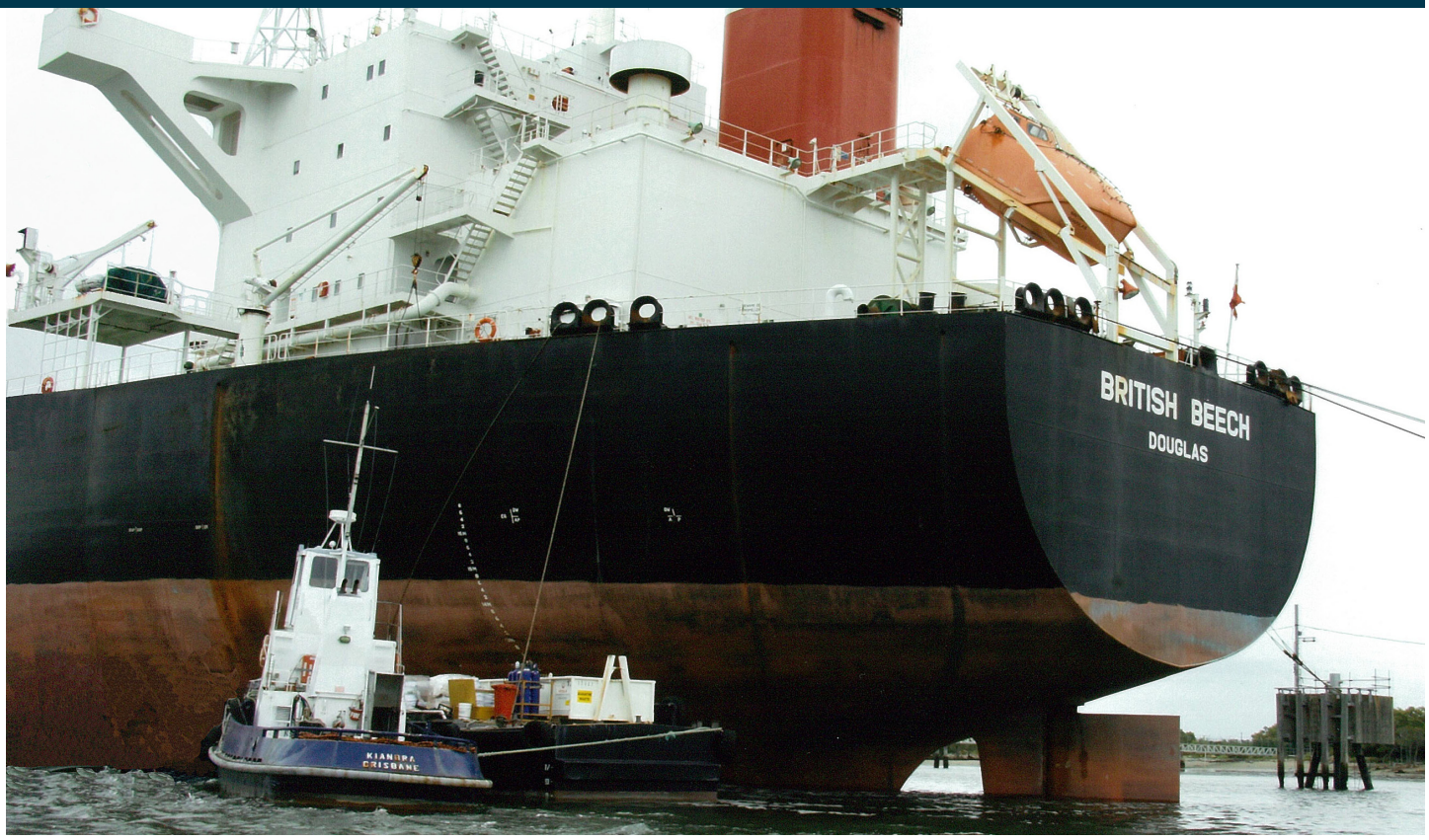
Australian Government
Australian Transport Safety Bureau

Fatality while storing the products tanker *British Beech*

in Brisbane, Queensland | 15 December 2011



Investigation

ATSB Transport Safety Report
Marine Occurrence Investigation
291-MO-2011-011
Final – 7 March 2013

Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

Marine Occurrence Investigation
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Final

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British Beech

in Brisbane, Queensland

15 December 2011

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

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SAFETY SUMMARY

What happened

On 15 December 2011, *British Beech* was berthed in Brisbane, Queensland, and its crew was taking on stores from a barge. During the return of a stores container from the ship to the barge, the container came free of its slings. It fell to the barge below, striking the master of the barge. The master was attended to by the barge crew and shore paramedics but he died from his injuries while being transported to hospital.

What the ATSB found

The ATSB found that the container had not been appropriately rigged on board the ship and the ship's crew had not warned the barge crew of its return. The ship's crew did not view the storing operation as dangerous and had, over time, removed identified safety barriers which would probably have prevented the accident. Compliance auditing processes had not identified and minimised such routine violations of the shipping company's procedures.

The ATSB also found that the barge master had placed himself in a position of danger under the suspended load, and that the barge crew had not followed their company's procedures for storing operations. The ATSB further found that the company had not adequately implemented compliance auditing or incident reporting schemes. As a result, the company had not acted on, or learnt from, previous less serious incidents.

What has been done to fix it

The method used for handling containers of this type in Brisbane has been altered so that the containers are top lifted and slings are no longer used.

The ship's manager, BP Shipping, implemented a requirement to have the lifting point fixed and above the centre of gravity of loads. A thorough review of lifting and slinging processes, practices, procedures and equipment was conducted as well as a review of lifting and slinging job hazard analyses. A fleetwide review and training workshop for lifting and slinging was also completed.

The barge's operator, Bowen Tug and Barge, undertook a review of its operations and work practices. On 1 July 2012, the company ceased ship storing operations and sold all associated vessels and equipment to another operator.

Safety message

Lifting operations, even when they are routine, involve inherent risks. Therefore, established procedures must be followed, reinforced and audited to ensure vigilance is maintained and complacency avoided. The basic precaution of standing well clear of suspended loads must always be taken.

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Fatality while storing the products tanker *British Beech* in Brisbane, Queensland, on 15 December 2011.

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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.

1 FACTUAL INFORMATION

1.1 *British Beech*

British Beech (Figure 1) is a crude oil/products tanker which was built in 2003 by the Tsuneishi shipyard, Japan. It has an overall length of 240.5 m, a breadth of 42.0 m and a deadweight of 106,138 tonnes at a summer draught of 14.85 m.

Figure 1: *British Beech* berthed in Brisbane

At the time of the accident, *British Beech* was managed and operated by BP Shipping, United Kingdom (UK). It was owned by Millerfield, UK, registered in the Isle of Man and classed with Lloyd's Register (LR).

The ship was crewed by 26 Indian nationals, all of whom held appropriate qualifications for the positions they held on board. The master began his seagoing career in 1989 and held an Indian master's certificate of competency which was first issued in 1998. He had sailed with various companies as master and chief mate and had also worked as a marine superintendent. This was his third assignment on board *British Beech* and he had joined the ship about 5 weeks before the accident.

The chief mate first went to sea as a cadet in 2002 and in 2005 he joined BP as a third mate. He had sailed on various ships in the BP fleet since that time, progressing to the rank of chief mate. He held an Indian chief mate's qualification and this was his second assignment as chief mate on board *British Beech.* At the time of the accident, he had been on board the ship for about 10 weeks.

The ship was crewed by two third mates, both of whom were involved with the storing operation on 15 December. One of the third mates kept the 8 to 12 deck watch in the usual 4 hours on, 8 hours off work cycle (the 8–12 third mate). He had been at sea since 2005 as a cadet and then third mate. This was his second ship as third mate after obtaining his Indian third mate's qualifications in 2009. It was his first time on board *British Beech* and he had been on board for 5 months.

The other third mate kept the 4 to 8 deck watch (the 4–8 third mate). He obtained his Indian third mate's qualification in 2010 after first going to sea in 2007 and had been on board *British Beech* for 4 months.

The boatswain (bosun) had been at sea for more than 30 years. In that time, he had served on tankers for more than 15 years. He held an Indian qualification as bosun and had sailed in that position for more than 10 years. *British Beech* was his sixth

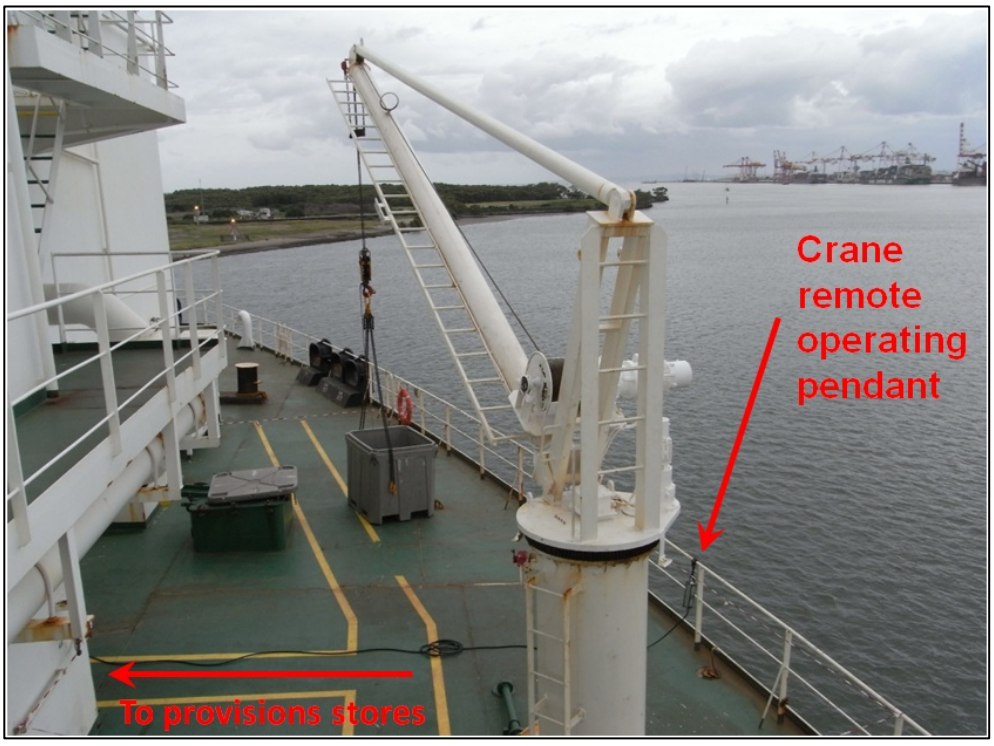
BP tanker since 2006 and he had joined the ship for the first time about 5 weeks before the accident.

1.1.1 Stores crane

British Beech was fitted with a non-luffing[1] Sekigahara Seisakusho stores crane (Figure 2) which had a slewing[2] radius of 7.2 m. The crane was mounted about 2.5 m from the ship's port side and plumbed[3] over the ship's side a maximum distance of about 4 m. The maximum hoist height was 24 m with a safe working load of 3.0 tonnes. The crane was driven from the deck using a remote control pendant which was linked to the crane by an electrical umbilical. The pendant reached to, and was used from, a position at the handrail outboard and just aft of the crane pedestal. From this position, the operator could monitor both the deck of the ship and over the side while controlling the crane.

Since the crane jib could not be luffed, any load to be lifted or landed using this crane had to be positioned under the hook. Therefore, any supply barge or vehicle had to be repositioned if multiple loads were involved.

Figure 2: *British Beech*'s stores crane



1 To raise or lower the boom of a crane or derrick.

2 To move the crane boom in a horizontal circular motion around the crane base.

3 To be positioned vertically under the crane hook.

1.2 The stores barge

At the time of the accident, *British Beech*'s stores were being loaded from the barge *BT7* (Figure 3). The barge was 23.56 m long and had a beam of 6.1 m. It had no propulsion of its own and was dependent upon tug assistance for all movement.

BT7 was owned and operated by the Brisbane based company Bowen Tug and Barge (BTB) and was mainly used for supplying ships at berths within the port of Brisbane.

Figure 3: Barge *BT7* with the tug *Kiandra* in Brisbane after the accident

On the day of the accident, the tug and barge combination was crewed by three appropriately qualified Australian nationals. Usually, the resupply of a ship within the port by barge would require a tug and barge crew of master plus one deckhand. On this occasion the number of lifts was expected to be more than 30, so an extra deckhand was assigned to the barge.

The tug master had in excess of 40 years of marine and related industrial experience and held qualifications relevant to tug skippering and and barge operations. These included a Queensland restricted master class 4[4] certificate of competency, a Queensland marine engine driver grade 1 certificate of competency and a slewing mobile crane operator's licence.[5] He also held a number of heavy machinery and vehicle driver's licences, and, until shortly before the accident, a dogger's[6] certificate. He had worked for BTB for more than 20 years and also held positions as the company's marine supervisor and workplace health and safety officer.

The deckhand had worked with BTB for 14 years as a machinery operator and general hand. He had completed qualifications including those as a dogger, crane

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[4] Restricted to the pilotage area of Brisbane and the Brisbane River.

[5] Registered under Queensland Department of Justice and Attorney-General, work health and safety legislation for a slewing mobile crane – grade C0 for cranes with a capacity over 100 tonnes.

[6] Dogging work is the use of slinging techniques including the selection and inspection of lifting gear to safely sling a load, or the directing of a plant operator in the movement of a load when the load is out of the operator's view.

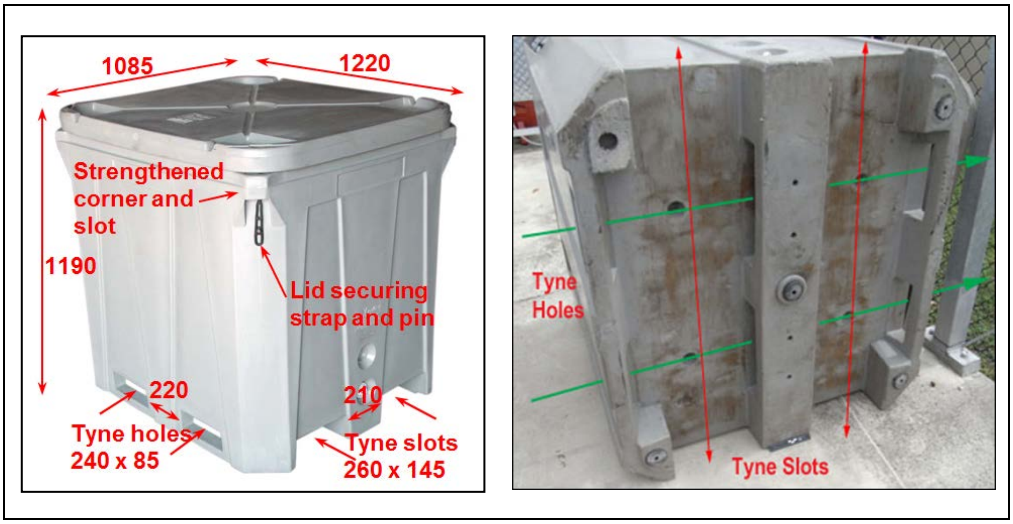
operator, and excavator and dredge operator. He had also completed nationally accredited first aid training. At the time of the accident, he was working as a deckhand and crane operator.

The additional deckhand had worked with BTB for 4 years. He held master class 5 and marine engine driver grade 2 qualifications, a number of heavy machinery (excavator and front end loader) licences and had also completed nationally accredited first aid training.

1.3 The stores container

The plastic insulated stores container involved in the accident (Figure 4) was of a design which had been in production since the mid-1970s. The container had a high volume capacity and was designed to withstand the rigorous work and physical environment in which it was used. The container was made of food grade polyethylene in a sandwich construction of varying thickness.

Figure 4: Stores container



The container had a capacity of about 1 m³ and 1,000 kg. The empty container was weighed after the accident at 98 kg, of which the lid weighed about 16 kg.

For ease of handling, the base of the container included four way ‘fork entry’ in the form of two slots and two holes.

The ‘tyne’ slots were slightly tapered vertically, about 260 mm wide and 145 mm high and open to the ground. These slots were separated by about 210 mm in the base moulding and allowed forklift and hand pallet lifting equipment tyne entry under the containers. The tyne holes, perpendicular to the slots, were about 240 x 85 mm in size, separated by about 220 mm of material. The holes allowed the container to be lifted and rotated to quickly empty its contents.

The upper four corners of the container were also strengthened, with the original intent to be able to use these corners to fit slings or some other arrangement to allow top lifting. Slots in the corner, about 75 x 25 mm in size, also allowed the lid securing strap to pass through to the retaining pin. There were no markings on the container to indicate slinging points or lifting methods.

1.4 The accident

During the morning of 14 December 2011, the crude oil/products carrier *British Beech* arrived off the port of Brisbane, Queensland. The ship was loaded with about 75,000 tonnes of crude oil for delivery to the BP refinery in Brisbane. By 1324,[7] the ship was all fast alongside at the BP wharf at Luggage Point in the Brisbane River.

Routine provisions and spare parts storing of the ship was to occur during the port stay, and soon after berthing the chief mate held a stores safety meeting with the bosun and others to be involved in the task. During this meeting, the common job hazard analysis (CJHA) for this task was discussed.

The ship's crew went about their normal duties preparing for the discharge of cargo and at 1718, discharge of the first parcel of crude oil commenced. Cargo operations continued throughout the remainder of 14 December and into 15 December. During the morning of 15 December, the chief mate held a meeting with the bosun and deck crew to discuss the day's activities, which included taking stores from a barge. The CJHA was again discussed and signed by personnel to be involved in the task. The bosun and the 8–12 third mate were on standby for the stores operation. They were not engaged in any other activities that day.

Meanwhile, at the BTB base, on the other side of the Brisbane River and about 4.5 miles[8] upstream from the ship, the barge was being loaded with the stores for the ship. The insulated food containers, containing cold food stores, were loaded last and positioned at the forward end of the barge. There was no prescribed stowage plan although the intent, once at the ship, was to work cargo on the barge from forward to aft. By 1300, the barge had been loaded, the tug prepared and the tow left the BTB base.

By 1340, the tug and barge had arrived at *British Beech* and the tug's master contacted the ship on very high frequency (VHF) radio to request permission to come alongside and for assistance with tying up. The chief mate called the bosun and by about 1400, the tug and barge were secure alongside the ship and ready for the stores to be lifted onto the ship.

The barge was positioned on the port side of *British Beech* under the stores crane and was moored using two lines (Figure 5). It was usual to keep the tug engines running slowly ahead with the rudders positioned to keep the barge pushing against the ship's side. In this configuration, as the ship discharged cargo and came higher out of the water, the barge moved in under the overhang of the ship's stern. Regular repositioning of the barge was required to keep it correctly positioned under the stores crane.

On board *British Beech*, the chief mate and the duty second mate were in the midst of cargo operations and tank washing. Aware that the storing operation was to be undertaken, the chief mate had left this task in the hands of the 8–12 third mate and the bosun. The third mate and bosun were to be assisted by an ordinary seaman and three catering staff. As deck preparations were being made, the 8–12 third mate asked the chief mate for additional crew to assist with stores. The chief mate directed the 4–8 third mate and an able seaman (AB) to assist. As a result, a total of

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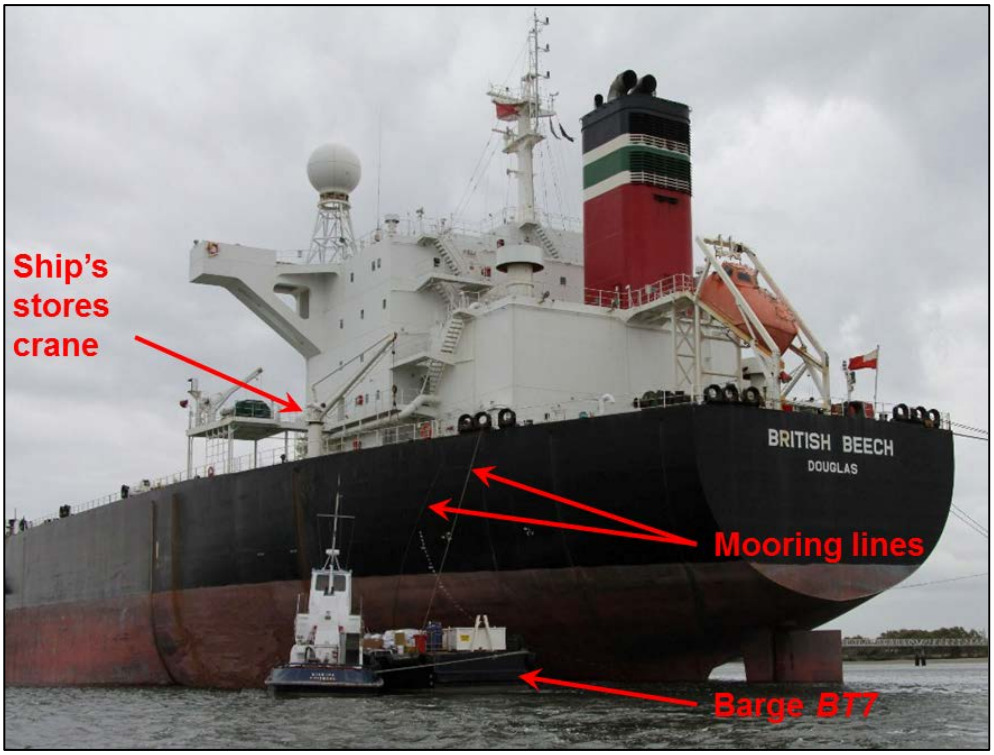
[7] All times refer to local time, Coordinated Universal Time (UTC) +10 hours.

[8] A nautical mile of 1,852 m.

Figure 5: *British Beech*, tug and barge tie-up arrangement



eight ship's crew were employed to load the stores, empty the stores containers and move the stores into the ship.

The bosun was to operate the crane and the remaining crew would be engaged in unloading the stores. A tag line[9] was attached to the crane's hook and a turn[10] made around the handrail. By holding tight or letting the line slacken, the bosun could use the tag line to control motion of the hook during the lifts.

By about 1400, both the ship and the barge were ready for the storing. The first container to be lifted was at the forward starboard side of the barge, the position closest to the hull of *British Beech*. While they waited for the ship's hook to be lowered, the two deckhands on board the barge moved forward, taking a four-leg chain sling assembly with them. The tug master was in the wheelhouse completing necessary preparations such as setting the engine speed and rudder position to hold the barge in place, and any necessary paperwork such as log entries. With the tug master otherwise occupied and not present at the lift, it was company policy that the deckhand with dogging qualifications would be responsible for the task and control operations.

The hook was lowered from the ship and the four-legged chain sling lifted onto it. Two webbing slings had been left in place under the container when it had been loaded and these were attached to hooks on the chain sling arrangement. The tug deckhand then signalled the bosun that the lift was ready and the container was lifted from the deck of the barge. As the weight came on the slings, the deckhands

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9 A rope attached to the load or crane hook and used by someone on the ground to control the motion of the load.

10 Rope terminology to indicate a loop in the rope made around an object.

held the slings as far out toward the sides of the container as possible. The lift came clear of the deck and when above shoulder height, the two deckhands moved aft along the barge to positions clear of the area under the lift.

The container was lifted as far as the ship's crane could raise it but it could not clear the ship's handrail. There were no radio communications between the ship and barge crews, so hand signals were used to indicate that the container could not clear the handrails. The tug's deckhands made a visual note of the amount the chains had to be shortened and the container was lowered back to the deck of the barge. By this time, the tug master had completed his tasks and had made his way from the tug onto the barge and then forward to where the deckhands were waiting for the container. After the container had been landed, all three men went about shortening the chains on the sling.

The tug master then signalled *British Beech*'s crew to lift and the deckhands guided the slings and the container as the weight came on. The deckhands then cleared the area and saw the container pass over the ship's handrails with no difficulty. The tug master remained toward the bow of the barge, standing amongst pallets of other stores.

The container was lowered onto the ship's deck adjacent to the accommodation, in a location convenient to the door leading to the provisions cool rooms. The webbing slings were disconnected from the hooks, removed from the container and reattached to the hooks for return to the barge for the next lift. With the exception of the bosun, the ship's crew began to empty the container.

The hook, chain sling assembly and slings were then lowered to the barge. The barge's deckhands connected the second container which was located in the middle of the most forward row of cargo. The webbing slings were pushed under the container through the open forklift tyne slots (Figure 4) and connected to the chain sling hooks. The tug master then gave the signal for the bosun to lift.

Once the container was clear of the deck and above head height, one of the tug's deckhands moved aft, to make a telephone call. The second deckhand moved clear and onto the bow area of the barge, forward of the cargo area. The tug master remained in the cargo area, to the port side, standing between the first and second rows of lifts remaining on the barge. The container was lifted up and slewed over the ship's handrail at which time the barge crew stopped looking up.

At this time, the tug master noted the barge was moving and saw the mooring lines were slack. He called to the deckhand at the aft end of the barge to take up the slack by moving the tug's rudders further to starboard. The deckhand went to the wheelhouse and made the necessary adjustments. He then returned to his telephone call and proceeded to look across the river, away from the storing operation.

Following some small talk with the tug master, the second deckhand moved clear of the work area and to the port aft area of the barge, adjacent to the tug and near the barge's stern mooring line. He too, then directed his attention away from the barge and the ship.

On board *British Beech*, the second container was lowered to the deck and the webbing slings removed from under it. These were then fed under the first container, through the open tyne slots, by the bosun. One end was then attached to the hooks on the chain sling. The lid was reattached and the container was moved

under the crane hook. Apart from two 10 kg packs of frozen fish, which the ship's chief cook was returning, the container had been emptied.

At about this time, the 4–8 third mate arrived. He saw the bosun working with the container and started to help. He connected the free ends of the webbing slings to the remaining chain sling hooks and the bosun then lifted the container off the deck. As the container was lifted, the 4–8 third mate noticed that it was not sitting evenly in the webbing slings and was leaning over at an angle. He signalled the bosun to stop lifting the container, and it was lowered back to the deck. The 4–8 third mate repositioned the slings more evenly under the container and when it was lifted again, he noted that it appeared more stable and evenly balanced. The container was lifted higher than the handrail and slewed out over the side of the ship.

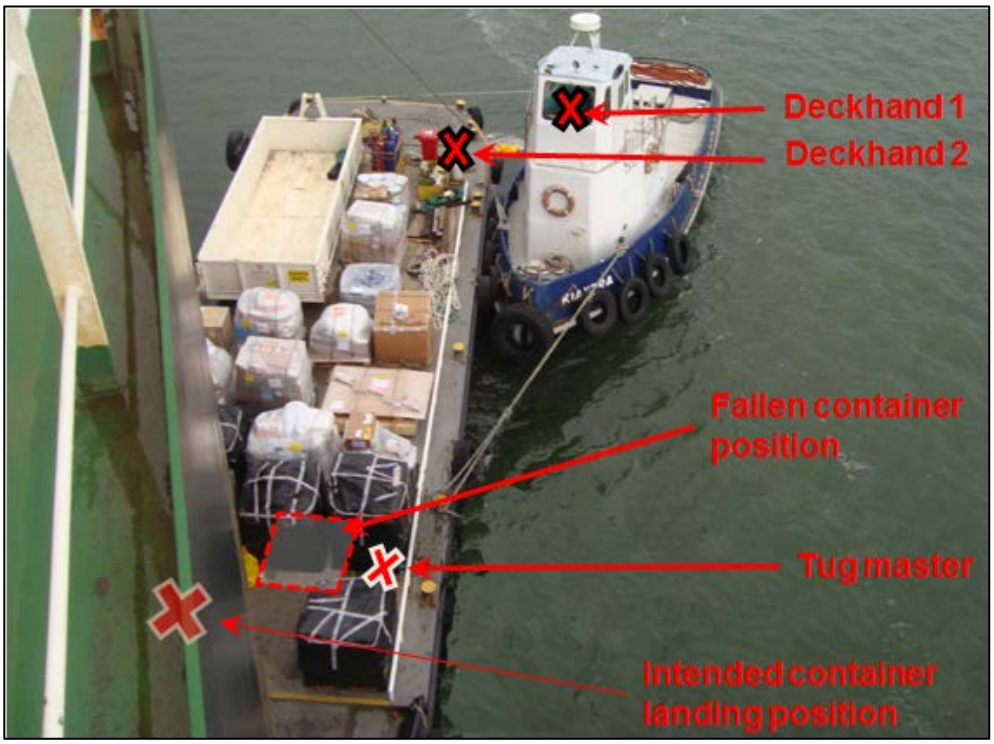
When the container was out over the ship's side, the bosun began to lower it. The 4–8 third mate watched the container clear the handrail and begin to lower and then turned his attention to assisting with the unloading of the second container. The bosun continued to lower the container, concentrating on the crane hook and wire.

At about 1413, while the container was on its way down to the barge's deck, it rotated out of the slings and fell to the deck of the barge below, striking the tug master who was standing under it.

The deckhand in the wheelhouse of the tug heard a bang. He turned and looked forward and could see the container sitting atop the stores pallets on the forward port side of the barge (Figure 6). He then saw the tug master lying on the barge deck with his head on the kick rail at the side of the barge. With a shout of exclamation, he rushed to the tug master's aid.

The second deckhand heard the shout. He turned and saw the fallen container and the tug master lying underneath. He also went to the aid of the injured tug master.

Figure 6: Barge as seen from the deck of *British Beech*



When the two deckhands reached the tug master, they saw that the container was not lying on the tug master but above him, wedged between the pallets of stores forward and aft of where he lay. The two deckhands moved the container onto the barge's forward deck (Figure 7), away from the tug master, and began providing first aid to the seriously injured man. After checking his vital signs, the second deckhand hurried aft to the tug's wheelhouse to raise the alarm.

Figure 7: The fallen container lying on the barge's deck

At 1415, the deckhand called Brisbane Harbour via VHF radio. They answered the VHF call, noted the details and then made contact with port services, the Brisbane Water Police and the Queensland Ambulance Service (QAS). The QAS paramedics were directed to the Brisbane Water Police base about 1.5 miles away, across the river from the accident location, for transport to the site of the incident.

On board *British Beech*, no-one had seen the container fall. The alert was raised by the 4–8 third mate who heard a loud noise and shouted to the bosun to attract his attention. At this point, they realised that something had gone wrong. The 4–8 third mate went to the railing and looked down to the barge. He observed that the container had fallen onto someone who was now lying on the deck of the barge.

The 4–8 third mate went to the cargo control room and reported the accident to the chief mate. The chief mate then called the master on the bridge who instructed him to investigate. Upon inspection, the chief mate could see the injured man on the deck of the barge, bleeding from a head wound. He returned to the cargo control room, called the master and informed him of the accident, advising him that urgent medical assistance was required. The master in turn informed the local authorities and his company representatives and asked for urgent medical assistance.

Across the river, the QAS paramedics arrived at the water police base and at 1436, a police launch departed with police and paramedics on board. Within 10 minutes, the paramedics were with the injured tug master and administering medical assistance. The tug master was transferred onto the police launch and returned to

the water police base. At about 1530, he was transferred to an ambulance for transport to hospital. About 20 minutes later, while en route to the hospital, he succumbed to his injuries and was declared deceased.

2 ANALYSIS

2.1 Evidence

On 16 December 2012, investigators from the Australian Transport Safety Bureau (ATSB) attended *British Beech* while the ship was berthed in Brisbane, Queensland. The master and directly involved crew members were interviewed and each provided their account of the accident. Photographs of the ship and copies of relevant documents were obtained, including log books, statutory certificates, reports, manuals and procedures. Data from the ship's voyage data recorder (VDR) was also obtained by the investigators.

Subsequently, the investigators attended the premises of Bowen Tug and Barge (BTB) and inspected the barge *BT7*. The stores container was inspected at the Brisbane Water Police base.

On 20 and 21 December, ATSB investigators interviewed the crew of the barge and the director of BTB.

During the course of the investigation, further information was provided by BP Shipping (BP), BTB, Maritime Safety Queensland (MSQ), Brisbane Water Police, the Queensland Ambulance Service, Workplace Health and Safety Queensland (WH&SQ), Inchcape Shipping Services, Qports (a tug and barge operator in the Port of Brisbane), the Queensland Coroner's office, the Australian Maritime Safety Authority (AMSA) and Xactics International (manufacturer of the stores container).

2.2 Slinging of the stores container

The master of the tug involved in the stores operation died after being struck by a stores container which had come free from its slings as it was being returned to the barge from the deck of *British Beech*.

The container had been poorly rigged[11] for the lift from the ship to the barge. There were no markings on the container to indicate how it was to be slung and the crew of *British Beech* did not adequately consider how the container should be slung and lifted. This included the weight of the load being rigged, the positioning of the webbing slings and the effect the movement of the loose packages in the container might have on its stability during the lift. Consequently, the slings were positioned through the container base tyne slots (Figure 8a) and the container, when lifted clear of the ship, was easily unbalanced and dislodged from the slings.

Had the webbing slings been passed through the tyne holes (Figure 8b), it would not have been possible for the container to come free of the slings and fall to the deck of the barge below, even if it did become unbalanced and turned upside down.

[11] Rigging involves the use of mechanical equipment to move or transport cargo. It includes dogging work which is the use of slinging techniques including the selection and inspection of lifting gear to safely sling a load, or the directing of a plant operator in the movement of a load when the load is out of the operator's view.

Figure 8: Possible slinging arrangements for the container with the equipment in use at the time of the accident

a) through tyne slots

b) through tyne holes

An object, like a stores container, remains in balance as long as its centre of gravity[12] remains inside the vertical envelope of its base of support. Once the line of gravity, acting vertically through the centre of gravity, moves outside the base of support, the object will be unbalanced and can topple over.

When the stores container was lifted off the deck of *British Beech*, the base of support was formed by the webbing slings passing under the container. Therefore, the horizontal position of the slings had a significant influence on the width of the base of support. The more widely spaced the slings, the wider the base of support provided by them, the more stable the container and the larger the force needed to generate sufficient turning moment to roll the container out of its supports (slings).

Figure 9 shows a comparison of the relative positions of the slings available when using the tyne slots. With the slings positioned widely apart (Figure 9b), the weight necessary to unbalance the container (Wt, positioned at the inside edge of the container) would be more than five times that to achieve the same result with the slings close together (Figure 9a).[13]

On board *British Beech*, the slings were not manually positioned to the outermost edge of the tyne slots under the container as the slack in the slings was taken and the weight came on. While the 4–8 third mate repositioned the slings under the container after noticing the container was askew during the first attempt at lifting, he did not hold the slings in any position as the load came back onto them. Consequently, as the slack was being taken up in the slings, the natural tendency was for the slings to be drawn toward the middle of the container, under the crane hook. This would have brought the slings close together adjacent to the inner sides of the tyne slots (similar to that shown in Figures 8a and 9a).

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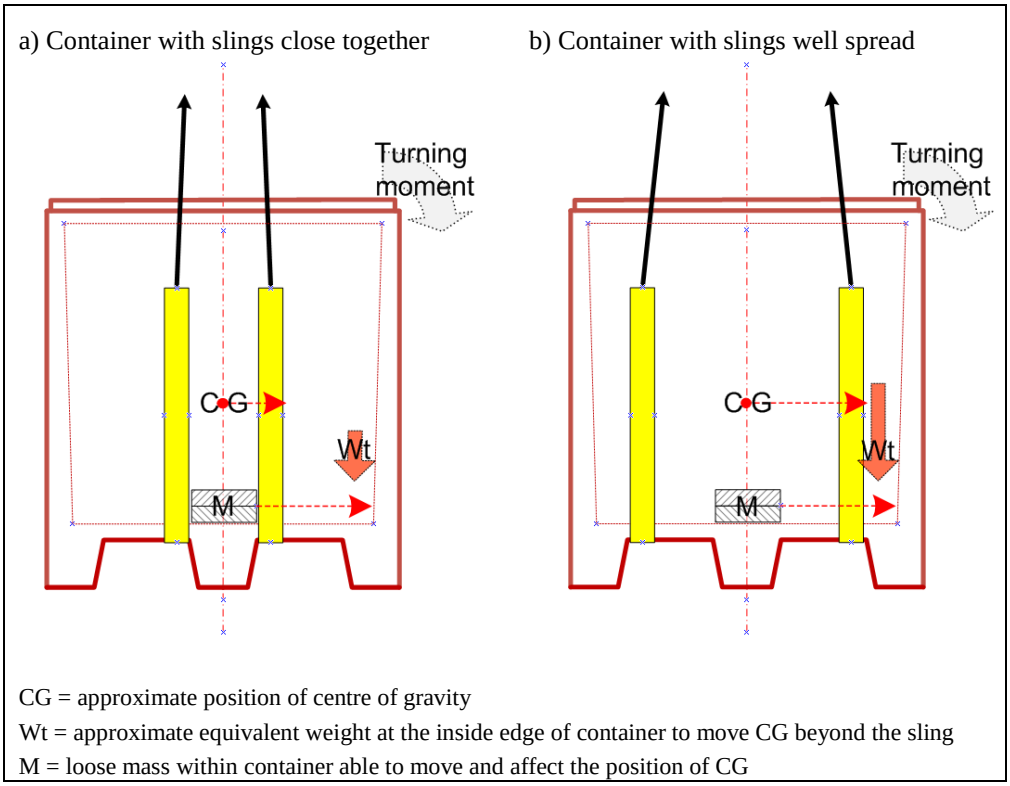
[12] Centre of gravity, also known as the centre of mass, is the theoretical point about which the weight of an object is considered to be concentrated.

[13] This does not take into account any movement of goods inside the container, such as the 20 kg of fish, or the application of any external forces.

Figure 9: Comparison of sling position on stores container



CG = approximate position of centre of gravity
Wt = approximate equivalent weight at the inside edge of container to move CG beyond the sling
M = loose mass within container able to move and affect the position of CG

Therefore, when lifted, the container needed a significantly smaller external force to topple it from the slings than if the slings had been positioned to the extremities of the tyne slots. In addition, the loose packages placed in the container, as they moved about, further reduced the external force needed to topple the container.

Although the positioning of the slings through the tyne slots was a similar sling position to that used by the barge crew when the container was rigged for lifting onto the ship, the slings had been manually positioned by the barge's deckhands as far apart as possible within the tyne slots, and the container was loaded and much heavier than when it was being returned. This made the container more stable in the slings, and less likely to move during the lift.

In contrast to 'bottom lifting' of a container as described above, if the centre of gravity of the lift is below the base of support, such as when top lifting a load, the object will remain in balance and cannot topple, regardless of any shift in its centre of gravity or the external forces applied.

2.2.1 Previous method of slinging the container

It was established during the investigation that the method used by the barge crew on 15 December had not always been the procedure BTB followed when rigging the insulated containers for lifting to and from ships.

In the past, with at least one tug master, it was the accepted approach to always rig the containers by passing the webbing sling through the tyne holes in the bottom of the container, not the open slots (Figure 8). However, over time, the normal practice of the barge crews had altered to sling through the tyne slots.

On the day of the accident, had the container been rigged for lifting onto the ship with the slings through the tyne holes, and not the slots, it probably would have been slung in the same way for its return. This is because when the crew received it, the additional effort in removing the slings would have drawn their attention to the tyne holes, making it likely that they used the same method when returning it.

2.2.2 Upsetting force

When the container was lifted clear of the deck, it was considered to be stable in the slings. To come free and fall to the barge below, an external force was necessary to roll the container out of the slings. As illustrated above, because of the positioning of the slings, a large force was not required. Such a force could have been generated by one or more sources, including:

- The frozen fish packages in the container, totalling about 20 kg, were free to move. Had these packages moved and impacted the side of the container, this force, along with the change in weight distribution in the container and slings, would have reduced the container stability.
- The tag line attached to the crane hook may have grabbed and induced a 'rocking motion' into the load.
- Crane movements, such as slewing, hoisting or sticky sheaves affecting wire motion, could have imparted intermittent and jerky forces and motion into the load or led to the container impacting the side of the ship.
- External forces such as ship motion and wind gusts would have applied forces and motion to the load. Witness testimony was that there was little if any motion or wind at the time of the accident.

From the evidence obtained during the investigation, the ATSB could draw no definitive conclusion as to the source of the force which upset the container. However, regardless of the source of the force, the container should have been made sufficiently secure in the slings to ensure that it could not be dislodged.

2.2.3 Container handling changes after the accident

The ATSB was advised soon after the accident that BTB and BP had issued directives to no longer handle containers of this design. Subsequently, the ATSB was further advised that purpose built and engineered cage frames suitable for lifting pallets and containers of this design had been manufactured and were in use (Figure 10). BP Shipping also advised that it had introduced requirements for all loads to be lifted from a point(s) above the load's centre of gravity.

The alterations in the method of handling described above limited the use of slings and provided for top lifting of the load, greatly reducing the risk of a similar accident.

Figure 10: Cage frames now in use for top lifting of containers

2.3 Communications

The storing operation was not discussed between the crew of the ship and the barge, there was no coordinated plan and there were no means in place to enable the ship's crew and the barge's crew to easily communicate with each other. Communication using hand signals or the crews shouting to each other were the methods of choice.

While legitimate, neither of these methods was satisfactory given the vertical distance between the barge and the deck of the ship and the background noise of the ship's engine room ventilation fans. Having placed near total reliance on hand signals, it was imperative that signallers were designated on board both the ship and the barge and that nothing was lifted or moved until both crews had signalled agreement. However, this precaution was not taken and, as a result, the crews on the ship and the barge proceeded to work almost as two independent work sites.

When *British Beech*'s crew began the lift to return the container to the barge, they did not ensure that the barge crew were aware that it was being returned. The crane driver did not adequately check that all the barge crew were clear of the landing area and he did not assess that the tug master was standing within the fall zone and therefore was not safe. The crane driver relied on the mistaken assumption that the barge crew were always watching and that, because the tug master had been in a similar position throughout the two lifts from the barge, he was safe in that location.

These issues had not been identified in the risk assessment and hazard analysis completed on board *British Beech* and no mitigating actions such as having a radio, a whistle or a horn had been put in place to assist the ship's crew to attract the attention of the barge crew.

While it was BTB practice to contact the ship using very high frequency (VHF) radio to announce that the tug and barge were approaching and for preparations for tying up, there was no policy or agreement to maintain radio contact with the ship's crew throughout the stores operation.

2.4 Safe operations

Legislation and regulations, at many administrative levels, exist to guide and control operations of ships. The International Maritime Organization (IMO) develops and maintains international treaties in the form of protocols and conventions which are ratified by contracting States.[14] Each State then develops its own national legislation which gives effect to the international treaties. Administrative areas within a country may also develop further legislation to address local requirements. As such, *British Beech* was required to meet legislation arising from the IMO, its flag State (Isle of Man), the port State (Australia) and the local administrative area in which the ship was located (Queensland).

According to Australian Government legislation, the handling of stores met the definition of cargo operations and was regulated by Marine Order 32.[15] For a ship receiving stores from a barge, this marine order applied to both the ship and the barge. As a result, BP and BTB were required to include procedures within their respective safety management systems (SMSs) to ensure compliance.

2.4.1 *British Beech*

BP maintained an SMS on its ships which provided guidance for safe ship operations. The SMS complemented the industry guide to safe working practices as contained in the UK's Maritime and Coastguard Agency *Code of Safe Working Practices for Merchant Seamen* (COSWP).[16] This system required all tasks to be risk assessed prior to being undertaken. Usually, the initial and primary risk assessment was conducted in the form of a job hazard analysis (JHA) conducted by the primary participants in the job. This was then reviewed and agreed to by all those undertaking the job. BP also used a permit to work system with a requirement for any relevant permit to be highlighted during the risk assessment and JHA process.

Regularly completed tasks like mooring, anchoring and receiving stores were not required to have a JHA completed each time they were performed, but could be done under a common JHA (CJHA) which had previously been developed for the task.

British Beech's CJHA for receiving and shifting provisions and stores using the provisions crane[17] contained the following 'recommended actions/procedures to mitigate hazard':

> Don't conduct the crane operation in absence of any officer I/C (in charge).

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[14] For more information see www.imo.org and www.imo.org/About/Conventions/Pages/Home.aspx

[15] Marine Order 32, issue 3 (Cargo handling equipment), available at www.amsa.gov.au/shipping_safety/marine_orders/Marine_Orders_currently_in_force.asp.

Marine Orders are a body of delegated legislation made pursuant to the Navigation Act 1912. In response to changes in international law, industry requirements, and technological developments, the Marine Orders are regularly amended or repealed. Many of these amendments are in response to technical amendments to international conventions made through the International Maritime Organization.

[16] Amendment 10, 2010, The Stationary Office, Norwich, UK.

[17] BP form HSSE-Safety-COW-Form-01, approved date 14/11/11.

Proper lifting procedures to follow.

Proper signalling procedures to follow.

All personnel to stay clear from the weight.

Check that the stores/provision and/or pallets are connected with slings/wire strops in proper manner.

Initially pick up the stores/provision slowly from the boat deck and once verified everything in good manner, heave the crane hook with proper speed of the crane.

Always remind the boat person to stay clear from the weight to be lifted.

Always keep the tag line tight and keep adjusting the tag line to avoid swinging of the stores/provision and/or pallet.

On 15 December 2011, most of these safeguards were not in place or were ignored. Importantly, there was no clearly designated officer in charge of the operation. While the CJHA designated the chief mate as the 'Area Authority' and the bosun as the 'Performing Authority', the chief mate was fully involved in cargo operations. In addition, while there were two third mates in attendance at the storing operation, neither had been assigned as the officer in charge.

An officer, or a designated person, in charge would be expected to do little other than supervise and act as lookout and signaller for the crane operator. The person in charge would also be expected to monitor the actions of others for any unsafe behaviour.

For the stores operations, the crane operator could see all aspects of the lift and, at some stage in the past, the crew had agreed that there was no need for a lookout or signaller for this operation. Therefore, the bosun, as the crane operator and 'Performing Authority' was, in the absence of any other clear direction, the person in charge. The implications of this decision had not been considered by the crew when they decided not to follow the guidance in the CJHA.

Furthermore, safe and proper lifting, signalling and communications procedures were not implemented or followed by the ship's crew. This was exacerbated by an assumption that the barge crew must be watching and resulted in no one checking the area was clear and no warning of the impending return of the container being given. Having undertaken the tasks of rigging the container, operating the crane, keeping a lookout and controlling the tag line, the bosun had an unnecessarily high workload.

In essence, the bosun was overloaded. He was doing the slinging, crane operation, load control, lookout and signalling roles and could not, therefore, do them all properly. Consequently, the defences identified in the CJHA were under the sole control of one person. This allowed single person errors to occur and go undetected and uncorrected.

2.4.2 Bowen Tug and Barge (BTB)

To comply with Queensland maritime legislation[18] BTB had implemented an SMS throughout the company. Barge to ship operations were part of the core and regular

[18] *Transport Operations (Marine Safety) Act 1994* as amended.

business of BTB and the dangers of lifting operations were repeatedly mentioned throughout the company's policies and documents. While the barge was required to have an SMS, it did not have one in place at the time of the accident. The tug involved in the storing operation had an SMS but this did not adequately reference the barge, or all its operations.

The company was small enough that a 'hands-on' approach to the formulation, training, monitoring and enforcement of company procedures was followed. This meant that a common technique for the storing of ships existed throughout the company and this procedure was taught, learnt and refined on-site under the guidance of suitably experienced and qualified employees, such as the tug masters. Compliance with this method was then monitored and enforced by the senior employee present during the task.

At interview, the tug crew agreed that there was an accepted approach to the storing operation. For the food containers, slings were the preferred rigging equipment. One crew member would be on either side of the container. The slings would be pushed under the container, through the tyne slots and then connected to the hooks on the chain sling. The signal to begin lifting would be given, and as the slack was taken from the slings the two crew members would hold the slings as widely apart within the tyne slots as possible. This would create the widest and most stable base for the container. As the container was lifted clear of the barge deck, it would be guided by hand until about shoulder height and clear of other items on the barge. At this point, the crew would clear the area and then watch the load as it was taken onto the ship. They would then standby until they became, or were made, aware of the returning crane hook with or without a load attached. On 15 December 2011, the operation was conducted following these general guidelines.

Among the documents in the tug's SMS was a document titled *Job Hazard Analysis Task loading and unloading ships stores*.

This JHA listed the following points:

> Please be aware of containers or other hazardous items falling or being knocked from the ship.
>
> You must at all times be wearing your lifejacket and helmet.
>
> When stores are lifted off deck all persons are to retire to a safe distance in case of a spill.
>
> At no stage should any persons stand under or near an empty container being returned from the ship to the deck of the barge until it has reached below shoulder height.
>
> At all times a crew member from the ship should observe the lifting and lowering operation.

The guidelines and precautions contained in the JHA were broadly in agreement with the lifting techniques described by the barge crew after the accident.

However, while there was an agreed technique, and a JHA addressing task risks, there was no documented procedure within the SMS and hence no standard against which compliance could be checked. This also meant that roles, responsibilities and tasks were not clearly assigned to individual crew members and, during lifts, danger zones or conversely safe areas on the barge were routinely not established. As a result, there was no individual nominated as lookout on board the barge and crew members were assumed to maintain their own lookout and remain vigilant to

movements of the crane and be prepared for the next operation. Further, as discussed earlier, the method of communication between the barge and ship crews was neither discussed nor adequate.

While the master had overall responsibility for all operations involving the tug and barge, this requirement does not, realistically, extend to being responsible for every individual or specific task involved in a job. It is likely that a number of tasks within any routine operation could be planned for and then documented and designated to individuals other than the master. This would actively engage the crew in all aspects of the job while reducing the tug master's workload and allow him to concentrate on other tasks such as safe operation of the tug and barge and other monitoring and administrative issues.

On the day of the accident, the requirements outlined in the JHA were not followed by the barge crew. Had they been adhered to, the container would have probably fallen to the deck without hitting anyone.

2.4.3 Personal protective equipment

When the risks associated with any task are analysed, the identified hazards need to be controlled to an acceptable level. In any heirarchy of risk controls the least effective control measure is personal protective equipment (PPE). According to Workplace Health and Safety Queensland:[19]

> PPE should only be considered as a control measure when exposure to a risk cannot be minimised in another way, or when used in conjunction with other control measures as a final barrier between the worker and the hazard. PPE does not control the hazard at the source.

Worksites and companies maintain a requirement for the use of PPE as all risks cannot be foreseen or eliminated from workplaces. According to BTB policies, for tug and barge work, requisite PPE included safety boots, hard hats where falling objects present a hazard, high visibility vests or clothing and lifejackets when working on the open deck, or adjacent to ships' sides. However, routinely and at the time of the accident, all the required PPE, including hard hats and lifejackets, was not being worn by the BTB crew. In particular, the tug master was not wearing a hard hat, lifejacket, high visibility vest or safety boots.

A post mortem examination showed that the tug master died from cardiac arrest as a result of multiple injuries to his head and chest.[20] It is not possible to determine if the missing PPE (a hard hat, lifejacket, high visibility vest and safety boots) would have made a difference to the outcome of the accident. However, in such instances where the outcome is not assured, hard hats potentially lessen the severity of any head injury and a high visibility vest increases the visibility of the wearer to others on the worksite and draws attention to their presence. In this case, wearing of such a vest, and a conspicuous hard hat, may have been sufficient to remind the crew of *British Beech* of the need to warn the people on the barge to stand clear of the returning container.

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[19] Queensland Department of Justice and the Attorney-General <http://www.deir.qld.gov.au/workplace/subjects/ppe/index.htm>

[20] Toxicology analysis detected no alcohol or drugs in his system.

The actions of the barge crew, both on this occasion and routinely, in not following the JHA and company guidelines on the wearing of PPE suggest that a pattern of unsafe behaviours had developed and was tolerated within BTB.

2.5 Reporting of risk-related events within BTB

The reporting of risk-related events is fundamental to any effective safety system. These events include what are commonly known as near misses, non-conformities, unsafe acts, risk events, incidents, accidents and hazardous occurrences. Reporting risk-related events is a proactive strategy because it can initiate remedial action to prevent a serious incident. The reaction to incidents usually involves addressing safety issues that could have been identified earlier from near misses. This means that the reporting of risk-related events provides an opportunity to identify the underlying risks which, if not addressed, can result in a serious incident.

With regard to proactive reporting, Hopkins states:

> **A reporting culture**
>
> Above all else, a safety culture is a reporting culture, in which people are prepared to report errors, near misses, unsafe conditions, inappropriate procedures and any other concerns they may have about safety. The issue is not whether the organisation has a reporting system; it is whether, as a matter of practice, such things are reported. This will happen only if people are on the lookout for things which need to be reported and alert to the ways in which things may be going wrong. [21]

Similarly, with regard to recording incident reports, Hopkins has stated:

> The lack of written recording meant that there was no systematic follow-up and no systematic compilation of the data. There was no possibility of learning from such a system.[22]

Multiple hazard and incident reporting requirements and guides were contained within the BTB document system. These included SMS requirements to report hazards and work related injuries, or harm to health, to both the company and MSQ. The MSQ requirements extended to reporting events where a real danger of injury existed even if no actual injury occurred (that is, near misses). A similar responsibility was contained in the *Bowen Tug Group Safety Handbook*, and a *Hazard Reporting Booklet*. Company personnel were aware of incident reporting requirements and that blank forms for reporting were included in the SMS. However, BTB encouraged verbal reporting of incidents to upper management through tug masters, the safety officer or the director. The workplace health and safety officer was responsible for recording and reporting these incidents to authorities, and to take necessary corrective action.

It is well known that people are not likely to report any risk-related event if they think that they will be punished or disadvantaged for reporting the event(s). It is also necessary for people to feel they are part of an organisation which learns from near misses, mistakes and incidents, one in which reporting of incidents will be

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[21] Hopkins, A. *Safety, culture and risk – the organisational causes of disasters*. CCH Australia. 2005, page 12.

[22] Ibid, page 71.

given due consideration and that actions will be taken to rectify the issues identified. In such a ‘learning culture’, people are less likely to become disillusioned and not report. These concepts of culture are the sum of the collective values, attitudes and behaviours of the management and individuals within an organisation.

Therefore, an effective safety system is heavily reliant on a reporting culture. It is important that individuals believe they are working to reduce risk within their organisation so that all opportunities to reduce risk are taken. Given the potentially severe consequences of a serious incident in the tug and barge industry, near miss reporting is critical.

At interview, several current and former BTB employees told of previous occasions during ship storing operations where items, including a container, or lid, had come free from the returning lift and fallen to the barge below. One such incident occurred less than a year before this accident when a container toppled from its slings after getting caught on the upper edge of a ship’s side. While the details of this, and a number of other earlier incidents, were different to this accident, many of those past incidents occurred while an empty container was being returned from a ship. About 7 years before the accident, a remarkably similar incident had occurred. On that occasion, an empty container being returned to the barge contacted the ship’s handrail, tipped out of the slings and fell, narrowly missing the tug master below on the barge’s deck. Coincidentally, it was the same tug master who died in this accident.

That serious near miss and other incidents of falling stores containers, or items, went unrecorded. Such incidents clearly met company and statutory reporting requirements and should have been recorded. While some incidents were verbally reported to the BTB safety officer, there is no formal company record of those incidents or any corrective actions. Nor does MSQ have any record of such incidents reported by BTB.

In submission, BTB advised that the company had a system to check procedure compliance. The documents provided by the company to support this statement, titled ‘JHA worksheets’, indicate that some hazards associated with forthcoming tasks were recorded on a weekly basis. The one page worksheets include up to ten tasks and the barriers (or defences) against listed hazards. The names of staff attending the weekly briefing were recorded on the worksheet.

However, the JHA worksheets are a record of a briefing and not a JHA or evidence of procedure compliance. For example, the worksheet covering the week before the accident includes the task of storing ships and identifies slips, trips and falls, person overboard and falling objects as the hazards. The barriers are listed as personal protective equipment and flotation devices. These barriers were not in place at the time of the accident. Furthermore, the most effective barrier against a falling object, that is, standing clear by designating safe or danger zones, is not recorded in any worksheet. Nor was this barrier and associated precautions such as a lookout in place at the time of accident.

The lack of any record of incident reporting by BTB along with the errors and omissions inherent in a verbal, memory based system indicates an ineffective reporting culture within the company. Hence, the opportunity to learn from previous incidents was lost.

2.6 Individual actions

Both BP and BTB provided guidance in the form of JHAs to reduce the risk of injury as a result of being hit by falling objects during the loading and unloading of stores. However, as discussed earlier, this guidance was not followed by either crew on 15 December 2011.

Guidance and JHAs provided in an SMS are 'good rules' and can only be effective in enhancing safety if the instructions/guidance contained within the documents are followed. They are written to shape people's behaviour with the aim of minimising accidents, and as such, they form part of any system defence against accidents.[23]

Assuming that a risk minimisation and control tool, such as a JHA, is well founded, any deviation will bring the violator into an area of increased risk and danger. The violation itself may not be damaging but the act of violating takes the violator into regions in which subsequent errors are much more likely to have negative outcomes.

2.6.1 Violations at the skill-based level

The act of storing a ship is work at the skill-based level of performance.[24] At this level, safe work procedures have to be fairly general in nature. This can mean that they are open to different interpretation by those who use them and, depending on how closely a person chooses to follow them, can lead to violations of the procedures. To reduce misinterpretation, these procedures can be augmented by other documents, such as JHAs, which are often more specific in detail and nature.

However, this does not mean that the safety guidance is always followed and if the initial violations are not identified, they can then become the routine way a task is done. These 'routine violations' can be characterised by the phrases 'this is how we have always done it and nobody has been hurt' or 'we do it like this all the time and nobody notices'. Routine violations are almost invisible until there is an accident or an audit identifies the fact that violations are occurring.

According to James Reason:

> These violations form part of a person's repertoire of skilled or habitual actions. They often involve corner-cutting (following the path of least effort between two task-related points). Such *routine violations* are promoted by inelegant procedures and a relatively indifferent environment. That is, one that rarely punishes violations or rewards compliance.
>
> In general, there is very little need to proceduralise activities at the skill-based level. For the most part, actions are governed by stored habits or actions whose details are, in any case, beyond verbal control or even recall. There is no point, for example, in writing procedures to tell a skilled tradesperson how to use a screwdriver. Where procedures do cover activities at the skill-based level, they tend to take the form of general exhortations

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[23] Lowle, M. *The Human Element – Errors and violations*, as contained in the UK P&I Club Loss Prevention News, September 2003, Issue 16, pages 11 to 14.

[24] Individuals carry out routine, highly-practised tasks, in a largely automatic way where there is little conscious thought, except for occasional checks on progress.

(e.g. proceed with due caution... care should be taken when...).[25]

Routine violations become established in a workplace when there is a lack of oversight or intervention by management in unsafe practices by employees. If management are aware of, but do not take action against routine violations, they will continue to occur within the workplace with an implicit 'approval' from management.

2.6.2 Complacency

Bengt Schager, in his book *'Human Error in the Maritime Industry – How to understand, detect and cope'* discusses the issue of 'complacency' in the maritime industry as:

> ...a state of mind. It is an unconcerned attitude, e.g. in connection with the presence of danger and risk, where individuals behave and think in a routine-like mode, anticipating an uneventful and ordinary development of the present situation.
>
> Complacency is a passive state, not an active one, and no one chooses to be complacent. It creeps into one's mind imperceptibly. Individuals are therefore unaware of being complacent and would, if asked, reassuringly deny it. Instead, individuals would probably justify their state of mind as rational, realistic, reasonable and in line with situational requirements, as well as a sign of experience.
>
> Complacency can lead to ... a false sense of security as well as a false sense that the situation is under control when it isn't. It can, furthermore lead to deficient risk assessment or to repressing risks and not paying proper attention to what one is engaged in.[26]

It is likely that both the ship's and the barge's crew viewed the storing operation as a mundane task and had, therefore, become complacent and developed a false sense of security about the dangers associated with loading and unloading stores. Consequently, the practices followed by both crews during the storing operation resulted in the breakdown of several identified risk minimisation controls contained in the respective JHAs.

Bowen Tug and Barge

It is most likely that the tug master had become desensitised to the risks associated with loading stores containers after having completed this task on multiple occasions over many years and having more than 40 years of experience in industry. Neither the safety training and company guidance nor the previous serious near miss with a falling stores container had sufficiently changed the tug master's behaviour to ensure he was not standing in a danger zone on the day of the accident.

The barge crew knew the tug master was at the forward end of the barge. However, they were not paying any particular attention, and consequently neither of them registered that the master was in a position of danger.

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[25] Reason, J. *The Human Contribution – unsafe acts, accidents and heroic recoveries*. Ashgate, England, 2008, pages 51-52.

[26] Marine Profile, Sweden, 2008, pages 100 - 112.

Despite having a JHA and an accepted stores handling technique, BTB did not have an effective process in place which was sufficient to ensure their employees were following the training they had received or the guidance contained in the documentation. Not following the training and guidance had not been identified and remedied by BTB management. Consequently, this behaviour was reinforced and tacitly approved by them.

In submission, BTB cited the lack of prior reported incidents and serious injuries as evidence that the procedures (including for storing), compliance auditing and incident reporting in place were effective. BTB also cited the JHA worksheets as evidence that there was continuing training and guidance on operations and that an effective compliance auditing system was in place.

However, the absence of incident records is indicative of an ineffective system, not a work environment where there are no risk events. Furthermore, the fact that the barriers identified in the worksheets were not complied with indicates that they were not effectively implemented and that this had not been identified.

British Beech

It is likely that the senior officers on board the ship were unaware that the storing procedures were not being followed as there had been no adverse outcomes as a result of these violations, and there had been no feedback from the crew regarding the effectiveness or otherwise of the CJHA.

Employee training, procedures and JHAs aimed at reducing the risk of an accident were in place but compliance auditing had not identified that these were not being fully implemented and followed. Consequently, the auditing system had not identified this behaviour and that it was going unnoticed.

After the accident, BP Shipping undertook a thorough review of lifting and slinging processes, practices, procedures and equipment. Fleetwide review and training workshops followed the company’s review.

3 FINDINGS

3.1 Context

On 15 December 2011, *British Beech* was berthed in Brisbane, Queensland, and its crew was taking on stores from a barge. During the return of a stores container from the ship to the barge, the container came free of its slings. It fell to the barge below, striking the master of the barge. The master was attended to by the barge crew and shore paramedics but he died from his injuries while being transported to hospital.

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 stores container was poorly rigged on board *British Beech*. As a result, it was easily unbalanced, and toppled free from its slings as it was being lowered to the barge.
- Bowen Tug and Barge had identified the need to spread the slings when lifting a stores container. However, there was no process in place to ensure that ships' crews were advised of this to ensure its safe return from the ship. *[Minor safety issue]*
- *British Beech*'s crew did not warn the crew of the barge of the returning container and the barge crew were not paying attention to the operation. As a result, they were not aware that the container was being returned.
- The master of the tug and barge was in a position of danger when he remained in the fall zone under the suspended load.
- The crane operator did not adequately check the landing area for the load and incorrectly assumed that the tug master was clear of the danger zone.
- On board *British Beech*, there was no agreed person in charge of the operation. As a result, the crane operator was, in the absence of any other clear direction, the person in charge.
- The job hazard analyses that had been carried out by Bowen Tug and Barge and the crew of *British Beech*, were not complied with. This removed multiple defences to the accident and exposed personnel involved in the operation to unnecessary risk. The implications of these decisions had not been considered by the crews.
- Bowen Tug and Barge's safety management system guidance for barge storing operations did not designate roles or responsibilities to specific individuals and a system for communicating with the ship's crew was not discussed and established. *[Minor safety issue]*
- Bowen Tug and Barge did not have an effective compliance auditing process in place to ensure that its employees were following the training they had received and the guidance contained in the safety management system documentation. *[Minor safety issue]*

- Compliance auditing on board *British Beech* had not identified that requirements of the job hazard analysis were not being followed by the crew during storing operations. *[Minor safety issue]*
- The lack of any record of incident reporting by Bowen Tug and Barge, and its employees, indicates an ineffective reporting culture within the company. Hence, the opportunity to learn from previous incidents was lost. *[Minor safety issue]*

4 SAFETY ACTION

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

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

4.1 Bowen Tug and Barge

4.1.1 Stores container handling

Minor safety issue

Bowen Tug and Barge had identified the need to spread the slings when lifting a stores container. However, there was no process in place to ensure that ships' crews were advised of this to ensure its safe return from the ship.

Action taken by Bowen Tug and Barge

Purpose built and engineered steel cage frames suitable for lifting pallets and stores containers were manufactured and put into service soon after the accident. This alteration in the method of handling provides for top lifting of the load and greatly reduces the possibility of an accident of this type occurring again.

4.1.2 Safety management system adequacy

Minor safety issue

Bowen Tug and Barge's safety management system guidance for barge storing operations did not designate roles or responsibilities to specific individuals and a system for communicating with the ship's crew was not discussed and established.

Response from Bowen Tug and Barge

On 01 July 2012, Bowen Tug and Barge ceased ship storing operations. The company subsequently entered into a contract for the sale of the associated equipment. Accordingly, the company's business no longer includes the loading or unloading of ship's stores.

4.1.3 Compliance auditing

Minor safety issue

Bowen Tug and Barge did not have an effective compliance auditing process in place to ensure that its employees were following the training they had received and the guidance contained in the safety management system documentation.

Response from Bowen Tug and Barge

On 01 July 2012, Bowen Tug and Barge ceased ship storing operations. The company subsequently entered into a contract for the sale of the associated equipment. Accordingly, the company's business no longer includes the loading or unloading of ship's stores.

4.1.4 Reporting culture

Minor safety issue

The lack of any record of incident reporting by Bowen Tug and Barge, and its employees, indicates an ineffective reporting culture within the company. Hence, the opportunity to learn from previous incidents was lost.

Response from Bowen Tug and Barge

On 01 July 2012, Bowen Tug and Barge ceased ship storing operations. The company subsequently entered into a contract for the sale of the associated equipment. Accordingly, the company's business no longer includes the loading or unloading of ship's stores.

4.2 BP Shipping

4.2.1 Compliance auditing

Minor safety issue

Compliance auditing on board *British Beech* had not identified that requirements of the job hazard analysis were not being followed by the crew during storing operations.

Action taken by BP Shipping

BP Shipping advised the ATSB of the following actions it has taken:

> Following the incident, BP Shipping took immediate steps to review and amend its lifting procedures, including the following:
>
> (a) The prompt implementation of a procedure mandating fixed point attachments above the centre of gravity, or the use of cargo nets, for all ship storing and other lifting operations involving storage bins, crates or other types of containers.

(b) A thorough review of lifting and slinging processes, practices, procedures and equipment.

(c) A full review of lifting JHA within a revised BP Shipping Control of Work including a new lifting permit system requiring a drawing detailing the attachment points and slinging arrangements.

(d) A fleet wide "safety stand down" review and training workshop for lifting and slinging arrangements was completed on all company vessels.

APPENDIX A : SHIP INFORMATION

British Beech

IMO Number	9266841
Call sign	MCLJ8
Flag	Isle of Man
Port of Registry	Douglas
Classification society	Lloyd's Register (LR)
Ship Type	Products/crude oil tanker
Builder	Tsuneishi, Japan
Year built	2003
Owners	Millerfield, UK
Ship managers	BP Shipping, UK
Gross tonnage	58,070
Net tonnage	32,118
Deadweight (summer)	106,138 tonnes
Summer draught	14.878 m
Length overall	240.50 m
Length between perpendiculars	230.00 m
Moulded breadth	42.00 m
Moulded depth	21.20 m
Engine	1 x Mitsui MAN B&W 6S60 MC-C Mk6
Total power	12,240 kW
Speed	14.50 knots
Crew	26

Barge *BT7*

Identification number	26242
Registered Number	26242QD
Flag	Queensland
Port of Registry	Brisbane
Ship Type	Dumb barge
Owner and manager	Bowen Tug and Barge, Brisbane, Queensland
Deadweight (summer)	1,000 tonnes
Summer draught	1.524 m
Length overall	23.558 m
Moulded breadth	6.096 m
Moulded depth	2.134 m
Crew	1

APPENDIX B : SOURCES AND SUBMISSIONS

Sources of Information

The sources of information during the investigation included the:

Master and crew of *British Beech*

Crew of the barge *BT7*

Australian Providoring and Trading Company

Bowen Tug and Barge management

BP Shipping

Inchcape Shipping Services

Maritime Safety Queensland

QPort Marine Services

Southern Cross Marine Supplies

The Australian Maritime Safety Authority

The Queensland Ambulance Service

The Queensland Police Service

The Queensland Coroner

Workplace Health and Safety Queensland

Xactics International

References

Commercial and Fishing Ships Operational Handbook – edition 2 - http://www.msq.qld.gov.au/~/media/98956679-155f-4991-9760-a46193b50607/comm_fish_op_handbook_ed2.pdf

Maritime and Coastguard Agency 2010, *Code of Safe Working Practices for Merchant Seamen Amendment 10, 2010*, The Stationary Office, Norwich, UK.

MSQ Safety management system reference manual - http://www.msq.qld.gov.au/~/media/ca488367-5edc-4d51-a385-0102ff678fb8/pdf_sms_reference_material_aug_10.pdf

MSQ marine incident report form - http://www.msq.qld.gov.au/~/media/ab0c0c55-3c97-44d5-9f3f-ebbe6992e91d/pdf_f3071.pdf

A guideline has been developed to clarify the requirements of sections 123 and 125 of the *Transport Operations (Marine Safety) Act 1994* - http://www.msq.qld.gov.au/~/media/af08bcf6-0c14-41ce-b942-37af0ab63ac9/reportable_marine_incidents_guideline.pdf

Website detailing documents required to be kept by Qld registered ships - http://www.msq.qld.gov.au/Registration/Commercial-and-fishing-ships/Operating-documents.aspx

National Standard for Commercial Vessels - Part E – Operational Practices - http://www.nmsc.gov.au/media/pages_media_files/files/NSCV%20Part%20E%20Edition%202%20V3_ready%20for%20Web%20(2).pdf

Transport Operations (Marine Safety) Act 1994 Reprinted as in force on 30 January 2012 - http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/T/TranstOpMSA94.pdf

Transport Operations (Marine Safety) Regulation 2004 - http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/T/TranstOpMSyR04.pdf

Uniform Shipping Laws (USL) Code 2008 - http://www.msq.qld.gov.au/Registration/Commercial-and-fishing-ships/Usl-code-2008.aspx

Uniform Shipping Laws (USL) Code 2008 - Section 15: Emergency procedures and safety of navigation - http://www.msq.qld.gov.au/~/media/30844379-e5fd-4367-9df1-c440d1a37aee/pdf_usl_pt15.pdf

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 the master, the chief mate, both third mates and the bosun of *British Beech*, the director of Bowen Tug and Barge, both deckhands of the tug and barge, BP shipping, the Australian Maritime Safety Authority (AMSA), the Isle of Man Ship Registry, Maritime Safety Queensland (MSQ), the Queensland coroner, the Brisbane Water Police, Workplace Health and Safety Queensland (WH&SQ) and Xactics International.

Submissions were received from the master and crew members of *British Beech*, Bowen Tug and Barge, BP Shipping, the Isle of Man Ship Registry, AMSA, MSQ, Xactics International and WH&SQ. These submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

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Investigation

ATSB Transport Safety Report
Marine Occurrence Investigation

Fatality while storing the products tanker *British Beech* in Brisbane, Queensland on 15 December 2011

291-MO-2011-011
Final – 7 March 2013