# National Transportation Safety Board

## Marine Accident Brief

### Equipment Failure on Bulk Carrier *Asia Zircon II*

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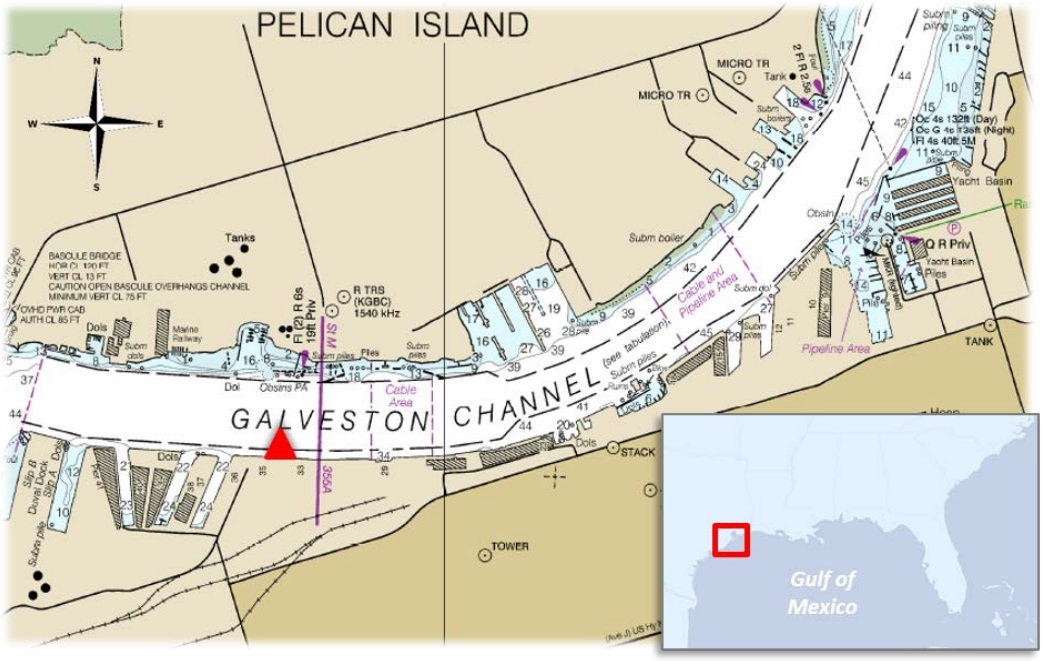
| **Accident no.** | DCA15LM026 |
| **Vessel name** | *Asia Zircon II* |
| **Accident type** | Equipment failure |
| **Location** | Pier 34, Port of Galveston, Texas<br>29°18.5' N, 094°48.4' W |
| **Date** | July 8, 2015 |
| **Time** | 0857 central daylight time (coordinated universal time − 5 hours) |
| **Injuries** | Minor |
| **Property damage** | >$1.5 million est. |
| **Environmental damage** | None |
| **Weather** | Visibility good with daylight, clear skies, light winds, air temperature 84°F |
| **Waterway information** | The Port of Galveston is located at the mouth of Galveston Bay and is directly accessible to the Gulf of Mexico. The dock facilities are located on the Intracoastal Waterway about 9 miles from the open sea. The shipping channel has a minimum depth of 45 feet. |

On July 8, 2015, at 0857 local time, the Singapore-flagged bulk carrier *Asia Zircon II* was discharging a cargo of wind turbine towers in the Port of Galveston, Texas, when the lifting wire rope for one of the ship's two cranes parted while hoisting a tower section out of the cargo hold. The wire failure caused the tower to fall back into the hold, damaging the tower and other tower sections in the hold. Two of the five longshoremen inside the cargo hold at the time suffered non-life threatening injuries. There was no reported pollution. Damages were estimated to exceed $1.5 million.


***Asia Zircon II* in the Port of Galveston, Texas, postaccident.**

The *Asia Zircon II* (formerly the *Marietta* of Liberian registry) was purchased by Maritime Asia Zircon PTE (private), Ltd. on April 20, 2015. The vessel was managed by Columbia Ship Management and chartered by Oldendorff Carriers for shipment of sections of wind turbine towers. It had been used previously for transport of wind turbine towers, but this voyage was the vessel's first under new ownership.

Oldendorff Carriers, the vessel charterer, prepared the cargo plan for both the Ports of Ciwandan (Indonesia) and Galveston, where a port captain was present in each to supervise the loading and unloading of the cargo. For this particular voyage, the *Asia Zircon II* had 84 tower sections on board. (There were no wind turbine or blade units on board.) When assembled, four sections would make one tower. Each of the four sections had a different weight and dimension with the base being the largest and heaviest and, inversely, the top being the lightest and smallest. Of the 84 tower sections on board, 48 were stowed on the main deck and the remaining 36 in cargo hold nos. 2, 3, and 4. In each hold, there were 12 sections in two tiers. Most of the tower sections were stowed in a fore-and-aft direction. However, in cargo hold no. 4 there were 2 sections stowed in an athwartships direction. The 10 fore-and-aft tower sections in this cargo hold were all base sections weighing about 66 metric tons (145,505 pounds), each with a length of 20 meters (65.6 feet) and a diameter of 4.5 meters (14.8 feet) at one end and 4.25 meters (13.9 feet) at the other end.

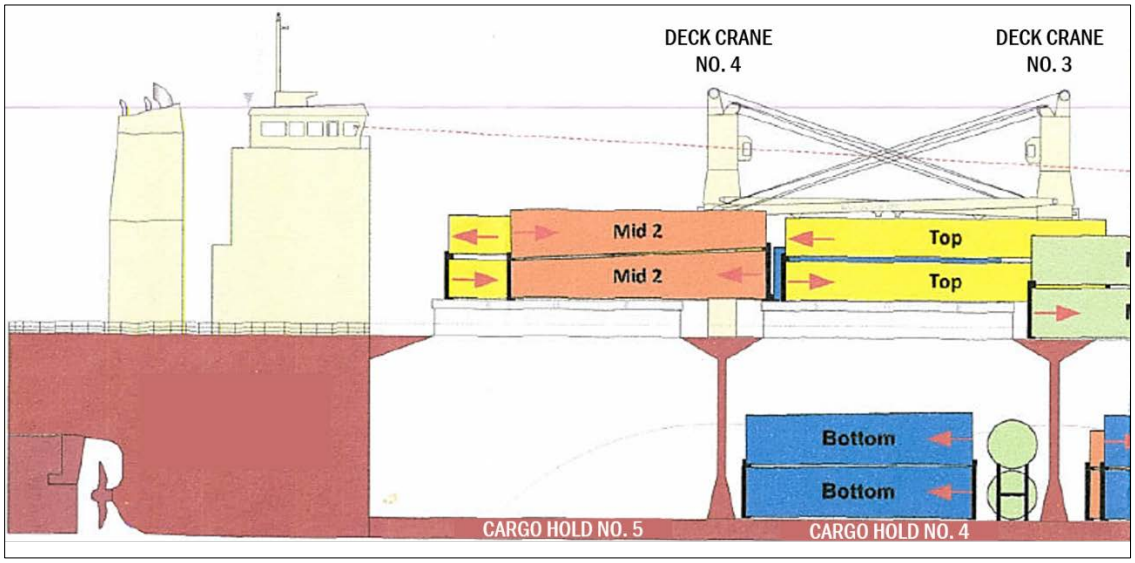



**Accident location at Pier 34 in the Port of Galveston identified by the red triangle. (National Oceanic and Atmospheric Administration [NOAA] chart 11324)**

For discharge operations, the port captain from Oldendorff Carriers and the operations manager from the stevedore company, Ports America, planned each lift, which they coordinated with the longshoremen. Crewmembers from the ship were not involved in discharge operations, except for the chief officer, who managed the stability and the trim condition of the vessel. At times, he requested specific cargo to be off-loaded in sequence for this purpose.

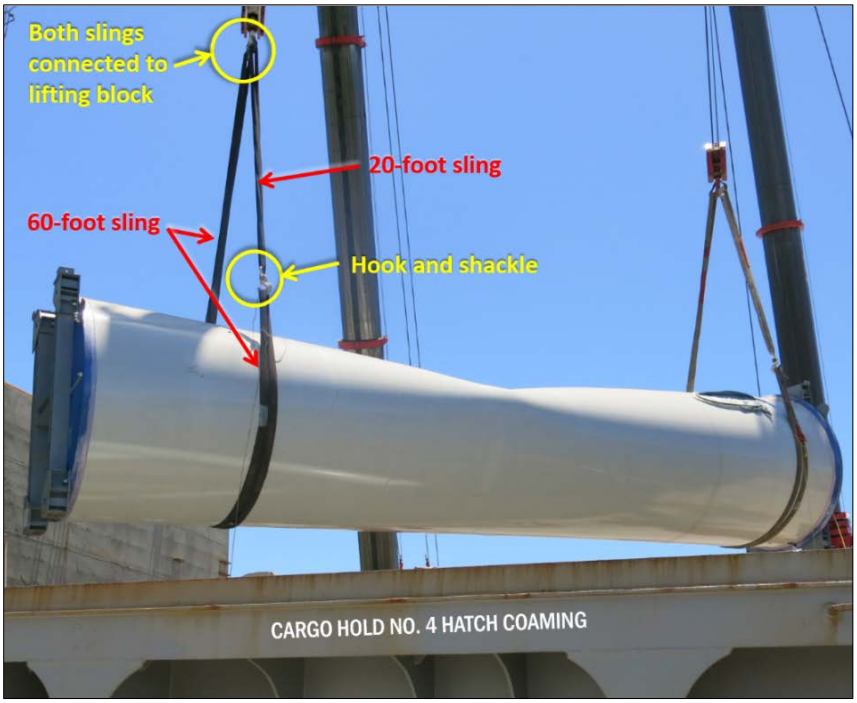
The process for lifting the base towers from cargo hold no. 4 was described as "belly slinging." Crane no. 3 on the forward end of the cargo hold and crane no. 4 at the aft end would lower their lifting blocks into the hold where the longshoremen would use a round cargo sling near each end of the tower section in a double-basket configuration. A long sling, which was made from a continuous rope folded in half (60 feet) and connected to the lifting block, would be passed under the bottom of the tower section. It then would be connected on the other side of the tower section to a hook shackled to a shorter sling, which would be doubled up (20 feet) and connected to the same lifting block. There were no specific pickup points, nor was there a rigging plan for the tower sections; each sling was placed near each end of the tower. Once both cranes were ready, the foreman would communicate via radio when the lift would commence and subsequently when

each crane would take up the weight evenly to keep the cargo level. The foreman would direct the hoist until the tower section was near the top of the hold, where its direction would be handed off to a supervisor at the top of the cargo hold. The supervisor would ensure the lift was level and clear of the hatch coaming. Once it was cleared, another supervisor on the dock would direct the cranes to swing the cargo inshore (port side) and lower it onto a flatbed truck on the pier for delivery.




**Starboard profile of the stowage plan for *Asia Zircon II*.**

The *Asia Zircon II* arrived at Pier 34 in the Port of Galveston, Texas, on the evening of July 5, 2015, from Ciwandan, Indonesia. Cargo discharge operations, which commenced shortly after arrival, were reportedly successful throughout July 6 and 7. During that period, all of the cargo on deck and in cargo hold no. 3 was offloaded.




**Removal of the damaged tower base section by a shore-based crane mirrors the lifting arrangement used by the vessel's cranes at the time of the accident.**

On the morning of July 8, the employees from the local International Longshoremen's Association (ILA Local 20) arrived on the dock about 0700 and began their morning safety briefing together with personnel from Ports America before going on board. The stevedore company managed operations and logistics while the longshoremen's union provided the workers and crane operators. According to the ILA employees interviewed by investigators, the safety briefing consisted of discussing communications procedures, ensuring workers were outfitted with their personnel protective equipment, and reminding them to keep clear of any lift areas. Shortly after the briefing, discharge operations commenced. The foreman for the five-man gang assigned to cargo hold no. 4 stated that after they reached the bottom of the hold he further briefed the gang on establishing a safe area during the cargo lift.

According to the foreman, they first began discharging the top tier of the fore-and-aft tower base sections. After the first two were unloaded successfully, the gang in the cargo hold rigged up the slings for the third base section. Once they were rigged, the foreman instructed the gang to clear the area to a location away from directly under the lift. After all persons were clear, he informed the crane operators via radio to commence the hoist. When the lift was high in the cargo hold, the two supervisors at the top of the cargo hold took over communications with the crane. The foreman then heard over his radio an announcement that the tower base was out of the hold and that the crane operators should follow the guidance from the supervisor on the dock. Upon hearing that instruction, he directed the gang to leave their safe area and to start preparing for a lift of the fourth tower base. However, suddenly he heard a "popping" sound similar to what he described as "guitar strings breaking." Recognizing the sound signaled a wire rope splitting, he shouted to the men in the hold, "Hit the deck!"


**Approximate location of the five-man gang inside cargo hold no. 4 when the cargo was dropped.**

The foreman recalled seeing the lifting block for crane no. 4 falling first, followed by two very loud bangs, which he surmised could only be the impact of the tower section dropping on the remaining base sections. Of the witnesses interviewed, no one could recall which part of the lifting gear separated or failed first, since at the time no one in the cargo hold was looking up.

The longshoremen in cargo hold no. 4 were between sections on the lower tier, which absorbed the impact from the falling cargo, and were thus protected. Numerous items of debris were ejected from the lower tier sections as a result of the impact and the compression forces from the falling section. The debris was mostly broken pieces of metal, sheered nuts and bolts, parts of the towers' footings, and securing structures. One of the men in the cargo hold reported he was hit by the flying debris; another said he was injured while taking cover. Both injuries were non-life threatening. According to the port log maintained by the ship's crewmember at the gangway, the accident took place at 0857 local time.

After the cargo drop, the workers in the gang evacuated cargo hold no. 4 using the spiral stairs and ladder in the aft part of the hold, all by their own ability. No one requested any immediate assistance from emergency medical services.

The operator for crane no. 4 told investigators that he had 32 years of experience in operating cranes and was certified as a ship's crane operator.[1] He said that it was his first day operating crane no. 4 and that the day before he had operated crane no. 3, an identical crane. On the morning of the accident, the previous lifts from cargo hold no. 4 transpired without problems. From his point of view in the cab, the base section looked to be almost above the hatch coaming when he heard a loud bang and saw pieces of wire rope and the lifting block drop at his end. He recalled that crane no. 3 held its end of the load until the end of the tower that fell away hit the tier at the bottom of the hold, at which time the sling for crane no. 3 separated. He did not see where the cable broke but speculated the break may have been behind him, given the amount of cable and debris he witnessed falling to the bottom of the hold. When asked if he was aware of the safe working load (SWL) of the crane and the weight of the load he was lifting, he stated that he did not know either, noting it was the responsibility of the foremen to know this information.

**Lifting block, with hook and broken wire rope, for crane no. 4 that fell to the bottom of cargo hold no. 4.**

When he was also asked if there was any type of safety inspection done on crane no. 4 prior to operation, the crane operator stated that it was the responsibility of the ship's crew to inspect and maintain the crane and wire rope. He did visually check the condition of the crane while climbing the ladder to the crane cab: he looked at the runner drum as he passed through the machinery space that led to the cab, but the lighting in that area, he added, was not ideal to see the condition of the wire in any detail.

[1] Training records for West Gulf Maritime Association indicate that the crane operator for no. 4 was last re-evaluated on winch/ships crane hands on July 1, 2015.

Of the five crewmembers interviewed by investigators—none of whom witnessed the accident—none had worked on the *Asia Zircon II* prior to joining the vessel at the change of ownership.

The *Asia Zircon II* was fitted with four deck cranes manufactured by Wuhan Marine Machinery Plant Co., Ltd. (China) under license from IHI Corporation (Japan). Each crane had the following markings on the jib: *SWL HOOK 36t–28m/GRAB 28t–28m*, which indicated that the safe working load of the hook was 36 metric tons and the minimum slewing radius was 28 meters.[2] The last certificate of test and thorough examination, issued on June 18, 2014, by the vessel's classification society, Bureau Veritas, stated that the safe working load of the crane was the same as that of the hook mentioned previously but was examined with a test load of 41 metric tons on the accident lifting wire. After the change of ownership, Bureau Veritas issued on April 28, 2015, an attestation of the cargo gear survey certificate for all crane wires.

The ship's chief officer, who was responsible for all deck maintenance and inspections, stated that the cranes were last used for the loading of wind turbine towers in Indonesia, during which time there were no problems reported. He said that he had ordered the crane wire ropes to be greased on July 1, which was carried out by the deck crew under the supervision of the bosun. According to the bosun, the chief officer and the deck crew greased all the crane wire ropes both by hand (no gloves) and by brush in hard-to-reach areas such as the cable drum. None of the crewmembers involved in the greasing reported any broken strands or any hand injuries from broken strands. Although there was no record of the wire ropes being lubricated on this date in the planned maintenance system, there was a work permit dated July 1, 2015, for deck crew seamen to grease the wire ropes of crane nos. 1, 2, 3, and 4. The last documented wire rope lubrication was completed on April 28, 2015.

**Crane no. 4 with its jib left in position after the cargo was dropped.**

The Columbia Ship Management's safety management system (SMS) detailed maintenance and inspection procedures for crane wires.[3] In particular, it required pre-operation checks of lifting equipment prior to arrival in port. Investigators were informed that these checks were carried out prior to arrival in port at about the same time as the wire rope greasing was ordered, but there was no documentation identifying which equipment and components were checked. The SMS manual also highlighted, "When lubricating crane wires, it is necessary to remove old grease and residue to inspect the strands, with particular attention to those areas of any wire which are not visible. … [It is] completely unsatisfactory to lubricate merely the parts of the wire, which are immediately visible and accessible." The manual further described four methods for lubricating wires, none of which involved lubricating by hand.

[2] None of the cranes were using cargo grabs at the time of the accident.

[3] Chapter 4: Lifting Equipment, DCO (Dry Cargo) Deck Operations Rev. 0, January 1, 2010.

The long and short polyester round slings were owned by the stevedore company. Shortly after the accident, the stevedores removed the broken cargo sling that was attached to the load block for crane no. 3 and placed it on the dock to be inspected by investigators. The shorter sling, used to connect to the crane hook and the longer sling, was intact, with no visible signs of breakage or abrasion. The longer sling, which was last inspected on April 27, 2014, had parted entirely at one location and was frayed with abrasion and tears in both the jacket and the rope fibers at another location. The shorter, unbroken sling had a vertical capacity never to exceed 90,000 pounds (40.8 tons) and a basket capacity of 180,000 pounds (81.6 tons). The longer, broken sling had a vertical capacity never to exceed 100,000 pounds (45.4 tons) and a basket capacity of 200,000 pounds (90.7 tons). None of the shackles or hooks that were used showed any signs of damage or deformation. The foreman for cargo hold no. 4 stated that he and the gang were physically handling each sling and that no one noticed any damage or problems in the time leading up to the accident.

**The long and short slings from crane no. 3. The area where the long sling separated is circled on the lower left; the section that sustained the abrasion and tears is in the upper right corner.**

## Crane Wire Examination

The lifting wire rope for crane no. 4 had a certificate of test and examination dated January 19, 2012. The type of wire rope was a non-rotating galvanized steel 300 meters in length and 36 millimeters in diameter, consisting of four bundles of 39 strands of wire in each (4 by 39) with a minimum breaking load of 897 kilonewtons (91.5 tons). According to the ship's planned maintenance system called C-trim, the wire rope was installed on May 26, 2014. How and where this wire rope was stored during the two and a half years prior to it being installed on the crane is unknown. While on board, investigators found new coils of crane wire rope secured on deck between cargo hold nos. 3 and 4. These coils, which had a date stamp of April 30, 2015, on the shackle end, were delivered when the ship was last in Singapore.

The US Coast Guard contracted Scientific Expert Analysis (S-E-A) Limited to investigate and evaluate pieces of the wire rope from crane no. 4 and the cargo slings collected from the accident site. The four pieces of wire rope came from the drum, the free end, the failure end, and the shackle end. In the final analysis report, dated December 9, 2016, the following conclusions were made:[4]

[4] Analysis of failed lifting wire rope, S-E-A matter no. 05.008435, (December 9, 2016).

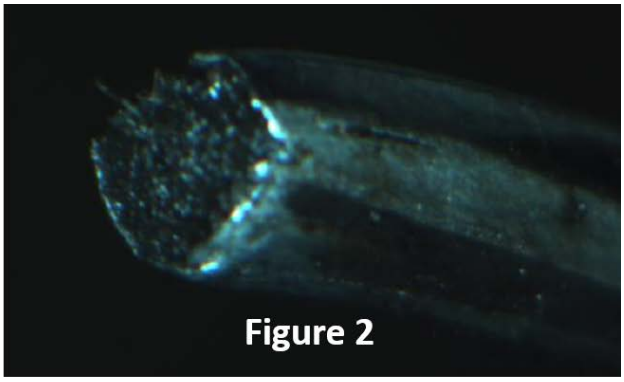
- The incident was precipitated by a failure of the wire rope used in the lifting mechanism of crane no. 4. When the wire rope failed, the sling on the end of the tower base gave way, causing a failure in the strap on the other end so that the tower base fell back into the hold.

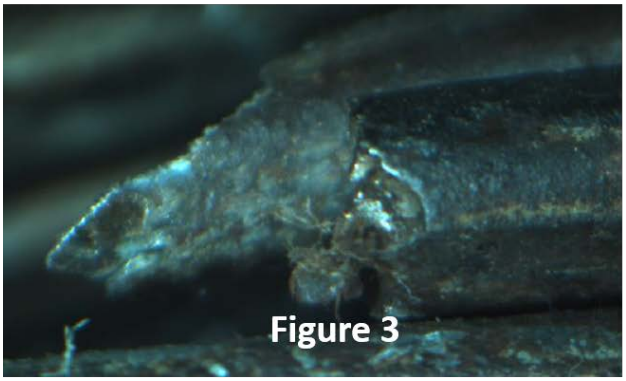

**Coils of wire rope found on deck, photographed on July 9, 2015: at left, larger coil for the lifting wire; at right, smaller coil for the luffing wire.**

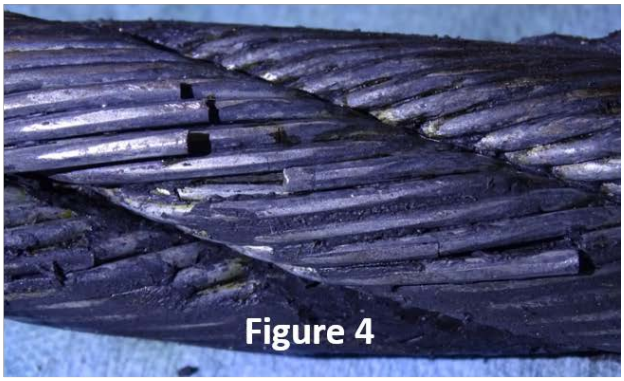
- The wire rope that failed showed signs of inadequate lubrication—that is, the lubricant applied was not distributed down into the inner wire surfaces. This [lack of lubrication] resulted in excessive wear on the wire contact surfaces, particularly those not near the surface where the lubricant was applied. The areas of excessive wear become centers of nucleation for cracks that propagated in the individual wire strands creating stress concentrations that lead to wire failures gradually reducing load capacity of the rope, until it failed on July 8, 2015.

- Examination of the free end of the failure (the end that was not pulled through the lifting block) verified that the interior surfaces of the wire-to-wire contact showed many signs of inner strand wear (exhibited by typical inner strand wear notches—flattened areas on the wire that become centers of failure initiation), and these locations were the places where the failure occurred.

- Further evidence of inadequate attention to maintenance of the wire rope was found in the condition of the wire rope surface in the working portion of the cable provided that had not been pulled through the lifting block components. The wire showed evidence of multiple broken surface strands at the maximum stress locations consistent with normal wear and tear that should have been observed as a part of a proper routine maintenance process. The surface failures are persuasive in the preserved wire rope and are evidence that the wire rope was near or beyond its recommended useful life.


**S-E-A report captured the following images of the wire rope from crane no. 4: (1) the failed point of the free end of the wire rope; (2) the wire strand from the failed end indicating a tensile overload; (3) the outer-surface strand indicating fatigue failure; and (4) an area where the surface wire failures were found. (Photos courtesy of S-E-A)**

## Probable Cause

The National Transportation Safety Board determines that the probable cause of the failure of the lifting wire rope of crane no. 4 on the bulk carrier *Asia Zircon II* was inadequate lubrication due to ineffective maintenance resulting in excessive wear of the wire rope.

### Maintenance of Lifting Gear

- Inspection, maintenance, and management of wire ropes are essential to the prevention of accidents.
- A deteriorated wire rope directly affects the ability to safely and reliably handle loads up to the rated capacity of the crane.
- Crane operators, signalmen, riggers, safety observers, and crewmembers should adhere to manufacturer operating guidelines, design limitations, safety precautions, and inspection and maintenance procedures.

### Crane Operations

Workers participating in crane operations should ensure that they remain in a safe area during a hoist. Entering the drop zone while the hoist is in progress puts them at risk.

## Vessel Particulars

| Vessel | *Asia Zircon II* |
|---|---|
| **Owner/operator** | Maritime Asia Zircon PTE, Ltd./<br>Columbia Ship Management PTE, Ltd. |
| **Port of registry** | Singapore |
| **Flag** | Singapore |
| **Type** | Bulk carrier |
| **Year built** | 2008 |
| **IMO number** | 9330678 |
| **Construction** | Steel |
| **Length** | 623.0 ft (189.9 m) |
| **Draft** | 41.3 ft (12.6 m) |
| **Beam/width** | 106.0 ft (32.3 m) |
| **Tonnage** | 32,578 gross tons |
| **Engine power** | 12,713 hp (9,480 kW) diesel engine |
| **Persons on board** | 21 |

**NTSB investigators worked closely with our counterparts from Marine Safety Unit Texas City throughout this investigation.**

For more details about this accident, visit http://www.ntsb.gov and search for NTSB accident ID DCA15LM026.

**Approved: April 20, 2017**