

The principal purpose of the Transport Accident Investigation Commission shall be to determine the circumstances and causes of accidents and incidents, with a view to avoiding similar occurrences in the future, rather than to ascribe blame to any person.



DANGEROUS LIST NEARLY CAPSIZED *TAHARAO EXPRESS*

At about 0150 hours on June 22, 2007, the crew of the bulk carrier *Taharao Express* advised the Rescue and Coordination Centre of New Zealand that the ship had developed a starboard list of 15° caused by a suspected cargo shift.

At the time of the incident the ship was in heavy weather and had been steaming approximately 42nm southwest of Cape Egmont as it made its way towards shelter in Tasman Bay.

An investigation by the Transport Accident Investigation Commission (TAIC) would later trace the cause of the list to the port of Zhoushan in China where, prior to sailing for New Zealand, *Taharao Express* had spent 45 days on surveys and repairs.

The day after departing Zhoushan, the duct keel bilge alarm activated and the water inside was removed using the bilge pump. The next day the alarm activated again and the first mate investigated the cause. He found seawater ballast, from number six cargo hold, leaking through a crack in a welded seam of the forward lower stool which had just been repaired in Zhoushan.

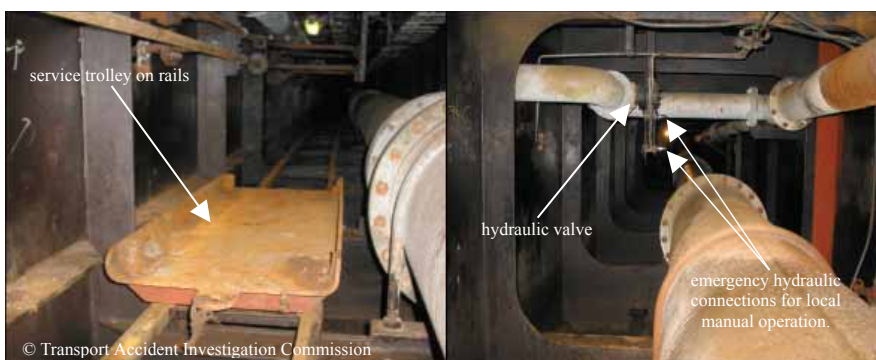
Because the leakage rate was manageable, it was decided not to attempt a repair until after the ship had loaded at Taharao when number six cargo hold would be empty. The first mate pumped the duct keel daily, starting at about 0900 and stopping around 1500 hours. The alarm activated most days on the voyage.

The ship arrived off Taharao on June 18 where about 116,000 dry metric tonnes of iron sand were due to be loaded over the next 54 hours. The iron was to be pumped on board as slurry through two lines from the terminal ashore via a buoy and floating hoses to the ship. A pipe system aboard distributes the slurry to the required hold. Under normal loading, once the sand settles out of the slurry, the excess water is pumped overboard using the ship's de-watering systems and the ship sails with, what is effectively, damp sand in the holds.

At about 1600, the first mate started de-ballasting to maintain a suitable trim and keep the stresses on the hull within the limits set in the ship's loading plan. The plan included ballasting out 18,665 tonnes of seawater from number six cargo hold.

Loading continued but at 0500 on Tuesday June 19, the duct keel bilge alarm activated. The duty engineer accepted the alarm but did not relay this information to the first mate who normally pumped the bilge.

At about 0800 a 220 volt earth fault alarm activated in the engine room. The alarm was not considered high priority so no immediate investigation was done to establish the cause. At 0915 the chief engineer found three electrical circuit breakers had tripped and suggested that the cause might be water in the duct keel. At 1000 a crewman, who had been sent to investigate, found two metres of water in the aft duct keel and pumps were activated



to remove it.

Arrangements were made to take regular soundings of the water level in the duct keel but its level remained at two metres for several hours. The superintendent from the ship's management company tried "for some time", to contact the company head office in Japan to seek advice, the TAIC report noted.

At around 1300 the superintendent tried to enter the duct keel through a mid access between holds five and six but the water was too high to make an inspection. At about the same time all ballast operations ceased due to the malfunction of the majority of remote operated valves in the duct keel. The majority of the hold de-watering system was also inoperable but loading continued.

At 1900, on advice from the ship's management company office, loading was eventually stopped. The aft duct keel sounding was now at about 5m and the access manhole door in the pump room was secured in case the water level overflowed into the pump room.

Pumping of the duct keel continued through Wednesday but by Thursday morning the weather was deteriorating. The forecast predicted wind and sea swell in the port to exceed the limits for the ship to remain on the buoy. The pilot suggested to the master that the ship leave the buoy and make for shelter in Tasman Bay, as bad weather was expected for a few days. Following consultation with the superintendent, and the company head office in Japan, it was decided to sail to Tasman Bay.

By now the aft keel sounding was 2.8m and the vessel had a starboard list of 1.50 "owing to cargo and/or ballast disposition," the report says. By about 1330 on Thursday, *Taharao Express* was underway towards Tasman Bay. The ship's ballast and de-watering systems were inoperable, number six ballast hold

contained about 11,500 tonnes of water, eight of the ballast tanks were also partially full. Each of the five partially loaded cargo holds contained iron sand and free water. The cause of the flooding of the duct keel had still not been identified.

At about 1500, a sounding of the duct keel indicated 2.6m of water and the first mate and superintendent entered the forward duct keel entrance to find out where the water was coming from.

They found that water was entering from the lower stools between numbers one and two cargo holds and numbers three and four cargo holds. They found water leaking in through unsealed cope holes in numbers one and three overflow recesses where steel repairs had been carried out in Zhoushan.

The crack in the forward lower stool of number six ballast hold was still leaking water at a similar rate to that noted on the voyage to Taharoa. They were not able to inspect further aft owing to the high water level in that part of the keel.

Most of the ship's staff, including the master, pilot and a trainee pilot who had stayed aboard with the captain's approval, had dinner and retired to their cabins for the evening.

At midnight the third mate relieved the second mate who estimated that the ship's list was about 150 although the third mate estimated it to be only 50.

At 0155 the ship took what was reported to be a violent roll that woke the pilot. He headed to the bridge, concerned at what he thought was a large list and the ship's unusual motion. Shortly after, Farewell Maritime Radio was notified that the ship had a 150 list and a radio schedule was agreed and maintained. By about 0300 the pilot advised Farewell Maritime Radio that the list had stabilised at 170.

The report says the prime mechanism for the cargo shift was most likely water sloshing in the cargo holds causing the entrainment of sand by wave action on the cargo surface, the sand gravitating to the low side of the holds caused by the initial and worsening list. An en-mass shift of sand in one or more holds could not be ruled out, and became increasingly possible as the list increased.

By about 1030, with the wind gusting at 45 to 50 knots and the swell at around 5m, it was decided to head into Tasman Bay. Course corrections were made but by 1210 the ship was now listing 220 to starboard.

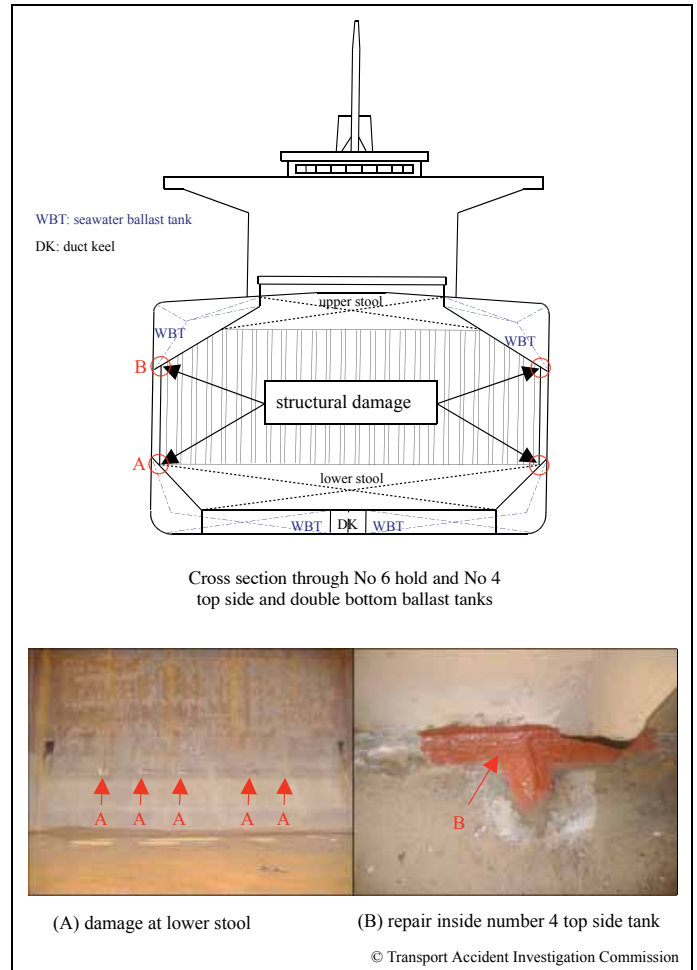
Before reaching its final shelter, the TAIC report notes that the ship was at "significant risk of capsize" owing to the shifting cargo and the free water in the cargo and ballast holds. It was also at growing risk of structural failure because of the increasing list, the distribution of cargo against the side shell plating and the sloshing forces generated by the moving water in the holds against the structure.

The report found *Taharoa Express* suffered a flooded duct keel while loading iron ore sand as slurry. Slurry water decanted into the overflow recesses in numbers one and three holds, entering the duct keel through cope holes left unsealed following repairs in dry dock.

Water in the flooded duct keel then entered receptacles containing electro-hydraulic solenoids that operated valves in the bilge, ballast and cargo de-watering systems, disabling all three systems.

In its findings the report notes that a combination of issues contributed to the problem and was damning of those connected with maintaining the vessel's safety systems. It states:

"Every person or entity that had some responsibility for oversight of the ISM system on *Taharoa Express* did not ensure that safety critical systems were identified and managed, did not ensure that repair and maintenance were being carried out to standard, did not ensure that compliance with New Zealand rules, flag requirements and international conventions



was being achieved, and did not ensure that the required level of communication on board and between other stakeholders was being achieved. They were:

- the master and crew
- the ship operator
- the flag state Panama through its recognised organisation Class NK
- Class NK with respect to its own class rules."

It blames a "hierarchical, rigid and compartmentalised culture within the ship's crew and its management company" for causing communication difficulties that meant early warnings of the failing systems were misdiagnosed or ignored.

"None of the organisations responsible had a clear understanding of the cargo sand's properties generally. The onboard stability computer could not adequately analyse the ship's stability characteristics for a specific load. International and New Zealand standards for carrying bulk cargoes and general regulatory requirements for safety management and oversight were unmet."

The report also criticised the safety management system for the port itself stating that "a safety management system for the port has not been completed in line with Maritime NZ guidelines and, in its draft form three years after having started, was significantly flawed."

According to the report "the potential for the *Taharoa Express*, or previous export vessels, to capsize and/or sustain major structural failure owing to cargo shift and sloshing by free water in the holds, was a foreseeable risk that should have been identified many years before this incident."

A range of safety recommendations, to the directory of Maritime Safety and the ship's flag state of Panama, ask for the deficiencies identified in the report to be addressed.