



# National Transportation Safety Board

## Marine Accident Brief

### Contact of Cruise Ship *Carnival Horizon* with Manhattan Cruise Terminal Pier 90

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<b>Accident type</b>	Contact	<b>No.</b> DCA18FM036
<b>Vessel name</b>	<i>Carnival Horizon</i>	
<b>Location</b>	Manhattan Cruise Terminal, Pier 90, New York City, New York 40° 46.08' N, 074° 00.05' W	
<b>Date</b>	August 28, 2018	
<b>Time</b>	0549 eastern daylight time (coordinated universal time – 4 hours)	
<b>Injuries</b>	None	
<b>Property damage</b>	\$2.5 million est.	
<b>Environmental damage</b>	None	
<b>Weather</b>	Clear visibility at 10 miles, winds southwest at 6–8 knots, ebb current at 1.3 knots, air temperature 78°F, water temperature 73°F	
<b>Waterway information</b>	Upper limit of New York City's major wharves on the Hudson River. Project depth for the channel is 45 feet. <sup>1</sup>	

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On the morning of August 28, 2018, the cruise ship *Carnival Horizon*, with a total of 6,361 people on board, was maneuvering to berth no. 2 at Manhattan Cruise Terminal's Pier 88 in New York City, New York, when its bow struck the southwest corner of adjacent Pier 90. No one was injured and no pollution occurred, but Pier 90's walkway, roof parking garage, and facilities suffered extensive structural damage, and the ship sustained minor damage above the waterline, totaling about \$2.5 million in cumulative damage.



***Carnival Horizon* at the Manhattan Cruise Terminal after the accident.**

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<sup>1</sup> National Oceanic and Atmospheric Administration (NOAA), *United States Coast Pilot 2 47<sup>th</sup> Edition* (Washington, DC: US Department of Commerce, 2017).

## Accident Events

The *Carnival Horizon* was returning to Manhattan from an 8-night Eastern Caribbean cruise, and at 0318 on the morning of the accident, the ship arrived at the entrance to New York harbor. There, a pilot from the Sandy Hook Pilots association boarded the *Carnival Horizon* for the inbound transit to the Manhattan Cruise Terminal. About 0329, after a master/pilot exchange about the ship and the inbound transit, the Sandy Hook pilot assumed navigational control, also known as the conn, of the *Carnival Horizon*. The master remained on the bridge, with overall responsibility for the safe navigation of the vessel for the duration of the arrival in port.



Map of the accident area. The site of the pier contact is overlaid by a red triangle. (Background source: Google Maps)

The Manhattan Cruise Terminal, located on the Hudson River on Manhattan's west side, consists of three finger piers with five 1,037-foot-long berths capable of accommodating five cruise ships simultaneously. The distance between berth no. 2 at Pier 88 and berth no. 3 at Pier 90

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is about 305 feet. Berth no. 2 has a 46-foot apron and 10 feet of fendering with a nominal draft of 33 feet below mean lower low water.<sup>2</sup> The *Carnival Horizon* was to dock starboard side to Pier 88.

Hiring an assist tugboat and a docking pilot to berth the vessel was not mandatory. However, the *Carnival Horizon* master had previously brought the ship to the Manhattan Cruise Terminal and had on occasion chosen this option when faced with strong ebb and flood currents at the pier. Therefore, due to the anticipated ebb current at the berth, the master determined it prudent to choose assistance with this docking. As a result, the scheduled 6,000 horsepower (hp) assist tractor tugboat *JRT Moran*, with a docking pilot from Metro Pilots on board, awaited the *Carnival Horizon*. While awaiting the ship just west of Hudson River Park (Pier 57), the *JRT Moran* conducted two short drifts to estimate the amount of ebb current, which the docking pilot determined at the time (approximately 0446) to be about 2.3 knots.

At 0530, the Metro docking pilot boarded the *Carnival Horizon* just west of Chelsea Pier 61 (1.25 miles from the final docking berth). About 4 minutes after boarding, the docking pilot arrived on the bridge. He and the master conducted a master/pilot exchange of information while the Sandy Hook pilot continued to conn the vessel. The *Carnival Horizon* master explained that he had requested the *JRT Moran* be positioned about midship on the cruise ship's starboard side, below the fourth lifeboat, to serve as a pivot point and maintain a safe distance from the northwest corner of Pier 88 due to the anticipated ebb current at the berth. The master explained, "We go a little closer [to Pier 90], right, and use a tug . . . not right up on the bow . . . by the corner [northwest corner of Pier 88] or by the lifeboats [points to the fourth lifeboat]." The master continued, "If we go in on the bow like last time, he [*JRT Moran*] had to leave." The Metro docking pilot reiterated, "going in higher [to Pier 90] so he [*JRT Moran*] can get past the corner [northwest corner of Pier 88]." The Metro pilot continued, ". . . put the bow near [Pier] 90, put him [*JRT Moran*] up front of all the boats [starboard lifeboats]; let him go in past the corner, then we'll start our turn, while he is up here [inside of Piers 88 and 90]." The master stated, ". . . once we start going in . . . it's okay but . . ." and the Metro docking pilot stated, "yeah once we get on the inside, yeah." The master ended the discussion with, "The problem is to get inside."

The Metro docking pilot then inquired about the distance from the ship's bow to the navigation bridge; the bridge team and master replied 40 meters (~132 feet). The master then asked about the present speed of the ebb current, stating that at 0339, he had noted it being as high as 4 knots. The Metro docking pilot replied that the current was ebbing at 2.3 knots, noting that low water was at 0418 and that they "have one hour of current left" and that "twenty feet below the surface, twenty minutes before that it starts to flood down below."

At 0537, as the ship was passing west of pier 76, the Metro pilot, after completing his discussion with the master, asked the Sandy Hook pilot at the conn what they were doing. The Sandy Hook pilot replied they were on a steady heading of 028 degrees and at 6 knots. Immediately after hearing that, the Metro pilot assumed the conn and issued a heading order of 030. After a few seconds' pause, and another officer repeating the course order, the helmsman read back 030 and stated, "the pilot has the conn." The Sandy Hook pilot stayed on the bridge for the remainder of the transit. The Metro docking pilot (hereafter referred to as "the pilot") had been a docking pilot for 28 years and told investigators he had berthed the *Carnival Horizon* at Pier 88 during the ship's two most recent arrivals with the assistance of a tugboat, with the same master. He said that during

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<sup>2</sup> AIA Engineers Ltd. PLLC, *Manhattan Cruise Terminal Dredging Topographic and Hydrographic Survey*, May 10, 2018.

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his career, he had also piloted several hundred other cruise ships of similar size to the *Carnival Horizon* in the Port of New York.

As the *Carnival Horizon* continued north on the Hudson River toward the terminal, the pilot was supported by the ship's bridge team, who manned various equipment and stations. In addition to the master, the *Carnival Horizon* bridge team consisted of the staff captain, who was tasked to maintain an overview of the entire bridge operation and monitoring of the master and the pilot; a second officer, who was tasked to monitor and cross-check the person conning the vessel and the ship's position using real-time navigation methods; and a deck cadet, who was tasked to maintain logs and checklists. There was also a helmsman and a lookout on the bridge. The staff captain was in the vicinity of the enclosed starboard bridge wing as was the Sandy Hook pilot. The second officer was positioned at the centerline of the bridge wheelhouse console and monitored navigational equipment, including visually displayed predictive software on the ship's electronic chart display and information system (ECDIS). The radar predictor was set to 120 seconds (2 minutes) with a 180-second (3-minute) vector. The lookout was positioned on the port bridge wing and performed lookout duties for the port side of the vessel. Civil twilight was to occur at 0550, and sunrise was recorded at 0619 for New York City, so it was still dark outside as the ship approached the terminal.

The vessel's third officer was stationed at the forward mooring platforms of the enclosed mooring deck as mooring officer. He relayed to the staff captain via handheld UHF radio the distances from the ship's bow to the southwest corner of Pier 90. The staff captain repeated the distances to the bridge team while simultaneously keying his UHF radio to confirm the distance.



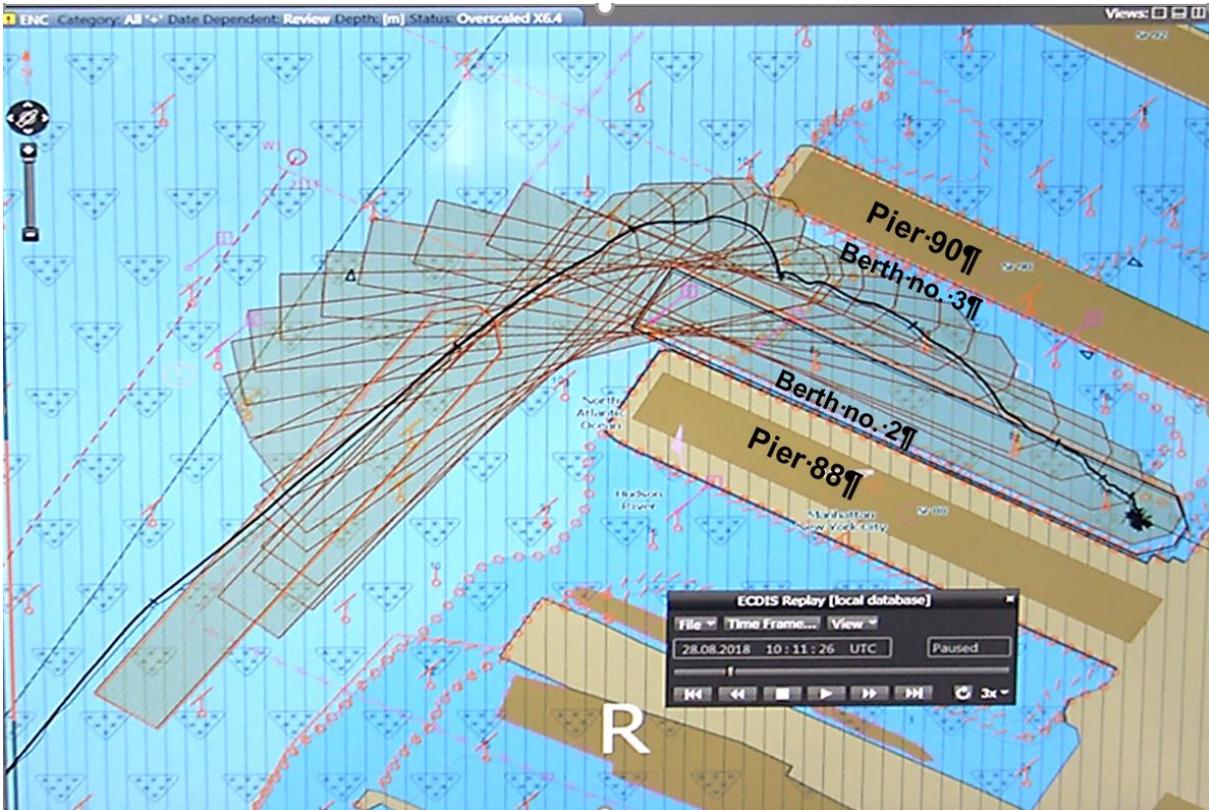
***Carnival Horizon's* bow after the accident. The forward mooring platforms where the lookout was stationed (about a 100 feet aft from the tip of the bow) are circled in red. (Source: Coast Guard)**

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The *Carnival Horizon*'s main propulsion was provided by two azimuthing electric drive motors and propellers contained in pods outside the hull at the stern of the ship (termed "azipod gearless propulsors" by the manufacturer or simply "azipods" by industry). The rated power output of each azipod was 22,126 horsepower (hp; 16,500 kW). The vessel also had three controllable-pitch tunnel thrusters at the bow to provide lateral control forward. Each bow thruster was capable of producing 3,352 hp (2,500 kW). The azipods and thrusters could be operated independently via separate controllers, or together via an integrated joystick that combined control of the amount of thrust and direction of all three bow tunnel thrusters and the two stern azipods.

At 0539, the master transferred control from hand steering to the starboard bridge wing control console and operated the three bow thrusters and the two azipods with the separate controllers. The master then announced that he was turning both azipods outward 30 degrees with 50 propeller rpm on both; this was the last verbal communication about the propulsion settings for the azipods. Two minutes later, the pilot ordered the *JRT Moran* captain to position the tugboat on the starboard bow: "You can drop in on the starboard bow . . . Yeah, where we talked about." The *JRT Moran* took up position on the starboard side just aft of the *Carnival Horizon*'s third bow thruster. No tow line was placed from the tugboat to the ship. The pilot explained to investigators that the reason he did not want the *JRT Moran* positioned farther aft (at the midship area, as the master preferred) was he thought the tugboat might get pinned between the ship and Pier 88 during the clockwise docking maneuver. Conning the *Carnival Horizon*, the pilot provided maneuvering commands to both the *Carnival Horizon* master and the *JRT Moran* captain.

The following image is a screenshot from the *Carnival Horizon*'s ECDIS, showing the vessel's track as the ship was maneuvering toward Pier 88 en route to its docked position.

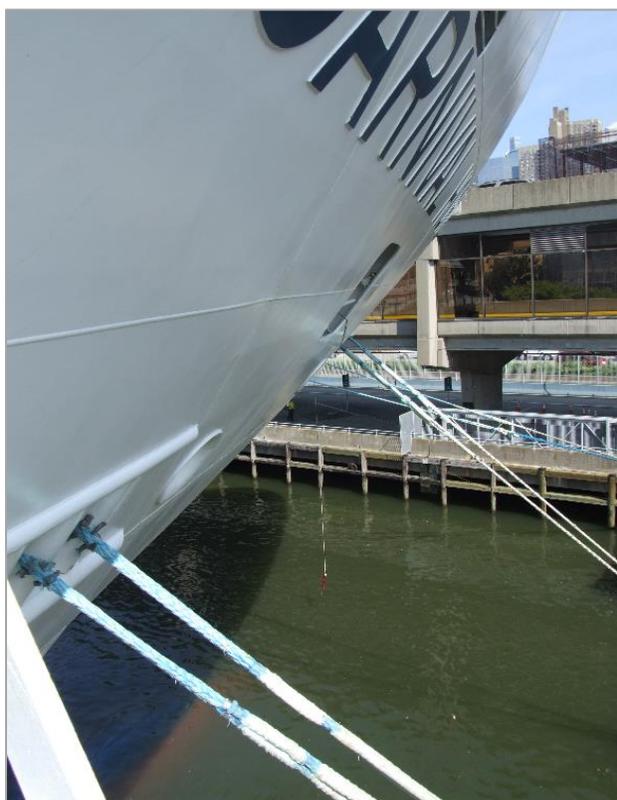


Screenshot from the *Carnival Horizon*'s ECDIS, showing the vessel's track beginning at 0539 and ending at 0611.

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In response to the pilot's heading orders, the master moved the azipod control levers individually to adjust the thrust angle and rpm (thrust amount) for each azipod to bring the ship to that course. At 0541, the rpm on both azipods were increased from 50 to 60. Between 0545 and 0548, at a speed over ground of about 1.3 knots, the ship's bow began to clear the corner of Pier 88 where the ship was to dock starboard side to. The pilot gave a series of thruster orders.

About 0548, with the ship on a heading of 038 degrees and a speed over ground of 1 knot, the master asked if they should "start bringing the stern in," to which the pilot replied, "easy yes." The third officer on the starboard mooring platform was asked about the distance to the southwest corner of Pier 90. He answered that the distance was 50 meters. On hearing that, the pilot replied, "that's good" and requested the *JRT Moran* push "ahead easy" from its position on the starboard bow. At that point, the ship was on a heading of 040 degrees and had a rate of turn of 12 degrees per minute to starboard with a ground speed of 1.1 knots.



View from *Carnival Horizon*'s starboard mooring platform looking forward toward the bow.

The pilot requested the bow thruster "full to port" as the third officer forward reported he was going to the port mooring platform to monitor the distance to Pier 90. Seconds later, he called the bridge and stated, "reducing the distance now" as the speed over ground increased to 1.3 knots. The bridge team members acknowledged the third officer's estimated distances to Pier 90 from the port and starboard mooring platforms but did not cross-check his estimates with the increasing headway of the ship.

At 0549, the pilot said, "stop the bow," meaning stop thrusting the bow, and requested "a little stronger astern." Immediately thereafter, the third officer reported the distance to Pier 90 as "one five" meters. The rate of turn to starboard was 14 degrees per minute with a ground speed of 1.2 knots and a heading of 050 degrees. About 15 seconds later, the third officer reported they were "getting really close," to which the pilot immediately responded with a request to "back; go back." At 0549, at a speed of 1.4 knots over ground ahead, on a heading of 054 degrees, the

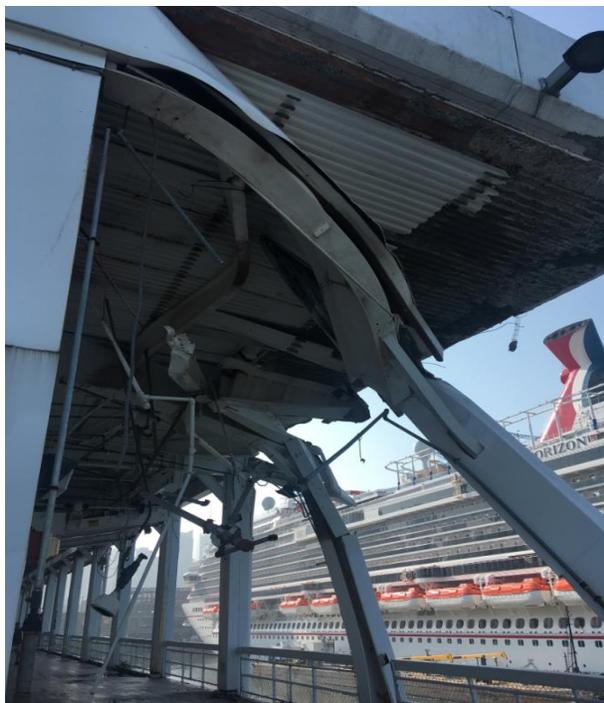
*Carnival Horizon*'s bow struck the second and third levels of Pier 90's facility and parking garage. The pilot immediately ordered the azipods stopped, the bow thrusters full to port, and the *JRT Moran* to push full ahead from the starboard bow. With the pilot continuing at the conn, the docking maneuver was completed without further incident, with all mooring lines secured and the vessel starboard side alongside Pier 88 at 0618. No one was injured in the accident nor did any pollution occur. Postaccident alcohol and drug testing was conducted on relevant crewmembers of the *Carnival Horizon*, the two pilots, and the *JRT Moran* crew as required. All results were negative.

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The southwest corner of Pier 90 sustained structural, electrical, and concrete slab damage to the second and third levels. Three metal support beams and parking level concrete slabs totaling 250 cubic feet needed short-term repairs. On the *Carnival Horizon* a forward mast light on deck 4 was struck down, one of its posts ripped off from the main deck, and the three other posts completely buckled at the base. Also, an associated approximately 8-inch-by-8-inch hole was found in the deck plating; the plating had ripped out and was attached to the dislodged post of the light mast. The top plate of the bulwark on deck 4 between frames 409 and 410 was indented downward, and the associated center bulwark and horizontal stiffeners were found slightly bent as well. The total cumulative damage resulting from the accident was about \$2.5 million.



Left, screenshot from *Carnival Horizon*'s thermal night-vision bow camera at the time of impact with Pier 90. Right, *Carnival Horizon*'s damaged forward mast and support structure.



Left, structural damage to Pier 90's parking garage. Right, passenger embarkation walkway among damaged and sagging concrete slabs and metal debris. (Source: US Coast Guard)

## Additional Information

There were no reported problems with the *Carnival Horizon*'s machinery, steering, thrusters or propulsion systems at the time of the accident. The ship was equipped with an Interschalt VDR-G4e voyage data recorder. Investigators were able to extract data from the recorder, including bridge and engine control room audio, navigational information, bow thruster and azipod orders and response, and radar images, to analyze the events leading up to and during the accident.

During interviews with the master, the staff captain, and the third officer, investigators inquired about the position of the forward lookout. The third officer stated that he went back and forth between the port- and starboard-side mooring platforms to estimate the distance from the bow to Pier 90 by line of sight. When switching position between the port and starboard mooring platforms, he would have to walk about 15 meters across the mooring deck. No crewmember was positioned on the tip of the bow to observe the clearing distances. The master and the staff captain both stated that, in the future, they would place a crewmember on the tip of the bow (one deck higher and farther forward than during the accident) for docking maneuvers. In a subsequent interview, the master told investigators that during the ship's next return trip to Pier 88 on September 5, 2018, a crewmember was placed at the tip of the bow. In fact, the ship's standard operating procedures were revised to include the addition of a crewmember on the bow specifically for maneuvers where the bow is expected to come in close proximity of objects while maneuvering in and out of port.

The New Jersey Maritime Pilot & Docking Pilot Commission conducted its own investigation and concluded that the Metro docking pilot failed to perform the appropriate pilot-to-pilot and master/pilot exchanges.

## Analysis

Carnival's navigation policy requires closed-loop communication and a process called "thinking aloud," meaning "sharing verbally a mental model of the current situation and future situations," which allows for greater situational awareness of the bridge team, while closed-loop communications ensure that when an order or request is made, the person executing it understands and acknowledges that order. By repeating it back (acknowledging the order), the likelihood of miscommunications and misunderstandings is significantly reduced. There was little audible evidence that the thinking-aloud concept was in practice during this accident sequence. While the pilot was issuing bow thruster and tug orders, the master used the stern azipods with the intention to bring the ship closer to Pier 90, but did not verbalize his actions to the pilot or bridge team.

The ship's bridge team could have been more effectively engaged in the ship's maneuvering to the dock. The Metro docking pilot was conning the vessel, and the master was focusing on the starboard side, concerned about the ship being set onto the corner of Pier 88 due to the ebb current. Although Carnival's navigation policy and task assignments require monitoring of the person conning the vessel, cross-checking of the ship's position, and predicting track and headway, there was no evidence that any bridge team member probed or alerted the master and pilot of the headway of the vessel toward the corner of Pier 90. For example, the staff captain was responsible for overseeing the entire bridge operation and monitoring the master and the pilot, yet he never voiced concern about the vessel's speed of approach toward Pier 90 before impact.

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In addition, there is no evidence that the bridge team discussed any minimum safe distances during the prearrival briefing or during the master/pilot exchange with the docking pilot. Had there been established “minimum clearances to dangers” for the maneuver—required to be prediscussed per company navigation policies—the bridge team members (including the officers monitoring distances from forward and aft) may have had better awareness of the threshold for when they should alert each other or stop the maneuver, re-assess, and try again. Further, the third officer was designated to communicate distances and clearances from the port and starboard mooring platforms forward but was not positioned in a suitable location. From his standing position on either platform—15 feet below the tip of the bow, at an angle of about 45 degrees, and in darkness—his view of the contact point was completely obstructed by the ship’s hull (as shown in earlier photo). Therefore, he had to estimate the distance from the tip of the bow—a point he could not see—to Pier 90. Furthermore, moving between two points meant that he was estimating the distances from two different vantage points and was also losing time as he moved between the port and starboard platforms. These factors limited the third officer’s ability to accurately determine distances and provide timely reports to the bridge. Carnival has amended its procedures for this vessel to include positioning a crewmember to report distances from the tip of the bow while maneuvering into the Manhattan Cruise Terminal.

As the ship continued to maneuver to the berth and rotated clockwise around the end of Pier 88, the bridge team and pilot progressively lost awareness of the vessel’s headway toward the end of Pier 90. The pilot was focused on reducing the vessel’s rate of turn to starboard, while the ship was still moving forward toward Pier 90. The closing distance went undetected or unchallenged by the bridge team until the ship was so close to the pier that no maneuver could have prevented the impact.

### Probable Cause

The National Transportation Safety Board determines that the probable cause of the *Carnival Horizon*’s contact with Pier 90 was the ineffective interaction and communication between the master and the docking pilot who were maneuvering the vessel, and the bridge team’s ineffective oversight of the docking maneuver. Contributing was the placement of the third officer in a location without view of the bow to monitor the close approach to Pier 90.

## Vessel Particulars

Vessel	<i>Carnival Horizon</i>
Owner / operator	Carnival Corporation / Carnival Cruise Lines, Inc.
Port of registry	Panama City, Panama
Flag	Panama
Type	Cruise ship
Year built	2018; Marghera Shipyard
Official number (US)	Not applicable
IMO number	9767091
Construction	Steel
Classification society	Lloyd's Register
Length	1062 ft (323.4 m)
Draft	27.9 ft (8.5 m)
Beam/width	122 ft (37.2 m)
Gross tonnage	133,596
Engine power; manufacturer	2 x 22,126 hp (16,500 kW) ABB Azipod, XO2100 and 3 x 3,352 hp (2,500kW) bow thrusters; Wärtsilä CT275H.
Persons on board	4,922 passengers, 1,437 crewmembers, 2 pilots

**NTSB investigators worked closely with our counterparts from Coast Guard Sector New York throughout this investigation.**

For more details about this accident, visit [www.nts.gov](http://www.nts.gov) and search for NTSB accident ID DCA18FM036.

**Issued: October 22, 2019**

The NTSB has authority to investigate and establish the probable cause of any major marine casualty or any marine casualty involving both public and nonpublic vessels under Title 49 *United States Code*, 1131. This report is based on factual information either gathered by NTSB investigators or provided by the Coast Guard from its informal investigation of the accident.

The NTSB does not assign fault or blame for a marine casualty; rather, as specified by NTSB regulation, “[NTSB] investigations are fact-finding proceedings with no formal issues and no adverse parties . . . and are not conducted for the purpose of determining the rights or liabilities of any person.” Title 49 *Code of Federal Regulations*, 831.4.

Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by conducting investigations and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. Title 49 *United States Code*, 1154(b).