



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Issued May 26, 2023

MIR-23-10

## Contact of Cruise Ship *Radiance of the Seas* with Sitka Sound Cruise Terminal Pier

On May 9, 2022, about 0727 local time, the cruise ship *Radiance of the Seas* was maneuvering in Sitka Sound toward the pier at the Sitka Sound Cruise Terminal near Sitka, Alaska, when the vessel struck and damaged a mooring dolphin.<sup>1</sup> No pollution or injuries were reported. Damage to the pier was estimated at \$2.1 million.



**Figure 1.** *Radiance of the Seas* before the casualty.

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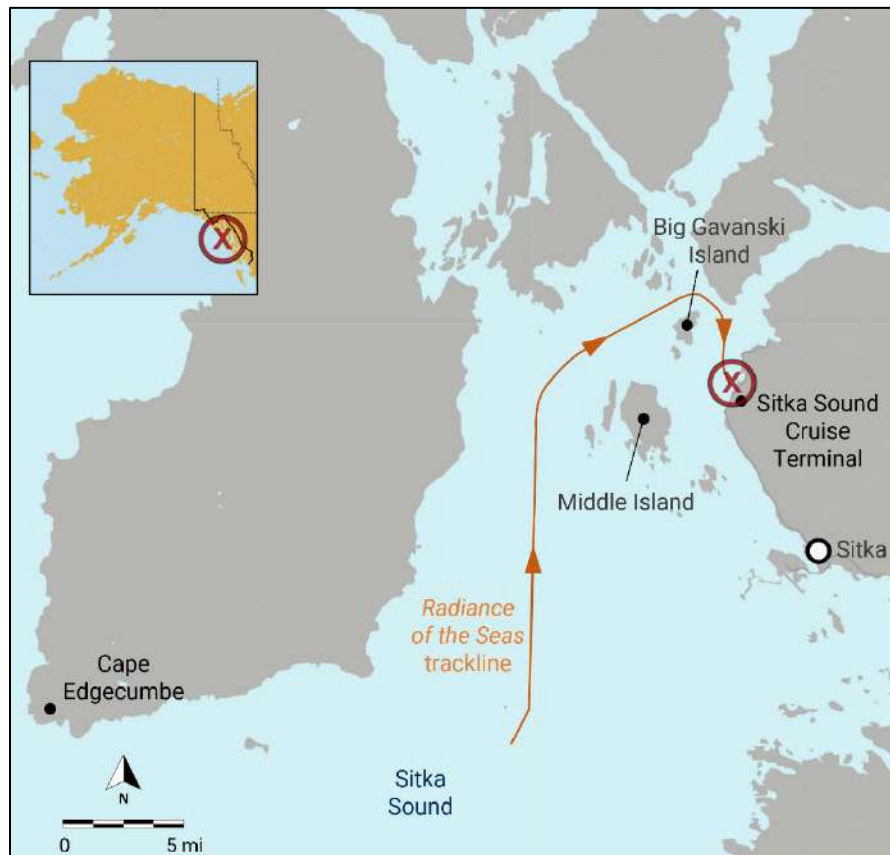
<sup>1</sup> (a) In this report, all times are Alaska daylight time, and all miles are nautical miles (1.15 statute miles).  
(b) Visit [ntsb.gov](https://www.ntsb.gov) to find additional information in the [public docket](#) for this NTSB investigation (case no. DCA22FM018). Use the [CAROL Query](#) to search investigations.

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<b>Casualty type</b>	Contact
<b>Location</b>	Sitka Sound, near Sitka, Alaska 57°07.07' N, 135°23.72' W
<b>Date</b>	May 9, 2022
<b>Time</b>	0726 Alaska daylight time (coordinated universal time -8 hrs)
<b>Persons on board</b>	2,161 (1,375 passengers, 782 crew, and 4 pilots)
<b>Injuries</b>	None
<b>Property damage</b>	\$2.1 million est.
<b>Environmental damage</b>	None
<b>Weather</b>	Visibility 10 nm, clear skies, winds northwest 6 kts, air temperature 45°F, water temperature 47°F, sunrise 0639
<b>Waterway information</b>	Sound, up to 420 ft deep

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**Figure 2.** Area where *Radiance of the Seas* contacted the Sitka Sound Cruise Terminal mooring dolphin, as indicated by a red X. (Background source: Google Maps)

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# 1. Factual Information

## 1.1 Background

The *Radiance of the Seas*, a 961.7-foot-long cruise ship, was operated by Royal Caribbean Cruise Lines on Alaskan itineraries during the spring and summer season of 2022. Built in Papenburg, Germany, in 2001, the ship was outfitted with three tunnel thrusters forward and two 360° azimuthing electric drive motors and propellers contained in pods outside the hull at the stern of the ship (termed “azipods” by industry).

## 1.2 Event Sequence

On May 8, 2022, the *Radiance of the Seas* left Ketchikan, Alaska, en route to Sitka, Alaska, with a crew of 782 and 1,375 passengers on board, as well as four pilots from the Southeast Alaska Pilots Association. Two pilots (Pilots 1 and 2) each worked an agreed-upon watch schedule and were accompanied by two other pilots (Pilots 3 and 4), whose competency to pilot larger vessels was being evaluated.

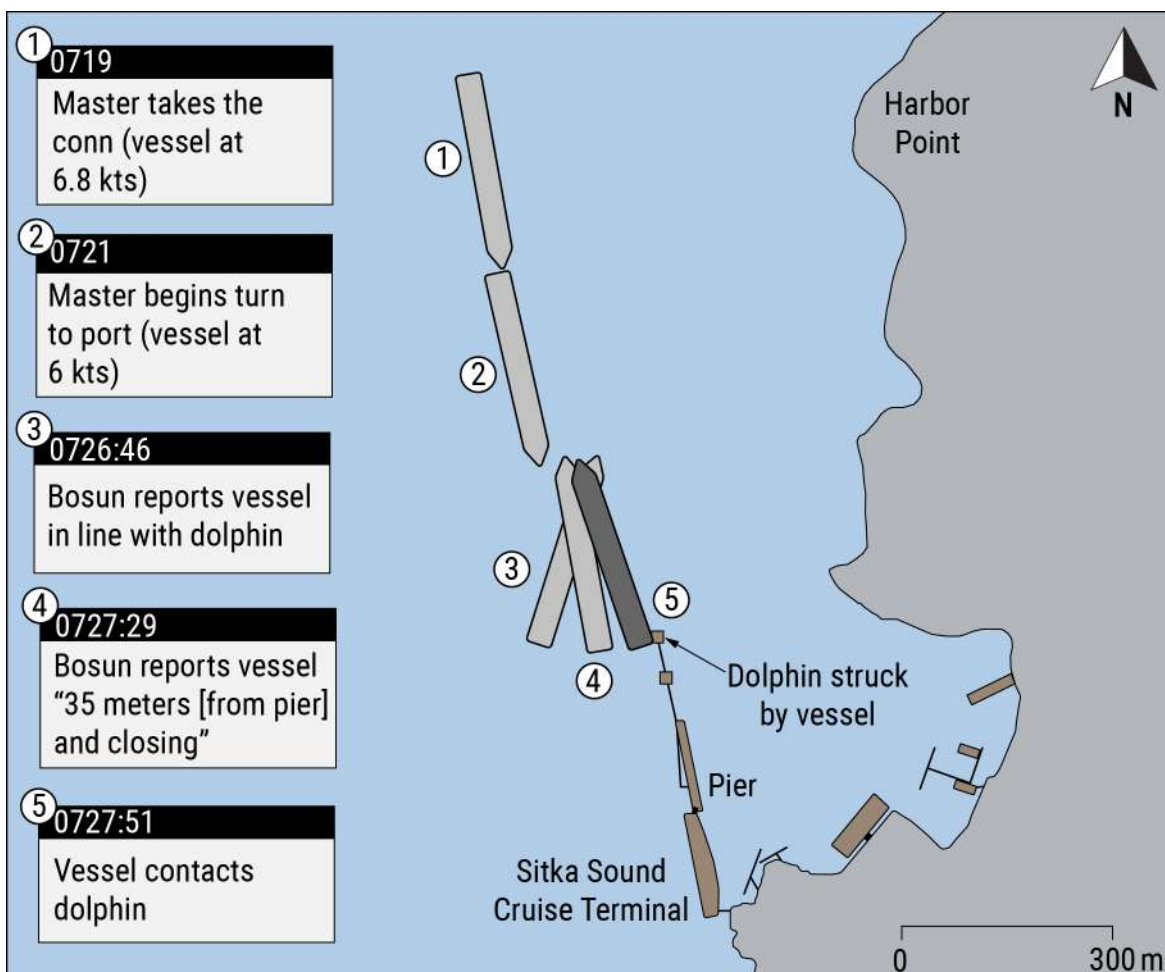
On May 9, between 0530 and 0600, the *Radiance of the Seas* passed Cape Edgecumbe at the entrance to Sitka Sound, with Pilot 3 conning the ship while being assessed by Pilot 1. About 0645, when the vessel was abeam of Middle Island, west of the Sitka Sound Cruise Terminal, the second officer led a pre-arrival navigation brief with the bridge team that covered multiple navigational safety topics required by the company’s safety management system. The bridge team discussed their planned approach to the terminal, which took the *Radiance of the Seas* north through Sitka Sound, around Big Gavanski Island, then south 1.5 miles to the terminal. The bridge team planned to rotate the ship about 180° before backing into the berth and mooring port side to the pier in the inboard (east side) berth, with the stern facing the terminal. Another cruise ship, the 1,094-foot-long *Norwegian Bliss*, was also due to arrive in Sitka later that day at 1100 and was assigned the outboard (west side) berth since that vessel was 132 feet longer. The master of the *Radiance of the Sea* requested that he or his crew moor and unmoor the ship to refamiliarize them with Alaskan ports following the COVID-19 pandemic (Royal Caribbean Cruise Lines had also made this request in writing to the pilots’ association), and the pilots agreed.

The *Radiance of the Seas* rounded Big Gavanski Island at 0709 making 10 knots. The master took the conn at 0719, about 0.5 miles from the pier head, with the ship making 6.8 knots. At 0721, when the vessel was about 0.37 miles from the pier and making about 6 knots of headway, the master began the near 180° rotation to port in order to back into the berth. Two of three bow thrusters and both azipods were online.

The master, staff captain, and Pilot 3 were stationed on the port bridgewing. As the ship rotated to port, its stern, which swung to starboard toward the pier, needed to clear the pier's northernmost mooring dolphin. The staff captain managed internal communications (with the forward and aft mooring decks and the gangway openings); he also operated a starboard bridgewing camera (using a joystick), which allowed him to see the pier and mooring dolphins. The chief officer and Pilot 1 were located on the starboard bridgewing. The first officer was stationed at the forward console, to monitor the electronic chart and information system (ECDIS)—which used integrated radar—and inform the master of the vessel's distance to the pier every tenth of a mile as it approached the terminal. The second officer was stationed at the console at the back of the bridge. A helmsman and a lookout were also on the bridge. The bosun, who was in charge of the aft mooring deck team, was stationed on the stern to provide by radio the vessel's distance to objects and the pier as requested by the staff captain on the bridge.

After the vessel began rotating, the first officer stopped calling out the vessel's position relative to the mooring dolphin at the end of the pier (which he referenced from the ECDIS). Instead, throughout the maneuver, the master relied on the bosun's distance callouts via radio and the ECDIS display on the bridgewing to identify the vessel's position relative to the pier. The master also used the starboard bridgewing camera operated by the staff captain to note when the ship, moving athwartships to starboard, was clear of the dolphin, allowing him to go astern to the berth. However, the crew stated that the camera froze during the maneuver due to a hardware issue.

At 0726:46, the bosun reported the vessel was in line with the dolphin, and 13 seconds later, he reported the vessel was 56 meters (184 feet) away from the dolphin. About 30 seconds later, he reported the vessel was "35 meters [(115 feet) from the pier] and closing." The master stated that he believed the bosun was reporting the vessel's swinging clearance—the amount the ship would clear the dolphin. However, the bosun stated that he was reporting the estimated distance from his position on the stern to the mooring dolphin. (After the casualty, investigators reviewed the bosun's reports and noted that they correlated with what was displayed on the ECDIS). At 0727:51, the ship's starboard quarter struck the mooring dolphin at the end of the pier.



**Figure 3.** *Radiance of the Seas*'s approach and turn in relation to the lengthened pier (scale approximate). (Vessel position source: Royal Caribbean Cruise Lines)

The master then moved 80 to 100 meters (262 to 328 feet) forward, cleared the mooring dolphin, and backed in to moor port side to the pier about 0801. After the damage to the vessel was assessed, the *Radiance of the Seas* resumed its scheduled itinerary.

## 1.3 Additional Information

### 1.3.1 Damage



**Figure 4.** The Sitka Sound Cruise Terminal pier on June 9, 2022, with barge alongside the damaged dolphin for repairs (with catwalk between dolphins removed).

The *Radiance of the Seas* sustained minor hull indentation. The mooring dolphin struck by the vessel sustained damage to three of the four pilings supporting it. Larger cruise ship traffic to Sitka Sound Cruise Terminal was impacted for the remainder of the 2022 season until repairs to the mooring dolphin were completed.



**Figure 5.** Damaged dolphin piling. (Source: Halibut Point Marine Services)

### 1.3.2 Sitka Sound Cruise Terminal Pier

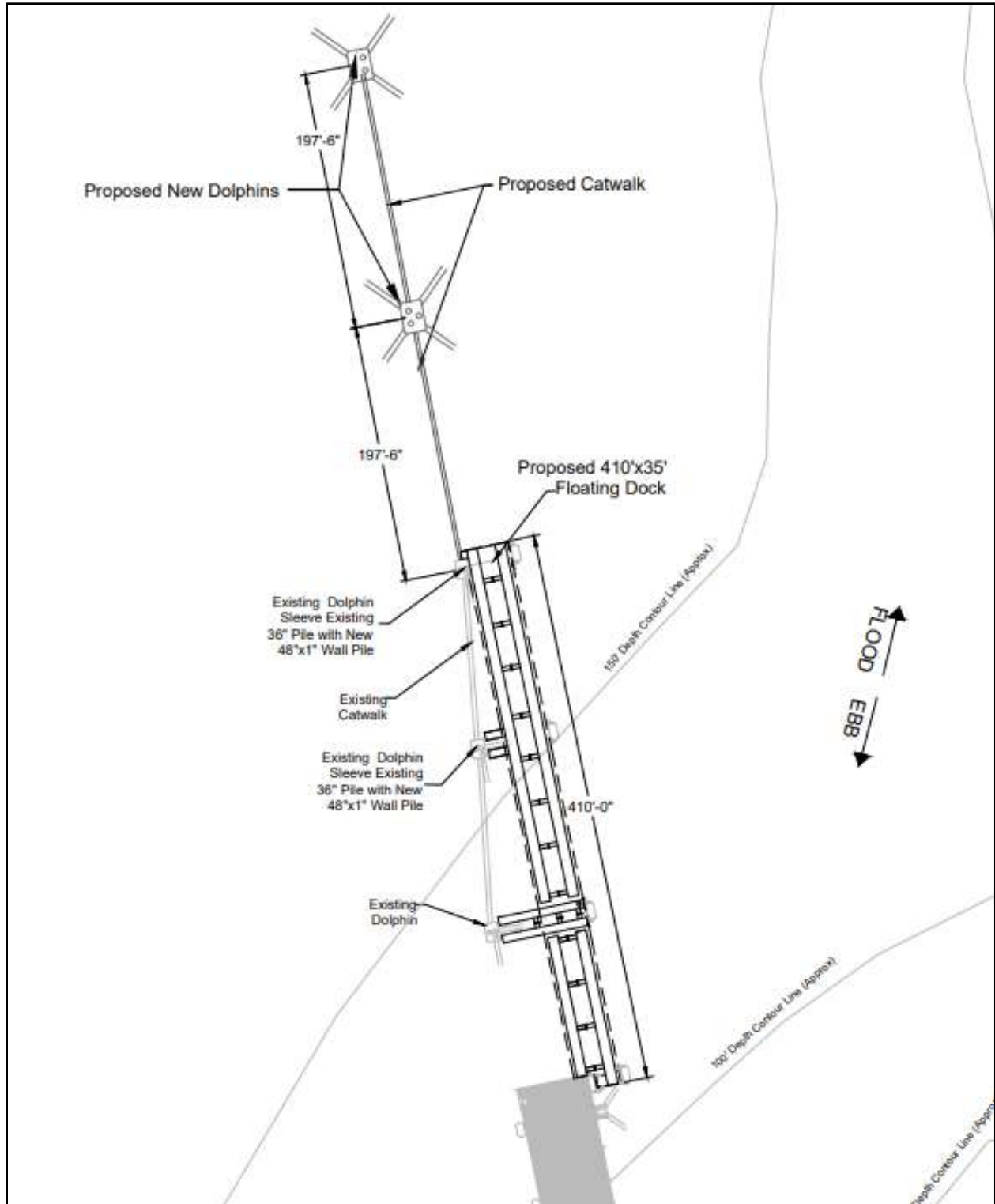
The Sitka Sound Cruise Terminal, previously the Old Sitka Dock, opened in 2011.<sup>2</sup> The cruise terminal pier was originally 895 feet. The facility hosted 200 cruise ship visits and about 340,000 passengers during the 2022 season (from May to September).

In April 2020, the US Army Corps of Engineers approved an extension of the Sitka Sound Cruise Terminal pier to the north by 395 feet, including the addition of two mooring dolphins (each with four piles) connected by a walkway and a 410-foot-long floating dock next to the existing dolphins. Work was completed in April 2021; the pier's length after extension was 1,390 feet.<sup>3</sup>

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<sup>2</sup> Before 2011, Sitka was only accessible to anchored cruise ships via tender.

<sup>3</sup> The Sitka Sound Cruise Terminal submitted an application to the Coast Guard (who is responsible for the maritime list of lights in the United States) for private aids to navigation in April 2021 for two additional lights on the new structure. A light was added to each new dolphin. Neither light was added to the corresponding navigation chart or the Coast Guard's *Light List*, nor announced in a *Notice to Mariners*.



**Figure 6.** The proposed addition to the pier in the application to the US Army Corps of Engineers approved in 2020. (Source: Halibut Point Marine Services)



The National Ocean and Atmospheric Administration’s (NOAA) Office of Coast Survey is the hydrographic authority responsible for maintaining and issuing corrections to all US coastal nautical charts. NOAA had no record of the construction completed on the Sitka Sound Cruise Terminal pier until after the casualty, when investigators informed them of the pier’s extension. NOAA staff told investigators that they would have updated the chart if they had been informed. They also stated that it is the responsibility of facility owners to inform them when permitted construction is complete and to provide drawings of the construction as built so that corrections and updates can be made to nautical charts for that area (neither the Sitka Sound Cruise Terminal’s permit nor regulations required this). The electronic navigation chart (ENC) did not show the extended pier and added dolphins until September 8, 2022, when NOAA updated the chart.<sup>4</sup>



**Figure 7.** ENC updated postcasualty (left) and as seen on *Radiance of the Seas*'s ECDIS (right) with the ship's outline after mooring shown in orange. (Sources: NOAA [left] and Royal Caribbean Cruise Lines [right])

The casualty voyage was the *Radiance of the Seas*'s second visit to Sitka during the 2022 season. The ship had last called at the Sitka Sound Cruise Terminal 7 days earlier, on May 2; the vessel had moored port side to the pier, on the outboard (west) side of the pier, with the bow facing south toward the terminal. The ship's officers stated they were not aware of the pier extension. The master of the *Radiance of the Seas* was on board the vessel when it called at the terminal on May 2; he also stated he was unaware

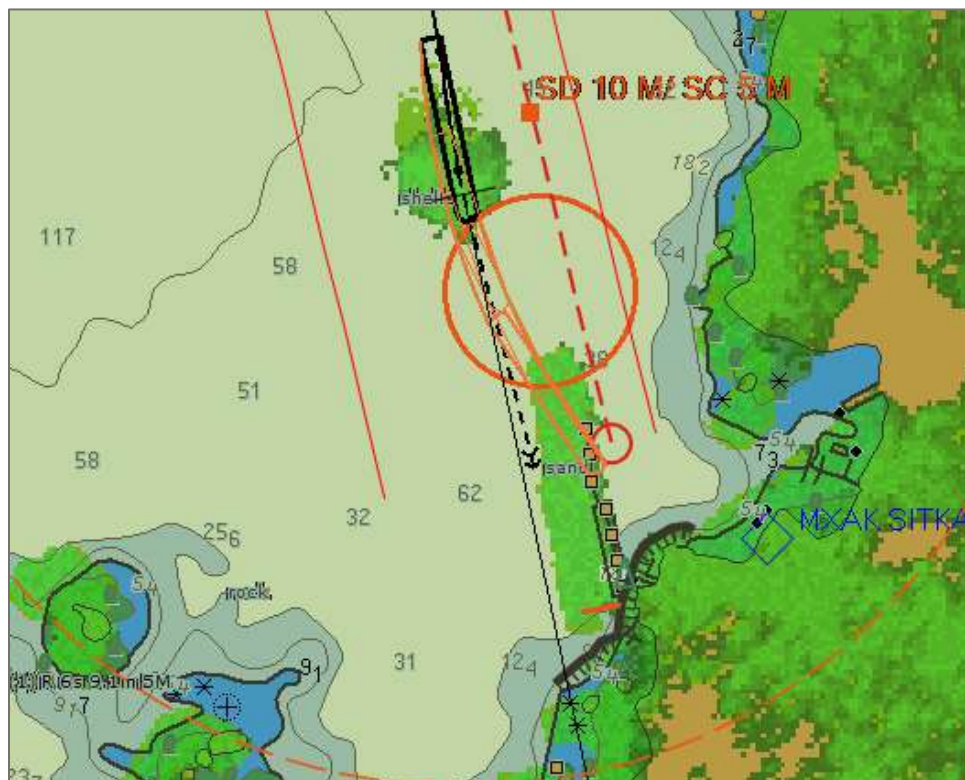
<sup>4</sup> NOAA considered the change a "routine" chart correction, which is not published in a *Notice to Mariners*. The correction was not made to the raster (paper) chart, since raster charts are currently being phased out.

that the pier had been lengthened in 2021. Pilot 1 stated that he was aware of the pier's extension.

The port had provided the company with a mooring plan depicting the new pier arrangement, and the company distributed the plan to its vessels.

### 1.3.3 Radar

The *Radiance of the Seas*'s radar returns could be viewed on the vessel's ECDIS. After the casualty, investigators reviewed data captured by the vessel's voyage data recorder. Investigators found the radar returns shown on the ECDIS did not correspond with the charted position of the Sitka Sound Cruise Terminal pier and showed uncharted infrastructure.



**Figure 8.** Screenshot of *Radiance of the Seas*'s ECDIS with radar overlay during the vessel's approach to the terminal about 0723 on the day of the casualty. The radar return (shown in green) of the extended pier does not coincide with the charted position of the pier beneath. The larger orange circle shows the vessel's planned turn, and the smaller orange circle is the final waypoint of the route, at the end of the older pier. (Source: Royal Caribbean Cruise Lines)

The *Radiance of the Seas* had an additional radar scanner and camera on the stern of the vessel, both used for maneuvering and to see objects astern, but neither was used during the casualty voyage.

## 2. Analysis

The Sitka Sound Cruise Terminal pier was extended northward by 395 feet with the addition of two dolphins and a connecting walkway in April 2021 (after the US Army Corps of Engineers approved the project in April 2020). However, according to NOAA, the facility did not communicate the change to the agency. As a result, the pier was not accurately depicted on any navigational charts. Therefore, during the casualty voyage, the *Radiance of the Seas's* ECDIS showed the original, nonextended pier. Although regulation does not require reporting of pier modifications, communication of the pier's extension to NOAA would have resulted in the ENC being updated, thus improving the vessel operator's awareness of the pier's extension.

The *Radiance of the Seas* had moored at the Sitka Sound Cruise Terminal the week before the casualty with the same master but on the west side of the pier, which did not require the vessel to rotate before docking. The facility had shared the updated mooring plan with the vessel's company. However, none of the members of the bridge team had noted the new length of the pier during the visit, and after the casualty, the officers and master stated that they were unaware of the change. As the *Radiance of the Seas* approached the port, the master planned to rotate the vessel about 180° before backing into the berth and mooring port side to the pier in the inboard (east side) berth, with the stern facing the terminal. The location where they chose to start the turn was based on the inaccurate ENC. The Alaska state-licensed pilot who was on the bridge at the time and was aware of the new expansion also did not inform the master or bridge team of the pier extension either before or during the maneuver. Had the bridge team identified the pier's extension on the previous visit, they likely would have planned to rotate the vessel in a different location in the Sitka Sound with ample distance to turn before mooring.

As the *Radiance of the Seas* approached the pier, the weather was clear, and visibility was good (10 miles). Therefore, the master and bridge team should have been able to see the extended pier and added dolphins. However, none of the members of the bridge team reported the extension as the vessel approached the pier. Instead, the master relied on the ECDIS—which showed the inaccurate ENC—to determine the vessel's position relative to the pier. When the vessel was about 0.37 miles from the pier, the master began rotating the vessel. Because the *Radiance of the Seas* was still making headway (about 6 knots) at the time, the vessel continued moving closer to the pier as the vessel rotated to port. Had the master slowed and stopped the vessel earlier in his approach, he likely would have been able to rotate the vessel with adequate space to avoid striking the mooring dolphin at the end of the pier.

In addition to the ECDIS, the master and bridge team had other navigation technologies, including radars and cameras, available to assist them with the approach

to the terminal and mooring arrangement. The vessel was equipped with radar, and the bridge team was able to see the radar return on the vessel's ECDIS. However, investigators found that during the vessel's approach, the main radar image overlay did not match the ENC on the ECDIS—the radar showed the pier extending beyond its location on the ENC. The fact that the charted pier did not match the radar return overlay on the ECDIS should have raised concern amongst the bridge team regarding their planned turn point. However, no one on the bridge team reported the discrepancy to the master, who was conning the vessel, indicating they either were not using the radar or were not paying attention to the radar returns.

A starboard bridgewing camera trained on the pier was also available to the bridge team. The staff captain operated the camera, but the camera failed (due to a hardware problem) as the vessel was rotating to port to back into the berth, leaving the bridge team without a clear image of the pier and dolphins behind them. Once the vessel began turning, the primary radar would not have been available due to a radar shadow area astern. The *Radiance of the Seas* had an additional radar scanner as well as a camera on its stern, both of which were specifically in place and available on the bridgewings to aid bridge teams in seeing objects aft of the ship during maneuvering operations. The radar scanner and camera could have been used by the bridge team to show objects—in this case, the pier and mooring dolphins—astern of the vessel, but the bridge team did not use these tools. Instead, they relied solely on the ECDIS, which showed an inaccurate ENC. Had the bridge team effectively used the technologies available to them to complete the turn and mooring maneuver, the casualty likely could have been prevented.

The bosun was stationed on the *Radiance of the Seas's* aft mooring deck to communicate by radio the distance from the vessel's stern to the pier. The bosun called out what were later determined to be accurate distances to the pier's northernmost dolphin from the ship's stern, and the master incorrectly assumed the bosun was calling out how much clearance the ship would have as the stern passed the dolphin. The bosun had either not been properly briefed before the maneuver or had received no instruction as to what exactly he was expected to communicate to the bridge team. Had the master and bosun clearly understood what distances were being communicated, the master and bridge team may have been aware of how close the vessel was to the dolphin and could have taken action to avoid the casualty.

Because the master and bridge team were unaware of how close the *Radiance of the Seas* was to the pier and mooring dolphins as they began rotating the vessel, the vessel struck the dolphin, resulting in damage to both the dolphin and the vessel's hull.

## 3. Conclusions

### 3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the contact of the cruise ship *Radiance of the Seas* with the Sitka Sound Cruise Terminal pier was the master and bridge team's overreliance on an electronic chart to identify the pier's position relative to their planned rotation location, and the master's misunderstanding of the clearance distances to the pier being called by the crewmember on the stern while the vessel was rotating. Contributing was the Sitka Sound Cruise Terminal not reporting the extension of the pier into the waterway to the appropriate hydrographic authority in order to update the relevant navigational chart.

### 3.2 Lessons Learned

#### Voyage Planning

Proper voyage planning includes developing a complete plan for every phase of the voyage—from the vessel's starting port to its end port (berth to berth), including leaving the dock and mooring. Reference points for maneuvering should be identified, measured precisely, and reported clearly. Vessel bridge teams should also ensure that they have the most up-to-date data before getting underway and consult with the local pilot(s) on the accuracy of navigation charts to ensure depictions of ports and/or terminals are correct.

#### Reporting Port or Terminal Modifications

Ports and terminals should immediately report significant modifications to port or terminal configurations to the appropriate hydrographic authority (for example, the National Oceanic and Atmospheric Administration) so that charts can be updated and the changes made readily available to vessel owners, operators, and crews/bridge teams.

Vessel	<i>Radiance of the Seas</i>
Type	Passenger (Cruise ship)
Owner/Operator	Royal Caribbean Cruise Lines (Commercial)
Flag	Bahamas
Port of registry	Nassau, Bahamas
Year built	2001
Official number (US)	N/A
IMO number	9195195
Classification society	DNV
Length (overall)	961.7 ft (293.1 m)
Breadth (max)	105.6 ft (32.2 m)
Draft (casualty)	27.9 ft (8.5 m)
Tonnage	90,090 GT ITC
Engine power; manufacturer	2 x 33,526 hp (25,000 kW); GE LM 2500 gas turbines

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

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For more detailed background information on this report, visit the NTSB investigations website and search for NTSB accident ID DCA22FM018. Recent publications are available in their entirety on the NTSB website. Other information about available publications also may be obtained from the website or by contacting—

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