Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT
Marine Occurrence Investigation No. 259
MO-2008-011
Final

Independent investigation into the fatality on board the Maltese registered container ship

Spirit of Esperance

at Townsville, Queensland

24 November 2008

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CONTENTS

THE AUSTRALIAN TRANSPORT SAFETY BUREAU vii

TERMINOLOGY USED IN THIS REPORT ix

EXECUTIVE SUMMARY xi

1 FACTUAL INFORMATION 1

1.1 *Spirit of Esperance* 1

1.2 Cargo crane arrangements 2

1.3 The accident 4

2 ANALYSIS 7

2.1 Evidence 7

2.2 The accident 7

2.3 Hook stowing practice 8

2.4 Safety management system 10

2.4.1 Cargo crane operating procedures 10

2.4.2 Job safety analysis 10

2.4.3 Working aloft procedure 12

2.4.4 The use of personal protective equipment 13

2.5 Alcohol consumption 13

2.5.1 Immediate or short term effects of alcohol on the body 13

2.5.2 24 November 2008 14

3 FINDINGS 17

3.1 Context 17

3.2 Contributing safety factors 17

3.3 Other safety factors 18

4 SAFETY ACTIONS 19

4.1 ASP Ship Management 19

4.1.1 Hook cradle design 19

4.1.2 Cargo crane operation procedure 19

4.1.3 Job safety analysis 20

4.1.4 Work aloft and at height procedure 20

4.1.5 HSSE meetings 21

4.1.6 Alcohol policy 21

4.2 Marlow Navigation 21

4.2.1 Hook cradle design 21

APPENDIX A: EVENTS AND CONDITIONS CHART 23

APPENDIX B: SHIP INFORMATION.....25

APPENDIX C: SOURCES AND SUBMISSIONS 27

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Abstract

At about 2117 on 24 November 2008, while preparing the ship to sail from Townsville, Queensland, a crew member on board the Maltese registered container ship *Spirit of Esperance* was injured after falling about 4 m during an operation to stow the number three cargo crane hook.

Immediately following the fall, the crew member was treated by the ship's crew and, shortly afterwards, by ambulance officers. He was then transferred to hospital where he later died as a result of the injuries he had sustained.

The Australian Transport Safety Bureau (ATSB) investigation found that the design of the cargo crane hook cradle did not allow for unassisted stowage of the hook when the ship had a stern trim in excess of 2.1 m; there were no guidelines or procedures available on board the ship to assist the crew with the task of stowing the cargo crane hook when it was misaligned from its cradle; the crane operations job safety analysis did not identify the risks associated with stowing the hook in these circumstances; and when the ship's stern trim was in excess of 2.1 m, the ship's crew routinely violated the working aloft procedure by climbing the emergency ladder adjacent to the hook's cradle without a permit or appropriate personal protective equipment.

The investigation also found that the deceased crew member was probably under the influence of alcohol at the time of the accident and this may have adversely affected his reaction time, balance and cognitive ability.

The ATSB acknowledges the safety actions taken by ASP Ship Management to address these safety issues and, in addition, has issued three safety advisory notices.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

TERMINOLOGY USED IN THIS REPORT

Occurrence: accident or incident.

Safety factor: an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, current risk controls and organisational influences.

Contributing safety factor: a safety factor that, had it not occurred or existed at the time of an occurrence, then either: (a) the occurrence would probably not have occurred; or (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or (c) another contributing safety factor would probably not have occurred or existed.

Other safety factor: a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report in the interests of improved transport safety.

Other key finding: any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which 'saved the day' or played an important role in reducing the risk associated with an occurrence.

Safety issue: a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

Risk level: The ATSB's assessment of the risk level associated with a safety issue is noted in the Findings section of the investigation report. It reflects the risk level as it existed at the time of the occurrence. That risk level may subsequently have been reduced as a result of safety actions taken by individuals or organisations during the course of an investigation.

Safety issues are broadly classified in terms of their level of risk as follows:

- **Critical** safety issue: associated with an intolerable level of risk and generally leading to the immediate issue of a safety recommendation unless corrective safety action has already been taken.
- **Significant** safety issue: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable. The ATSB may issue a safety recommendation or a safety advisory notice if it assesses that further safety action may be practicable.
- **Minor** safety issue: associated with a broadly acceptable level of risk, although the ATSB may sometimes issue a safety advisory notice.

Safety action: the steps taken or proposed to be taken by a person, organisation or agency in response to a safety issue.

EXECUTIVE SUMMARY

At about 1700[1] on 23 November 2008, *Spirit of Esperance* berthed starboard side to number three berth in Townsville, Queensland. Cargo operations commenced shortly afterwards. At 1905 on 24 November, cargo operations were completed and the stevedores completed lashing the containers. The ship's departure draughts were 4.6 m forward and 7.1 m aft, giving the ship a stern trim of 2.5 m.

At 2100, the chief integrated rating (CIR) directed two integrated ratings (IRs) to prepare the number three cargo crane so that the ship's brow[2] could be lifted on board. By 2107, the brow was stowed and secured. A few minutes later, the IR (IR1) who acted as 'dogman[3]', moved to the lashing platform below the number two cargo crane in order to direct the crane driver (IR2) to stow the number three crane's jib and hook. The IRs were using hand-held radios to communicate.

The stern trim resulted in the hook being misaligned with its cradle. At about 2117, after several unsuccessful attempts to stow the hook, IR1 climbed the emergency ladder adjacent to the cradle and tried to manually position the hook. At about 2118, IR2 tried to confirm the hook's position but he could not raise IR1 on the radio. After at least three unsuccessful attempts to contact IR1, IR2 informed the chief mate that IR1 was not responding to radio calls. The chief mate then directed the CIR to the lashing platform to check that IR1 was all right. When he got there, the CIR found IR1 lying unconscious on his back, with injuries to his head and body.

First aid was provided to IR1 by the ship's crew and at 2124, the master telephoned the emergency services. By 2150, an ambulance had arrived and the paramedics began treating the injured IR. At 2210, he was taken off the ship on a stretcher and transported to hospital, where he later died as a result of his injuries.

The Australian Transport Safety Bureau (ATSB) investigation found that the design of the cargo crane hook cradle did not allow for unassisted stowage of the hook when the ship had a stern trim in excess of 2.1 m; there were no guidelines or procedures available on board the ship to assist the crew with the task of stowing the cargo crane hook when it was misaligned from its cradle; the crane operations job safety analysis did not identify the risks associated with stowing the hook in these circumstances ; and when the ship's stern trim was in excess of 2.1 m, the ship's crew routinely violated the working aloft procedure by climbing the emergency ladder adjacent to the hook's cradle without a permit or appropriate personal protective equipment.

The investigation also found that the deceased crew member was probably under the influence of alcohol at the time of the accident and this may have adversely affected his reaction time, balance and cognitive ability.

The ATSB acknowledges the safety actions taken by ASP Ship Management to address these safety issues and, in addition, has issued three safety advisory notices.

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1 All times referred to in this report are local time, Coordinated Universal Time (UTC) + 10 hours.

2 Portable gangway to access the ship.

3 A person who is assigned to provide directions to a crane driver.

1 FACTUAL INFORMATION

1.1 *Spirit of Esperance*

Spirit of Esperance (Figure 1) is a geared cellular container ship. At the time of the accident, it was owned by Christine Partrederiet, Denmark, and managed by ASP Ship Management (ASP), Australia[4]. It was registered in Malta and classed with Germanischer Lloyd (GL).

The ship was built in 1992 by Kvaerner Warnow Werft, Germany. It has an overall length of 167.24 m, a beam of 25.24 m, a depth of 13.40 m and a deadweight of 20,270 t at its summer draught of 9.84 m.

Figure 1: *Spirit of Esperance*

Propulsive power is supplied by a Sulzer 6RTA58 single acting, direct reversing, two-stroke diesel engine which develops 9,540 kW. This engine drives a single fixed-pitched propeller, giving the ship a service speed of 17 knots[5].

Spirit of Esperance's navigation bridge was equipped with a range of navigational equipment in accordance with SOLAS[6] requirements. The ship's crew used ultra high frequency (UHF) hand-held radios for on board communications.

Spirit of Esperance has six cargo compartments accessed through nine hatches, all located forward of the accommodation superstructure. The ship can carry 1,388 TEU[7], 854 of which can be stowed on deck. At the time of the accident, the containers were stacked two high on deck.

At the time of accident, the ship had a crew of 21, comprising 19 Australian and two New Zealand nationals. All of the crew were appropriately qualified.

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4 In May 2009, *Spirit of Esperance*'s name and management were changed. When this report was published, the ship's name was *CS Christine* and it was managed by Marlow Navigation.

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

6 The International Convention for the Safety of Life at Sea, 1974, as amended.

7 Twenty-foot Equivalent Unit, a standard shipping container. The nominal size of a ship in TEU refers to the number of standard containers that it can carry.

While in port, the ship's deck officers maintained 8 hour watches, working additional hours if required. The watch keeping IRs maintained a traditional 4 on/8 off watch keeping routine. The remaining crew were day workers.

The master first went to sea in 1989. In 1990, he began sailing as a deck officer on small passenger ships in Australia and in 1999; he joined ASP as third mate. He gained his Australian master class 1 certificate of competency in 2004 and had sailed as master since 2005. This was his first time in command of *Spirit of Esperance*, which he had joined on 3 November 2008.

The chief mate had been at sea since 1989. He had sailed on various types of ships and joined ASP in 1999. He was promoted to chief mate in 2002 and obtained an Australian master class 1 certificate of competency in 2003. He first joined *Spirit of Esperance* in April 2008.

The deceased integrated rating (IR1) was 63 years of age and held a New Zealand certificate as a deck rating with STCW[8] II/4 endorsement, which he obtained in 1978 and revalidated in 1991. He started his career at sea on tugs and barges and in 1995, left the sea to work ashore. In March 2008, he joined *Spirit of Esperance* for the first time. He had rejoined the ship this time on 3 November 2008.

1.2 Cargo crane arrangements

Spirit of Esperance is equipped with three electro-hydraulic cargo cranes which were manufactured by Hagglunds Marine, Germany. The cranes are located forward of the accommodation superstructure, along the ship's centre line, numbered one to three from forward to aft . Each crane has a safe working load (SWL) of 40 t and is mounted on a 14.8 m high pedestal. This ensures that there is sufficient clearance for the crane to operate when containers are stowed five high on the hatch covers. Each jib has an operating radius ranging from 3.4 m, when fully raised, to 28 m at its maximum reach.

Each crane has a luffing wire for raising and lowering the crane jib, and a hoisting wire for raising and lowering the hook. The hoisting wire runs through a block and rams-horn hook assembly (hook) (Figure 2). The total weight of each crane's loose gear and wires is 5 t and the hooks each weigh about 2 t.

When the cranes are not in use, the hooks can be stowed in cradles, which were designed and constructed by the shipyard (Figures 3 and 4). The cradles for the hooks of number two and three cranes are mounted athwartships on the crane pedestal, about 10.7 m below the jib's stowed position and 4.1 m above the lashing platform between the cargo hatches. This allows ease of access below and around the cradle during cargo operations.

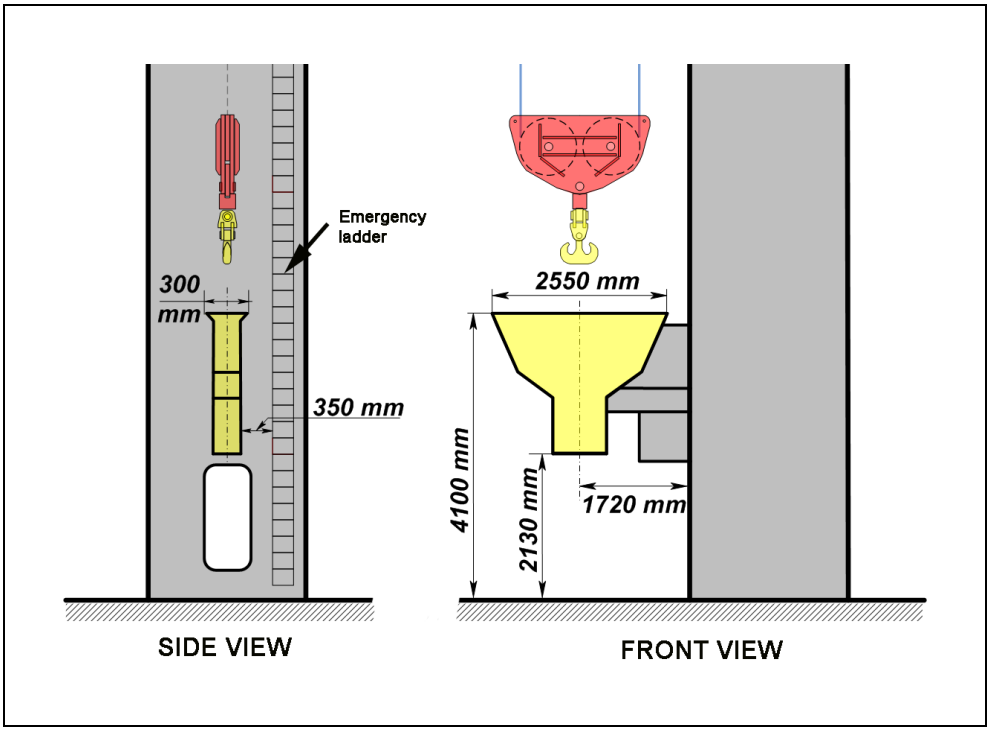
The cradle is positioned so that the hook can stow vertically when the jib is housed and is designed to minimise hook movement in a seaway without the need for additional securing.

8 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995.

Figure 2: The block and rams-horn hook assembly

Figure 3: The hook cradle and the emergency ladder

Figure 4: Schematic of the hook cradle and the emergency ladder



The dimensions of the cradle's opening are 2550 mm x 300 mm. This allows the hook to be stowed without intervention when the ship has a stern trim of 2.1 m or less. However, with a greater trim, the hook will not stow in the cradle without manual assistance.

The cradle cannot be seen from the crane driver's cabin when containers are stowed two or more high on the hatch cover. Hence, it became usual for a crew member (known as a 'dogman') to give directions to the crane driver, via a hand-held radio, to lower the hook until it was stowed.

Access to the crane driver's cabin is provided by a ladder fitted inside the pedestal. An emergency ladder is mounted on the outside of the crane pedestal in the event of the internal ladder becoming inaccessible (Figures 3 and 4).

1.3 The accident

At about 1700 on 23 November 2008, *Spirit of Esperance* berthed starboard side to number three berth in Townsville, Queensland, after a voyage from Gladstone, Queensland. At 1724, the ship's brow was lowered using a ship's cargo crane and a short time afterwards cargo operations began.

At 1905 on 24 November, cargo operations were completed and at about 1910, the stevedores left the ship. The ship's departure draughts were 4.6 m forward and 7.1 m aft, giving the ship a stern trim of 2.5 m.

At 2030, about 1 hour before the ship's scheduled sailing time, preparations began for departure. At 2050, the master came to the bridge and at 2057; a Townsville harbour pilot boarded the ship. Soon after, the master began the pre-departure information exchange with the pilot.

At about 2100, the CIR told IR1 and IR2 to prepare number three crane to lift the ship's brow on board. By about 2107, the brow had been secured. A short time later, IR1 moved to the lashing platform below number two cargo crane where he was intending to use a hand-held radio to direct IR2, who was in the crane driver's cabin, to stow number three crane's hook.

The chief mate, who was standing on the bridge, could hear the radio conversation between the two IRs securing the crane.

At about 2110, after the jib was properly stowed, IR1 began to give directions to stow the hook. During the first attempt, the hook did not align with the cradle so IR1 asked IR2 to raise the hook and then lower it again. However, this attempt was also unsuccessful.

At about 2116, IR1 told IR2 that he needed to 'just go up'. IR2 interpreted this statement as meaning that IR1 was going to climb the crane emergency escape ladder so that he could manually position the hook. IR2 asked if he should raise the jib but IR1 replied 'it is not going to go in'.

At 2117, IR2 confirmed that he was lowering the hook. IR1 asked IR2 to 'hold a bit' and shortly afterwards, IR2 lifted the hook up and lowered it again. Several times IR1 asked IR2 to 'hold it there'. During this operation, IR2 could see IR1's hard-hat as he tried to align the hook with its cradle.

At 2118, IR2 tried to confirm the hook's position with IR1 but he could not get a response. About a minute later, IR2 again tried to contact IR1 but he still could not get a response.

After trying unsuccessfully to raise IR1 for a third time, IR2 informed the chief mate that IR1 was not responding to radio calls. The chief mate then tried to contact IR1 himself but he too received no reply.

At about 2120, the chief mate directed the CIR to go to number two crane pedestal and make sure the IR had not 'had a fall or anything'. The chief mate then informed the master and the pilot, who had both overheard IR2's radio call, that he had sent the CIR to check the situation.

At 2122, the CIR found IR1 lying unconscious on his back on the lashing platform below number two cargo crane. His head was about 1 m from the crane pedestal and his feet were pointing outboard, towards the starboard side of the ship. The CIR saw that IR1 was bleeding from a head injury and immediately informed the chief mate.

The chief mate contacted the rest of the deck crew, who were in the process of preparing the ship for letting go, and instructed them to go to the accident location. The third mate and a trainee IR arrived at the base of the crane soon afterwards. The third mate positioned himself next to IR1's head and confirmed that there was blood coming from the back of IR1's head and that he was non-responsive.

The chief mate left the bridge and went to the accident site. On his way, he picked up a first aid kit and told the chief steward and another trainee IR to bring the ship's stretcher and portable oxygen resuscitator unit to the base of number two crane.

After IR1's condition had been assessed by the third mate, the chief mate informed the master that shore assistance was needed.

At 2124, the master telephoned '000' (the Australian emergency services telephone number) and requested an ambulance. The master then instructed the chief mate to make the necessary arrangements to land the ship's brow so that paramedics could board the ship as soon as they arrived. The chief mate passed the instruction to IR2, who was still in the number three crane driver's cabin, and the brow was lifted and again made fast at the ship's side.

At 2150, an ambulance arrived. The paramedics boarded the ship and began treating the injured IR.

At 2210, after an initial assessment and treatment, the paramedics removed IR1 from the ship, assisted by members of the Queensland Fire and Rescue Service who had also arrived on the wharf. At 2215, the master and the pilot agreed that in light of the accident, the departure of the ship should be delayed.

At 2230, following discussions with the chief mate, company senior management and the ship's crew, the master decided to proceed with the departure. At 2303, the last mooring line was let go and *Spirit of Esperance* departed Townsville bound for Esperance, Western Australia.

At 2345, following an initial examination by medical staff at the Townsville Hospital, IR1 was admitted to the hospital's intensive care unit. However, at 1709 on 25 November, despite the efforts of hospital medical staff, IR1 died as a result of his injuries.

Following the IR's death, *Spirit of Esperance*'s master was asked by Queensland Police to divert to the nearest port so that the crew could be interviewed about the accident.

On the afternoon of 26 November, *Spirit of Esperance* arrived off Brisbane, Queensland, where the ship was boarded by Queensland Police officers and a surveyor from the Australian Maritime Safety Authority (AMSA). By 1800, the officials had left the ship and *Spirit of Esperance* resumed its voyage.

On 2 December, the ship berthed in Esperance. Soon afterwards, representatives from the Australian Transport Safety Bureau (ATSB), AMSA, the ship's flag State, the Maritime Union of Australia (MUA), ASP and ASP's lawyers boarded the ship.

Following an investigation of the accident, AMSA issued a prohibition notice, under the Occupational Health and Safety (Maritime Industry) Regulations, prohibiting access to the emergency ladder of number two and three cargo cranes for the purpose of assisting with the housing of the hooks or any other activities other than emergency escape.

2 ANALYSIS

2.1 Evidence

On 2 December 2008, two investigators from the Australian Transport Safety Bureau (ATSB) attended *Spirit of Esperance* while the ship was berthed in Esperance, Western Australia. The master and directly involved crew members were interviewed and copies of relevant documents were obtained, including crew member statements, photographs, log books, STCW hours of rest records and company procedures. Data from the ship's voyage data recorder (VDR) was also downloaded.

Since IR2 (the crane driver) was not on board the ship when initial interviews were carried out in Esperance, he was interviewed by an ATSB investigator at ASP Ship Management's offices in Melbourne, Victoria, on 31 December 2008.

Information relating to the accident was also provided by the cargo crane manufacturer, Queensland Police, Townsville Hospital and the Queensland Coroner's office.

2.2 The accident

The accident occurred while *Spirit of Esperance*'s crew was securing the number three cargo crane for sea prior to the ship's departure from Townsville, Queensland.

The ship's departure draughts were 4.6 m forward and 7.1 m aft, giving the ship a stern trim of 2.5 m. At that trim, the crane's hook did not align with its cradle and the deceased IR climbed the emergency ladder on the number two cargo crane pedestal in an attempt to manually guide the hook into position. The crane driver said that during the attempt to stow the hook, he saw the deceased IR's hard-hat. This indicates that IR1 had climbed about 4.1 m up the ladder to the height of the cradle.

It is likely that while trying to position the hook, the IR fell, landing on the platform below. He was found lying on his back, with his head about 1 m away from the crane pedestal and his feet pointing outboard, indicating that he probably rotated during the fall. The injuries he sustained as a result of the fall led to his death in hospital the next day.

According to the autopsy report, the cause of the IR's death was brain trauma. There were a series of patterned lacerations on the right side of his head and extensive bruising on the right side of his upper body and right arm. This indicates that the IR probably fell from a height, rather than tripping over an object on the platform, and that he landed on the right side of his head and upper body.

The report also notes the presence of alcohol and drugs of a therapeutic origin in the IR's blood. While it is likely that he had consumed alcohol in the hours before the incident, the drugs were administered by medical staff after his admission to the Townsville hospital following the fall.

In summary, the autopsy report stated that:

> This man had an intracerebral haemorrhage on the left side of his brain and he had a burst lobe and contusions to the right cerebral hemisphere. The latter may have been caused by a fall and in the same fall he sustained injury to the right side of the chest and to the right upper limb.
>
> A fall may be precipitated by spontaneous intracranial haemorrhage and may be severe enough to produce a fracture of the skull, cerebral contusions and intracranial haemorrhage. The interpretations of findings can be very difficult. The left-sided haematoma was in the parietal lobe and in this area it is more likely to be spontaneous than traumatic. It is not known if this man was hypertensive. Alcohol may precipitate a cerebral haemorrhage and it is noted that blood from 23:55 on the day before his death had a moderate level of alcohol together with drugs of therapeutic origin (morphine and midazolam).

The reason the IR fell could not be determined exactly. He may have suffered a cerebral haemorrhage while attempting to position the hook. It is also possible that he overextended (or overreached) himself in order to take hold of the hook and lost his balance, or that his foot may have slipped off the cradle support bracket.

Whatever the reason for the fall, the IR was not wearing the correct personal protective equipment (PPE) required for carrying out tasks at a height of 4 m on an emergency ladder that was not fitted with safety devices to reduce the risk of a fall, such as hoops or safety railings.

2.3 Hook stowing practice

The hook cradles for number two and three cargo cranes had tapered openings and were designed to allow the hook to stow easily and unassisted if the ship was trimmed by up to 2.1 m by the stern. However, at the time of the accident, *Spirit of Esperance* had a stern trim of 2.5 m. Consequently, the hook hung clear of the after end of its cradle by about 20 mm (Figure 5) and in order to stow the hook, the crew needed to physically guide it into the cradle.

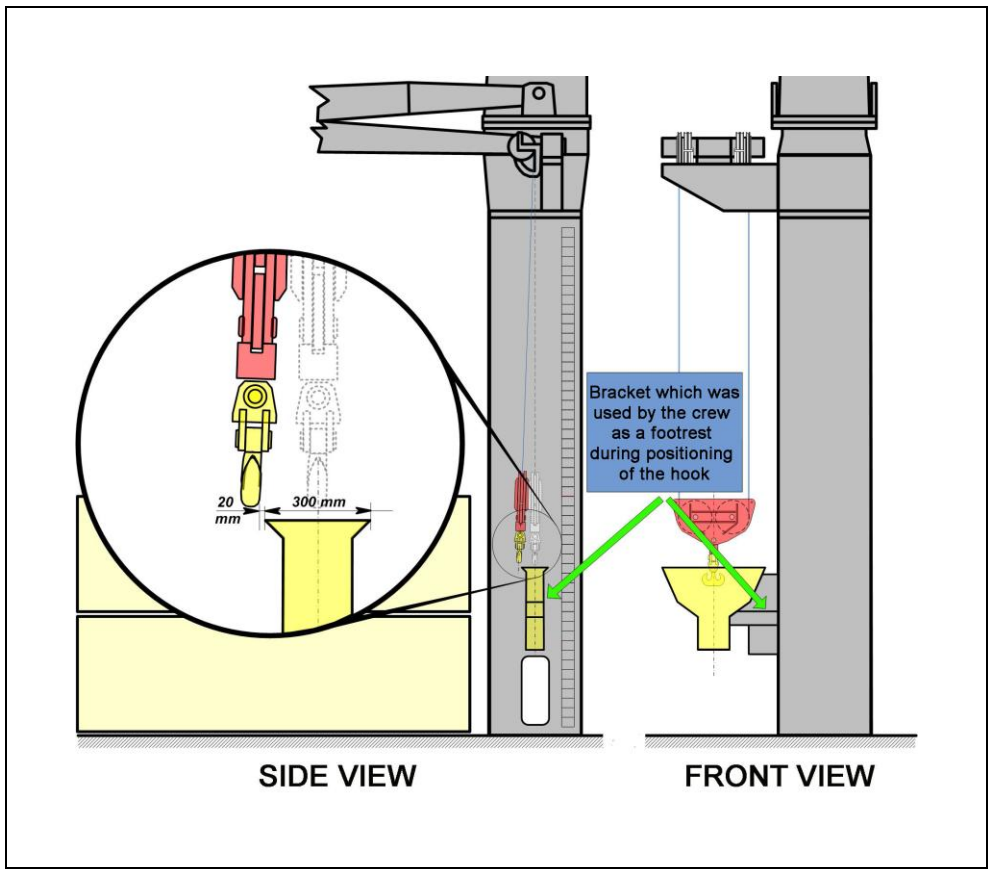
Between March 2008 and 24 November 2008, *Spirit of Esperance* had sailed with a stern trim in excess of 2.1 m on 17 out of 36 occasions. Therefore, the need to manually intervene with stowing the hooks of number two and three cranes was, by necessity, a common practice.

The ATSB investigators were informed that after an earlier unsuccessful attempt to use a rope attached to the hook, to guide the hook into the cradle, it had become the normal on board routine for the dogman to climb the emergency ladder and 'man-handle' the hook into a position where the crane driver could, on direction, lower the hook into the cradle.

The ladder used to reach the hook was an emergency escape ladder for the crane cabin. It was not designed as a working/access ladder. Consequently, it was not constructed to the safety standards[9] that are required for an access ladder, such as having cage hoops, to prevent a fall.

Climbing the ladder was a relatively easy solution to the problem as the ladder was there and there was an area on the cradle bracket on which the dogman could place his foot (Figure 5). With one arm holding onto the ladder, and a foot on the bracket, the hook could be aligned manually.

Figure 5: The illustration of hook misaligned position



This practice was not part of any procedure and the risks associated with the practice had never been identified. In addition, when the problem of hook/cradle misalignment became known, no analysis was undertaken to determine the safest and most appropriate solution to the problem, which may have been a modification of the cradle guides. Hence, the practice of manual intervention was allowed to continue because it achieved the desired outcome, that of a secured cargo hook, in a relatively short period of time.

9 Marine Orders Part 32, appendix 12 and 17.

2.4 Safety management system

Spirit of Esperance's safety management system (SMS) contained procedures for critical shipboard operations, hazard identification and risk management. The SMS also provided for risk analysis of identified hazards. In order to encourage the reporting of previously unidentified hazards encountered on board, the SMS also included a 'job hazard opportunity' log.

2.4.1 Cargo crane operating procedures

The ship's SMS contained a crane operation procedure. The procedure provided detailed guidance for checking the cranes' operating limits before use. It also contained a brief guide for stowing the crane:

> The hoist and luff wires are to have nil weight on them when the crane is housed. The hooks are to be lowered into their cradles, strop applied from below, and jib clamp applied.

The procedure also stated the need for a dogman:

> A dogman is required to tend the hook and be able to provide effective communications with the crane driver at all times. The dogman is to watch the position of the jib in relation to the surrounding environment and provide guidance and instructions where necessary during lifting operations.

The crane operation procedure did not contain any guidance for stowing the hook in the cradle when the ship had a large stern trim. Consequently, when the problem of stowing the hook in such a situation arose, the crew arrived at a solution based on the practicalities on board, without reviewing or rectifying the procedures.

2.4.2 Job safety analysis

The aim of any job safety analysis, or any risk identification process, is to develop a comprehensive list of the risks, events or hazards that might have an impact on the safe performance of a task. In order to arrive at a list which identifies all the risks, a proper analysis of the task should be undertaken by those involved in the formation of any risk management strategy. This aim, or principle, applies in all work places, including on board a ship.

According to the risk management guidelines companion to AS/NZS 4360:2004 (the Australia/New Zealand Risk Management Standard)[10]:

> To develop a comprehensive list of risks a systematic process should be used that starts with the statement of context. To demonstrate that risks have been identified effectively it is useful to step through the process, project or activity in a structured way using the key elements defined while establishing the context. This can help provide confidence that the process of identification is complete and major issues have not been missed.
>
> It is essential that people involved in identifying risks are knowledgeable about the detailed aspects of the risk study being undertaken. Identifying risks can also require imaginative thinking and appropriate experience. Teams allow for the

10 AS/NZS 4360:2004, p38-40.

> pooling of experience. Team involvement also helps build commitment and ownership into the risk management process and helps ensure that risks to different stakeholders are considered where appropriate.

*Spirit of Esperance'*s SMS included a job safety analysis (JSA) process which should have been used to identify potential hazards relating to particular jobs and to specify risk controls. A specific cargo crane operations JSA was completed by *Spirit of Esperance*'s chief mate 2 months before the accident. It identified the general 'job steps' necessary to safely operate the ship's cranes:

1. Inspect lift and work area for hazards.
2. Start the crane.
3. Operate crane as required by task.
4. Pack up crane after use.

These four 'job steps' do not represent a proper analysis of crane operations on board *Spirit of Esperance*. They can only be described as generic and high-level in nature, as none of them properly identify the actual sub tasks necessary to ensure that each 'job step' is done.

The 'job step' identification itself was too broad and non-specific. Therefore, it was not possible to properly identify the risks associated with the sub tasks. With regard to the final step, it did not contain specific sub tasks, for example, house the jib and stow the hook in its cradle; and any potential hazards associated with the operation of 'packing up the crane' were not properly identified. Consequently, the JSA did not identify that crew members regularly needed to manually guide the hook into the cradle; and that risk controls were necessary for the task.

Spirit of Esperance's health, safety and security environment (HSSE) committee met once a month. These meetings were an opportunity for the crew to raise safety issues that they had encountered on board and to review any procedures and JSAs. The meetings were also an opportunity to analyse previous incidents with a view to identifying safety lessons. However, in past meetings, none of the crew had reported the need to climb the ladder during the operation to stow the cargo crane hooks and there had been no entries in the job hazard opportunity log regarding problems encountered when stowing the cranes.

Furthermore, when the JSA for crane operations was reviewed on 25 September 2008 at the monthly HSSE meeting, no issues were raised by anyone about crane operations, so no amendments were made to the document.

Spirit of Esperance's crew were the people best placed to systematically consider the operation of the ship's cargo cranes including, properly identifying the steps necessary to safely operate the cranes and the risks associated with each step. By not identifying those steps, or subsequently reporting the hook stowing problem at HSSE meetings, an important opportunity to properly identify the risks associated with the operation of the ship's cargo cranes was missed.

In summary, the JSA for crane operations, and subsequent reviews of it, did not identify the potential hazards associated with stowing the hooks. Furthermore, no issue regarding hook stowage problems at stern trims in excess of 2.1 m had been raised at HSSE meetings or entered in the job hazard opportunity log.

2.4.3 Working aloft procedure

The ship's SMS included a procedure and JSA for working aloft and over the side. This procedure was to be followed when a risk of falling existed while a task was being carried out and stated that:

> A work aloft and over side permit must be completed for all work at heights whether aloft or over the vessel's side where there is potential for a fall of more than 2 metres. Where local regulations stipulate a lower height, this will be complied with before the 2 metres requirement previously mentioned.
>
> All personnel working aloft must be provided with and use a safety harness.

When the ship's stern trim was greater than 2.1 m, it was necessary for the crew to manually guide the cargo crane hooks into their cradles. While it was possible to use a long pole to manoeuvre the hook into position, crew members informed the ATSB investigators that they often aligned the hook by climbing the adjacent ladder and pushing the hook into position.

When this occurred, the crew member was required to work about 4 m above the deck, in an area which did not have any protection to prevent a fall. Consequently, there was a risk of falling more than 2 m from the ladder or cradle assembly and a working aloft permit should have been completed. In addition, a safety harness should have been worn, in accordance with the procedure.

The crew may have considered that the working aloft permit requirements were too onerous for what was a simple task, climbing a 4 m ladder. However, there were risks associated with the task that they had not appropriately considered.

One of the main aims of a permit system is to ensure that all identified risks are reviewed and that appropriate defences are implemented. However, the ship's records indicate that no permit was issued on the day of the accident and that those requirements were routinely violated when the crane hook needed to be manually assisted into its cradle.

In submission, ASP Ship Management stated:

> ASP disputes this was routinely disregarded and disputes this was the case at the time of the event. All work carried out on board which required a work permit was strictly adhered to and carried out in accordance with our vessel operations manual within our integrated management system. Work Permits are subject to scrutiny during marine standards internal audits of the vessel.

Routinely not following the working aloft procedure is an example of a 'normalised deviance'[11]. The crew were either not aware of, or underestimated the severity of, the risks involved with climbing the ladder. They had deviated from a known procedure or standard and had not experienced any negative outcomes as a result of the practice before this accident. Therefore, over time, they had probably come to believe that it was acceptable to climb the ladder without issuing a permit or using a safety harness.

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11 Normalised deviance occurs when groups, or individuals, take risks by deviating from a known standard and, because there is no negative outcome, they receive false feedback that they can get away with it. Over time, they grow to believe that deviation from the standard is acceptable.

In summary, no working aloft permit had been issued, in accordance with procedures, for the practice of climbing the emergency ladder when stowing the hook on 24 November. Furthermore, no permit had ever been issued for this task. This indicates that the crew had routinely deviated from the working aloft procedure when it was necessary to manually assist with the stowing of the cargo crane hook and that the working aloft procedure was not effectively implemented on board the ship.

2.4.4 The use of personal protective equipment

The JSA for work aloft stated that, in addition to completing a working permit, any crew member working aloft was required to wear PPE including, safety boots, overalls, gloves, head/eye protection, safety harness and sun protection.

The evidence indicates that before the accident, IR1 was wearing overalls, safety shoes, rubber grip gloves and a hard-hat (with a chin strap). However, he was not wearing a safety harness.

The practice of not wearing a safety harness when climbing the ladder to secure the cargo crane hooks indicates that the IR was not appropriately aware of the risks associated with working from a ladder 4 m above a platform while trying to physically guide the hook into the cradle. Had the IR worn a correctly fitted safety harness, and appropriately fastened it, it would have prevented his fall.

Following the fall, the IR's hard-hat was found on the main deck, below the platform on which he was found, and the chin strap was hooked above the visor. This indicates that the strap was not in place under his chin. Had the chin strap been worn as designed, the helmet may not have fallen off the IR's head when he fell and it may have offered his head some degree of protection, potentially eliminating or reducing the seriousness of his head injuries.

2.5 Alcohol consumption

An ante-mortem[12] test of the deceased IR's blood, taken at 2355 on 24 November, when he was admitted to hospital, showed that his blood had an alcohol concentration of 0.09g per 100ml of blood. This level equates to a blood alcohol concentration (BAC) of 0.09% and was described in the autopsy report as being 'moderate'. Medical records state that the IR smelt of alcohol and that alcohol intoxication complicated the treatment of his injuries.

2.5.1 Immediate or short term effects of alcohol on the body

The effects of alcohol on a person's body are well known and documented. According to the Australian National Health and Medical Research Council (NHMRC)[13]:

12 Before death.

13 Australian guidelines to reduce health risks from drinking alcohol. February 2009, p 22.

> The range of normal pathophysiological reactions to alcohol begin with dampening of the brain's arousal, motor and sensory centres, which reduces reactions to stimuli and affects coordination, speech, cognition and the senses.
>
> There is evidence that drinking decreases cognitive performance, even at low levels of consumption. The first potentially adverse effect of alcohol consumption is loss of fine motor skills and inhibitions.... As more alcohol is consumed and the BAC rises, performance and behaviour deteriorate progressively.
>
> As well as effects on the body, the amount of alcohol consumed on a single occasion increases the risk of accidents and injury during and immediately after drinking. Every additional drink significantly increases the risk of injury and death for the drinker and may place others at risk of harm as well.

With regard to metabolising alcohol after its consumption, NHMRC[14] states that:

> Alcohol usually starts to affect the brain within about five minutes of being swallowed. The BAC reaches its peak about 30–45 minutes after the consumption of one standard drink. Rapid consumption of multiple drinks results in a higher BAC because the liver has a relatively fixed rate of metabolism regardless of how many drinks are consumed.
>
> It generally takes about an hour for the body to clear one standard drink, although this varies from person to person. The rate of this metabolism depends on several factors including liver size, body mass and composition, and alcohol tolerance.
>
> After a very heavy drinking occasion, it takes many hours for the BAC to return to zero.

In Australia, one standard drink is any drink containing 10 g of alcohol, regardless of container size or alcohol type (i.e. beer, wine or spirit). For example, a 375 ml glass of full strength beer (5% alcohol/volume) equates to 1.5 standard drinks. A 150 ml glass of wine (12.5 % alcohol/volume) equates to 1.5 standard drinks and a 750 ml bottle of wine equates to 7.5 standard drinks. One 30 ml 'nip' of spirits (40% alcohol/volume) equates to one standard drink.

According to the NHMRC, if an individual has consumed 6 x 375 ml glasses of full strength beer, the equivalent of nine standard drinks, it could take as long as 9 hours for that individual's BAC to reduce to zero.

2.5.2 24 November 2008

Carrying out certain activities after consuming alcohol is dangerous. Therefore, limits of BAC when a person is driving a car or is engaged in activities on a worksite are set down in law. Limits of BAC also apply when a person is serving on a ship in Australia.

At the time of the accident, *Spirit of Esperance* crew were subject to the alcohol provisions contained in the *Navigation Act 1912*. The *Navigation Act 1912* specifies the BAC limit for seafarers as 0.04 g of alcohol per 100 ml of blood (0.04 % BAC) when on duty and 0.08 g of alcohol per 100 ml of blood (0.08 % BAC) when on board the ship but not on duty.

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14 ibid, p 21/22.

In order to comply with the statutory requirements, ASP Ship Management had implemented an alcohol policy on board *Spirit of Esperance*, the BAC limits of which were lower than that permitted by the *Navigation Act 1912*. The policy stated that:

- On duty: All personnel shall observe a period of abstinence from alcohol prior to scheduled watch keeping duty or work periods of 4 hours, to ensure that, prior to going on scheduled duty, the blood alcohol content of the seafarer is theoretically zero.
- Off duty: 0.04 grams per 100 millilitre of blood.

The policy also stated that no alcohol was to be brought on board the ship without the knowledge and agreement of the master and that alcoholic beverages were only to be available in the ship's recreation room. It was the master's duty to control and monitor the consumption of alcohol on board the ship.

Underlying the company's alcohol policy were a set of procedures which included risk controls such as random, for cause[15] and post incident breath testing of crew members.

On 24 November, the weather conditions in Townsville were described as being hot, with a temperature of 37° C recorded in the ship's bridge log book. IR1 had been on duty at various times during the day. He had been off duty during the late morning and early evening before the ship's sailing time, during which time he had been ashore in the company of another crew member, before retiring to his quarters.

The sailing time of the ship was known well in advance of when IR1 went on duty. Given that his BAC was 0.09% when a sample of his blood was taken by hospital staff at 2355, it is likely that he had consumed a number of alcoholic drinks that afternoon and evening. Consequently, when he went on duty at or just before 2100, he would have had a BAC well in excess of the company and statutory limits.

At 2100, he was assigned the task of providing directions to the crane driver, which in itself was not a difficult undertaking. However, when he climbed the emergency ladder in order to manually direct the hook into its cradle, he was physically exposed to danger.

At that time, IR1 may have had a BAC in the region of 0.12%[16]. Therefore, his reaction time, his ability to coordinate the movement of his limbs, his reflexes and his reasoning may have been impaired to some degree. This would have had a major impact on his ability to both carry out his assigned tasks and to help himself if something went wrong while carrying out those tasks.

On 24 November 2008, the deceased crew member went on duty with a BAC in excess of the standard set out in the company's alcohol policy. However, his actions were not challenged by any other crew member. While, this may have been an isolated incident, it may also be indicative of a policy and a set of underlying procedures that had not been effectively implemented.

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15 Where a fellow crew member believes a crew member is impaired by alcohol.

16 Based on the fact that 3 hours later his BAC was 0.09%.

3 FINDINGS

3.1 Context

At about 2117 on 24 November 2008, while preparing to sail from Townsville, Queensland, a crew member on board the Maltese registered container ship *Spirit of Esperance* was injured after falling about 4 m during an operation to stow a cargo crane hook.

Immediately following the fall, the crew member was treated by the ship's crew and ambulance officers. He was then transferred to hospital where he later died as a result of the injuries he had sustained.

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

3.2 Contributing safety factors

- The design of the cradle for the cargo crane hook did not allow for unassisted stowage of the hook when the ship had a stern trim in excess of 2.1 m. *[Significant safety issue]*
- On 24 November 2008, the cargo crane hook misaligned with its stowage cradle by about 20 mm because of the ship's stern trim. As a result, the hook had to be manhandled into position by a crew member.
- The deceased crew member was not wearing a safety harness when he climbed the emergency ladder adjacent to the cradle in an attempt to assist with stowing the hook.
- The ship's safety management system crane operation procedure did not provide the crew with sufficient guidance in stowing the hook when the ship's stern trim was in excess of 2.1 m. *[Minor safety issue]*
- The cargo crane operations 'Job Safety Analysis' did not identify the potential hazards associated with stowing the hook and it had not been effectively reviewed by the ship's crew. *[Minor safety issue]*
- The ship's safety management system working aloft procedure was not effectively implemented on board the ship and was not routinely followed when crew members climbed the emergency ladder to assist with the stowage of the cargo crane hook. *[Minor safety issue]*
- The ship's health, safety, security and environment meetings and job hazard opportunity log were not effectively used to raise and discuss safety issues associated with cargo crane operations. *[Significant safety issue]*
- The deceased crew member had a blood alcohol concentration in excess of company and *Navigation Act 1912* limits when he went on duty on the evening of 24 November 2008 and this probably impaired his ability to safely carry out the tasks he was assigned.

3.3 Other safety factors

- On 24 November 2008, the deceased crew member went on duty with a BAC in excess of the standard set out in the company's alcohol policy. However, his actions were not challenged by any other crew member. While this may have been an isolated incident, it may also be indicative of a policy and a set of underlying procedures that had not been effectively implemented.
  [Minor safety issue]

4 SAFETY ACTIONS

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.

4.1 ASP Ship Management

4.1.1 Hook cradle design

Significant safety issue

The design of the cradle for the cargo crane hook did not allow for unassisted stowage of the hook when the ship had a stern trim in excess of 2.1 m.

Action taken by ASP Ship Management

ASP Ship Management has advised the ATSB that investigations into modifications to the cradle were initiated but changes could not to be made before the vessel departed Australia in January 2009 and subsequently changed name and managers in May 2009.

ASP Ship Management has also advised the ATSB that Marlow Navigation, the ship's new management company, have been advised of this safety issue.

ATSB assessment of action

The Australian Transport Safety Bureau is satisfied that the action taken by ASP Ship Management has been adequate and that the responsibility for undertaking any further safety action lies with Marlow Navigation.

4.1.2 Cargo crane operation procedure

Minor safety issue

The ship's safety management system crane operation procedure did not provide the crew with sufficient guidance in stowing the hook when the ship's stern trim was in excess of 2.1 m.

Action taken by ASP Ship Management

ASP Ship Management has advised the ATSB that this procedure was amended and remained on board the vessel on change of management. The company also advised that the cargo stowage plan was amended following the accident so that the crane operator would have a full view of the cradle and hook at all times whilst stowing the hook.

ATSB assessment of action

The Australian Transport Safety Bureau is satisfied that the action taken by ASP Ship Management adequately addresses the safety issue.

4.1.3 Job safety analysis

Minor safety issue

The cargo crane operations 'Job Safety Analysis' did not identify the potential hazards associated with stowing the hook and it had not been effectively reviewed by the ship's crew.

Action taken by ASP Ship Management

ASP Ship Management has advised the ATSB that the cargo crane operations 'Job Safety Analysis' was reviewed by the crew following the accident and subsequently amended.

ATSB assessment of action

The Australian Transport Safety Bureau is satisfied that the action taken by ASP Ship Management adequately addresses the safety issue.

4.1.4 Work aloft and at height procedure

Minor safety issue

The ship's safety management system working aloft procedure was not effectively implemented on board the ship and was not routinely followed when crew members climbed the emergency ladder to assist with the stowage of the cargo crane hook.

ATSB safety advisory notice MO-2008-011-SAN-042

The Australian Transport Safety Bureau advises that ASP Ship Management should consider the safety implications of this safety issue and take action where considered appropriate.

4.1.5 HSSE meetings

Significant safety Issue

The ship's health, safety, security and environment meetings and job hazard opportunity log were not effectively used to raise and discuss safety issues associated with cargo crane operations.

ATSB safety advisory notice MO-2008-011-SAN-045

The Australian Transport Safety Bureau advises that ASP Ship Management should consider the safety implications of this safety issue and take action where considered appropriate.

4.1.6 Alcohol policy

Minor safety issue

On 24 November 2008, the deceased crew member went on duty with a BAC in excess of the standard set out in the company's alcohol policy. However, his actions were not challenged by any other crew member. While this may have been an isolated incident, it may also be indicative of a policy and a set of underlying procedures that had not been effectively implemented.

Action taken by ASP Ship Management

ASP Ship Management has advised the ATSB that random drug and alcohol testing is taking place fleet wide. The testing regime also includes 3 monthly alcohol testing of the crew by the master and testing in cases where the master has grounds to believe that an alcohol (or drug) test is required. Due to this policy there is now increased awareness by the ship's complement on the strict drug and alcohol policy implemented by ASP Ship Management.

ATSB assessment of action

The Australian Transport Safety Bureau is satisfied that the action taken by ASP Ship Management adequately addresses the safety issue.

4.2 Marlow Navigation

4.2.1 Hook cradle design

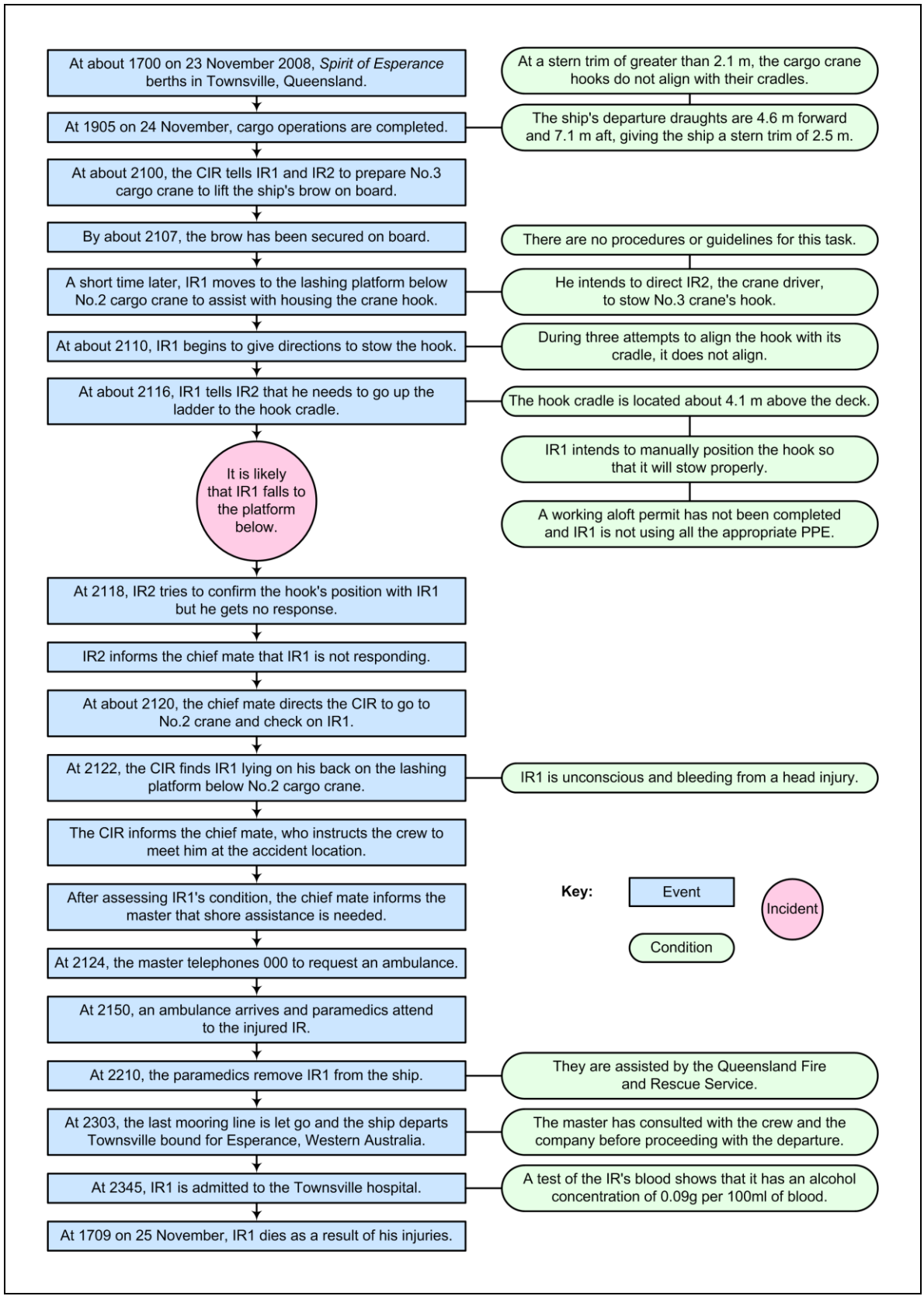
Significant safety issue

The design of the cradle for the cargo crane hook did not allow for unassisted stowage of the hook when the ship had a stern trim in excess of 2.1 m.

ATSB safety advisory notice MO-2008-011-SAN-019

The Australian Transport Safety Bureau advises that Marlow Navigation should consider the safety implications of this safety issue and take action where considered appropriate.

APPENDIX A: EVENTS AND CONDITIONS CHART



APPENDIX B: SHIP INFORMATION

Spirit of Esperance

IMO Number	9031466
Call sign	9HIV8
Flag	Malta
Port of Registry	Valetta
Classification society	Germanischer Lloyd (GL)
Ship Type	Container ship
Builder	Kvaerner Warnow Werft, Germany
Year built	1992
Owners	Christine Partrederiet, Denmark
Ship managers	ASP Ship Management, Australia
Gross tonnage	14,858
Net tonnage	7,642
Deadweight (summer)	20,270 tonnes
Summer draught	9.8 m
Length overall	167.2 m
Length between perpendiculars	156.7 m
Moulded breadth	25.0 m
Moulded depth	13.4 m
Engine	Sulzer 6RTA58
Total power	9,540 kW
Speed	17 knots
Crew	21

APPENDIX C: SOURCES AND SUBMISSIONS

Sources of information

Master and crew of *Spirit of Esperance*

ASP Ship Management

The Queensland Coroner's office

The Queensland Police

The Townsville Hospital

MacGregor

References

Australian Maritime Safety Authority, Marine Order Part 32

Australian Maritime Safety Authority, Marine Notice 18/2008

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Pidd K, Berry JG, Harrison JE, Roche AM, Driscoll TR, Newson RS. 2006. *Alcohol and work: patterns of use, workplace culture and safety*. Injury Research and Statistics Series Number 28. (AIHW cat no. INJCAT 82) Adelaide: AIHW

Standards Australia/Standards New Zealand. *HB 436:2004: Risk Management Guidelines Companion to AS/NZS 4360:2004*. Sydney 2004

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 *Spirit of Esperance*'s master, chief mate, chief integrated rating and crane driver, the deceased integrated rating's next of kin, the Queensland Coroner, the Australian Maritime Safety Authority (AMSA), ASP Ship Management and the Maritime Union of Australia (MUA).

Submissions were received from AMSA, ASP Ship Management, the MUA and *Spirit of Esperance*'s master, chief mate and crane driver. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

Independent investigation into the fatality on board the Maltese registered container ship *Spirit of Esperance* at Townsville, Queensland, on 24 November 2008.