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Marine Occurrence Investigation No. 284
MO-2011-002
Final

Crew member fatality following a fall on board the bulk carrier *Hanjin Sydney* at sea 2 February 2011

Abstract

On 2 February 2011, the boatswain (bosun) on board the Panamanian registered bulk carrier *Hanjin Sydney* died as a result of injuries he received after falling about 25 m from the hatch coaming[1] of the ship's number eight cargo hold to the tank top below.

The bosun had climbed onto the top of the hatch coaming to free a cargo runner that had jammed in the head of a davit the crew were using to lift iron ore residue from the hold. He lost his balance while pulling on the wire to free it and fell into the empty cargo hold.

The ATSB investigation found that the crew had previous experience with the cargo runner jamming in the head of the davit. However, nothing had been done to prevent it from happening again.

As a result of the accident, Hanjin Ship Management have instigated the requirement for the ship's safety officer to be more proactive in tool box meetings and safety 'walk arounds' to ensure that he is aware of issues which may not be automatically brought to his attention.

The ATSB is satisfied that this safety action adequately addresses the report's identified safety issue.

FACTUAL INFORMATION

Hanjin Sydney

Hanjin Sydney (IMO No. 8606329) is a conventional capesize[2] bulk carrier which has nine cargo holds located forward of the accommodation superstructure (Figure 1).

Figure 1: *Hanjin Sydney*

1 A raised border around a hatch or an opening in a deck that is designed to prevent water from running below.

2 Dimensions larger than that allowable for transit of the Panama Canal.

Each cargo hold is accessed via a pair of side sliding hatch covers which are pulled open and closed by hydraulic motor driven chains.

The ship was built in 1987 by Samsung Heavy Industries, Korea. It has an overall length of 291.0 m, a moulded breadth of 48.0 m and a moulded depth of 24.5 m. At a summer draught of 18.019 m, the ship has a deadweight of 188,126 tonnes.

Propulsive power is provided by a single B&W 6L80MCE(D) single acting, direct reversing, two-stroke diesel engine. The engine develops 12,294 kW at 71.5 rpm and drives a fixed pitch propeller. The ship has a service speed of about 13.5 knots[3].

At the time of the accident, *Hanjin Sydney* was registered in Panama and classed with the Korean Register of Shipping (KR). It was owned by Wicklow Shipping, Panama, operated by Hanjin Shipping, South Korea, and managed by Hanjin Ship Management, South Korea.

Hanjin Sydney had a crew of 24, consisting of four South Korean and 20 Filipino nationals. All of the crew held appropriate qualifications for the positions they held on board the ship.

The master had 28 years of seagoing experience. He held a master's certificate of competency that was first issued in South Korea in 1995 and had been sailing as master since 1999. He had been employed by Hanjin Ship Management since 2005 and joined *Hanjin Sydney* for his first contract on board the ship in December 2010.

The chief mate started his seagoing career in 2001 and joined Hanjin Ship Management in 2003. He held a South Korean chief mate's certificate of competency and had been sailing as a chief mate for about 3 years. He joined *Hanjin Sydney* for the first time 10 days before the accident.

The bosun had over 10 years of seagoing experience. He held a deck rating certificate that was issued in the Philippines and had worked on board a number of Hanjin Ship Management ships. He joined *Hanjin Sydney* for his first assignment as bosun in October 2010.

The deck cadet (cadet) finished his maritime university studies in the Philippines in 2010 and joined *Hanjin Sydney*, his first ship, about 5 months before the accident.

Cargo hold cleaning

It was routine practice on board *Hanjin Sydney* for the cargo holds to be cleaned after the ship had sailed from its discharge port and was en route to its next loading port.

When the previous cargo and the next cargo were the same, the cleaning involved emptying the cargo hold bilge wells of cargo residue and either spreading it across the tank top or removing it from the cargo holds.

When there was a change of cargoes, the bilge wells were emptied of cargo residue and the cargo holds were swept clean. The cargo residue was then removed from the holds before they were washed out and allowed to dry.

The ship's crew used a bucket (a 200 litre steel drum cut in half) suspended from a portable davit to lift the cargo residue out of the cargo holds. When the davit was fitted to cargo holds one, four, five, six or seven, a portable electric winch was used to raise and lower the davit cargo runner. When the davit was fitted to cargo holds two, three, eight or nine, the drum end of the adjacent mooring winch was used to raise and lower the cargo runner (Figure 2).

Two guy ropes were attached to the top of the davit arm. These were used to swing and secure the davit as required during the lowering and hoisting operations. A small trolley was used to transport full buckets of cargo residue to the ship's side, where they were emptied overboard.

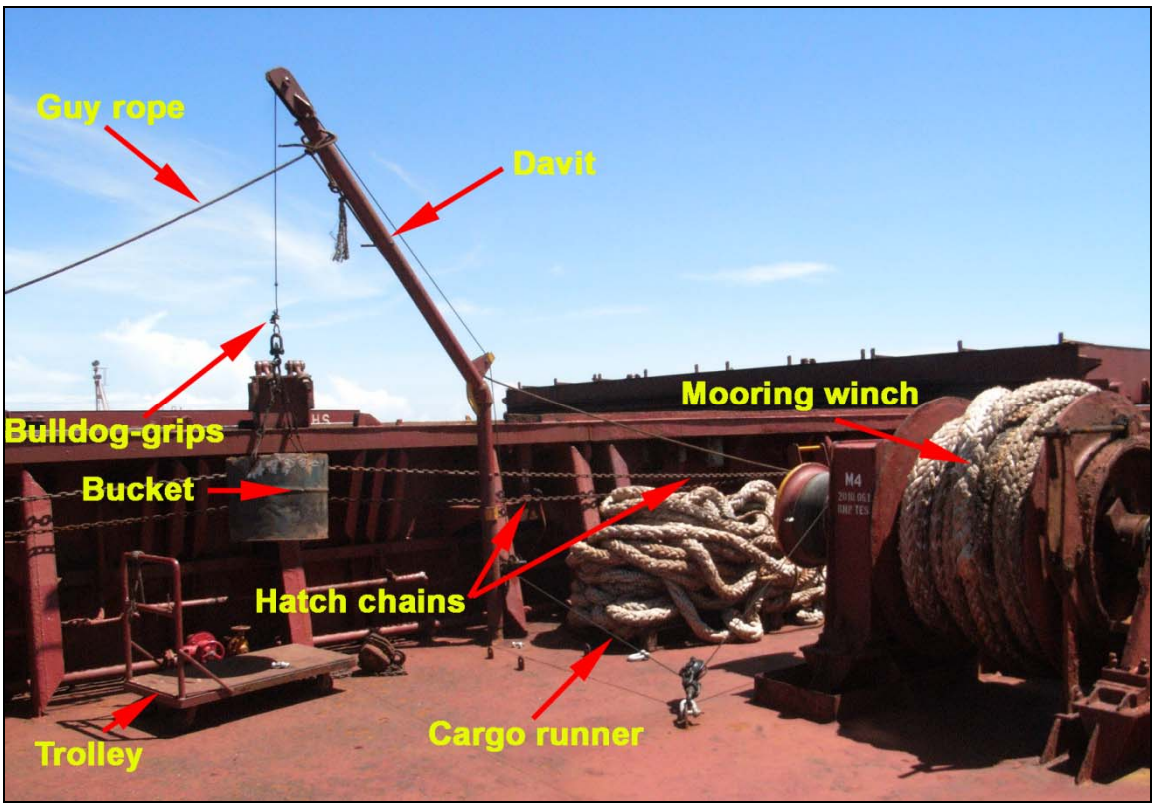
There were two portable davits on board *Hanjin Sydney*, so the crew were able to form two teams and, hence, work in two cargo holds at the same time. Each team usually used two buckets so that one could be filled while the other was being emptied.

The accident

On 11 January 2011, *Hanjin Sydney* berthed in Pohang, South Korea, to discharge its cargo of iron ore. On 26 January, after the cargo discharge was completed, the ship departed Pohang bound for Port Hedland, Australia, to load another cargo of iron ore.

3 One knot, or one nautical mile per hour equals 1.852 kilometres per hour.

Figure 2: Portable cargo hold davit in position alongside *Hanjin Sydney*'s number eight cargo hold



At 0700 each morning, the ship's deck crew met with the chief mate on the bridge to discuss the day's work. The chief mate allocated tasks to the crew and then discussed any specific safety precautions that should be taken before they started work.

Over the first few days of the voyage, the deck crew's efforts were concentrated on cleaning the cargo holds in preparation for the next cargo.

By the end of the working day on 1 February, they had cleaned all of the iron ore out of the cargo hold bilge wells (each cargo hold had two bilge wells) and placed it in a pile in each cargo hold.

At 0700 on 2 February, the deck crew met with the chief mate as usual. He told them to split into two teams and to remove the iron ore residue from the cargo holds. The chief mate and the crew discussed the task and the necessary precautions to be taken. In particular, they discussed the care that should be taken while the crew climbed up and down the cargo hold ladders.

At 0800, the ship was on a southerly heading, about 110 miles[4] northeast of the northern tip of Sulawesi, Indonesia. The weather was fine and the ship was rolling easily about 2 to 3° on a low swell. However, rain was expected at times during the day.

The crew split into two teams, each consisting of four men. One team started work in number seven cargo hold and the other started in number nine hold. The davits were set up and the hatch covers were opened on the two holds. The crew then began removing the iron ore residue.

By about 1000, when the crew stopped for a coffee break, the team working in number nine hold had finished removing the residue from that hold. However, the team in number seven hold still had more cargo residue to remove.

At about 1030, the crew returned to work. One team went back to work in number seven hold while the other moved the davit from the forward end of number nine hold to the after end of number eight hold and then opened the hatch

4 A nautical mile of 1852 m.

covers. However, soon afterwards, all the hatch covers had to be closed because of heavy rain.

Once the rain had passed, the crew opened the hatch covers so that they could start work again. Before they could remove any iron ore, they had to close the hatch covers because of more rain. The rain continued and the crew were unable to return to work before lunch.

At 1300, when the crew returned to work, the rain showers had passed. One team returned to number seven hold and the other, consisting of the bosun, the cadet, a quartermaster and an oiler, went to start work at number eight hold. They opened the hatch covers and agreed that the quartermaster and the oiler would climb down to the bottom of the hold to fill the bucket, the cadet would operate the winch and the bosun would work the davit and direct the cadet.

The bosun and the cadet connected the bucket, lifted it and swung it over the hatch coaming. They tied off the davit's guy ropes and then began lowering the bucket into the cargo hold.

While the bucket was being lowered, the bosun climbed up the side of the hatch coaming and stood on the hatch lid drive chains (Figure 2) so that he could look over the hatch coaming into the hold and give directions to the cadet.

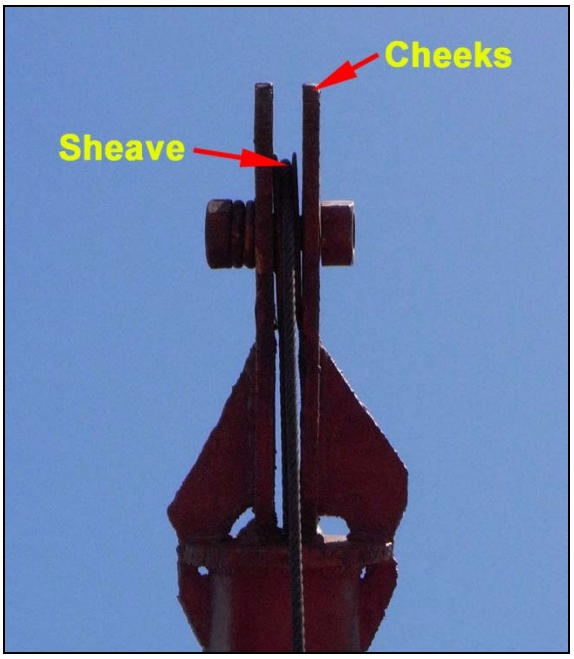
When the bucket reached the tank top, the bosun signalled the cadet to stop lowering. The quartermaster and the oiler then filled the bucket with iron ore. Once they had finished, the bosun signalled the cadet to start hoisting. When the bucket had cleared the hatch coaming, the cadet stopped hoisting. He and the bosun then untied the guy ropes, swung the davit over the hatch coaming and lowered the bucket onto the trolley.

The bosun unshackled the bucket, connected the spare empty bucket to the cargo runner and then signalled the cadet to hoist it. Once the cadet had hoisted the bucket clear of the hatch coaming, he stopped hoisting. However, the winch ran on a little.

The bosun swung the davit back over the hatch coaming. He then told the cadet to lower the bucket. When the cadet tried to lower the bucket, it did not move. The cargo runner went slack, but the bucket did not lower because the bulldog grips attaching the shackle to the wire had jammed at the head of the davit in between the sheave and the davit head cheeks (Figure 3).

The bosun told the cadet to stop lowering. He then climbed onto the hatch coaming, walked along the top of it and grabbed hold of the bucket. He pulled on the bucket, trying to release the shackle from the davit head, but it did not come free.

Figure 3: Davit head



The bosun pulled on the bucket again and, as he did so, the davit moved. As the davit moved, the bosun lost his balance and fell into the cargo hold, landing on the tank top about 25 m below.

The quartermaster and the oiler saw the bosun falling and as soon as he landed on the tank top, the quartermaster went to his aid. However, he could not detect any signs of life. The time was approximately 1340.

The cadet used a hand-held radio to report the bosun's fall to the second mate, the duty bridge watchkeeper. The second mate immediately telephoned the master in his cabin and reported the accident. The master came to the bridge and then called the chief mate and the chief engineer on their hand-held radios, telling them to go to the number eight cargo hold.

The chief mate went to the number eight cargo hold and climbed down the ladder to the tank top. He checked the bosun, but he found no signs of life. He then reported to the master that the bosun

had died. About a minute later, the chief engineer and the first engineer arrived at the accident site.

The master reported the accident to the ship's manager and he was given some advice as to what actions he should take.

The master instructed the chief mate to take photographs of the davit and the scene of the accident before the bosun's body was moved. The bosun's body was then removed from the cargo hold and placed in a stores freezer.

Hanjin Sydney continued on its voyage to Port Hedland. The next day, the master reported the accident to the Australian Rescue Coordination Centre (RCC) and the ship's Port Hedland agent.

At 0906 on 7 February, *Hanjin Sydney* anchored off Port Hedland while waiting for a berth. At 1212, police officers boarded the ship to investigate the bosun's death and, later that day, they took his body ashore.

ANALYSIS

The accident

At about 1340 on 2 February 2011, the bosun on board *Hanjin Sydney* died from the injuries he received as a result of falling about 25 m from the ship's number eight cargo hold coaming to the tank top below.

A post mortem examination concluded that the bosun died as a result of non-survivable injuries to his face, chest, abdomen, pelvis and limbs. The post mortem report also noted that it was possible that he sustained an injury to the brain. Post mortem toxicology tests did not detect any signs of alcohol or drugs.

At the time of his fall, the bosun was part of a team of crew members that were removing iron ore residue from the ship's cargo holds. They were completing a task that they considered to be routine and relatively low risk.

The portable davit

The portable davits and the associated lifting equipment[5] that were used by the crew to remove cargo residues from the holds were not listed on the ship's cargo gear register and had not been certified fit for purpose by an accredited testing agency. However, according to *Hanjin Sydney*'s crew, the davits were part of the ship's original equipment and they had been used for many years without incident.

While the crew had not experienced an incident when using the davits, they had encountered some problems. On previous occasions, the cargo runner had jammed in the head of the davit when the bucket was hoisted too high, as it did on 2 February 2011. However, on these occasions the crew had swung the davit over the deck and either climbed up the davit or used a ladder to reach the davit head to resolve the problem.

On each of these occasions, the crew were presented with an opportunity to learn from their experience and to take action that would improve future operations and safety. They could have put a mark on the cargo runner to indicate to the winch operator when to stop hoisting or modified the lifting arrangement by fitting a preventer (a ball or a plate) to the cargo runner to prevent it from jamming in the head of the davit. However, they did not. They simply kept using the davit, knowing that the wire would probably jam again sometime in the future.

Risk identification and assessment

The task of removing iron ore residue from the cargo holds was assigned to the crew by the chief mate at about 0700 on 2 February 2011. At the time, the chief mate and the crew discussed the risks associated with the task. The only risks they identified were those associated with the crew ascending and descending the cargo hold ladders.

Since they considered these risks to be routine and well understood, no formal risk analysis was carried out and no work permits were issued.

The crew did not identify falling from a cargo hold hatch coaming into an empty cargo hold as a risk that required mitigation. They did not think that anyone would have a need to climb onto the top of a hatch coaming while they were removing the cargo residue from the holds. They probably also thought that the hatch coaming would provide a safety barrier between them and the open cargo hold.

However, these assumptions were only valid if each and every crew member clearly understood that a safety barrier (the hatch coaming) would

5 Cargo runner, shackles, bucket and bridle.

not be breached by anyone, at any time, for any reason; unless additional risk controls were implemented. On 2 February 2011, no additional risk controls were implemented when the bosun breached the safety barrier by climbing onto the hatch coaming.

Personal acceptance of risk

On a number of occasions, the bosun had warned the cadet that he should not sit or stand on the top of a cargo hold hatch coaming because it was possible that he may fall into the hold.

While this demonstrates that the bosun was aware of the risks associated with climbing onto the top of the hatch coaming, his actions on 2 February show that he was willing to accept those risks himself.

On 2 February 2011, the bosun did not take the time to stop and assess the risks associated with climbing onto the hatch coaming. Had he done so, he probably would have determined that he needed to wear a safety harness, or that it was not necessary for him to climb onto the hatch coaming at all because he could swing the davit over the deck and then use a ladder to safely access the davit head.

However, the bosun did not have a safety harness or a ladder at his worksite, so he would have had to go and get either one. This would have taken some time and held up work. He probably thought that he was suitably experienced; he would only need to be on the hatch coaming for a moment and that it was unlikely that he would fall. So, in an attempt to 'get the job done'[6], he accepted the risks associated with climbing onto the coaming of the open cargo hold.

Violations and safety culture

The bosun knew that he should not climb onto the hatch coaming and, in choosing to do so, he violated what was a good rule - the need to complete a working at height permit and adhere to its requirements when working at height[7]. With reference to such violations, Patrick Hudson[8] states:

> Violations are not usually the last event in an accident sequence. However, they tend to increase the risk of subsequent errors as they make the environment less understood and less error-tolerant.

When interviewed, *Hanjin Sydney*'s crew appeared to have a good understanding of the ship's safety management system (SMS). However, it was a violation of one of the SMS procedures (working at height) that led to the bosun's death.

With reference to violations and SMSs, Hudson[9] states that;

> Violations are a significant safety issue as they undermine the basic assumption of a safety management system – procedures will be followed.

One of the objectives of a SMS is to identify and mitigate the risks involved with operating a ship. However, the SMS can only be effective if the culture on board a ship fosters the idea that the SMS requirements must be complied with at all times. For this reason, the International Safety Management (ISM) Code requires all companies to develop a safety culture on board their ships. While the ISM Code does not define safety culture, the ICS/ISF[10] guidelines for the application of the ISM Code define safety culture as:

> ...the values and practices that management and personnel share to ensure that risks are always minimised and mitigated against to the greatest degree possible.

While the effectiveness of a safety culture is a difficult concept to measure, the observed behaviours of the group may be considered as one of its measures.

Prior to 2 February 2011, *Hanjin Sydney*'s crew had been provided with an opportunity to improve

6 According to James Reason, (*Human Error*, Pg 196) it is a natural human tendency to take the path of least effort.

7 Working at a height of 2 m or more where there is a risk of falling.

8 Hudson, P. (2000) *Non-adherence to procedures: Distinguishing errors and violations.*

9 ibid

10 International Chamber of Shipping and International Shipping Federation.

future safety by engineering a solution to a known problem - the davit cargo runner jamming if hoisted too high. However, they did not take the opportunity and, as a result, the system remained unchanged.

Then, on 2 February, when the bosun was faced with a jammed cargo runner, he disregarded the SMS requirements relating to working at height and climbed onto the hatch coaming of the open cargo hold. In doing so, he accepted a well understood risk, working at height, without implementing equally well understood risk controls.

These may have been two isolated and unrelated examples of the on board attitudes towards safety. However, it is also possible that they were a reflection of the crew's shared attitudes and, hence, an indication that the on board safety culture had not been fully and effectively developed.

In submission, Hanjin Ship Management stated that:

> Neither the chief mate nor Hanjin Ship Management were told of the problem with the jamming. As a result, there was no opportunity for them to rectify the problem.

FINDINGS

Context

At about 1340 on 2 February 2011, the bosun on board the bulk carrier *Hanjin Sydney* died as a result of injuries he received when he fell about 25 m from the ship's number eight cargo hold coaming to the tank top below.

From the evidence available, the following findings are made with respect to the accident. They should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- On 2 February 2011, the davit cargo runner jammed in the head of the cargo hold davit when the bucket was hoisted too high.
- The bosun climbed onto the hatch coaming of the open number eight cargo hold to free the jammed davit cargo runner.
- A working at height permit was not issued before the bosun climbed onto the hatch coaming and the risk controls that such a permit required were not implemented.
- Prior to 2 February 2011, the crew had encountered problems with the cargo runner jamming in the head of the davit when the bucket was hoisted too high. However, nothing had been done to prevent it from happening again in the future. *[Minor safety issue]*

Other safety factors

- The bosun's actions, and those of other crew members, may have been a reflection of their shared attitudes and, hence, an indication that the on board safety culture had not been fully and effectively developed.

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety Actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Hanjin Ship Management

Learning from experience

Minor safety Issue

Prior to 2 February 2011, the crew had encountered problems with the cargo runner jamming in the head of the davit when the bucket was hoisted too high. However, nothing had been done to prevent it from happening again in the future.

Response from Hanjin Ship Management

The ATSB has been advised by Hanjin Ship Management that because the problem of jamming was not reported to the chief mate, neither he nor Hanjin Ship Management were aware of it. As a result of the accident, it is now a requirement for the ship's safety officer to be more proactive during tool box meetings and safety 'walk arounds' in questioning the crew about problems they are encountering during routine operations.

ATSB assessment of the response

The ATSB is satisfied that the action taken by Hanjin Ship Management adequately addresses this safety issue.

SOURCES AND SUBMISSIONS

Sources of Information

Hanjin Sydney's master and crew

Hanjin Ship Management

Western Australia Police

Western Australia Department of the Attorney General

References

International Chamber of Shipping and International Shipping Federation *Guidelines on the application of the IMO International Safety Management (ISM) Code.* Marisec Publications, London, Fourth Edition, 2010

Hudson, P. (2000). *Non-adherence to procedures: Distinguishing errors and violations*. Proceedings of the 11th Airbus Human Factors Symposium, Melbourne

Reason, J (1990). *Human Error*, Cambridge University Press, United Kingdom, 1990

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to *Hanjin Sydney*'s master, chief mate, quartermaster, oiler and cadet, Hanjin Ship Management, the Western Australia Department of the Attorney General, the Panama Maritime Authority and the Australian Maritime Safety Authority (AMSA).

Submissions were received from *Hanjin Sydney*'s master, quartermaster and oiler, Hanjin Ship Management, the Panama Maritime Authority and AMSA. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.