



National Transportation Safety Board

Washington, D.C. 20594

Marine Accident Brief

Accident No.: DCA-06-MF-013

Vessel: Hong Kong–registered container ship *New Delhi Express*, official No. HK-1610, IMO No. 9301770, 853 feet long, 39,941 gross tons, steel construction, built in 2005

Accident Type: Grounding

Location: New York Harbor, Kill Van Kull waterway near buoy 14, Bergen Point West Reach, latitude 40° 38.5' N, longitude 74° 08.7' W

Date: April 15, 2006

Time: 0420 eastern daylight time

Owner: Seaspan Ship Management Ltd., Vancouver, BC, Canada

Property Damage: \$1.5 million, *New Delhi Express*
\$83,000, tug *Miriam Moran*
\$35,000, tug *Kimberly Turecamo*
\$0, tug *Turecamo Girls*

Injuries: None

Complement: 22 crew, 2 pilots, 3 noncrewmember guests

Accident Description

At 0420¹ on Saturday, April 15, 2006, the Hong Kong–registered container ship *New Delhi Express* (figure 1), with a master, 2 pilots, 21 crewmembers,² and 3 noncrewmember guests (relatives of crewmembers) on board, ran aground in the Kill Van Kull waterway in New York Harbor (figure 2). The *New Delhi Express* and two of the three tugs assisting it were damaged in the accident. No one was injured, and no water pollution resulted from the accident.

¹ Sunrise was at 0618 eastern daylight time in New York Harbor the day of the accident, with twilight beginning at 0549 (U.S. Naval Observatory, Astronomical Applications Department <http://aa.usno.navy.mil/cgi-bin/aa_pap.pl>).

² The master, a native of India, held a master's license issued by India in 1994 and had worked for the vessel's owner for 3 years. Of the crewmembers, 7 were from India, 11 from the Philippines, and 3 from Sri Lanka.



Figure 1. Container ship *New Delhi Express* (formerly *CP Khana*). The 853-foot-long vessel was powered by a single 49,680-horsepower MAN B&W diesel engine and could make 24.5 knots. The vessel's bridge was at the top of the eight-story white superstructure at the stern. Two pilots joined the master and other crewmembers on the bridge for the transit of New York Harbor.



Photo courtesy Airphoto Jim Wark and National Oceanic and Atmospheric Administration

Figure 2. View of the Kill Van Kull looking west toward Bayonne and Newark Bay. The *New Delhi Express* was on its way to Port Newark, at right rear of photo, when it went aground just past the Bayonne Bridge (upper left). (Red vessel in foreground is not the *New Delhi Express*.)

The *New Delhi Express* arrived at the entrance to New York Harbor about 0200 on April 15, after a transatlantic voyage that began in Gibraltar on April 8. The pilot who would navigate the vessel from the harbor entrance near Sandy Hook to the Kill Van Kull (the Sandy Hook pilot) boarded the vessel at 0210,³ carrying with him a laptop computer that contained relevant navigation programs. The Sandy Hook pilot held both a U.S. Coast Guard first-class pilot's license and a New York state pilot's license issued by the Board of Commissioners of Pilots of the State of New York.⁴ He had piloted another ship the evening before the accident but had been off duty most of the previous 2 days and told investigators that he was well-rested when he boarded the *New Delhi Express*.

After the Sandy Hook pilot exchanged information with the master,⁵ the pilot assumed navigational control. The *New Delhi Express* then proceeded inbound toward the Verrazano Narrows Bridge and the Lower Bay of New York Harbor.⁶ The weather was calm, with fair to poor visibility in passing fog patches.

Two tugs, the *Miriam Moran* and the *Kimberly Turecamo*, had been ordered for the transit through the Kill Van Kull and into Newark Bay.⁷ At 0342, near buoy 22, after the *New Delhi Express* had reduced speed to about 6 knots, the tug *Miriam Moran* came

³ Foreign vessels entering or departing the Port of New York and New Jersey must employ a pilot licensed by the states of New York or New Jersey. The pilot directs bridge team personnel in navigating the vessel through the harbor. Pilots and pilot boats for vessels entering New York Harbor are provided by the United New York and New Jersey Sandy Hook Pilots Association.

⁴ The oversight of pilots and pilotage matters is generally vested by state law in state pilotage commissions, which vary in size and composition from state to state. Oversight includes the procedures to qualify new pilots and monitor pilot performance. Commissions can also establish training requirements for pilots.

⁵ Cargo ships and other vessels that make international voyages are required to follow the regulations established by the International Maritime Organization (IMO), a specialized agency of the United Nations. Minimal requirements for exchanges of information between masters and pilots are established in annex 2 of the IMO Pilotage Resolution (Resolution A.960[23]), adopted in 2003. The 1998 International Safety Management Code (International Management Code for the Safe Operation of Ships and for Pollution Prevention) establishes safety management objectives and requires shipowners, or those responsible for ship operation, to establish safety management systems for their vessels. The safety management systems incorporate the international requirements, including procedures for master-pilot exchanges. For further discussion of master-pilot exchanges, see the "Bridge Resource Management" section of this brief.

⁶ New York Harbor is divided into the Upper Bay and the Lower Bay by the Narrows, which is about 0.6 mile wide at its narrowest point between Ft. Wadsworth, Staten Island, and Ft. Hamilton, Brooklyn (National Oceanic and Atmospheric Administration, National Ocean Service, *United States Coast Pilot*, vol. 2 [Cape Cod to Sandy Hook], 2005, p. 372).

⁷ The Kill Van Kull waterway separates the southern shore of Bayonne, New Jersey, from Staten Island and connects the Upper Bay of New York Harbor with Newark Bay and Arthur Kill. The transit through the Kill Van Kull, after leaving the Upper Bay, begins just east of Constable Hook, Bayonne, and continues west for 3.75 miles to buoy 14 at Bergen Point, just west of the Bayonne Bridge. The bridge spans the width (approximately 370 yards) of the navigable channel of the Kill Van Kull between Bayonne and Staten Island. The bridge has a minimum clearance of 138 feet over the channel (151 feet at the centerline). The mean range of tide in the Kill Van Kull is about 4.5 feet (*United States Coast Pilot*, vol. 2, p. 398). Depth through the Kill Van Kull is 45 feet at mean lower low water (average of all lowest water levels for tidal days over a period of usually 19 years), but is being increased to 50 feet (U.S. Army Corps of Engineers, press release, May 10, 2006).

alongside to embark a second pilot, the docking pilot,⁸ for the transit to the dock at Port Newark. The pilot, a 1978 graduate of the U.S. Merchant Marine Academy, had worked as a docking pilot in New York Harbor since 1989. He was licensed by the Coast Guard as a master of oceangoing vessels (not more than 1,600 gross tons domestic or 3,000 gross tons international), as a third mate on oceangoing vessels, and as a first-class pilot in New York Harbor and nearby sounds and rivers. He also held a New Jersey state docking pilot's license for the Port of New York and New Jersey,⁹ issued by the new Jersey Maritime Pilot and Docking Pilot Commission, and had received radar and bridge management training. He had been on duty the day before the accident but was not called into work and had been off duty for 2 days before that. He was sleeping in the pilots' trailer at the tugboat yard on Staten Island when called for work on the *New Delhi Express*.

Accompanied by one of the ship's crew, the docking pilot made his way up eight decks to the bridge. After greeting the Sandy Hook pilot and exchanging information with him, the docking pilot assumed navigational control of the vessel. The master of the *New Delhi Express* witnessed the exchange. The vessel was nearing the part of the waterway known as the "Conhook" Reach (Constable Hook Reach). The docking pilot stated that he took the conn¹⁰ when the Conhook Reach was dead ahead, that is, when the vessel left the Upper Bay and entered the Kill Van Kull.

The docking pilot's duties were to issue steering and engine orders to the bridge team that would guide the vessel 3.8 miles through the dredged channel of the Kill Van Kull, around the turn at Bergen Point into Newark Bay, and to the vessel's intended docking site at berth 59 of the Port Newark terminal (figure 3). Buoy 14 marks the start of the turn at Bergen Point and is intended to mark the limit of navigable water beside a submerged ledge where the water is 20 feet deep or less.¹¹ According to the president of his pilots' association (Metro Pilots), the docking pilot had navigated over 3,000 ships around Bergen Point.

⁸ A docking pilot is a pilot with expertise in maneuvering deep-sea vessels in confined spaces (such as alongside a pier). The docking pilot boards the ship, assumes navigational control, and brings the vessel into port, usually with tugboat assistance. Docking pilots are licensed by the Coast Guard (in Maryland and New Jersey, they are also licensed by the state) and are employed by tug companies. (U.S. Department of Homeland Security, Federal Emergency Management Agency <www.nimsonline.com>.)

⁹ Both pilots were operating the *New Delhi Express* under their state licenses. The United States has a dual system of pilotage administration. Under state law, vessels in foreign commerce (foreign-flag vessels and U.S.-flag vessels on foreign voyages) are required to employ state-licensed pilots. Under Federal law, U.S. vessels in domestic commerce must be under the direction and control of a federally licensed pilot, or of a master or mate whose license carries a Federal pilotage endorsement. Most state pilots also hold a Federal license, as did the *New Delhi Express* pilots. When operating a U.S. vessel in domestic commerce, state pilots operate under the authority of their Federal license and are subject to Coast Guard jurisdiction.

¹⁰ "Take the conn" means assume control of a ship's movements.

¹¹ A concrete platform was under construction near buoy 14 at the time of the accident.

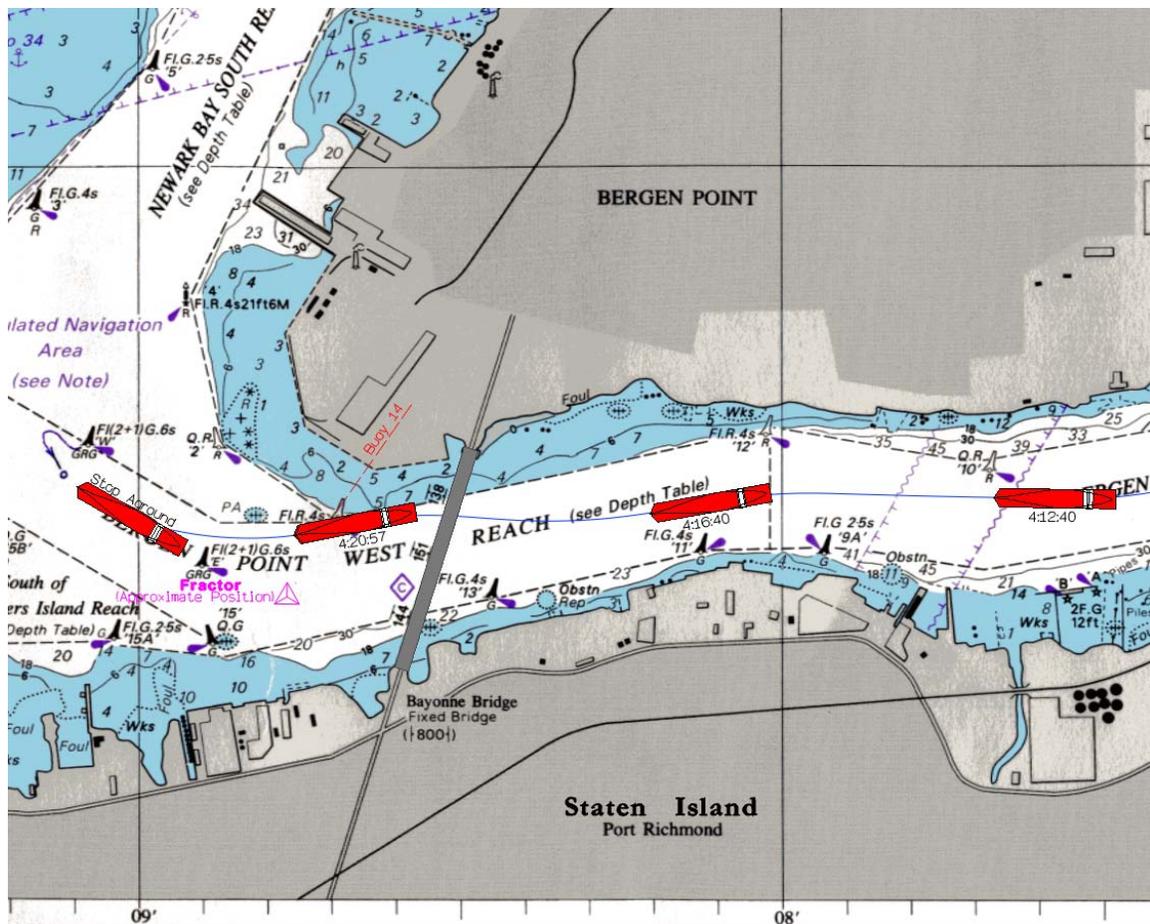


Figure 3. Westward track of the *New Delhi Express* through the Kill Van Kull to its grounding position. The vessel model is dimensionally correct and indicates the vessel's position at referenced times along its track (blue line). Immediately east of the *New Delhi Express*'s "stop aground" position is the approximate position of the drill/dredge boat *Fractor*. Latitude and longitude for the *New Delhi Express* were obtained from voyage data recorder (VDR) data. The vessel track is overlaid on the navigation chart used aboard the *New Delhi Express* (*United States—East Coast, New York, Arthur Kill, Kill Van Kull and Newark Bay*, Admiralty chart 4357, 4th ed. [Taunton, United Kingdom: United Kingdom Hydrography Office, June 2005]). The *Fractor*'s position was approximated from an image generated by the Coast Guard vessel traffic service, New York Harbor, using data from the automated identification system (AIS).¹²

¹² All ships of 300 gross tons or more engaged on international voyages are required by the International Convention for the Safety of Life at Sea (SOLAS), 1974, chapter V, regulation 19.2, to be fitted with an AIS—a shipboard broadcast system, operating in the very-high-frequency (VHF) maritime band, that can send and receive ship information such as identity, position, course, and speed. In U.S. waters governed by vessel traffic service or vessel movement reporting systems, certain commercial and towing vessels and all passenger vessels carrying 150 or more passengers are required to carry AIS equipment. The Coast Guard's vessel traffic service in New York uses AIS data to continuously monitor waterway traffic from a center at Ft. Wadsworth, Staten Island.

An ongoing U.S. Army Corps of Engineers project to deepen the channels in New York Harbor to accommodate deeper-draft¹³ vessels required the presence of dredges or drill boats in the Kill Van Kull, including one near buoy 14.¹⁴ Because of the dredging project, the Coast Guard designated the waterway in the accident area as a regulated navigation area. For approximately 0.75 mile on either side of the Bayonne Bridge, the channel was restricted to about half its normal width, and vessel movement was one way only.

When the *New Delhi Express* entered the Kill Van Kull, the bridge team consisted of the two pilots, the master (who maintained overall command of and responsibility for the vessel¹⁵), the second mate, and the helmsman. The second mate was stationed at the telegraph¹⁶ to relay engine orders from the pilot and make sure the helmsman followed the pilot's steering orders. The second mate also kept the logbook. The docking pilot maintained radio contact with the tugmasters and ordered them to either secure lines (ropes) to the vessel or lie alongside and assist in the maneuvering of the vessel by pushing or pulling when instructed. The Sandy Hook pilot stated, "Legally, I'm responsible for the ship from sea to the dock and dock to sea."¹⁷ He described his responsibilities after the docking pilot took control as follows:

Depending on the situation, depending on the traffic and the visibility, usually basically it's just a matter of maybe monitoring, you know, radio calls for him [the docking pilot], trying to help him out with the radio calls because of the increased traffic within the Kills. In this case, because of the visibility, it's a matter of trying to help without getting in the way, you know, we work on the assumption that four eyes are better than two and that any assistance I can give or the docking pilot will ask for, I will provide.

The docking pilot stated that although the Upper Bay had noticeable pockets of fog when he boarded, visibility was good as the *New Delhi Express* entered the Kill Van

¹³ Draft is the vertical distance measured from the lowest point of a ship's hull to the waterline.

¹⁴ In some project areas, drilling and blasting were required to remove rock from the harbor bottom.

¹⁵ Although both masters and pilots are subject to various state and Federal laws and regulations, the master-pilot relationship is not clearly defined. A pilot is a mariner with expert knowledge of local waters and special shiphandling skills, and while the pilot is on board, he or she is in command of the vessel's navigation. However, the master is still in command of the vessel: ". . . by tradition, admiralty law, and legal precedent, the master always remains in command and is ultimately responsible for the safe navigation of the vessel, including the actions of the pilot (except in the Panama Canal . . .)" (National Research Council, *Minding the Helm: Marine Navigation and Piloting* [Washington, DC: National Academy Press, 1994], p. 70).

¹⁶ The telegraph is a device with a lever for transmitting and acknowledging orders for engine movements.

¹⁷ The use of a pilot in the waters of the Port of New York and New Jersey is compulsory, and the Board has previously requested information from the American Pilots' Association regarding the responsibilities of a compulsory pilot. In a letter of December 13, 1996, an association representative stated: "The compulsory pilot has direct control of the navigation of the ship, subject to the master's overall command of the ship and the ultimate responsibility for its safety. 'It is always to be presumed, in the absence of positive evidence to the contrary, that a local pilot employed for the occasion and actually on the bridge is in charge of the navigation of the ship, subject to the authority of the master.' *United States v. Jacksonville Forwarding Co.* ISF 2nd 39, 40 (5th Cir. 1929)." See also footnote 15.

Kull. According to data from the vessel's VDR,¹⁸ while proceeding west, the docking pilot asked for and received reports on visibility over the VHF radio, which indicated a significant reduction in visibility near the Bayonne Bridge and into Newark Bay. The docking pilot called his office and ordered an additional tug. After receiving acknowledgement that a tug (the *Turecamo Girls*) would be available, the docking pilot told the tugboat office that his vessel was next to the Coastal Bayonne pier (west of the Conhook Reach) and that "he [the tug] could drift out this way." The docking pilot gave the tug a position order, "You will be on the port bow with a rope," before it left the boatyard. The *Turecamo Girls* did not put a line on the *New Delhi Express* before the accident.

The *New Delhi Express* continued west through the Kill Van Kull. The tug *Miriam Moran* was on the vessel's starboard bow, with one line secured, and the tug *Kimberly Turecamo* was following closely on the vessel's starboard quarter. The ship was on a slow-ahead bell and making about 6 knots. Various commands from the docking pilot to the vessel's bridge team were given and answered during the transit, as indicated on the VDR. The responses of both the helmsman controlling the rudder and the second mate at the engine order telegraph were accurate and timely. Directions to the tugs from the docking pilot and the tugmasters' responses are also audible on the VDR recording.

In the Bergen East Reach east of buoy 10, the patchy fog became so dense that, according to the docking pilot, "The visibility by then had dropped down to just about zero." The docking pilot asked the *Turecamo Girls* for its position. The tugmaster responded that the tug was just coming out of the yard and asked the docking pilot, "Is that you going by?" The docking pilot responded, "Yeah, that's me going by." The docking pilot immediately ordered stop engine, followed quickly by the stop bell. The docking pilot then said, "Just for a minute we will get her down to about 4 knots," indicating that the *New Delhi Express* had overshot the position of the *Turecamo Girls*. The VDR data show that the vessel's speed did not go below 6 knots.

Through the sequence of events leading to the grounding, conversations recorded on the vessel's VDR show that the docking pilot repeatedly consulted the tugmasters for their advice on reference points and on the vessel's progress through the water, as well as frequently asking for the Sandy Hook pilot's opinion. The *New Delhi Express* master monitored the vessel's progress on the starboard radar. The docking pilot was positioned at the port radar. The Sandy Hook pilot stated that he moved between the port radar and his laptop display, which he had set up on the forward bridge rail in front of and a little to the left of the port radar (figure 4). According to the VDR recording, conversation was casual between the two pilots and limited between the pilots and other members of the bridge team, except for issuing and acknowledging steering and engine orders.

¹⁸ Under regulation 20 of SOLAS chapter V, ships other than passenger vessels of 3,000 gross tons or more are required to carry VDRs if they were constructed on or after July 1, 2002. The *New Delhi Express* was built in 2005. VDRs, which are similar to the flight data recorders carried on aircraft, maintain continuous, sequential records of data relating to a ship's equipment and its command and control. The Safety Board obtained a copy of the *New Delhi Express*'s VDR data, not the original.



Figure 4. Bridge of the *New Delhi Express*. Top photo shows the overall layout. Bottom left photo shows the docking pilot's position at the port radar. Bottom right photo shows the helmsman's station (bridge telegraph knob is immediately to right).

As the *New Delhi Express* approached the Bayonne Bridge, now on a dead-ahead-slow bell, the docking pilot called the master of the lead tug (the *Miriam Moran*, on the vessel's starboard bow) for a visual check of his vessel's position. The *Miriam Moran* master responded, "It looks like you are right in the middle of the channel." After trying to identify contacts on the radar, the docking pilot then asked the Sandy Hook pilot, "What do you think, a little right?" The Sandy Hook pilot responded, "Yeah, got to come right."

Immediately after the Sandy Hook pilot's response, with the vessel moving at about 6 knots, the docking pilot ordered starboard 20°. He then asked the *Turecamo*

Girls, on the vessel's port bow, "Do you see anything?" The *Turecamo Girls* master responded, "I don't see a chock here," indicating that he was looking for a place to put a line on the *New Delhi Express*. This statement should have alerted the docking pilot that the tug on the port bow was not yet secure. Instead, the pilot said to the tugmaster of the *Turecamo Girls*, "I am looking for anything you can see, I'm at zero here." The docking pilot then asked the *Miriam Moran*, the forward tug, "How we looking?" The *Miriam Moran* master responded, "Still looking good you know, you're a little bit right of the middle of the channel but . . ."

The docking pilot then asked the Sandy Hook pilot, "What do you think, come right?" The Sandy Hook pilot responded, "Wait until you get under the bridge, then you can start coming right." On the VDR recording, the docking pilot can then be heard starting a sentence with "I'm still . . ." then the steering order "midship." This order of events indicates that with the rudder still at starboard 20°, the docking pilot had started the vessel on its path toward the ledge at Bergen Point. While the docking pilot talked to the tugs and the Sandy Hook pilot about visibility and the next course of action, the wheel had remained on starboard 20°. The pilot immediately ordered the rudder back to midships, but by that time, the vessel's course over the ground was already toward the shallow water. The vessel continued toward the waterway's north bank.

As the *New Delhi Express* passed under the Bayonne Bridge, the docking pilot had to navigate between buoy 14 and the drill/dredge boat *Fractor*. When the Sandy Hook pilot, who was looking at the radar screen, stated, "Beacon, buoy," the docking pilot said, "We've got another buoy to go around?" A few seconds later, the *Miriam Moran* (on the starboard bow) radioed to the docking pilot, "I think you are too far right. I'm seeing the red side of the bridge here."¹⁹

The Sandy Hook pilot then told the docking pilot, "Yeah, you want to come left a little bit here." The docking pilot immediately ordered "port 20." The master of the *Miriam Moran* then warned the *New Delhi Express* that he was "looking straight out at the buoy," and the docking pilot began issuing orders to avoid the close-quarters situation with the buoy. The docking pilot ordered "hard to port" with the ship's wheel and had the *Miriam Moran* push the vessel away from the buoy. He also asked the *Turecamo Girls* on the port bow to go half astern, but the tug did not have a line on the *New Delhi Express*.²⁰

At this point, the Sandy Hook pilot was on the starboard bridge wing shouting distances off the buoy to the docking pilot. The *Miriam Moran* master was telling the docking pilot that things were "getting better all the time." To navigate by buoy 14, the docking pilot first ordered "midship." Then, about 30 seconds later, he ordered "starboard 20." Eight seconds later, as the vessel passed buoy 14, the Sandy Hook pilot said, "You got it midship." The docking pilot responded "midship," and the helmsman changed the

¹⁹ The Bayonne Bridge showed red lights on the outside, a green light in the middle. The *Miriam Moran* master's comment indicates that the *New Delhi Express* was passing under the bridge on the far north side.

²⁰ Even if the tug had had a line on the bow, it might have moved the stern of the *New Delhi Express* even closer to the ledge. The VDR recorded no orders before the grounding for the *Kimberly Turecamo*, which was on the vessel's stern, to push the *New Delhi Express* away from the danger.

rudder to midship. The Sandy Hook pilot estimated that the vessel's starboard side passed buoy 14 within about 50 feet.

Shortly afterward, with the vessel's bow swinging to the left back into the channel, the *New Delhi Express* began listing to starboard. None of the bridge team, including the pilots, had felt the vessel touch the ledge. But the list quickly increased to approximately 10° to starboard. The pilots continued to maneuver the vessel away from the ledge and back into the deeper water. The crew was ordered to sound the tanks, which revealed that the *New Delhi Express* was holed in both the empty No. 4 fuel oil tank and the No. 5 water ballast tank and was taking on water. The increased weight in the empty fuel oil tank and the 10° list to starboard caused the vessel to come to rest on the bottom in the center of the Bergen Point West Reach (figure 3).²¹

The pilots notified the vessel following them (the container ship *Maersk Georgia*, about 1 1/4 miles behind) and the Coast Guard vessel traffic service for New York Harbor that the *New Delhi Express* had grounded, and the vessel's crew set about reducing the list by pumping ballast into the portside tanks. Additional tugs were called to stand by until the vessel could be moved again. Relief pilots boarded the vessel, and the two pilots of record left to submit statements and undergo mandatory drug and alcohol testing. The vessel refloated on the incoming tide at approximately 0630. By 0800, the *New Delhi Express* had docked at berth 86 in Port Newark, where Coast Guard personnel boarded it and began an investigation into the accident. The Safety Board's investigation began a week later, after the Coast Guard discovered a discrepancy in the position of buoy 14 (see "Buoy Position" section for further information).

The *New Delhi Express* incurred serious damage along 85 feet of the starboard side at the turn of the bilge (figure 5).²² The accident displaced part of the vessel's bilge keel²³ and breached the No. 4 heavy fuel oil tank and the No. 5 water ballast tank. Because the fuel oil tank was empty, no oil was released into the water. A residual amount of unpumpable oil was removed at the drydock²⁴ before repairs began. The vessel's owner estimated repair costs at \$1.5 million. The shipyard used approximately 52 tons of steel to repair the damage.

The two tugs that assisted the *New Delhi Express* on the starboard side—the *Miriam Moran* at the bow and the *Kimberly Turecamo* at the stern—suffered hull and propeller damage. Repair costs were \$83,000 for the *Miriam Moran* and \$35,000 for the *Kimberly Turecamo*.

²¹ The vessel's draft was 39 feet. As noted earlier, the channel depth was being increased from 45 to 50 feet by an Army Corps of Engineers project.

²² Curved portion of ship's bottom where it turns from horizontal to vertical, or nearly so.

²³ A beam or fin fastened lengthwise along the outside of a ship's bilge to inhibit heavy rolling.

²⁴ A dock in or on which a vessel lies entirely out of water for repairs or painting.

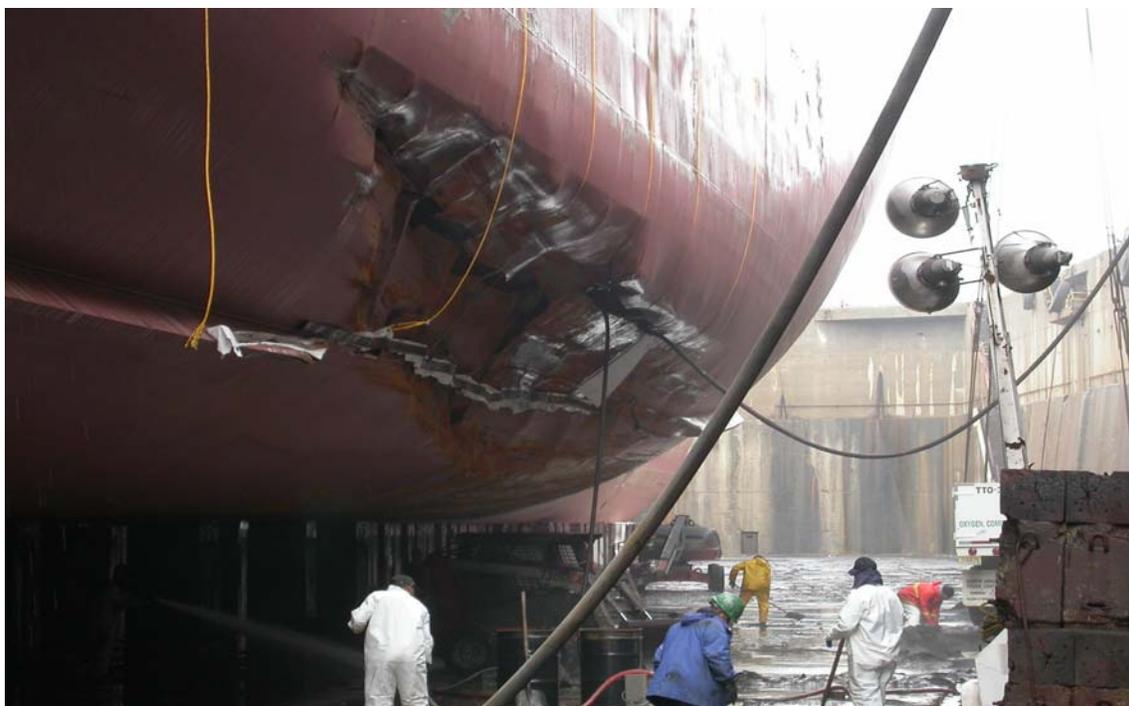


Figure 5. Damage to the starboard side of the *New Delhi Express*. The impact with the submerged ledge breached an empty heavy fuel oil tank and a water ballast tank. No oil was released into the water. Repairs cost an estimated \$1.5 million and required about 52 tons of steel.

Toxicological Testing

Postaccident drug and alcohol testing was performed on the *New Delhi Express* master and the two pilots.²⁵ The results were negative.

Additional drug and alcohol testing was performed on the crews of the tugboats that were damaged while assisting the *New Delhi Express*. Again, test results were negative for drugs and alcohol.

²⁵ Federal regulations at 46 *Code of Federal Regulations* (CFR) 4.06 require postaccident drug and alcohol testing on “each individual engaged or employed on board the vessel who is directly involved in” any accident meeting the criteria of a serious marine incident, defined at 46 CFR 4.03-2 as (a) a marine casualty or accident that results in any of the following: (1) one or more deaths, (2) injury that requires medical treatment beyond first aid and renders the individual unfit to perform routine duties, (3) property damage exceeding \$100,000, (4) actual or constructive total loss of an inspected vessel, or (5) actual or constructive total loss of any uninspected vessel that exceeds 100 gross tons; (b) discharge of 10,000 or more gallons of oil into U.S. waters; or (c) the release of a reportable substance into the environment of the United States. On June 20, 2006 (2 months after the *New Delhi Express* grounded), new Coast Guard regulations (46 CFR 4.06-3) went into effect requiring alcohol testing within 2 hours of a serious marine incident and the collection of drug-test specimens within 32 hours.

Buoy Position

Buoy 14 marks the northern limits of the Bergen Point West Reach at the turn around Bergen Point into Newark Bay. On April 15, 2006, after the accident, the Coast Guard conducted a position check of the navigation aids (buoys) in the immediate vicinity of the grounding. All aids were reported to be functioning properly. A review of the data, however, revealed that buoy 14 was positioned in only 28 feet of water, whereas it had been intended to be placed in 50 feet of water, to mark the northern edge of the navigable channel. Further review indicated that the position data might be erroneous. Because of that new information, on April 21, the Coast Guard asked the Safety Board to lead the accident investigation.²⁶ The Coast Guard broadcast safety warnings to mariners until the buoy was redeployed on April 24, as described below.

On April 24 (9 days after the accident), a Safety Board investigator boarded the Coast Guard cutter *Katherine Walker* (WLM 552) to observe an additional position check of buoy 14. The buoy was found to be positioned at latitude 40° 38' 34.836" and longitude 74° 08' 40.967" (the position to which it had been deployed in December 2004) in approximately 28 feet of water corrected to datum (mean low water). The moorings²⁷ were fouled by what appeared to be the discarded remains of former Kill Van Kull light tower 14. After the position check, buoy 14 was redeployed to a position in 56 feet of water about 26 yards south, to latitude 40° 38' 33.990" and longitude 74° 08' 41.280".

During the recovery of buoy 14's moorings, the *Katherine Walker* hauled aboard 90 feet of chain, measured from the base of the buoy to the top of the clump anchor pad eye.²⁸ According to Coast Guard personnel on board the *Katherine Walker*, the standard rigging for buoys usually includes 10 to 15 feet of chain beyond what is required by the water depth. Sometimes enough chain is deployed so that it has sufficient slack to be brought on board the buoy tender for maintenance without disturbing the anchor. That, however, is less of a consideration in modern buoy operations that use precise navigation fixing via satellite and highly maneuverable vessels with exact station-keeping abilities.

When buoy 14 was originally deployed with 90 feet of chain, about 60 feet of chain would have remained on board the tender after the buoy anchor touched bottom at 28 feet. With that much chain remaining to be deployed, command personnel on board the buoy tender should have recognized that something was wrong and should have verified the position information. The Coast Guard's manual for the operation and maintenance of federally controlled aids to navigation states:²⁹

²⁶ The Coast Guard's request for the Safety Board to lead the accident investigation was consistent with the memorandum of understanding between the two agencies that was signed on September 12, 2002.

²⁷ Chain connected to an anchor (weighing 5,000 pounds) to hold a buoy in position.

²⁸ A fitting having one or more eyes or rings to which a block, wire rope, chain, or line can be secured.

²⁹ U.S. Coast Guard, "Aids to Navigation Manual—Administration," Commandant Instruction M16500.7A (Washington, DC: U.S. Department of Homeland Security, March 2, 2005), p. 8-3.

When servicing aids to navigation, the information regarding the aid as published in the [aid record³⁰] shall be verified. . . . Errors and omissions should be brought to the attention of the district (oan [Office of Aids to Navigation]) staff.³¹

Because of their deep draft, vessels such as the *New Delhi Express* that navigate around Bergen Point up to Newark Bay can operate only in the navigable (“good”) water of the Kill Van Kull. Coast Guard instructions regarding aids to navigation state: “The aid *MUST* mark the depth of water appropriate to the waterway. Ensuring that an aid reasonably marks ‘good’ water is of more importance than ensuring that the aid marks a precise geographical position.” Whether or not a sounding was taken when buoy 14 was originally deployed, the instructions state: “A sounding *MUST* be taken each time a buoy is positioned.”³²

To accommodate the ongoing dredging project in the Kill Van Kull, buoy 14 had been moved numerous times. Discussions with Coast Guard personnel after the accident suggested that during one of the moves, old data had erroneously been entered into the Coast Guard’s database on aids to navigation, and that the buoy was then deployed by the Coast Guard buoy tender in the wrong position. Subsequent position checks would also have been compromised by the erroneous database.

In their written statements submitted to the Coast Guard shortly after the accident, neither of the vessel’s pilots called into question the location of the buoy, and they had ample radar data during the transit showing land, bridges, navigational aids (buoys, platforms), and the return echo off the channel bank. Moreover, navigational texts caution mariners against relying completely on buoys. The navigational text known as *Bowditch* discusses the fallibility of buoys:³³

Buoys cannot be relied on to maintain their charted positions consistently. They are subject to a variety of hazards including severe weather, collision, mooring casualties and electrical failure. . . . For these reasons and others, a mariner must not rely completely upon the position or operation of buoys, but should navigate using bearings of charted features, structures, and aids to navigation on shore. Further, a vessel attempting to pass too close aboard a buoy risks a collision with the buoy or the obstruction it marks.

The *United States Coast Pilot* cautions that “prudent mariners will not rely solely on any single aid to navigation, particularly a floating aid.” That is because the position

³⁰ The aid record contains the buoy’s position data (latitude, longitude, global positioning system coordinates), position history, watch circle (maximum drift in all directions from nominal mooring position), and Federal Information Aid Document (length and type of chain, “sinker” weight, rate of wear on chains and other gear, message traffic on discrepancies, and accidents in the aid’s area).

³¹ The Office of Aids to Navigation in the Coast Guard districts has been incorporated into the Waterways Management Division.

³² U.S. Coast Guard, “Aids to Navigation Manual, Positioning,” Commandant Instruction M16500.1C (Washington, DC: U.S. Department of Transportation, March 26, 1996).

³³ *The American Practical Navigator: An Epitome of Navigation*, originally by Nathaniel Bowditch, pub. no. 9 (Bethesda, Maryland: Defense Mapping Agency Hydrographic/Topographic Center, 1995), p. 72.

of buoys is imprecise and subject to change due to the weather and sea conditions, because buoys are checked only periodically (“maintenance visits often occur more than a year apart”), and because “buoys are liable to be carried away, shifted, capsized, sunk, etc.”³⁴

The Safety Board finds that the erroneous position of buoy 14 was not causal to the grounding of the *New Delhi Express*. However, the fact that the buoy was misplaced and that the misplacement was not noted until an accident occurred nearby is a matter of concern to the Board. Coast Guard crews who are tasked with the proper and accurate placement of navigational aids should make every effort to ensure that the aids are in their assigned position. Any discrepancy encountered during deployment or subsequent position verification visits, no matter how small or seemingly inconsequential, should be noted and either corrected on scene or brought immediately to the attention of the Coast Guard’s Waterways Management Division. The Safety Board has issued a recommendation addressing this matter.

Bridge Resource Management

Bridge resource management can be defined as the effective use by a vessel’s bridge team (officers, crew, and pilots) of all available resources—information, equipment, and personnel—to safely operate the vessel. The concept of bridge resource management was developed to help mariners recognize and correct operational and human errors before they lead to an accident. One of the principles of bridge resource management is that everyone on the bridge should understand his or her responsibilities and be able to communicate observations on the vessel’s progress to others on the bridge freely and professionally.

In 1997, the trustees of the American Pilots’ Association³⁵ adopted the following statement:

Navigation of a ship in United States pilotage waters is considered to be a shared responsibility between the pilot and the master/bridge crew. The compulsory state pilot directs the navigation of the ship, subject to the master’s overall command of the ship and the ultimate responsibility for its safety. The master has the right, and in fact the duty, to intervene or to displace the pilot in circumstances where the pilot is manifestly incompetent or incapacitated or the vessel is in immediate danger (in extremis) due to the pilot’s actions. With that limited exception, international law requires the master and/or the officer in charge of the watch to “cooperate closely with the pilot and maintain an accurate check on the ship’s position and movement.”

Since 1974, the Safety Board has investigated numerous marine accidents in which the officers on the bridge and the pilot failed to communicate, did not coordinate

³⁴ *United States Coast Pilot*, vol. 2, pp. 28-29.

³⁵ For further information about the American Pilots’ Association, see the organization’s website <<http://www.americanpilots.org>>.

their efforts, did not recognize potential problems, and did not solve imminent problems cooperatively.³⁶ A relevant sample of those recommendations is discussed below.

Between 1974 and 1991, the Board issued four recommendations to the Coast Guard (Safety Recommendations M-74-15, M-77-33, M-88-20, and M-91-28) calling for exchanges of information between masters and pilots, all of which the Coast Guard opposed.³⁷ After the tankship *World Prodigy* grounded off Rhode Island in 1989, the Board also asked the Coast Guard to require training for deck officers in bridge resource management (Safety Recommendation M-91-6), and to propose to the IMO that it amend the Seafarers Training, Certification and Watchkeeping Code (STCW code)³⁸ to require bridge resource management training for deck watch officers (Safety Recommendation M-91-7). The Coast Guard concurred with both recommendations. The Board classified

³⁶ See the following marine accident reports issued by the Safety Board: *Allision of the Liberian Freighter Bright Field with the Poydras Street Wharf, Riverwalk Marketplace and New Orleans Hilton Hotel in New Orleans, Louisiana, December 14, 1996* (NTSB/MAR-98/01); *Grounding of the Liberian Passenger Ship Star Princess on Poundstone Rock, Lynn Canal, Alaska, June 23, 1995* (NTSB/MAR-97/02); *Collision of the Netherlands Antilles Passenger Ship Noordam and the Maltese Bulk Carrier Mount Ymitos in the Gulf of Mexico, November 6, 1993* (NTSB/MAR-95/01); *Grounding of the United Kingdom Passenger Vessel RMS Queen Elizabeth 2 near Cuttyhunk Island, Vineyard Sound, Massachusetts, August 7, 1992* (NTSB/MAR-93/01); *Grounding of the U.S. Tankship Star Connecticut, Pacific Ocean, near Barbers Point, Hawaii, November 6, 1990* (NTSB/MAR-92/01); *Collision between the Greek Tankship Shinoussa and the U.S. Towboat Chandy N and Tow near Red Fish Island, Galveston Bay, Texas, July 28, 1990* (NTSB/MAR-91/03); *Grounding of the Greek Tankship World Prodigy off the Coast of Rhode Island, June 23, 1989* (NTSB/MAR-91/01); *Ramming of the Spanish Bulk Carrier Urduliz by the USS Dwight D. Eisenhower (CVN 69), Hampton Roads, Virginia, August 19, 1988* (NTSB/MAR-90/01); *Ramming of the Sidney Lanier Bridge by the Polish Bulk Carrier Ziemia Bialostocka, Brunswick, Georgia, May 3, 1987* (NTSB/MAR-88/03); *Collision of the Greek Bulk Carrier M/V Irene S. Lemos and Panamanian Bulk Carrier M/V Maritime Justice, Lower Mississippi River near New Orleans, Louisiana, November 9, 1978* (NTSB/MAR-80/4); *SS Edgar M. Queeny – S/T Corinthos; Collision at Marcus Hook, Pennsylvania on 31 January 1975 with Loss of Life* (USCG/NTSB/MAR-77/02); *SS African Neptune: Collision with the Sidney Lanier Bridge at Brunswick, Georgia, November 7, 1972* (USCG/NTSB/MAR-74/04). See also Marine Accident Brief MAB-99-01, *Collision between Panamanian Container Ship Ever Grade and U.S. Coast Guard Buoy Tender Cowslip, Columbia River near Astoria, Oregon, May 14, 1997*.

³⁷ For example, in response to the Board's 1977 recommendation that it "require that masters and pilots discuss beforehand and agree to the essential features and relevant checkpoints of maneuvers to be undertaken" (Safety Recommendation M-77-33), the Coast Guard stated that it was preparing to publish proposed recommendations for master-pilot exchanges before any "substantial" maneuvering that required a pilot, but that requiring agreement on "essential features and relevant checkpoints" would "impinge on the traditional master/pilot relationship." On September 27, 1993, after the Coast Guard indicated that it did not intend to amend its regulations, the Safety Board classified the last recommendation related to master-pilot exchanges (Safety Recommendation M-91-28) as "Closed—Unacceptable Action." Current regulations require: "If a pilot other than a member of the vessel's crew is employed, the pilot is informed of the draft, maneuvering characteristics, and peculiarities of the vessel and of any abnormal circumstances on the vessel that may affect its safe navigation" (33 CFR 164.11[k]).

³⁸ The STCW code is an adjunct to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, adopted by the IMO in 1978 and revised in 1995. The convention established, for the first time, basic international requirements for mariners. Previously, standards were established by individual governments, with the result that standards and requirements for mariners varied from country to country. U.S. mariners with Coast Guard licenses who sail on international voyages must obtain an STCW certificate, issued on completion of the training requirements of the STCW code, which includes training in bridge resource management. The Coast Guard's STCW requirements are incorporated in 46 CFR Parts 10 and 12.

Safety Recommendation M-91-7 as “Closed—Acceptable Action” on January 16, 1992, and classified Safety Recommendation M-91-6 as “Closed—Acceptable Action” on September 12, 2001, after the Coast Guard amended 46 CFR Part 10 to incorporate requirements of the STCW code.

In response to its investigation of the 1995 grounding of the passenger vessel *Star Princess* in Alaska, the Safety Board issued recommendations to several maritime organizations³⁹ promoting joint training in bridge resource management for passenger vessel pilots and bridge watch officers. In 1995, the trustees of the American Pilots’ Association, of which the United New York and New Jersey Sandy Hook Pilots Association is a member, formally adopted the concept of bridge resource management by recommending that all member pilots take bridge resource training, with a refresher course every 3 years. The Sandy Hook pilot in the *New Delhi Express* accident belonged to the United New York and New Jersey Sandy Hook Pilots Association and had taken the training in bridge resource management that the association made available to its pilots. The docking pilot, who belonged to the Metro Pilots Association (a New Jersey organization that is not a member of the American Pilots’ Association), told investigators that he voluntarily underwent such training 5 years before the accident but had not repeated it.

The Safety Board’s investigation indicates that effective bridge resource management was not practiced in the events leading up to the grounding of the *New Delhi Express*. The investigation found deficiencies in several essential elements of bridge resource management, as described below.

Passage Plan. One element of effective bridge resource management is the development of a detailed passage plan, in which “particular attention is paid to high traffic areas, shallow waters, or pilotage waters where the plan incorporates appropriate margins of safety and contingency plans for unexpected incidents.”⁴⁰ The recorded conversations on the bridge of the *New Delhi Express* indicate that neither the master nor the Sandy Hook pilot had been informed of the docking pilot’s intended course under the Bayonne Bridge. The course required passing safely between the drill/dredge boat and the shallow ledge near buoy 14. Before visibility worsened, the docking pilot should have informed the other members of the bridge team about his intended course for navigating safely past the obstacles (for example, where he would pass under the bridge and how he would maneuver between the shallow ledge and the drill/dredge boat *Fractor*). If he had done so, the master and the Sandy Hook pilot, who were monitoring the port and starboard radar images,⁴¹ might have alerted him that he was too far right in the channel as he approached the bridge to avoid the ledge near buoy 14. The docking pilot himself

³⁹ Alaska Board of Marine Pilots, Southeastern Alaska Pilots Association, Alaska Coastwise Pilot Association, Princess Cruise Lines, American Pilots’ Association, International Council of Cruise Lines.

⁴⁰ “Bridge Resource Management Guide,” *Focus on Bridge Resource Management*, Washington State Department of Ecology Spill Prevention, Preparedness, and Response Program, publication 99-1302, rev. December 2003 <www.ecy.wa.gov/pubs/991302.pdf>, p. 2.

⁴¹ The Sandy Hook pilot told investigators that he moved between the starboard radar and his laptop computer while the *New Delhi Express* traveled through the Kill Van Kull.

appeared to have lost his bearings as the *New Delhi Express* approached the bridge, when he said, “We’ve got another buoy to go around?”

Information Exchange. A further element of bridge resource management is the sharing of information between master and pilot. The required exchanges of information between master and pilot were brief and lacking in detail (as were the exchanges between the pilots when the docking pilot boarded the vessel). The IMO recommends the following as the minimal information that should be included in master-pilot exchanges:⁴²

1. Presentation of a completed Standard Pilot Card. In addition, information should be provided on rate of turn at different speeds, turning circles, stopping distances, and, if available, other appropriate data.
2. General agreement on plans and procedures, including contingency plans, for the anticipated passage.
3. Discussion of any special conditions such as weather, depth of water, tidal currents and marine traffic that may be expected during the passage.
4. Discussion of any unusual ship-handling characteristics, machinery difficulties, navigational equipment problems or crew limitations that could affect the operation, handling or safe manoeuvring of the ship.
5. Information on berthing arrangements; use, characteristics and number of tugs; mooring boats and other external facilities.
6. Information on mooring arrangements.
7. Confirmation of the language to be used on the bridge and with external parties.

The master and Sandy Hook pilot briefly discussed the *New Delhi Express*’s handling characteristics and speed, the berthing arrangements, and that visibility was “up and down” in the harbor. The initial exchange between the pilots was casual and included no discussion of the dredging work in the Kill Van Kull or of the navigation obstacles near the Bayonne Bridge. A pilot card (which conveyed vessel particulars and handling characteristics) was available to the pilots, but the VDR recording indicates that the docking pilot may not have paid close attention to the card. For example, after the grounding, the Sandy Hook pilot is heard reminding the docking pilot that the vessel had a bow thruster. This reminder demonstrates the kind of bridge teamwork that should have been exhibited before the accident.

Clear Communication. Another element of effective bridge resource management is clear, effective communication. Clear communication is vital for the bridge team to maintain its situational awareness and make the adjustments necessary to maintain a safe passage. Early in the transit, the docking pilot properly called for a third tug when visibility deteriorated. However, the pilot did not give clear instructions to the tug *Turecamo Girls* after he called for it, even though visibility was lessening, saying that the tug could “just drift on out this way.” After the docking pilot gave the tug a position

⁴² International Maritime Organization, IMO Pilotage Resolution 960 (Resolution A.960 [23], December 5, 2003), Annex 2, section 5, “Master-Pilot Information Exchange.”

order, “You will be on the port bow with a rope,” he did not make certain that the tug had received his instructions. Later in the transit, when the *Turecamo Girls* master indicated that he was looking for a place to put a line on the *New Delhi Express*, the docking pilot did not appear to recognize that the *Turecamo Girls* was not yet secured to the *New Delhi Express*. Instead of instructing the tug to put a line on the *New Delhi Express*, the pilot asked the tugmaster whether he could see anything (“I am looking for anything you can see, I’m at zero here”).

Clear Responsibilities. Good bridge team management also requires that roles and responsibilities be clear, and that those on the bridge clearly understand how decisions and instructions are made, responded to, and challenged.⁴³ In the conversations recorded on the VDR, the docking pilot repeatedly deferred to the Sandy Hook pilot’s judgment, despite having piloted over 3,000 ships around Bergen Point. This pattern indicates that the pilots did not have a clear and unambiguous understanding of their duties or of how decisions should be made.⁴⁴

Effective Use of Resources. The VDR record shows that in the conditions of restricted visibility that prevailed before the grounding, the docking pilot did not make effective use of all resources available to him. Rather than obtaining information about reference points and the *New Delhi Express*’s progress through the water from the vessel’s navigation equipment, the docking pilot relied on the tugmasters to supply that information. The Safety Board considers that the *New Delhi Express* would have been better served had the docking pilot relied more strongly on the vessel’s radar to navigate the vessel through the waterway in the restricted visibility. Although the tug operators might have been able to see the buoys first, the images from the vessel’s starboard (10-centimeter [cm]) radar⁴⁵ captured every 15 seconds by the VDR show a clear picture of the area around the Bayonne Bridge. In addition, the radar images give a true indication of the vessel’s position relative to the channel and its true motion through the waterway. In the Safety Board’s opinion, the radar images were sufficient to have guided the pilot safely through the waterway.

The Safety Board has issued a recommendation addressing pilot training in bridge resource management.

⁴³ Section B-VIII/2, part 3-1, of the STCW code lists the principles of bridge resource management. Item 3 states: “duties should be clearly and unambiguously assigned to specific individuals, who should confirm that they understand their responsibilities.” Item 4 states: “tasks should be performed according to a clear order of priority.”

⁴⁴ In 1995, the Transportation Safety Board of Canada published “A Safety Study of the Operational Relationship between Ship Masters/Watchkeeping Officers and Marine Pilots” (report SM9501). The study considered 273 marine accidents (collisions, groundings, striking, contacts, and sinkings) between 1981 and 1992. The study found, among other things, frequent misunderstandings between pilot and master, inattention by the pilot or the officer of the watch (OOW), continuing problems with bridge teamwork, differences in perceptions between masters/OOWs and pilots about information exchanges, reluctance on the part of masters and bridge officers to question a pilot’s decisions, and misperceptions and erroneous assumptions about knowledge of local conditions and the intended passage plan.

⁴⁵ Marine radars are available in higher-resolution X-band (3-cm wavelength) and longer-range S-band (10-cm wavelength).

Probable Cause

The National Transportation Safety Board determines that the probable cause of the grounding of the *New Delhi Express* was the error of the docking pilot in not using all available resources to determine the vessel's position as he navigated the Kill Van Kull waterway. Contributing to the cause of the grounding was the failure of both pilots to practice good bridge resource management.

Recommendations

As a result of its investigation of the grounding of the *New Delhi Express*, the National Transportation Safety Board made the safety recommendations listed below. For more information about the recommendations, see the Board's safety recommendation letters to the recipients.⁴⁶

To the U.S. Coast Guard:

Use the circumstances of this accident related to the improper redeployment of buoy 14 in the Kill Van Kull waterway as a "lesson learned" and disseminate the information to appropriate personnel, emphasizing the need to verify all buoy positioning data during routine position checks and during buoy redeployments. (M-07-2)

To the State Commissions Whose Harbor Pilots Work With Docking Pilots:

Require your harbor and docking pilots to take part in recurrent joint training exercises that emphasize the concepts and procedures of bridge resource management. (M-07-3)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

MARK V. ROSENKER
Chairman

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Adopted: May 30, 2007

⁴⁶ The letters are available on the Safety Board's website <www.nts.gov>.