caribbean Fantasy*'s approved procedures.

Figure 24. Left image from the back of a passenger cabin door. Instructions were in Italian and English and stated that the signal for a "great fire" was "two long blasts followed by alarm bells," which was not a signal used on board. Right image from a public space on deck 7 describing lifejacket donning instructions in English and Japanese for a type of lifejacket not found on board.

17 Post-accident Equipment Tests and Assessments

17.1 NTSB and Coast Guard Cruise Ship National Center of Expertise Examinations of Lifeboats

On August 24, 2016, a member of the Coast Guard Cruise Ship National Center of Expertise (CSNCOE) and an NTSB investigator examined the *Caribbean Fantasy* lifeboats.

Lifeboats no. 1 and no. 2 had been lifted out of the water by a crane and placed on the pier, and thus investigators could not document their immediate postaccident condition. The hooks on lifeboat no. 2 did not open when the CSNCOE representative used the release handle inside . When the CSNCOE representative used the manual release wrench on each of the four hooks, only one of the four hooks released; the forward hook on lifeboat no. 1 opened with difficulty.

The *Caribbean Fantasy* entered San Juan with lifeboat no. 3 hanging by its falls, a few feet above the water. The lifeboat was never launched. A successful release test was conducted dockside by dropping the weight of the boat onto truck tires after operating the release handle inside the lifeboat. Before the release test, the team examined the davit hooks and found the recovery pins in the position for recovering the lifeboat—a position that locks the hook, preventing it from accidently opening as the lifeboat is raised from the water. Each recovery pin should

normally be kept in its stored position in preparation for lowering and launching lifeboats in an emergency. According to the commander of lifeboat no. 3, the pins were put in the recovery position prior to their attempted hoist of the lifeboat back to the embarkation deck. It could not be determined if the pins were in the stowed or recovery position prior to the boat being lowered.

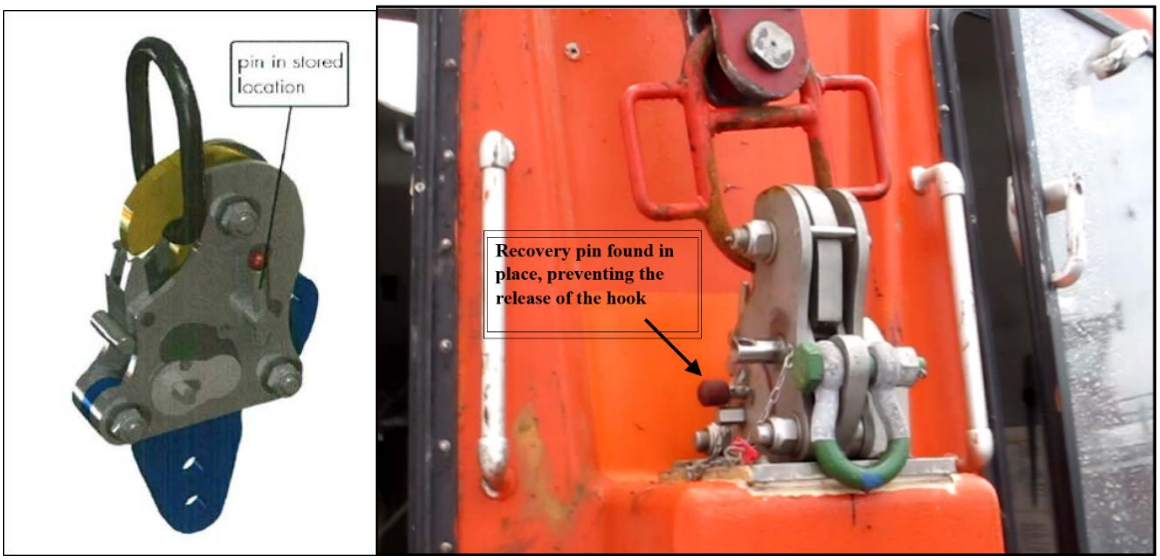

Figure 25. At left, the U-hook with recovery pin in stored position. (Source: *U-Hook 3 – 6 – 10 – 15 ton Operation and Maintenance Manual*) At right, *Caribbean Fantasy* lifeboat no. 3 aft hook with the recovery pin inserted in the hook mechanism.

All lifeboat manuals contained instructions for the operation of the old release hooks that had been replaced in the shipyard. SOLAS Regulation III/B/I/9.2.1 requires posters or signs containing the relevant instructions and procedures for operating the hooks to be placed in the vicinity of survival craft launching controls. After the accident, investigators found posted instructions in lifeboat no.3 that explained how to release the newly installed U-hooks. However, instruction sheets in lifeboats no. 1 and no. 2 were for the previously removed release hooks. Step 36 of the U-hook installation procedure directs the technician is to apply a hook instruction poster in the boat. The instruction did not specify where to place the poster in the boat, but U-hook instructions were not found anywhere in either lifeboat no. 1 or 2.

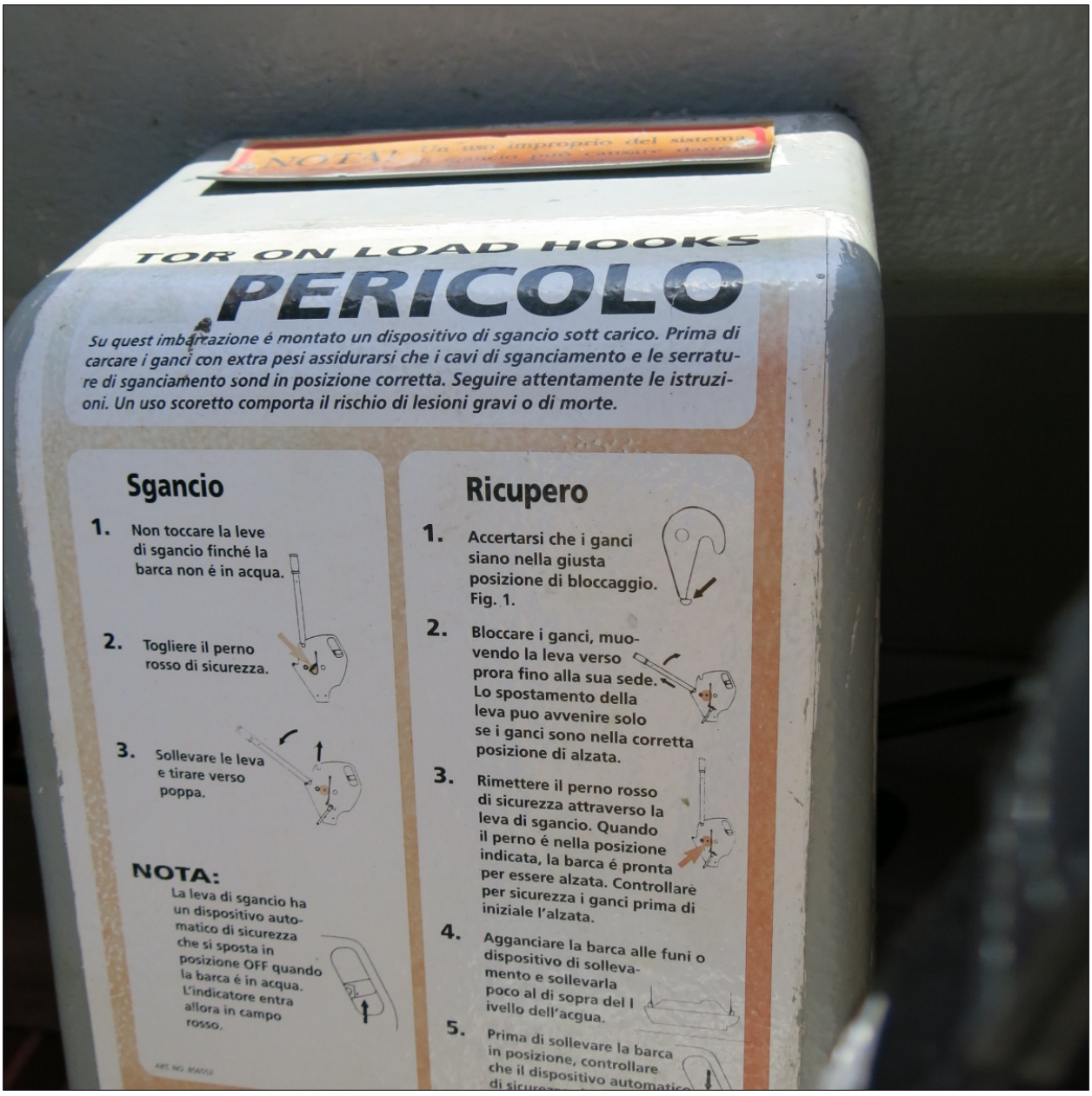

Figure 26. Instructions (Placard) for TOR On load release hooks posted in lifeboat no. 1 in English and Italian.

The lifeboat no. 1 commander, the second officer that had joined the ship four days prior to the accident, said the manual bilge pump did not remove water that entered the lifeboat. By using a valve located behind the operator's control station on the lifeboats (shown in figure 27 as found by investigators), water can be bailed from either the engine compartment or the main part of the boat. Investigators noted that, unlike the operations and maintenance manual for lifeboat no 3, the manual for lifeboats no. 1 and no. 2 did not contain an explanation or diagram explaining how to use the hand operated bilge pump to "bail" different spaces in the lifeboat. The manual also

did not contain any instructions for operating the fixed hand bilge pump on the forward end of lifeboat no. 1. Investigators found the pump functioned and used only one hose - to bail the boats main compartment.

Figure 27. *Caribbean Fantasy* lifeboat no. 1 bilge pump valve handle in position to remove water from the engine compartment. Note labels are in English and Italian.

The lifeboat no. 3 engine was successfully started and run by investigators. The manual in the lifeboat directed that the engine had to be started manually. The manual crank handle required an extension piece that was not readily available but found by investigators in the bilge under 5 inches of water. After turning the crank handle eight times, the manual referred to pulling a "trigger chord" as the final step to start the engine. Lifting the chord, a lever near the bottom of the engine, provided engine ignition.

On October 12, 2016, at the request of the Coast Guard, a representative from Schat-Harding (now acquired by Palfinger Marine), examined the lifeboats accompanied by a member of the Coast Guard CSNCOE. He also conducted a document check of lifeboat examination records and guidance. His findings stated:

- Hook damage may have occurred after the accident. There is evidence that the hook systems of lifeboats no. 1 and no. 2 suffered damage caused by the improper lifting of the lifeboats by means of a shore crane with a single lifting point. An unloaded lifeboat must be lifted by maintenance/lifting lugs designated for this purpose. When using a spreader bar or, alternatively, a single lifting point, both slings must have a minimum length of 1.5 times the length of the lifeboat.

- The aft release cables installed on lifeboats no. 1 and no. 2 were longer than prescribed. This fact may have prevented hook release once waterborne. The excessive length increased the resistance in the push-pull cables.

- There was evidence that lifeboat no. 1 engine had been under repair at the time of incident. Bolts surrounding the engine compartment had been removed, brackets holding cables and tubes were unfastened, the end cover was missing, and the coolant tank was empty.

- The lifeboat no. 1 drain plug was missing and could not be located. If the drain plug had been in place, even in the open position, it would have prevented water from entering the vessel. A floater valve would have prevented water intrusion. The drain plug was designed to keep the floater ball in place.

- Lifeboats no. 1, no. 2, and no. 3 incurred GRP, hand rail, and hatch damage that included fractures and laminate shearing.

Figure 28. Damage to lifeboats (Photos courtesy of Palfinger Marine)

The representative also stated in his report that: No evidence was found to confirm the that the installations of the new davit hooks were carried out in accordance with the guidelines found in IMO MSC Circular 1392 or if U-Hook was on the IMO's white list for release and retrieval systems. He recommended that "operators ensure that retrofitted hooks are compatible with the

lifeboat design, installed according to regulatory requirements, and the hooks are on the IMO white list."

Investigators found that the release and retrieval system installed on the lifeboats met IMO circular requirements. The IMO does not publish a "white list" of acceptable lifeboat release and retrieval systems but does maintain a list of information of lifeboat release and retrieval systems on its public website (https://gisis.imo.org/Public/HOOKS/Default.aspx). Not all accepted systems are included on the list because the IMO depends on member states to submit system information, once an administration approves a system for its vessels, so that the list can be updated. The release and retrieval system recently installed on the three Caribbean Fantasy lifeboats was not yet included on the list.

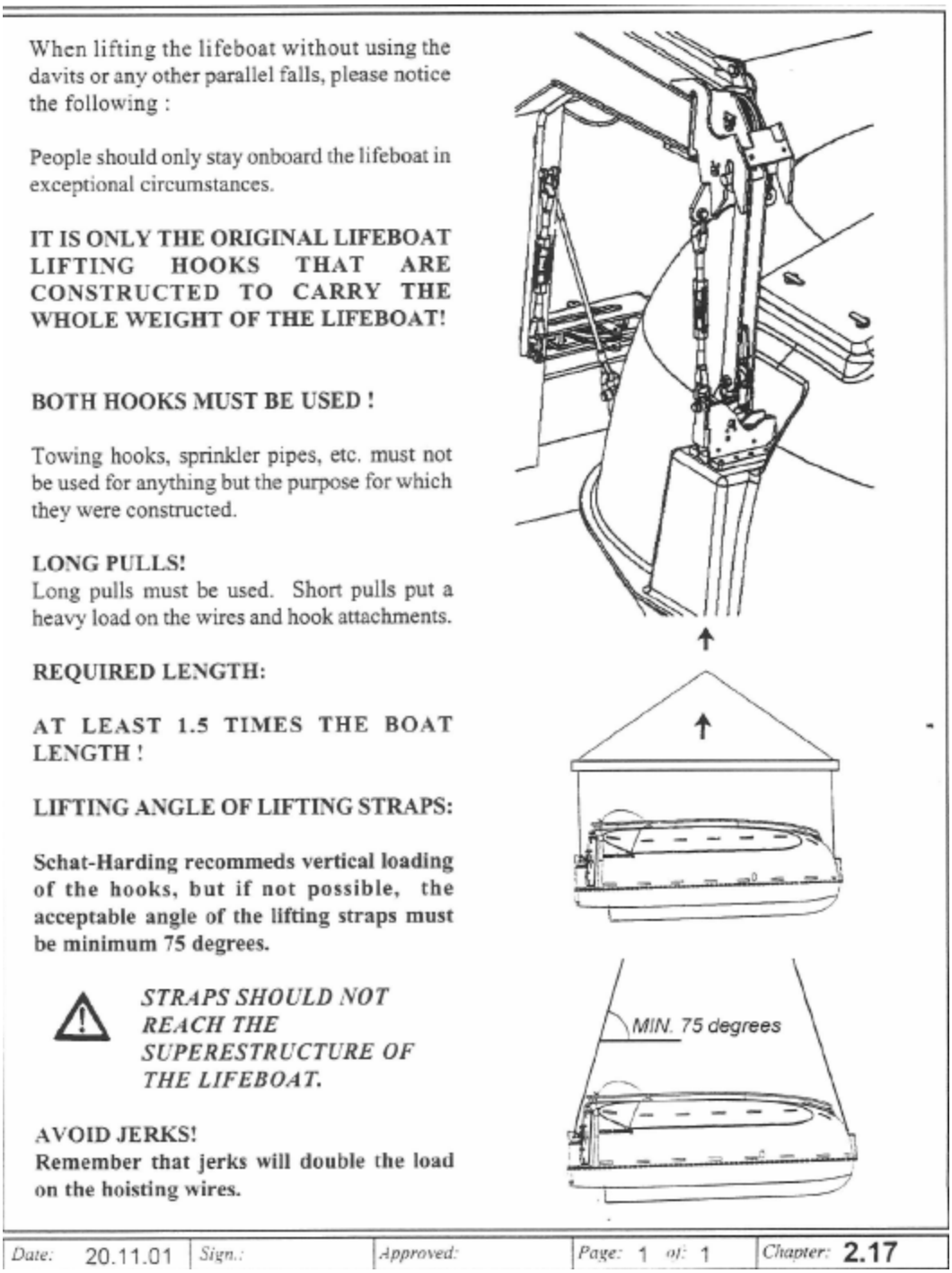

Figure 29. Guidance for using a crane to lift a lifeboat from lifeboat no. 3 *Operations and Maintenance Manual*.

17.2 BC Service Assessment

On September 16, 2016, a service team of four representatives from BC Service (the company the produced the U-Hook system), accompanied by a member of the Coast Guard CSNCOE, examined the *Caribbean Fantasy* lifeboat hooks installed on lifeboats no. 1 and no. 2.

The Coast Guard asked the BC Service representatives to examine the hooks to help investigators determine why they did not release automatically on the day of the accident and why investigators were unable to open the hooks manually on August 24.

The service team first examined the release control unit (RCU) for lifeboat no. 2. Other than the broken emergency glass, the team concluded the RCU mechanism was functional. However, when they then examined the hooks and tried to open them using the RCU, the hooks did not open. The team noted that the hooks had been moved inward, “most likely when the lifeboats were incorrectly moved by shore side cranes from the water to the pier." Once the team moved the hooks into their original positions, the hooks opened by using the RCU. The team found lifeboat no. 1 in the same condition except for the emergency glass, which was intact. After adjustment, the hooks opened using the RCU. The team’s report concluded that the damage sustained to the lifeboat hooks was consistent with damage resulting from a crane using a single point lift and short slings. The report also noted that

- the emergency glass was found broken on the RCU for lifeboat no. 3 (as well as lifeboat no. 2, as previously stated);
- the hydrostatic interlock moved freely for lifeboat 2; and
- a Teleflex cable was found damaged on no. 1 lifeboat. (The vendor suggested this may have been caused by previous attempts to open the hooks while in the wrong position.)

BC service noted there were no reports of problems or any service requests made from the *Caribbean Fantasy* after the installation and testing of the hooks were completed in Tunisia in May 2016.

17.3 Examination of MES Launching Areas

Investigators found the port bowsing line as shown in figure 30. The bowsing line is neatly coiled on the winch drum, and blue paint is on the line at the deck—the same blue paint used for the deck, deck edge, and chock in the vicinity of the line.

Figure 30. Port side MES bowsing line and winch.

Investigators found the starboard bowsing line and winch as shown in figure 31, with bowsing line slack, lying on the deck. The starboard side MES had been cut away from the vessel before investigators arrived. None of the witnesses interviewed by investigators said that they operated the starboard winch during the evacuation. VIKING representatives noted slack in the starboard bowsing when they viewed videos of the evacuation.

Figure 31. Starboard side MES bowsing line and winch.

17.4 VIKING LIFE-SAVING EQUIPMENT A/S Assessment of Buckled MES Slides

A team of six VIKING employees assessed why the port and starboard MES slides buckled during the evacuation. The team evaluated nine failure modes and could not identify a root cause. Specific information provided by the Viking assessment team in their report is provided below.

Table 1. VIKING LIFE-SAVING A/S assessments and conclusions.

Failure mode	Effect	Component	Verification Method	Conclusions
Insufficient pressure in the cylinders of nitrogen (N_2) used to inflate slides	The slide may not fully inflate	N_2 cylinders	Verified previous pressure checks	Very unlikely one of the cylinders lost pressure. With a loss of pressure in one cylinder, a spare cylinder provided redundancy
Failure of the N_2 cylinder operating heads	N_2 cylinder would not activate	N_2 cylinder operating head	Found diaphragms punctured indicating the heads functioned as designed	Cylinder diaphragm heads functioned as designed
N_2 reduction valves leaking during inflation of the slide	Slide may not be fully inflated.	N_2 reduction valves	All reduction valves were shipped to manufacturer facility and checked	Inspection and testing of the reduction valves showed that the valves leaked during inflation due to leaking gaskets, which was concluded to be a contributing factor Note: The valves remained on board the vessel after the accident. The team dismantled the reduction valves one month after the accident. The additional exposure time could have affected the deterioration of the valves, and the analysis.
Slide aspirators not working correctly	Slide may not be fully inflated	Slide aspirators	All aspirators were shipped to manufacturer facility and checked	Inspection and testing of the aspirators showed all worked correctly
Slide platform relief valves opening at too low pressure	Slide may not be fully inflated	Relief valves	All relief valves were shipped to manufacturer facility and checked	2 out of 8 relief valves had an opening pressure of 290 mbar, slightly below the acceptable limit of 294 mbar Note: At the time the team dismantled the relief valves on site, the equipment had been on the pier for a month which could have affected the deterioration of the valves, and the analysis.
Bowsing system not used correctly	Slide may become buckled due to lack of pull from the	Bowsing system, crew handling	During on-board inspections, the team identified that the bowsing winches had not been used.	The crew did not handle the bowsing winches correctly and the bowsing lines were slack

	bowsing lines		Videos taken during the evacuation showed slack bowsing lines.	Bowsing lines are designed to position the slide and keep the slide straight.
Vessel making way through the water during the evacuation	Slide may become buckled	Crew handling	Information from French Ferries	Slides may have buckled if the vessel was making way through the water and the bowsing lines were not used.
Evacuation took place when vessel was aground	The slides may buckle.	NA	Information from French [France] Ferries[3]	The slides may buckle from the force of a current if the bowsing lines were not adjusted.
Slide or platform exposed to an accidental tear, caused by the assisting rescue boats	The slide will buckle	Crew handling and handling by assisting rescue boats	Rough recovery/handling of the slide and platform on the pier, and time on the pier may have caused a leak.	In a possible scenario: a small boat collision with the slide or platform may have caused a tear.

The VIKING team could not determine why some of the liferafts were "floating around, not connected with the connection lines." The team noted that the rafts were not installed by an authorized VIKING service technician and offered two possible causes: the rafts were not connected correctly during installation or "incorrect handling by the crew during evacuation."

18 Medical and Pathological Information

18.1 Injuries

The injuries sustained in the *Caribbean Fantasy* accident, shown in table 2, are categorized according to the injury criteria of the International Civil Aviation Organization (ICAO). The Safety Board uses the ICAO injury criteria in all its accident reports, regardless of transportation mode.

[3] France Ferries, based in Marseille, France, is a wholly owned subsidiary of Baja Ferries S.A. de C.V and provides procurement of spare parts and technical support for the parent company and other subsidiaries' vessels. See *Group Chairman's Factual Report - Port State Control, Flag, Classification, and Mass Rescue Operations* for more information.

Table 2. Injuries sustained in *Caribbean Fantasy* accident.[4]

Type of Injury*	Crew	Passengers	Other	Total
Fatal	0	0	0	0
Serious	1	4	0	5
Minor	2	**	0	**
None	**	**	0	**

* Title 49 CFR section 830.2 defines a fatal injury as any injury that results in death within 30 days of an accident. It defines serious injury as that which requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; results in a fracture of any bone (except simple fractures of fingers, toes, or nose); causes severe hemorrhages, nerve, muscle, or tendon damage; involves any internal organ; or involves second- or third- degree burns, or any burn affecting more than 5 percent of the body surface.

** The total number of minor injuries to passengers is unknown.

By reviewing the San Juan Emergency Management Service computer aided dispatch (CAD) records and ship operator injury reports, investigators identified five ankle injuries. Investigators were not able to interview the crewmember and passengers who sustained these injuries; however, witnesses told investigators that the ankle injuries occurred while sliding down the MES. Witnesses also told investigators that passengers and crew incurred friction burns on the inside of their upper arms when using the slide. In addition to these injuries, the chief engineer and third engineer were treated for smoke inhalation.

There were also passengers transported to the hospital from the receiving area and released the same day. Some of the complaints were faintness, nausea/vomiting, symptoms affecting pregnancy, hypertension/high blood pressure, and dehydration. According to computer-aided dispatch records provided to investigators, there were a total of 49 passengers and crew transported to local area hospitals.

Detailed minor injury data, such as the names of people with friction burns or other minor injuries, was not collected during the response operation. The Coast Guard and the NTSB had limited success tracking down passenger contact information to arrange interviews. Some of those contacted spoke only Spanish and others did not wish to speak with investigators. Investigators interviewed four passengers and the Coast Guard collected 20 one-page statement forms from

[4] The *Caribbean Fantasy* Injury Table is based on the number of injured crew reported and passenger medical claims received by the ship's operator.

passengers when they came ashore. The Coast Guard constructed and distributed a survey for passengers but did not receive any responses.

18.2 Fatal Injuries

There were no passenger or crew fatalities.

18.3 Animal Fatal Injuries

Two of seven dogs on board the *Caribbean Fantasy* during the accident died as a result of smoke inhalation. Salvage teams found both in their plastic crates in Garage B near the aft ramp at and starboard stairway at frame no. 5. Investigators learned that the dogs had been placed there by crewmembers who were positioning them on the vehicle decks for their owners in advance of debarkation.

Figure 32. Photo of the two dog crates recovered from Garage B (Photo by San Juan Fire Department)