ATSB
Australian Transport Safety Bureau

AUSTRALIAN TRANSPORT SAFETY BUREAU

MARINE SAFETY INVESTIGATION
REPORT 179

Independent investigation into a fatality aboard
the Panama flag bulk carrier

Western Muse

at Port Kembla, NSW
on 19 June 2002

COMMONWEALTH DEPARTMENT OF TRANSPORT AND REGIONAL SERVICES

Department of Transport and Regional Services
Australian Transport Safety Bureau

Navigation Act 1912
Navigation (Marine Casualty) Regulations
investigation into a fatality aboard the Panama flag bulk carrier *Western Muse* at Port Kembla, NSW on 19 June 2002

Report No.179
April 2003

ISSN 1447-087X
ISBN 1 877071 29 3

Investigations into marine casualties occurring within the Commonwealth's jurisdiction are conducted under the provisions of the Navigation (Marine Casualty) Regulations, made pursuant to subsections 425 (1) (ea) and 425 (1AAA) of the *Navigation Act 1912*. The Regulations provide discretionary powers to the Inspector to investigate incidents as defined by the Regulations. Where an investigation is undertaken, the Inspector must submit a report to the Executive Director of the Australian Transport Safety Bureau (ATSB).

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Australian Transport Safety Bureau
PO Box 967
Civic Square ACT 2608
AUSTRALIA

Phone: 02 6274 6478
1800 621 372
Fax: 02 6274 6699
E-mail: marine@atsb.gov.au

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Western Muse **at Port Kembla**

Summary

At 0712 on 18 June 2002, the Panama flag bulk carrier *Western Muse* berthed at Port Kembla, NSW, to load a cargo of steel slabs and coils for Pohang in South Korea. The vessel had been chartered for the voyage by BHP Transport and Logistics.

The cargo was to be loaded using the ship's cranes. The master was advised to ensure that the cranes and wires were in good condition as they would be inspected by the stevedores before being used. Before the vessel's arrival at Port Kembla, after checking the cargo gear, both the master and mate were satisfied that the cranes and wires were in good condition.

The stevedore's inspection of the cargo gear started soon after the vessel had berthed, but unsuitable weather conditions led to only one crane being checked that day. The next morning the other cranes were inspected and, as a result, the mate was told to change the cargo wire of no. 2 crane.

During the remainder of that day, the crew carried out the task of changing the wire. Much of the work was carried out from the platform on top of the crane, requiring the use of safety belts.

By about 1745 the wire had been changed. The bosun, who was on the platform on top of the crane, gave the order for the operation of the crane to be checked. He then released the clip on the rope lanyard attached to his safety belt from the railing on the platform. At the same time, the deck cadet, who had been operating the crane, raised the cargo hook, then the jib.

The lanyard on the bosun's safety belt was drawn into the sheaves for the jib, dragging the bosun in between the sheaves and the luffing wire. He screamed out and one of two seamen with him immediately shouted to the cadet, by handheld radio, to stop the crane.

By the time the bosun was freed, he was haemorrhaging severely from wounds to his leg and pelvis. The master asked for ambulance assistance and, by about 1830, paramedics and a police rescue squad were in attendance on the ship. Soon afterwards, one of the paramedics advised the master that the bosun was dead.

The police forensic squad arrived to carry out their work and, at about 2230, the bosun's body was removed from the top of the crane and taken to the mortuary. The interim post-mortem report stated that the cause of death of the bosun was massive traumatic injuries resulting in amputation of the left leg and the side of the pelvis.

The ATSB investigation concludes that, among other factors contributing to the incident:

- The task of changing the wire was physically and mentally demanding, possibly causing the bosun's concentration to lapse at the end of the day;
- It is probable that the bosun was concentrating on the cargo wire and that he was not watching the luffing wire after he released the lanyard on his safety belt. In addition, poor light would have made it difficult to see any detail on the platform.

This report recommends that:

- In accordance with the objectives of the ISM Code, companies, in addition to documenting preventive maintenance procedures, also develop, document and implement associated safety procedures;
- Procedures and precautions for personnel working aloft include warnings that loose clothing or personal safety equipment might become entangled in moving machinery.

Sources of information

The master and crew of *Western Muse*

Australian Maritime Safety Authority

Bullivants Lifting and Safety Specialists

References

Guidelines on the application of the IMO International Safety Management (ISM) Code, Third edition 1996.

Code of Safe Working Practices for Merchant Seamen, Consolidated edition 2002.

Narrative

Western Muse

Western Muse is a Panama flag bulk carrier of 48 913 tonnes deadweight at a summer draught of 11.62 m. The vessel, owned by Hawaii Shipping Corporation, is operated by ASP Ship Management Singapore Pte Ltd.

Western Muse is classed with Nippon Kaiji Kyokai and was built in 2001 by Hyundai Heavy Industries in Ulsan, South Korea. It has an overall length of 190 m, a moulded breadth of 32 m and a moulded depth of 16.5 m. Propulsive power is provided by a 6-cylinder Sulzer, single acting, 2-stroke diesel engine of 7 700 kW. The main engine drives a single, fixed pitch, propeller which gives the ship a service speed of 14.5 knots.

The ship is of standard bulk carrier design with 5 cargo holds located forward of the accommodation superstructure. It is equipped with four 30 tonne cranes and four grabs, each of 10 m^3.

At the time of the incident *Western Muse* had a complement of 23, including a master, three mates, a deck cadet, a bosun, three able bodied seamen (ABs) and two ordinary seamen (OSs). The entire complement was from the People's Republic of China.

The master had a Chinese master's licence, first issued in 1995. He had been at sea since 1980, sailing in command for the last 7 years and had joined *Western Muse* as master on 14 April 2002.

The mate had a Chinese first mate's licence. He had been at sea since 1994 and, in November 2001, had joined *Western Muse* as trainee mate for about three months. Since then, he had sailed as mate on the ship.

The bosun, who was 34 years old, was on his second contract with the company. Both the master and the mate considered that the bosun was capable and reliable.

Cranes and wires

The cranes aboard *Western Muse* are manufactured by Ishikawajima-Harima Heavy Industries Co Ltd, Aichi Works, in Japan. They were type IHI H300185-260B (20°) cranes and their certificate stated that their rated load was 30 tonnes and the hoisting speed was 18.5 m/min. The certificate, dated 31 January 2001, also stated that the cranes had been produced and tested, with satisfactory results, in accordance with the Rules of Nippon Kaiji Kyokai.

The cargo wires for the cranes had been examined and tested on 19 January 2001. They were 250.6 metres in length, 33.5 mm in diameter, of four strands each with 48 wires, right-hand ordinary lay and were described in the certificate as semi-sealed, galvanised with a fibre core. The breaking load was 784 000 N and the safe working load was 156 800 N. The ship's records showed that these wires had been installed on the cranes on 24 May, 2001.

The luffing wires were also examined and tested on 19 January 2001. These wires were 203.4 metres in length, 26 mm in diameter, made up of 6 strands with 29 wires per strand, right-hand ordinary lay of hard steel wire rod. The breaking load was 487 000 N and the safe working load was 97 400 N. These wires had also been installed on the cranes on 24 May 2001.

The incident

The master had been advised, by telex on 6 March 2002, that *Western Muse* had been fixed to load a cargo of steel from Port Kembla to Pohang, Korea. The telex advised him that the itinerary was for the vessel to be at Port Kembla from 17-27 June to load 40 000 tonnes of steel slabs and 2 000 tonnes of steel coils.

With reference to the cargo gear, the telex read in part:

> **Important Important**
>
> Note your cargo gear will be inspected by stevedores for the below mentioned points. They now check every vessel…. Pls note that if cargo

operations are held up because of any of the following points we will have no choice but to place the vessel off hire.

As you are doubtless aware, port authorities and stevedores in Australia are all exceedingly strict on condition of cargo gear and you should ensure that your cranes meet all requirements. Identifying marks on hooks, shackles, swivels etc must be clearly legible and will be cross checked against certificates and cargo gear register. If marks as per cargo gear register are not clearly readable or fail to match register, or if cargo gear register is not up-to-date, then expensive delays are likely.

In addition you should carefully check the following:

1. All hoist and topping lift wires must be in good condition with very few if any broken wires per strand. Wires should also be well oiled/greased.

2. Any pieces of equipment such as lights etc which are attached to the crane booms must be very securely attached and also have a wire strop to act as a preventer to prevent falling if the securing bolts were to fail…

Before the ship's arrival at Port Kembla, the mate had checked the cranes and wires. Both he and the master were satisfied that the cargo gear met the requirements contained in the telex.

Western Muse anchored off Port Kembla at 2300 on 16 June and berthed at the multi-purpose berth at 0712 on 18 June. An inspection of the cranes by a professional rigger commenced at 0730 and, because of adverse weather conditions, only no. 3 crane was examined that day. It was passed fit for use.

The next morning, on 19 June, nos. 1 and 4 cranes were passed fit for use, but no. 2 crane failed an inspection of its cargo wire. The mate was instructed verbally, by the rigger inspecting the cargo gear, to renew the cargo wire of no. 2 crane.

In his report to the stevedores, the rigger noted that, with respect to the hoist rope of no. 2 crane:

> The main working sections showed evidence of significant deterioration;
>
> Main working area has multiple broken outer wires with adjacent crown wire breaks evident;
>
> Broken wires exceed retirement criteria as per Marine Orders Pt 32 and relevant Australian Standard guidelines;
>
> Heavily lubricated throughout.

The mate ordered the bosun to replace the cargo wire on no. 2 crane with the spare wire on board.

The mate signed a 'permit to work' at 0900 on 19 June to renew the cargo wire of no. 2 crane. According to the permit, the designated person in charge was the bosun. The crew assigned to the task included the deck cadet, three able bodied seamen and two ordinary seamen. The permit stated that:

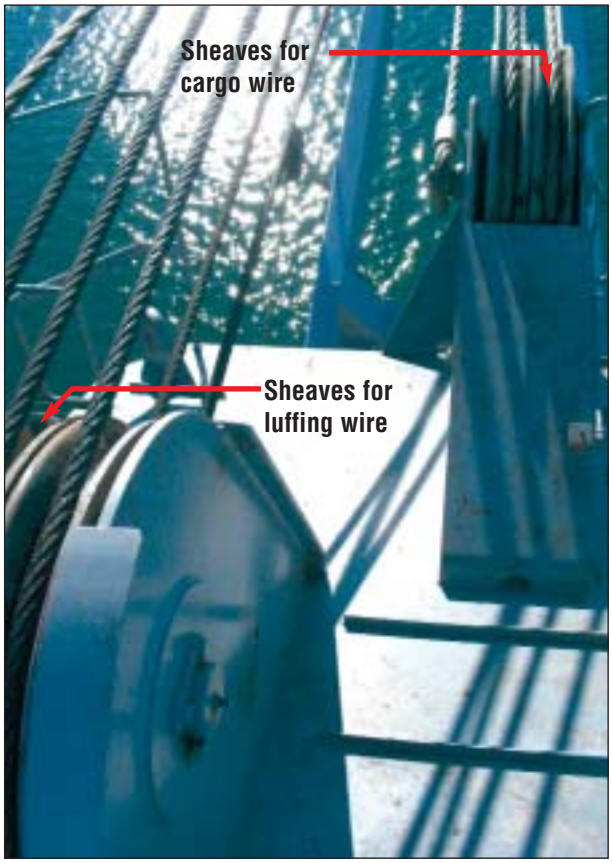
- The area was adequately ventilated and safe;
- Electrical connections had been isolated;
- Additional precautions had been taken;
- A joint inspection had been made and the area was safe and clean;
- Adjacent areas were clean and safe.

At about 1000, the spare wire had been flaked out on deck. The crew attached an end of the new wire to the old wire to enable the new wire to be reeved through the sheaves on the crane.

One OS spent much of the time on top of the crane to assist with changing the wire, work which continued through the day with a break for lunch at 1230, resuming at about 1315. The cadet operated the controls from the crane's cab to assist the crew.

The platform on top of the crane was not horizontal, nor was there much room to work. The platform, measuring about 2 metres by 2.15 metres, sloped down towards the front of the crane at an angle of about 15°. In addition it was fitted with two housings for sheaves for the luffing and cargo wires which took up space. Protective railings were fitted only to the sides and back of the platform, due to the lead of the wires.

FIGURE 2:
Top of crane: platform and sheaves for cargo and luffing wires



At about 1700, the bosun and the other OS joined the seaman who had been working on the platform on top of the crane and, just after 1730, the new wire had been fitted. The sun had set at 1653 and, by this time, it was dark.

The bosun and both seamen were using safety belts clipped to the railing around the platform on the crane. After the new wire had been set up, one OS lowered the tools they had been using to the deck in a bucket. The other OS had a hand held radio with him and, when the bosun told him they needed to check that the wires were running freely, he told the cadet to park the crane. The time was about 1745.

The cadet who had turned off power to the crane, confirmed that he was to turn on the power and park the crane.

The bosun, crouching beside the sheaves for the luffing wire, unclipped his safety belt from the rails on the platform. The jib was over the ship's side at the time, so the cadet hoisted the cargo hook about a metre to clear the bulwarks.

The cadet then started to raise the jib, the first time that he had operated the control for the jib since the bosun had been working on top of the crane. The seaman who had just lowered the bucket of tools to the deck, heard the bosun scream and turned to see what had happened.

The other seaman heard the bosun cry out 'Stop, stop' and immediately used his radio to tell the cadet to stop the crane. The rope lanyard on the bosun's safety belt was entangled in the sheaves and, by this time, the bosun's left leg and hip had been drawn in between the sheaves and the luffing wire.

The two seamen were able to free the bosun after the cadet had lowered the jib a little. He was haemorrhaging and it appeared to them that the bosun's leg had almost been severed. One seaman attempted to stem the flow of blood, while the other cradled his head. The bosun asked the seamen to undo his safety belt, which they did.

The mate had heard the shouts and he climbed to the top of the crane. By this time blood was flowing down the crane and onto the platform below the cab. The mate attempted to raise the bosun's leg to stop the bleeding. The seamen were pleading for ambulance assistance and for help in stopping the bosun's bleeding. The second mate arrived shortly afterwards, with a first aid kit and a blanket.

The cadet, who had turned off the power to the crane, heard the calls for bandages and cotton wool. He descended from the cab to see a pool of blood on the crane's platform. He ran to the hospital, returning to the crane with the bandages and cotton wool, but he was too weak with shock to climb the ladder. Another seaman took the bandages and cotton wool aloft, where the seamen used them, in what became a futile attempt, to try to stop the bleeding.

The second mate got down from the crane, then ran to the master's cabin to inform him that the bosun had been seriously injured. The master phoned the agent immediately to call for assistance and told the second mate to ask the stevedores for an ambulance.

The mate also went to the master's cabin to tell him what had happened, whereupon the master gave him a camera to take photographs of the accident scene. When the mate returned to the top of the crane, the bosun was still alive, despite his injuries and loss of blood.

The master then went to the stevedore's office ashore where he learnt that an ambulance had been despatched at 1758 to the vessel.

At about 1826, the ambulance arrived with two paramedics who immediately went to the bosun's assistance on top of the crane. Shortly after this, the Police Rescue Squad and the agent arrived. However, at about 1900, despite the efforts of the paramedics, one of them advised the master that the bosun was dead.

The police cleared the area to prepare for the arrival of the Forensic Squad, who, when they arrived, carried out their investigative procedure for fatal accidents. At about 2230, the bosun's body was removed from the platform on top of the crane and, after formal identification by the master, was taken to the mortuary.

Comment and analysis

Evidence

Investigators from the ATSB interviewed the master, the mate, the deck cadet and both seamen who had assisted the bosun with changing the crane wire. Copies of relevant ship's documents were obtained including those from the crane manuals, the cargo gear register and safety manuals.

The professional rigger from the company engaged to examine the cargo gear on *Western Muse* was also interviewed.

The ATSB took custody of the condemned crane wire for examination.

Cargo handling equipment

The Australian Maritime Safety Authority's Marine Orders Part 32, on Cargo Handling Equipment, lists the requirements for such equipment. This Part applies to the loading and unloading of any ship at a port in Australia.

Issue 2 (Amendment) of Marine Orders Part 32 defines cargo gear as:

> an article of equipment for use with a crane or derrick in loading or unloading cargo, that:
>
> a) is not riveted, welded or otherwise permanently attached to the crane or derrick and includes any wire rope…

According to Provision 15.3.2 on wire ropes, a wire rope may only be used if:

a) a responsible person[1] has issued a certificate in respect of the rope in accordance with the appropriate form in Part 3;

b) a competent person[2] has inspected the rope, externally and, as far as practical, internally every 6 months or immediately preceding its use and found that the rope is not worn, corroded or otherwise defective so that it is unfit for its proposed use;

c) the rope is free from knots and kinks;

d) the rope complies with the requirements of Appendix 15 of Marine Orders Part 32…

The ship had the required certificates for all wire ropes used on the cranes. The ship's cargo gear register had been endorsed on 10 April 2002 by the classification society for the annual thorough examination of cranes and accessory gear. The wires themselves were free from knots and kinks.

However, with respect to the requirements of Appendix 15 of Marine Orders Part 32, the wire that was changed on no. 2 crane had a certain number of broken wires within each strand.

According to Provision 15.3.3 of Marine Orders Part 32, if a constituent wire in a rope is broken:

a) the rope must be inspected by a competent person within one month of its intended use to determine if it is fit for use;

b) the competent person must record the result of the inspection in the materials handling register; and

c) the rope must not be used unless the competent person has determined that the rope continues to be fit for use.

Inspections on board ship of entire lengths of wire ropes more than 250 metres in length are problematic and time consuming. On-board pre-arrival inspections are usually concentrated on lengths of wire that are repeatedly in contact with sheaves. While records indicated that the mate had inspected the cargo gear before arriving at Port Kembla, there were some broken wires in the cargo rope that was renewed and he had not recorded the results of his inspection in the ship's cargo gear register.

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1 A responsible person includes a person responsible to the manufacturer of that equipment or a class society.

2 A competent person includes a chief officer or other person having practical and theoretical knowledge and relevant experience, sufficient to detect and evaluate any defects or weaknesses that may affect the intended performance of the equipment.

Section 2.2 of Appendix 15 of Marine Orders Part 32, on wire ropes, states that:

> Where a constituent wire in a rope is broken, that rope must not be used unless the total number of visible broken constituent wires in a length of rope equal to 10 times its diameter does not exceed 5% of the wires constituting the rope.

For the cargo wires on *Western Muse* (33.5 mm in diameter, of 4 x 48 construction) to be considered fit for use, over any length of 33.5 cms there could be no more than 9 broken constituent wires.

The rigger who had conducted the examination of the cargo gear on behalf of the stevedores had not been in any doubt that the cargo wire of no. 2 crane needed renewal. When he inspected and reported on wire ropes and their condition he used, for guidance, the relevant provisions of Marine Orders Part 32 and Australian Standard 2759.

The instruction manual published by the manufacturer of the cranes stated that the wires should be changed when the rope was deformed, kinked or broken or when the worn-out portion exceeded 5% of the original sectional area. The manual also stated that the time to change a wire, in accordance with Labor Safety Regulations in Japan, was when the individual wires in a rope that had snapped exceeded 10% of the total number of wires in 1 pitch, or 5% of one strand of wire in 1 pitch.

However, although the wire was changed, neither the master nor the mate felt that the condition of the wire warranted its renewal. The cranes and wires were just over a year old and the cranes had only been used for cargo operations on nine occasions.

The crane wire

The ATSB arranged for the wire removed from no. 2 crane to be examined by a company that specialises in lifting appliances and safety.

A visual examination of the wire was carried out (see Attachment) at the premises of that company which revealed that:

- The actual average diameter of the rope was 33.9 mm, within the usual manufacturing tolerances of –1% to +4%;
- There were numerous broken wires throughout the section where most cycling would occur on a normal hoist rope for a crane;
- At about 50 metres from one end, a 3 metre section of heavy wear was examined and 140 broken wires were counted;
- The external surface of the rope was well lubricated;
- Abrasive wear on the rope surface was moderate and commensurate with the amount of fatigue failure of the wires examined.

For a closer examination, each strand was wound off a 2 metre section of the wire and it was observed that:

- All strands were uniformly bedded about the core;
- External wear was moderate and consistent through all the strands;
- There was no corrosion evident in the samples;
- Internal lubrication was good.

The assessment was that:

- The rope exhibited normal patterns of deterioration for this construction and application; and
- The judgement to change the rope was correct, based on the rope having exceeded normal discard criteria through wire breaks within strands (reference Australian Maritime Safety Authority Marine Orders Part 32).

Based on the result that, over a 3 metre length of the cargo wire, there were 140 broken wires, over a length of 33.5 cm, there could be expected to have been an average of between 15 and 16 broken wires.

FIGURE 3:
Wire from No. 2 crane showing breaks within strands

This would be well in excess of the criteria permitted by section 2.2 of Appendix 15 of Marine Orders Part 32 and the wire was therefore not fit for use.

The ISM code

On 1 July 1998, the International Safety Management (ISM) Code became mandatory under SOLAS for certain types of ships including bulk carriers.

The purpose of the ISM Code is to provide an international standard for the safe management and operation of ships and for the prevention of pollution.

The objectives of the Code are to ensure safety at sea, prevention of human injury or loss of life and avoidance of damage to the environment, in particular to the marine environment and to property.

The Code states that the safety-management objectives of companies should:

- provide for safe practices in ship operation and a safe working environment;
- establish safeguards against all identified risks; and
- continuously improve safety-management skills of persons ashore and aboard ships…

The third edition of the publication, 'Guidelines on the application of the IMO ISM Code' published by the International Chamber of Shipping and the International Shipping Federation states, on a safety management system:

> The introduction of a safety management system requires a company to develop and implement safety management procedures to ensure that conditions, activities and tasks, both ashore and afloat, affecting safety and environment protection are planned, organised, executed and checked in accordance with legislative and company requirements…

On the advantages of establishing a safety management system, the same publication states that:

> A structured safety management system enables a company to focus on the enhancement of safe practices in ship operations and in emergency preparedness. A company that succeeds in developing and implementing an appropriate safety management system should therefore expect to experience a reduction in incidents which may cause harm to people…

Company policy

The operators of the vessel, ASP Ship Management Singapore Pte Ltd have a health and safety policy for their vessels dated 1 July 1998. The policy states that the objectives of ensuring the continuing health and safety of all employees, contractors and visitors are paramount.

To achieve those objectives, the policy requires that all business has to be conducted in accordance with relevant local and international codes and regulations and the company's own safety management system. It also believes that all employees have a primary responsibility for their own health and safety, ensuring that safe work practices are followed.

The company had been issued with a Document of Compliance by Lloyd's Register of Shipping on 14 February 2000, valid until 28 October 2002, subject to periodical verification. This document certified that the Safety Management System of the company had been audited and that it complied with the International Safety Management (ISM) Code.

Safety management on board

Western Muse had been issued with a Safety Management Certificate by Nippon Kaiji Kyokai on 27 November 2001, valid until 20 September 2006, subject to periodical verification and the validity of the Document of Compliance. This certificate confirmed that the Safety Management System (SMS) of the ship had been audited and that it complied with the requirements of the ISM Code.

While the SMS for the ship might have complied with the requirements of the ISM Code, there were no procedures in the ship's safety manual for the maintenance of cranes with respect to renewal of crane wires.

That the crane wires would need to be renewed at intervals as part of maintenance of the cargo gear was foreseeable. To renew those wires, contractors or the ship's crew would have to work on small platforms on the cranes more than 20 metres above the deck. If, as on this occasion, it was intended that the ship's crew would be used to renew the crane wires, it is reasonable to expect that the company would have procedures in place to cover all aspects of this task. Those procedures and any special precautions to be observed should have been available in the ship's safety manual.

When the availability of procedures for renewing crane wires was discussed with the mate and the master, their opinion was that the bosun was sufficiently experienced and was familiar with this task.

Safe working practices

There was a copy of the Code of Safe Working Practices for Merchant Seamen[3] on board *Western Muse*, with amendment 01 of October 1999 attached.

This Code, which is concerned with improving health and safety on ships, provides guidance on safe working practices. With respect to the ISM objective of establishing safeguards against all identified risks, the Code of Safe Working Practices for Merchant Seamen is intended to assist companies with identifying those risks and establishing safe practices.

The Code contains advice on the conduct of risk assessment and states that the assessment should cover risks arising from work activities on ships. In determining how thorough any assessment should be, a suitable and sufficient assessment is required to be made of the risks to the health and safety of workers arising in the normal course of their duties. The extent of any assessment would depend on the level of risks identified and whether or not those risks are already controlled by satisfactory precautions or procedures.

The introduction to chapter 15, on safe systems of work, suggests measures, based on risk assessments, to protect those who may be at risk in some key areas, including while working aloft.

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3 Published for the Maritime and Coastguard Agency, UK, under licence from the Controller of Her Majesty's Stationery Office.

In chapter 21 of the Code, on lifting gear, including ship's cranes, the introduction contains advice that, based on the findings of a risk assessment, appropriate control measures should be put in place to protect those who may be affected.

A checklist in the Code for use by a safety officer contains such questions as:

- Is machinery adequately guarded where necessary?
- Are lighting levels adequate?
- Are permits-to-work used when necessary?
- Are crew wearing necessary protective clothing and equipment?

With respect to moving machinery being adequately guarded, the sheaves on the ship's cranes for the luffing and cargo wires were not fitted with guards, but that is normal for cranes. Any permanent guards may have interfered with the run of the wires in the sheaves. While the crew were in the vicinity of the wires and sheaves, these moving parts were an identifiable risk and suitable precautions should have been in place to protect the crew from the danger of the unguarded sheaves.

The crew had started changing the wire in the morning, but they had not finished the job by sunset and continued until the new wire was fitted. Twilight ended at 1721 and, from then on, lighting would have been required for the crew on top of the crane to be able to work safely. However, there was no lighting on top of the crane other than that available from lights on pylons on the berth which were the only source of illumination for the bosun and the two seamen.

Both seamen and the bosun were wearing appropriate safety gear and the mate had issued a permit to work at 0900 that day. Though the permit stated that the area was safe, by the time the crew had completed the job, the conditions had changed. It was dark and their safety on the crane would have been compromised by the conditions of lighting in which they were now working.

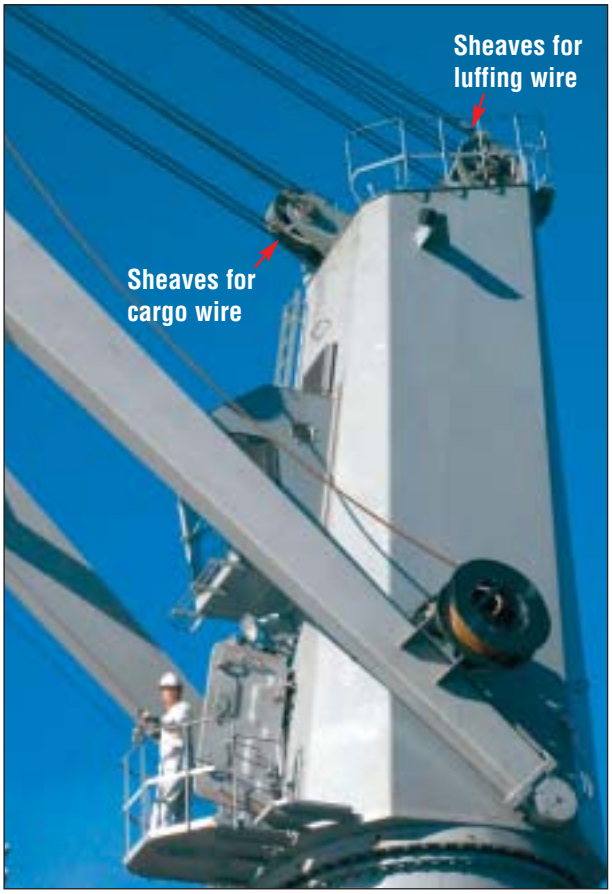
Advice from professional riggers is that any loose clothing or equipment that can be caught in moving machinery is a major hazard. Though the Code of Safe Working Practices for Merchant Seaman recommends that personnel working aloft use a safety harness with a lifeline, there is the danger that a lifeline could be caught in moving machinery, as occurred in this incident.

Appropriate procedures to manage both the risks of falls from aloft and of being trapped in unguarded machinery should have been in place.

A long day

The mate confirmed that the hours of work and rest of the bosun were such that fatigue should not have been an issue. For the week before the accident, the bosun had been working normal hours during the day only and he appeared rested and alert on the morning of 19 June.

FIGURE 4:
No. 2 crane on *Western Muse*



However, replacing the wire took a full day. The work involved in renewing the cargo wire, given its size, length and the height of the crane, would have been arduous and physically demanding, requiring a high level of concentration. At the end of a long day, the nature of the task and the fact that he was working in low lighting levels on a sloping cluttered platform at a considerable height above the deck may have affected the bosun.

The bosun ordered that the crane be housed so that he could confirm that the cargo wire was running freely in its sheaves. The cadet recalled that, while the bosun had been on the platform on top of the crane, he had only operated the control for the cargo wire. He now operated the control for the same wire to lift the cargo hook a metre or so, before raising the jib, bringing a different set of sheaves on the platform into play.

The bosun, who had been focussing on the cargo wire all day, probably did not recognise that the luffing wire would also soon be moving. In the meantime he unclipped his safety belt from the railing, releasing the rope lanyard. He did not seem to have ensured that the lanyard was clear of the luffing wire or the sheaves for that wire because, almost immediately after the cadet lifted the jib, the bosun was dragged by the lanyard between the luffing wire and the sheaves, suffering injuries that proved fatal.

The lanyard for the bosun's safety belt was later recovered. It had been torn from his safety belt and the D-ring that had connected it to the safety belt had been distorted by the forces exerted on it by the moving machinery.

The master responded promptly when he was informed of the injuries to the bosun and there was no evidence that the procedures followed immediately after the accident caused any delay. The bosun's injuries were so massive that there was nothing that the crew couold do to save him.

FIGURE 5:
Crew member demonstrating length of lanyard attached to safety belt

FIGURE 6:
Crew member demonstrating the use of the safety belt and lanyard

Conclusions

These conclusions identify the different factors contributing to the incident and should not be read as apportioning blame or liability to any particular individual or organisation.

Based on the evidence available, the incident occurred due to a combination of the following factors:

1. After the bosun released the rope lanyard on his safety belt, the lanyard became entangled in the luffing wire or was drawn into the sheaves for that wire, dragging him in between the sheaves and the wire.
2. The task of changing the cargo wire, in addition to being arduous and lengthy, was physically and mentally demanding, possibly causing the bosun's concentration to lapse at the end of the day.
3. The conditions of lighting under which the crew were operating at the top of the crane would have made it difficult to see any detail on the platform.
4. It is likely that the bosun was concentrating on the movement of the cargo wire and that he omitted to watch for movement of the luffing wire.
5. Though the mate had signed a permit to work that morning, the conditions for the permit were not re-assessed once darkness had fallen.
6. While the company and the ship had the necessary ISM accreditation, the safety manual contained no precautions or procedures for the crew when working in close proximity to moving machinery on cranes.

In addition, although not a contributing factor, the Inspector concludes that the condition of the wire that was renewed did not meet the requirements of Marine Orders Part 32. The wire was not fit for use and, hence, did require replacing.

Submissions

Under sub-regulation 16(3) of the Navigation (Marine Casualty) Regulations, if a report, or part of a report, relates to a person's affairs to a material extent, the Inspector must, if it is reasonable to do so, give that person a copy of the report or the relevant part of the report. Sub-regulation 16(4) provides that such a person may provide written comments or information relating to the report.

The final draft of the report, or relevant parts thereof, was sent to the following:

ASP Ship Management Singapore Pte Ltd,

The master,

The mate,

Both ordinary seamen,

The deck cadet,

IHI Co Ltd, the manufacturers of the cranes fitted on board '*Western Muse*',

ClassNK,

Lloyd's Register of Shipping, and

AMSA.

Submissions were received from ASP Ship Management Singapore Pte Ltd, IHI Co Ltd, ClassNK and Lloyd's Register of Shipping, Singapore.

The submission from ASP Ship Management stated, in part:

> As the operational tasks on board are very diversified, it is very difficult to be specific in providing instructions on our safety management system for individual operations. In practice, changing of the crane wire is normal work on board geared vessels. The bosun was an ex crane/derrick seaman with sufficient experience.

The submission from ClassNK stated, in part:

> As a concrete measure we would conduct an enhanced investigation at the next periodical audit for the ship to verify how the company and ship worked in their activities to improve the existing procedures to establish safety measures in order to prevent recurrences of similar accidents. … The preparation of documents, such as the safety management manual or a procedure is the responsibility of the company. These documents are to be revised in comformity with the ISM Code by the Administration or recognised organization who conducts an audit for the company and issues the Document of Compliance. That was done by Lloyd's Register of Shipping (LR) and we would appreciate your forwarding the draft copy to LR to inform them of the necessity of improving the company's safety documents.

The submission from Lloyd's Register of Shipping stated that, with reference to the Document of Compliance:

> ...it should be issued by the Administration, by an organization recognised by the Administration or, at the request of the Administration, by another Contracting Government to the Convention to any Company complying with the requirements of the ISM Code for a period specified by the Administration which should not exceed five years. Such a document should be accepted as evidence that the Company is capable of complying with the requirements of this Code.

Recommendations

MR20030017

Shipowners and operators, in addition to documenting preventive maintenance procedures, should also establish, document and implement associated safety procedures in accordance with the objectives of the ISM Code.

MR20030018

Administrations are reminded that they should ensure that companies have developed appropriate procedures for their safety and management systems.

MR20030019

Shipowners' and operators' procedures and precautions for personnel working aloft should include warnings that loose clothing or personal safety equipment might become entangled in moving machinery.

MR20030020

Procedures should be implemented on ships to ensure that people and their clothing or equipment are clear of moving parts before any machinery is used.

MR20030021

Shipboard permits to work should be reviewed and rewritten where necessary to take account of changes in working conditions.

Western Muse

IMO No.	9234214
Flag	Panama
Classification Society	ClassNK
Vessel type	Bulk carrier
Owner	Hawaii Shipping Corporation
Operator	ASP Ship Management Singapore Pte Ltd
Year of build	2001
Builder	Hyundai Heavy Industries Co Ltd, South Korea
Gross tonnage	28 097
Summer deadweight	48 913 tonnes
Length overall	189.96 m
Breadth, moulded	32 m
Draught (summer)	16.5 m
Engine	Sulzer diesel, 6RTA48T
Engine power	7 700 kW
Service speed	14.5 knots
Crew	23, Chinese

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Rope Inspection / Assessment Report
Report BW 15402
Relating to Crane Hoist Rope Vessel Western Muse.

To: Australian Transport Safety Bureau

From: Bullivants Lifting & Safety Specialists
Unanderra NSW (Sthn NSW Region)

Please find report details of hoist rope " "omitted by your office for assessment.

Report BW 15402
Examination of rope from vessel "Western Muse" - crane hoist rope.

Introduction.
This rope was removed from vessel as part of normal maintenance process following inspection of rope which indicated discard criteria had been met or exceeded.
Following removal from vessel rope was delivered to Bullivants loose coiled for visual assessment of condition with mechanical testing if deemed necessary.

Results of rope visual examination.
The full working hoist rope from the vessel's crane was supplied loose for examination.
The loose rope was mechanically wound onto a reel for closer examination.

The following observations and measurements were made of the rope:

- The actual diameter of the rope measured at 15 points and averaged was 33.9mm
  This is within usual manufacturing tolerances of –1% to +4%.
- The rope was 4x 48 Right hand ordinary lay and was galvanised.
- There were numerous broken wires throughout the section where most cycling would occur on a normal hoist rope for a vessel crane.
  At some 50 metres from one end a 3 metre section of heavy wear was examined and 140 broken wires were counted.
  6 groups of these broken wires were composed of 2 adjacent broken wires.
  The broken wires occurred around the entire rope circumference.
  The predominant breaks occurred on the crowns of the strands, however a number of breaks originating from the valleys were also sighted.
  All breaks examined indicated failure in fatigue as opposed to tensile strength failure.
- The external surface of the rope was well lubricated including within the valleys between strands.
- Abrasive wear on the rope surface was moderate and commensurate with the amount of fatigue failure of the wires examined.

In order to more closely examine the sample, each of the strands were wound off from a 2 metre section.
The following was observed;

- All strands were found to be uniformly bedded about the core.
- The construction of each strand comprising 48 wires was checked and found correct.
- There was as expected heavy strand to strand nicking at contact points as is common with this rope construction.
- External wear was moderate and consistent through all strands.

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- There was no corrosion evident in the sample.
- Internal lubrication of the rope was good with uniform distribution of the lubricant.
- The helix of the removed strands was compared and was found consistent.

Assessment of examination results.

Following visual examination as described above it was decided not to further submit the sample to any mechanical tests.
The rope in all respects exhibited normal patterns and modes of deterioration for this construction and application.
The judgement to change this rope given the state of the sample supplied was correct, based on the rope having exceeded normal discard criteria through wire breaks within strands.
(Reference AMSA Marine Orders Part 32)
A certificate No. 6341-494-2 from Shinko Wire Company was presented as representing the rope sample.
Given the results of the visual examination the certificate appears to verify the rope sample presented as that represented on the certificate.

Examination carried out at Bullivants Wollongong.
Report results verified by Branch Manager.

Investigation into a fatality aboard the Panama flag bulk carrier Western Muse at Port Kembla, NSW on 19 June 2002

ISSN 1447-087X
ISBN1 877071 29 3