



Australian Government

Australian Transport Safety Bureau



ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Marine Occurrence Investigation No. 243
Final

Independent investigation into the grounding of the
Panamanian registered bulk carrier

Pasha Bulker

on Nobbys Beach, Newcastle, New South Wales
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Abstract

On 23 May 2007, the Panamanian registered bulk carrier *Pasha Bulker* anchored 2.4 miles off the coast near Newcastle, New South Wales. The ship had sufficient water ballast on board for the good weather at the time, and was not expected to load its coal cargo for about three weeks.

At midday on 7 June, *Pasha Bulker*'s master veered more anchor cable after a gale warning was issued. The weather deteriorated and shortly after midnight, the wind had reached gale force.

At 0500 on 8 June, the wind had increased to strong gale force and the weather was severe. At 0625, *Pasha Bulker* started to drag its anchor. The master decided to put to sea and at 0748, the anchor was aweigh. The ship was now 1.2 miles from the shore and, with the southeast wind fine on the starboard bow, it made good a north-easterly course. At 0906, the master altered the ship's course to starboard to put the wind on the port bow in an attempt to make good a southerly course on a south-southeasterly heading. However, its heading became south-westerly and, with the wind on the port beam, the ship started to rapidly approach the coast.

At 0931, with Nobbys Beach 0.8 of a mile away, the master attempted a starboard turn. The manoeuvre did not succeed and at 0946, with grounding imminent, he requested assistance from authorities ashore. At 0951, *Pasha Bulker* grounded on Nobbys Beach and the ship's momentum carried it further onto the beach. The crew were evacuated by helicopter during the afternoon.

On 2 July, *Pasha Bulker* was successfully refloated. The ship was temporarily repaired in Newcastle and on 26 July, taken in tow to Vietnam to undergo permanent repairs.

The report identifies a number of safety issues and issues recommendations or safety advisory notices to address them.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Infrastructure, Transport, Regional Development and Local Government. ATSB investigations are independent of regulatory, operator or other external bodies.

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 enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not the object of an investigation to determine blame or liability. However, 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 proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

The ATSB has decided that when safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

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, risk controls and organisational influences.

Contributing safety factor: a safety factor that, if it had not occurred or existed at the relevant time, 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.

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.

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

- **Critical safety issue:** associated with an intolerable level of risk.
- **Significant safety issue:** associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable.
- **Minor safety issue:** associated with a broadly acceptable level of risk.

EXECUTIVE SUMMARY

At 0742¹ on 23 May 2007, the Panamanian registered bulk carrier *Pasha Bulker* anchored 2.4 miles² off the coast near Newcastle and joined the queue of 57 ships in the anchorage. All of *Pasha Bulker*'s cargo holds were empty in readiness to load a cargo of coal, scheduled to take place in three weeks. The ship had sufficient water ballast on board for the good weather conditions which continued for the next fortnight.

At midday on 7 June, *Pasha Bulker*'s master veered³ more anchor cable after noting a gale warning. The weather deteriorated with the southeast wind strengthening and rain becoming persistent. During the evening, seven ships put to sea while another got underway and berthed that night. At midnight, the first of the 49 ships remaining in the anchorage started to drag its anchor.

By 0100 on 8 June, the wind was consistently gale force and the seas became rougher. Newcastle Vessel Traffic Information Centre (VTIC) was monitoring ships in the anchorage on radar and advising the masters of any that appeared to be dragging their anchors. Some of these ships then put to sea. By 0500, the wind was strong gale force with 8 m high seas. There were 41 ships remaining at anchor. *Pasha Bulker*'s master observed the deteriorating conditions and continued to monitor the ship's position.

At 0625, *Pasha Bulker* started dragging its anchor in the severe weather. When the master became certain of this, he decided to weigh anchor. At 0748, when the ship was underway, there were still 11 ships at anchor. The master turned the ship away from the coast, now only 1.2 miles away. On its initial east-southeast heading, with the wind and heavy seas fine on the starboard bow, the ship's course made good was in an east-northeasterly direction, parallel to the coast.

At 0906, *Pasha Bulker*'s master altered course to put the wind on the port bow in an attempt to make good a southerly course. The alteration was poorly controlled and the ship's heading became south-westerly instead of south-southeast as he had intended. With the severe weather now on its port beam, the ship started moving west, towards the coast. The main engine speed was increased to assist the turn to port, into the wind, but this had limited success.

At 0927, as the ship approached the coast, VTIC offered assistance. The master declined the offer and soon after, began a turn to starboard. The ship began rapidly closing on Nobbys Beach, now only eight cables⁴ away. The turn was unsuccessful and at 0946, when grounding was imminent, the master requested assistance.

At 0951, *Pasha Bulker* grounded on Nobbys Beach. The ship's momentum carried it further onto rock ledges on the beach and its hull was breached but there was no pollution. The ship was hard aground and the master requested a crew evacuation. By 1330, all of the crew had been safely winched off by a rescue helicopter.

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

2 A nautical mile of 1852 m.

3 To pay out anchor cable under power using the windlass.

4 One cable equals one tenth of a nautical mile or 185.2 m.

At that point in time, another four ships had still not cleared the coast, with *Sea Confidence* being of most concern. The ship was about five cables from Stockton Beach and both of its anchors had been let go to prevent it from grounding. At 1413, authorities ashore directed the master to accept assistance. A tug was dispatched but was unable to connect a tow line in the extreme weather conditions.

Of the other three ships, *Betis*, at about three miles off, was closest to the coast. The windlasses of all three ships had failed while they were attempting to weigh anchor. At 1610, *Betis*'s master had the anchor cable cut and put to sea. At 2006, *Sea Confidence* also got underway and headed to sea during a lull in the weather which subsequently deteriorated.

By about midday on 9 June, the last two remaining ships had also slipped their anchor cables and put to sea. In the afternoon, salvage personnel boarded the grounded *Pasha Bulker* by helicopter.

At 2138 on 2 July, *Pasha Bulker* was refloated successfully.

On 26 July, after completing temporary repairs in Newcastle, the ship was taken in tow, bound for Vietnam to undergo permanent repairs.

The ATSB investigation found that *Pasha Bulker*'s master did not appropriately ballast the ship and did not weigh anchor until it dragged in severe weather. The unwise decision to not ballast the ship for heavy weather and remain at anchor were the result of his inadequate knowledge of issues related to ballast, anchor holding power and local weather.

Furthermore, the master incorrectly assumed that Newcastle VTIC would, if necessary, instruct ships to put to sea and the fact that most other ships also remained at anchor reinforced, in his mind, the initial unwise decision to remain at anchor. Consequently, he ignored signs of the dangerous situation developing. After the ship got underway, the master became increasingly overloaded and affected by fatigue and anxiety and his inappropriate control of the ship at critical times inevitably led to its grounding.

The ATSB report issues a number of recommendations and safety advisory notices to address the following safety issues identified by the investigation.

Pasha Bulker's safety management system did not provide the master with guidance about safely putting to sea in adverse weather. Procedures on board the ship did not sufficiently encourage the use of bridge resource management which, at the time of the incident, was ineffective.

The advisory role of VTIC was misunderstood by many masters in Newcastle anchorage at the time. A number of them expected that the centre would, if required, instruct or advise them to leave the anchorage. Some masters may have assumed that individual advice from the centre when a ship dragged its anchor was the appropriate time for it to get underway and put to sea. Communications by VTIC during this period, with regard to the berthing schedules of ships and clearing the restricted area off the port were confusing and of no benefit.

Newcastle Port Corporation's (NPC) incident control system was activated at 0830 on 8 June suggesting that the corporation was not sufficiently responsive to the increasing seriousness of the situation until this time. Subsequently, weather advisories to ships, notification to the Australian Maritime Safety Authority and offers to assist *Pasha Bulker* were made at a late stage in extreme weather conditions.

A number of masters had deployed insufficient anchor cable in Newcastle's relatively deep water anchorage. Several of them also had inadequate knowledge of the local weather and did not ballast their ships for heavy weather and put to sea at an appropriate time before the onset of the severe weather. Initiatives by Port Waratah Coal Services (PWCS) related to improving the performance of ships with regard to their de-ballasting time at its coal terminals may also have influenced the decisions of some masters to not ballast their ships for heavy weather.

The queue of 57 ships off Newcastle at the time of the incident increased the risks of collision and grounding. Coal chain capacity allocation systems, primarily intended for commercial benefit, have in the past proved effective in reducing the queue and a positive consequence of a reduced queue is enhanced maritime safety.

More than 40 discarded anchors and cables, most of them uncharted, which lie on the seabed in Newcastle anchorage, are a hazard to ships.

In addition to the safety issues, the investigation found that:

- Masters of ships off Newcastle at the time of the incident generally considered VTIC to be the most useful information source for the anchorage.
- The masters of the seven ships that put to sea before the onset of gale force winds demonstrated the highest levels of seamanship.
- The emergency deployment of the anchors, use of the main engine and taking heavy weather ballast probably prevented the grounding of *Sea Confidence*.
- A reduction in the ship queue can benefit coal producers by reducing demurrage costs while enhancing maritime safety.

The report also records the safety actions that have been taken by NPC and PWCS.

1.1 *Pasha Bulker*

*Pasha Bulker*⁵ is a Panamanian registered bulk carrier (Figure 1). The ship is managed and operated by Fukujin Kisen Company, Japan. At the time of the grounding, the ship was owned by Wealth Line, Panama and on a long-term charter to Lauritzen Bulkcarriers, Denmark.

The 'Panamax'⁶ sized *Pasha Bulker* was built in 2006 by Sasebo Heavy Industries Company, Japan and is classed with Nippon Kaiji Kyokai (ClassNK). With an overall length of 225 m, the ship has a moulded breadth of 32.20 m and a moulded depth of 19.80 m. At a summer draught of 14.221 m, it has a deadweight of 76 781 tonnes.

Figure 1: *Pasha Bulker*



Pasha Bulker is a conventional, gearless bulk carrier with all of its seven cargo holds located forward of the accommodation superstructure. An area for helicopter operations is provided on the hatch covers of number four cargo hold. This cargo hold is also designated for heavy weather water ballast and may be filled in adverse weather to provide ballast capacity in addition to the ship's 22 water ballast tanks.

Propulsive power is provided by a B&W 7S50MC-C diesel engine that develops 9230 kW at 106 rpm. The main engine drives a single, fixed pitch, right-handed propeller which gives the ship a service speed of 14.5 knots⁷.

Pasha Bulker has a raised forecastle deck where the windlasses for its port and starboard anchors are located. Each anchor, an Admiralty Class (AC) 14 type,

5 The ship, which was renamed in 2008, is referred to by its former name throughout this report.

6 A ship that is limited in size to the dimensions of the Panama Canal.

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

weighs 7425 kg and is fitted with 12 shackles⁸ of 78 mm diameter chain cable which weighs about 3800 kg per shackle.

The ship's navigation bridge (bridge) is equipped with navigational equipment consistent with SOLAS⁹ requirements. The equipment includes two JRC JMA-9900 series radars, both equipped with automatic radar plotting aids (ARPA). The chart table incorporates an electronic chart plotter. Two JRC JR-7700MK II differential global positioning system (DGPS) receivers are mounted adjacent to the plotter. Other equipment includes an echo sounder and automatic identification system (AIS). A JRC JCY-1700 voyage data recorder (VDR) is connected to the navigational equipment. The VDR records navigational data as well audio data from microphones fitted on the bridge.

The global maritime distress and safety system (GMDSS) communications equipment is also located on the ship's bridge. In addition to two very high frequency (VHF) radios, the equipment includes a satellite communications (Inmarsat-C) terminal. This terminal automatically receives and prints maritime safety information including navigational warnings and weather reports. A dedicated weather facsimile receiver is also provided. To monitor local weather conditions, a barometer and wind speed (anemometer) and direction indicators are fitted on the bridge.

At the time of the incident, *Pasha Bulker* was on its third call to Newcastle, the previous occasions being in January and March 2007. Most of the ship's crew of 21 had been on board for the nine months since the ship was delivered to its owners on 29 August 2006.

The master and chief engineer were South Koreans and the remaining crew were Filipinos with English being the working language. All the crew held endorsements issued by the ship's flag state, Panama, attesting the recognition of their national qualifications with the relevant international convention.

The master graduated from a South Korean maritime university in 1982. In 1984, after serving for two years in the navy, he joined his first merchant ship. In 1994, he obtained South Korean qualifications for a master and was promoted to master in 2000. He had sailed on different types of ships and had also commanded bulk carriers larger than *Pasha Bulker*. This was his first assignment with the ship's managers and he had joined the ship one month before the incident. It was his first visit to Newcastle as master, having last been to the port in 1997.

The chief engineer started his seagoing career in 1979. In 1996, he obtained South Korean qualifications as a chief engineer. He had sailed on different types of ships and *Pasha Bulker* was his third assignment with the ship's managers. He had been on board the ship for nine months.

The three mates held certificates of competency for their respective ranks which were all issued in the Philippines. Each of them had sailed at their ranks for three years or more. The chief mate started his seagoing career in 1995. The chief mate and the second mate had been on board *Pasha Bulker* for nine months. Both had sailed on bulk carriers, including several operated by the ship's managers, and had

⁸ One shackle equals 90 feet or 27.43 m.

⁹ The International Convention for the Safety of Life at Sea, 1974, as amended.

been to Newcastle many times. The third mate had been on board the ship, his first bulk carrier, for one month.

The helmsman, at the time of the incident, had 10 years of experience as an able seaman. He had been trained in the Philippines and first went to sea in 1991.

1.2 Newcastle

The port of Newcastle lies at the entrance to the Hunter River on the east coast of Australia (Figure 2). The second major port of New South Wales (NSW), after Sydney, it predominantly handles bulk cargoes. Coal exports comprise over 90 per cent of the port's trade and exceeded 80 million tonnes for the financial year ending June 2007. Newcastle is the world's largest loading port for coal, two-thirds of which is destined for Japan. There are a total of five berths at the port's two coal terminals capable of handling ships up to 300 m in length and 50 m beam. Maximum draught is subject to tide in the Steelworks Channel, which has a charted depth of 15.2 m.

Figure 2: New South Wales coast from Coffs Harbour to Sydney



1.2.1 Newcastle Port Corporation

Newcastle Port Corporation (NPC) is a NSW government-owned entity created and operated under the state's *Ports and Maritime Administration Act 1995*. Under this legislation, NPC is responsible for managing and operating the port of Newcastle, including exercising safety functions. Within state waters, which extend out to three miles seaward, NPC also has prime responsibility in relation to oil and chemical pollution response between Fingal Head, about 20 miles along the coast to the north of Newcastle and Catherine Hill Bay, a similar distance to the south of the port.

The responsibility for safe and effective port operations rests with NPC and it provides pilotage services for Newcastle. The corporation exercises its authority within the port's limits through the harbour master, who has the power to direct ships within these limits which extend seaward along an arc of radius three miles centred on Nobbys Head lighthouse (Figure 3). The area off Newcastle, used by ships to anchor while waiting to enter the port, lies outside port limits. To fulfil its communication responsibilities which include providing 'marine warnings' and port related reports, NPC operates a vessel traffic information centre 24 hours a day throughout the year.

Newcastle Vessel Traffic Information Centre (VTIC)

The principal objectives of Newcastle VTIC, as stated by NPC, are to:

- improve safety and efficiency of navigation
- improve the protection of the marine environment
- respond to the business needs of the port's customers.

Newcastle VTIC is not a navigational control centre and its main role is to prepare 'shipping programs'¹⁰. The centre's secondary role is to communicate with both internal and external customers. This includes ship communications to coordinate and monitor traffic movements and services within the port. The centre provides the masters of ships with information only and does not instruct or direct them unless specifically directed to do so by the harbour master.

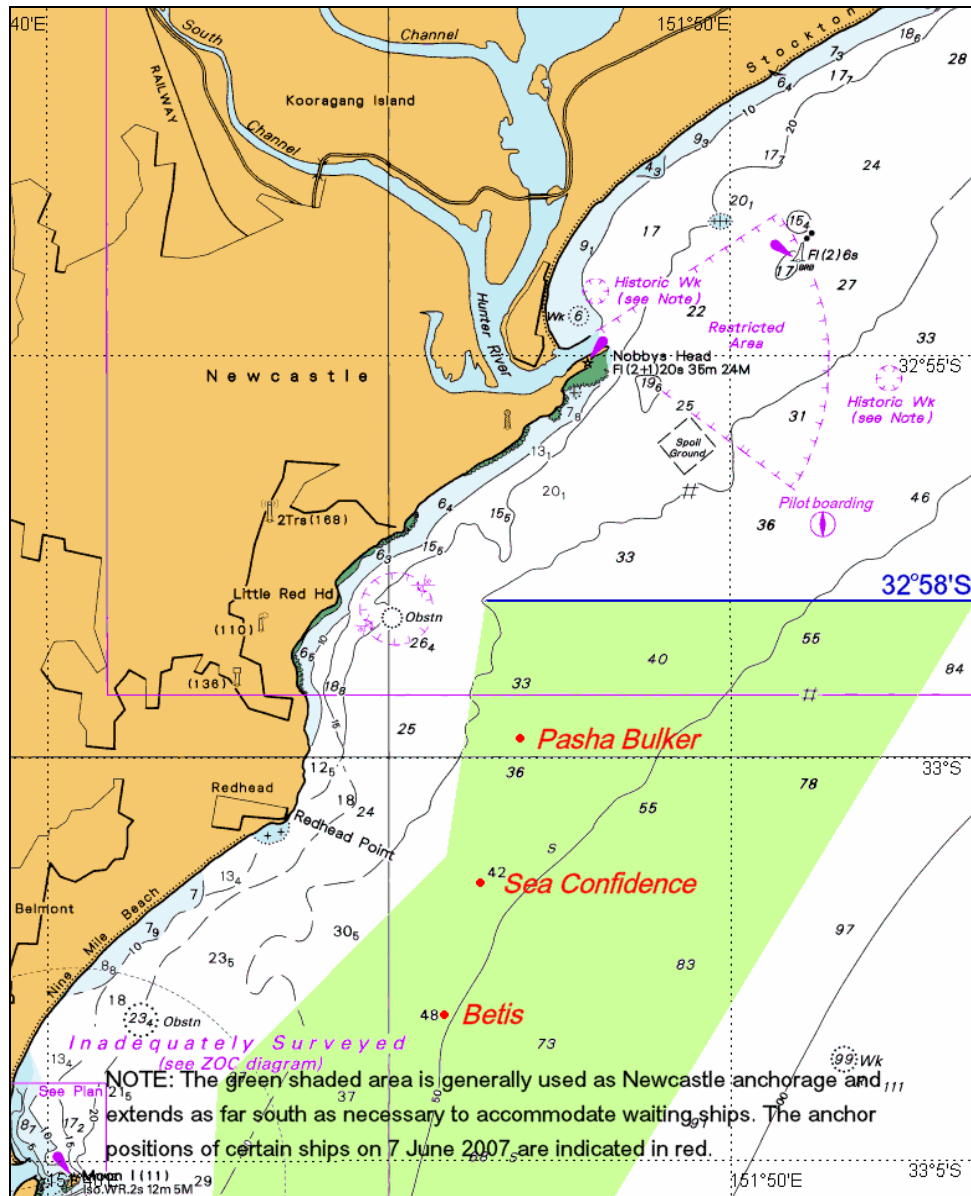
The purpose of the charted restricted area (Figure 3) off the harbour entrance is to keep the entrance clear for ships entering or leaving port. It also assists in keeping unnecessary traffic clear of the pilot boarding ground. Newcastle VTIC closely monitors the restricted area and, when necessary, issues directives on VHF radio to keep ships clear of the area.

The VTIC officers are not required to have a seafaring background. They are trained in-house and, if necessary, externally to use the centre's radar and communications equipment. At least one VTIC officer is on duty at all times to attend to the necessary communications and monitoring. The officers have a duty roster and normally work 12 hour shifts that are completed at 0700 and 1900 daily.

On weekdays, an additional VTIC officer is on duty from 0800 to 1600 to allow the shipping program to be prepared. The pilot office is located on the centre's premises and the duty pilot is either present or on call at all times. The pilot may provide advice to the VTIC officer if necessary but leaves all communications to the officer.

¹⁰ Refers to the scheduling of ships, including their berthing and un-berthing.

Figure 3: Section of navigational chart Aus 809 showing area off Newcastle from Stockton Beach to Moon Island off Swansea



Ship communications with VTIC are conducted primarily on VHF channel nine. On arrival, necessary information including the ship's arrival time, which determines its turn for berthing, is reported. The centre calls itself 'Newcastle Harbour' and provides masters with advice to assist with anchoring. This includes guidance about the location of the fair weather anchorage provided in the Australia Pilot¹¹, a nautical publication that is required to be carried by all ships for their voyage to Australia. Masters are also advised to anchor a safe distance from other ships, maintain a good anchor watch, as anchors may drag, and to monitor VHF channel nine at all times.

As an additional service, VTIC monitors all ships within its radar coverage. For an anchored ship, a five cable radius guard ring, centred on its position, is set up. If a ship appears to be dragging its anchor or moves outside this circular area of one

¹¹ Admiralty Sailing Directions, Australia Pilot, Volume III, NP 15, Tenth Edition, 2005.

mile diameter, the guard ring alarm activates and the VTIC officer advises its master that the ship 'appears to be dragging'.

A weather watch is maintained by VTIC to assist the pilots. Equipment to monitor and record the wind speed and direction at Nobbys Head is provided. Additionally, wave height and direction information from two wave rider buoys stationed outside the harbour entrance is automatically transmitted to VTIC. The weather data obtained is used by pilots for ships' under-keel clearance calculations and for planning the arrival or departure of ships.

In the 'operational guidelines' for VTIC, the weather is considered to be 'fair' unless a storm warning has been issued and/or the swell has increased to 4.5 m, in which case it is defined as 'bad'. In 'bad' weather, the radius of the anchor position guard rings on the radar is reduced to 2.5 cables, or halved, the duty pilot is asked to attend the centre and the harbour master is notified.

At the time of the incident, VTIC did not provide weather information to ships. Masters were expected to obtain marine weather reports normally promulgated by the Australian Bureau of Meteorology (BoM). If the designated coast stations broadcasting weather reports on VHF radio were inoperative, then VTIC would broadcast these reports.

1.2.2 The anchorage

The sea area off Newcastle is fully exposed to the weather, particularly from the south and no sheltered anchorage is available (Figure 3). The Australia Pilot states:

Whilst no anchorage off the port can be recommended as suitable for all weather use, good fair weather anchorage can be found S [south] of 32°58'S at a distance greater than 2 miles from the shore.

Where there are several vessels at anchor a safe clearance from other vessels should be maintained in case of vessels dragging anchor.

A good anchor watch should be maintained and main engines should not be dismantled or immobilised in any way as weather conditions may deteriorate rapidly.

Water depths in this fair weather anchorage are relatively deep with the 30 m isobath, or depth contour, running about two miles off the coast. Four miles from the coast, the depths are about 50 m and become increasingly unsuitable for anchoring. A further two miles seaward, at 90 m, the water is too deep for ships to anchor effectively. Consequently, the anchorage is an almost rectangular area about three miles wide, running parallel to the coast, extending south of latitude 32°58'S. To accommodate the number of waiting ships, the anchorage has, at times, extended more than 35 miles south of Newcastle.

Foul areas, some of which are charted, exist off Newcastle. Discarded anchors and cables, estimated by the harbour master to number at least 40, lie on the seabed and are a concern for masters. Tidal streams and currents are not known to be significant for ships using the anchorage.

The weather in the area may deteriorate rapidly at any time of the year and can be particularly severe in the winter months from June to August. Southerly winds in

particular, with their extended fetch¹², make the resultant swell very heavy. As winter approaches, the predominant southerly winds become even more frequent, thus increasing the swell. During winter, eastward moving anticyclones and frontal troughs can also cause extreme weather.

The Australia Pilot advises that:

Onshore winds can sometimes increase strongly within the hour, and occasionally during summer, at the end of a hot day a Southerly Buster can persist for several hours. During autumn, significant swells are generated by cyclonic depressions (known locally as an East Coast Low) in the central Tasman Sea and during winter extreme weather is caused by lows forming close to the coast. During these periods of extreme weather, coastal swells may exceed 10 m in height.

During S weather, sea and swell can become confused. If so, it is recommended that vessels weigh anchor and proceed to sea until the weather moderates.

Advice about this type of local weather is also provided in nautical publications such as port entry guides and other information sources that are generally available to the masters of ships. The guidance includes warnings that anchors may drag and ships can have difficulty in weighing their anchors as they roll and pitch in the heavy swells.

1.2.3 Hunter Valley Coal Chain

The term Hunter Valley Coal Chain (coal chain) refers to all the stages of mining, transporting, stockpiling and loading coal onto ships in Newcastle.

There are 17 producers who mine 80 different grades or types of coal from 40 mines in the Hunter Valley. Railways transport more than 99 per cent of the coal to Newcastle where, presently, approximately 1000 ships are loaded every year. Coal chain logistics are complex and delays at any stage can quickly impact on the entire process.

In 2003, the Hunter Valley Coal Chain Logistics Team (HVCCLT) was created to maximise coal chain throughput. Team members include the railway companies, NPC and Port Waratah Coal Services (PWCS), which operates both coal loading terminals in Newcastle. Daily planning by the team coordinates ship berthing, coal stockpiling and train sequencing to maximise throughput with an aim to achieve the declared coal chain capacity, which was 93.5 million tonnes for 2007. The team's long term planning includes provision for future coal chain infrastructure to increase capacity.

In recent years, the worldwide demand for coal and its increasing price has resulted in individual producers attempting to export more coal. Consequently, the total quantity of coal sold has exceeded the coal chain capacity. The ships chartered to load coal already sold by the producers arrive off Newcastle and wait their turn for loading. In early 2004, the queue increased to about 50 ships.

At that time, PWCS, which was owned by several industry participants including a number of coal producers, applied, at the producers' request, for necessary authorisation for a capacity allocation system in an attempt to reduce and manage the substantial ship queue. The general objective was to protect Newcastle's

¹² The distance over which the wind blows constantly and uninterrupted over the sea.

international reputation and reduce costs to the industry by sharing coal chain capacity proportionally amongst the producers.

In April 2004, a capacity allocation system, authorised by the ACCC¹³, was introduced. Such a system, operating under different names, has been in place, intermittently, since then. When an allocation system is in place, periodical coal demand nominations from producers and declared coal chain capacity are used to calculate the pro-rata reduction to each producer's nomination. In simple terms, if the coal chain capacity is, for example, 90 per cent of the total of the forecast demand, then a reduction of 10 per cent is applied to each producer's nomination. The quantity of coal sold, therefore, is intended to match the coal chain capacity and result in only the necessary number of ships arriving to load.

A capacity allocation system lapses when the authorised time period is completed or a system is 'voted off' by a majority of coal producers. Once a system lapses, re-application for authorisation must be made.

In September 2006, producers voted off the capacity allocation system in place at the time. Depending on individual circumstances, some producers believed that the allocation system was disadvantageous as it reduced their profits. Some of the other producers considered that the system was unnecessary because the queue had reduced to 20 ships.

In early 2007, the queue was, once again, more than 50 ships when PWCS, at the request of a number of coal producers, re-applied for another capacity allocation system. In March 2007, when authorisation for the system was obtained, the number of ships waiting at anchor off Newcastle exceeded 60. The queue persisted and, at the time of the incident, there were 57 ships in the anchorage.

1.3 The incident

At 0605 on 23 May 2007, *Pasha Bulker* arrived off Newcastle after a 12 day voyage from Japan. The 22 000 tonnes of water ballast on board was sufficient for good weather and all of the ship's water ballast tanks, except the fore and aft peak tanks, were full. All of its cargo holds were empty in readiness to load coal. The ship had sailed from Japan in a similar condition and completed a ballast water exchange, in accordance with Australian quarantine requirements, during the voyage. It had draughts of 4.85 m forward and 7.10 m aft, which was slightly less than the 7.17 m aft draught necessary to keep the propeller blades fully submerged, at the top of their rotation, in still water. The ship had on board 760 tonnes of fuel oil and much smaller quantities of diesel and other oils to operate its machinery.

At the time, there were 57 ships in the anchorage and *Pasha Bulker* was scheduled to berth on 12 June. Newcastle VTIC provided the standard advice for the ship to anchor south of 32°58'S and at least two miles from the coast. The master identified a vacant position in the congested anchorage, about five miles south of Nobbys Head, and manoeuvred the ship towards it.

13 The Australian Competition and Consumer Commission (ACCC) administers the *Trade Practices Act 1974* and other acts and is responsible for regulating and promoting competition and fair trade in the market place to benefit consumers, business and the community.

At 0742, *Pasha Bulker*'s starboard anchor was let go in position 32°59.7'S 151°47.0'E (Figure 3). The ship was 2.4 miles from the coast and the nearest anchored ship was about one mile away. Given the water depth of 35 m, the master deployed nine shackles of anchor cable. The weather was good with a moderate breeze, partly cloudy sky and the forecast for the next few days was also good.

Over the next two weeks, the good weather continued and *Pasha Bulker*'s crew carried on with their routine duties. A mate was on duty on the bridge at all times to keep an anchor watch. The near new ship had no machinery overhauls due or any repairs to complete. The crew were mainly involved with cleaning, cosmetic maintenance and routine inspections.

On 6 June, the BoM issued a strong wind warning (Appendix D, Wind warnings) for the area off Newcastle. An area of low pressure (low) was forecast to develop off the NSW mid-north coast on 7 June. As expected, the low developed off Coffs Harbour (Figure 2) and, in the early hours of 7 June, the BoM issued a gale warning.

At the Newcastle anchorage, it began to rain and the wind became south-southeasterly and increased to force five (Appendix D, Beaufort wind scale). Scheduled BoM coastal weather reports, including a gale warning, were broadcast by coast radio stations via VHF radio. These reports were, as usual, also promulgated via Inmarsat-C for automatic reception by ships.

The number of ships at anchor in the previous fortnight had been nearly constant as more ships arrived and replaced those that had loaded and sailed from Newcastle. About two miles south of *Pasha Bulker*, another bulk carrier, *Sea Confidence*, was anchored (Figure 3). This smaller ship has a summer deadweight of 52 300 tonnes, was built in 2005 and registered in Panama.

In the late morning of 7 June, *Betis* arrived off Newcastle. The ship, of the same hull design and size as *Pasha Bulker*, was built in 2004 and registered in Hong Kong. At 1050, *Betis* anchored about two miles south of *Sea Confidence*.

Pasha Bulker's master noted the deteriorating weather and the forecast and at 1145, he had additional anchor cable veered to have 11 shackles on deck (10 in the water). *Betis*'s master had deployed nine shackles in the water on its port anchor and *Sea Confidence* was riding to its starboard anchor with six shackles in the water. Both of these ships, like *Pasha Bulker*, were not in a heavy weather ballast condition.

At 1210, *Pasha Bulker*'s Inmarsat-C terminal printed the following weather report:

SECURITE

HIGH SEAS WEATHER WARNING FOR METAREA 10 ISSUED BY THE
AUSTRALIAN BUREAU OF METEOROLOGY, SYDNEY

0203UTC 7 JUNE 2007

GALE WARNING FOR THE SOUTHEASTERN AREA.

Please be aware:

Wind gusts may be a further 40 per cent stronger than the average given here, and maximum waves may be up to twice the height.

SITUATION

LOW 1010 HPA NEAR 32S 153.5E IS EXPECTED TO DEEPEN AND DRIFT SLOWLY SOUTHWARDS AND EXPECTED NEAR 33S 152E AT 080600UTC AND NEAR 34S 152E AT 081800UTC.

AREA AFFECTED

32S 153E TO 33S 157E TO 35S 156E TO 36S 151E TO 32S 153E

FORECAST

E/SE WINDS 30/40 KNOTS SOUTH OF LOW REACHING 40/45 KNOTS AT TIMES AFTER ABOUT 071800UTC. GALE WINDS EXPECTED NORTH OF 34S TODAY, EXTENDING SOUTH OF 34S AFTER 071500UTC. SEAS RISING TO VERY ROUGH TO HIGH. MODERATE SWELL RISING TO HEAVY ON FRIDAY.

REMARKS

WEATHER SYDNEY

07-06-07 02:10

The low was forecast to deepen and expected near 33°S 152°E, a position about 10 miles off Newcastle, at 1600 on 8 June. Gale force winds were forecast for 7 June and expected to reach their maximum after about 0400 on 8 June with worsening sea and swell conditions (Appendix D, Sea and swell).

During the afternoon, *Pasha Bulker's* master discussed the weather with the chief engineer. They decided to keep the engine room attended at all times with the main engine ready for use at short notice. The overcast, rainy conditions with the south-easterly force five wind persisted. Weather reports issued by BoM continued to repeat the gale warning.

At 1700 on 7 June, the first of the 57 ships in the anchorage weighed anchor and headed for open sea.

After 1900, the VTIC duty officer became increasingly busy with communications. There were delays to the shipping schedule, some related to the deteriorating weather. By 2200, a further five ships had reported their departure from the anchorage to VTIC. The rain continued and the wind had increased to 25 knots.

Pasha Bulker's master anticipated being busy during the night and he slept for an hour in the afternoon. In the evening, he had another hour of sleep. He woke shortly before 2300, checked the weather and wrote his night orders. They included an instruction for the duty mate to check the ship's position every 15 minutes and to make hourly wind condition reports to the master in his cabin, where he would remain awake.

At 2335, a ship sailed from Newcastle and its pilot called VTIC for a check of the wave rider buoy readouts. He was advised that the sea and swell conditions were 3.14 m and 4.52 m respectively from the southeast. Soon after, the scheduled sailing of another ship was cancelled by VTIC. The berthing of the ship replacing it was also cancelled due to 'unfavourable harbour entrance conditions'. The ship was one of two that were underway off the pilot boarding ground waiting to berth. The master of this ship then decided not to re-anchor and put to sea.

At 0006 on 8 June, VTIC advised the master of one of the 49 ships remaining in the anchorage that it 'appeared to be dragging its anchor'. The ship was the first to drag and, subsequently, it weighed anchor and put to sea. The wind at Nobbys Head was gusting to 30 knots (Figure 4). In the previous two hours, the wind direction had become constant from the southeast, the wave heights had steadily increased (Figure 5) and the rain had been persistent.

At about 0030, the pilot of the ship that had sailed from Newcastle earlier disembarked from it. He then boarded the remaining ship waiting at the pilot

boarding ground for its scheduled berthing and piloted the ship to its berth. Subsequently, all ship movements in and out of the port ceased.

Figure 4: Wind speed at Nobbys Head recorded at VTIC

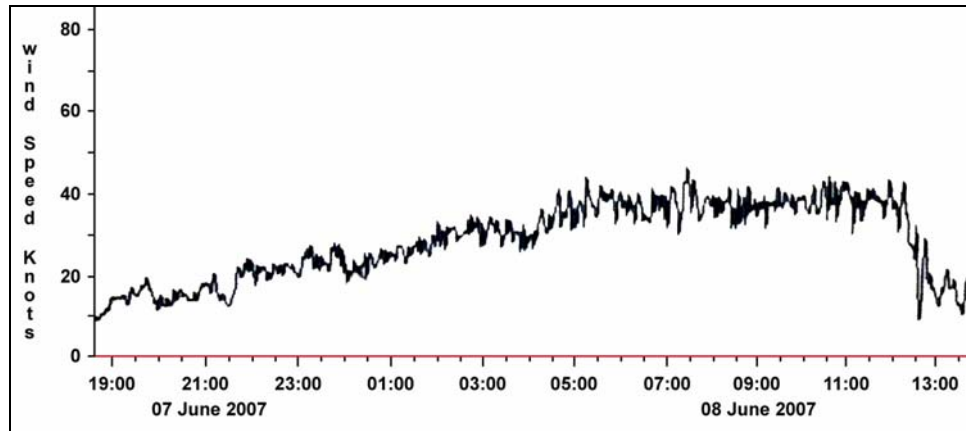
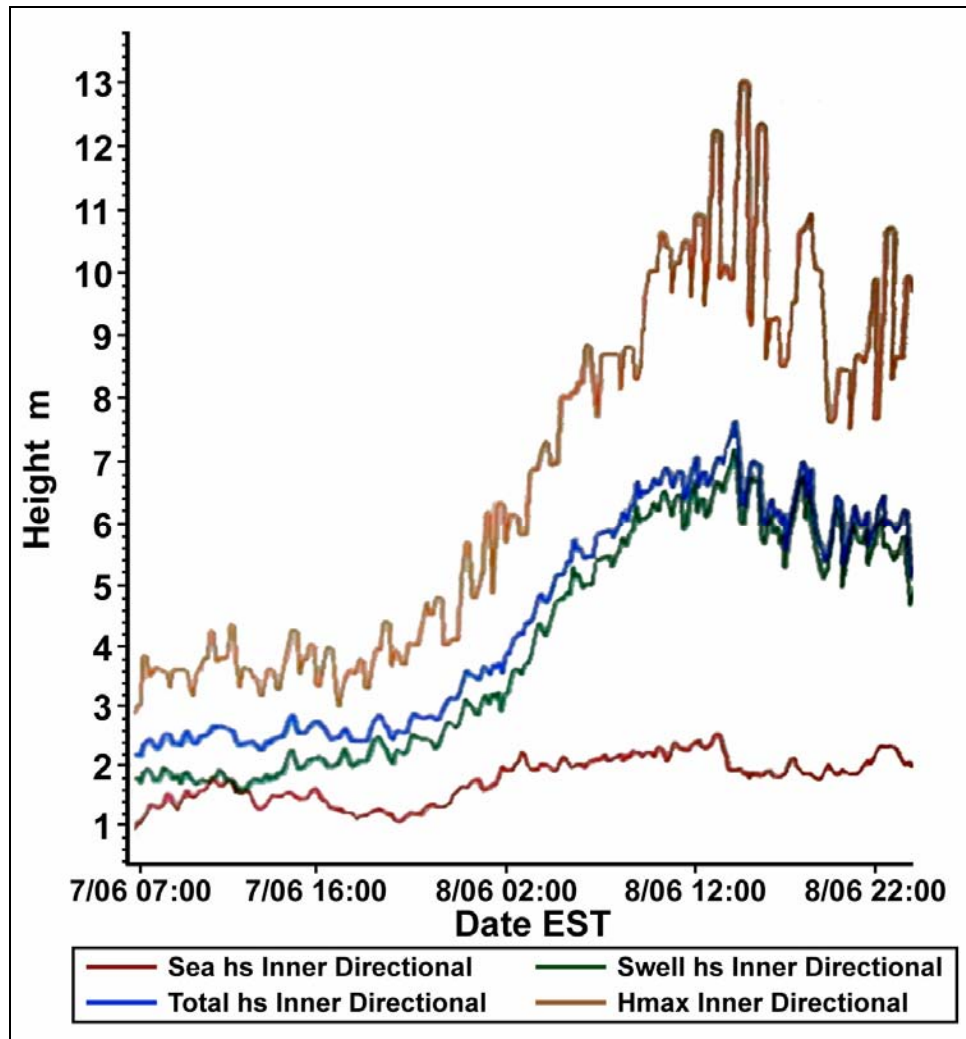


Figure 5: Wave heights at the inner wave rider buoy recorded at VTIC



At 0100, *Pasha Bulker*'s second mate recorded the wind as force eight. The ship was yawing¹⁴ through about 30° in the 35 knot gale force winds. The ship's barometer indicated 1006 hPa, a drop in pressure of 3 hPa during the previous three hours.

At about 0200, the main engine was placed on five minutes notice as required by the master's night orders. A short time later, the master checked and confirmed that the ship was maintaining its anchor position.

At 0230, the master of *Santa Isabel*, a ship scheduled to berth that morning, asked VTIC for 'permission' to weigh anchor and for berthing information. He was advised that the pilot boarding time for the ship was still scheduled for 0630.

By 0300, the wind at Nobbys Head was gusting to more than 35 knots. The maximum wave heights at the wave rider buoys were 6 m and rising. As the weather deteriorated, the VTIC duty officer was constantly communicating with ships dragging their anchors or getting underway.

Shortly before 0400, *Pasha Bulker*'s master again checked and confirmed that the ship was maintaining its anchor position.

At 0400, when the chief mate relieved the second mate on the bridge, he was advised that the master was in his cabin and aware of the weather conditions. The weather report received soon after indicated that the low was northeast of Newcastle and was expected to move south. The earlier forecast conditions, including the gale warning, were repeated.

At about 0430, the master briefly went to the bridge to check the anchor position. The chief mate informed him that there had been a great deal of radio traffic with a number of ships dragging their anchors and putting to sea.

At VTIC, the duty officer had become busier as some masters requested 'permission' to weigh anchor. Others were using their main engines to maintain their anchor positions. At 0448, a ship which had dragged its anchor and had closed to within two cables (370 m) of another anchored ship, finally got underway and manoeuvred clear.

At 0500, *Pasha Bulker*'s chief mate recorded the weather. The pressure had dropped a further 3 hPa and the wind was now force eight to nine. The range of the ship's yawing, which had become more rapid, had increased to 40°.

At that time, there were 41 ships remaining in the anchorage. *Sea Confidence* was weighing its anchor after it had started to drag. At 0530, the ship got underway and manoeuvred to depart the anchorage. The maximum wave height off the harbour entrance was now about 8 m and still rising.

The ship anchored closest to *Pasha Bulker* also started to drag its anchor. At 0550, when the ship was five cables (900 m) off, *Pasha Bulker*'s chief mate called its duty mate on the VHF radio to warn him about its anchor dragging. He then telephoned the master in his cabin and informed him. Soon after, the master arrived on the bridge and the chief mate advised him that the wind was force nine and that *Pasha Bulker*'s anchor position was 'good'. He also advised the master that about 20 ships had dragged their anchors and put to sea.

14 The ship's head swinging from one side to the other.

By 0600, only 27 ships remained and some of these were weighing anchor.

At that time, *Santa Isabel*'s master called VTIC. He reported that the ship had fouled its anchor on a discarded anchor cable and asked if the pilot boarding at 0630 for berthing had been cancelled. He was advised that berthing was 'unlikely'.

Pasha Bulker was yawing more rapidly through about 60° in the strong southeast gale force winds and, at 0625, the ship started to drag its anchor. At 0637, this became apparent to the chief mate and he informed the master that the ship had dragged 'a little'. The ship was 2.2 miles from the coast, two cables closer than it had been anchored.

Soon after, the master notified the chief engineer that he was preparing to weigh anchor. The master and the chief mate discussed the weather. The master noted that the wind speed was 50 knots and the mate advised that the weather should improve by 11 June. The mate remarked that ships had started dragging after 0200. The master told him that the 'holding power' of the anchors of old ships was not as good as the new *Pasha Bulker*. Shortly before 0700, the chief engineer telephoned the master from the engine room and confirmed that the main engine was ready.

At about this time, *Betis*'s master reported to VTIC that the windlass had failed while weighing anchor with seven shackles of cable still out and that he was using the engine to maintain the ship's position which was 3.1 miles from the coast.

At VTIC, the duty officer for the next shift took over. He was advised that most of the ships had departed the anchorage. At 0701, he received a call from *Pasha Bulker*'s chief mate requesting 'permission' to weigh anchor and advised the chief mate to call again when the anchor was aweigh. The ship was one of the 19 that remained anchored. The wind at Nobbys Head was southeast at 45 knots and the maximum wave height off the harbour entrance was about 9 m.

After reporting to VTIC, *Pasha Bulker*'s chief mate handed over the watch to the third mate and went forward to weigh anchor. At 0710, as the crew started to weigh anchor, the ship was 1.9 miles from the coast.

Pasha Bulker continued yawing through 60° and it was also pitching and rolling. As the anchor cable was heaved in, its tension and lead, or relative direction, changed constantly. The master used the engine frequently, both ahead and astern, together with several hard-over rudder movements as the cable's tension and lead varied.

The chief engineer, as was usual for him, operated the main engine from the engine control room where an engineer responded to the engine telegraph orders from the bridge and manually controlled the engine speed. The ship was in 'hand steering' mode with an able seaman on duty as helmsman.

Pasha Bulker moved towards the coast in a north-westerly direction as the anchor was being weighed. At 0735, with five shackles of cable in the water, the ship's heading became north-easterly. With the wind on its starboard beam and the cable shortening, the ship began moving rapidly northwards. It also began to roll heavily and unsecured items on the bridge moved and fell to the deck.

At 0748, the anchor was reported to be aweigh. The ship was now only 1.2 miles from the coast and its distance off was decreasing as it moved northwards at 3.1 knots. Soon after, the master ordered the anchor to be secured and the crew to then

return aft. He ordered a ship's heading¹⁵ of 060° to be steered and full ahead manoeuvring speed on the main engine.

At VTIC, the day officer on duty had arrived. He was advised that *Pasha Bulker* had reported being underway and he noted, with surprise, that there were some ships still at anchor. Of the 11 ships remaining, two were weighing anchor.

At 0756, when the crew were clear of the main deck after securing the anchor on the forecastle, *Pasha Bulker* was nine cables from the coast. The ship's heading was then progressively turned to starboard away from the coast with the master giving the helmsman courses to steer by ordering gyro compass headings.

At 0805, when the ship's heading had been steadied on 110°, the helmsman's routine change of watch was completed. The south-easterly wind was 30° on the starboard bow with the ship's course and speed made good being 080° (T) at 4.1 knots. The distance from the coast had increased to one mile. The main engine was set at 67 rpm in response to the full ahead manoeuvring speed order but its speed was fluctuating between 60 and 75 rpm as the propeller frequently broke out of the water as the lightly ballasted ship pitched and rolled.

Many of the ships that had weighed anchor in the previous few hours were still in the area. There were frequent collision avoidance related communications between these ships on the VHF radio. The visibility was about two miles in the persistent rain and spray in the wind which was gusting to about 50 knots.

At about 0809, while VTIC was confirming with the master of a ship if it was still at anchor, *Pasha Bulker's* master asked the third mate if the harbour was closed. The third mate, after some hesitation, replied that it was closed.

Pasha Bulker did not communicate with any other ships and none presented it with a risk of collision. *Sea Confidence*, the nearest ship underway, was about 1.5 miles off and also making good a north-easterly course.

At 0810, *Pasha Bulker's* engine speed was reduced to slow ahead following a request from the engine room. The master ordered a gyro heading of 120°. At the reduced speed, the helmsman could not, even with full starboard rudder, prevent the ship's head from falling away from the wind to port and to the north. The speed made good decreased to 2.5 knots before the engine speed was increased again.

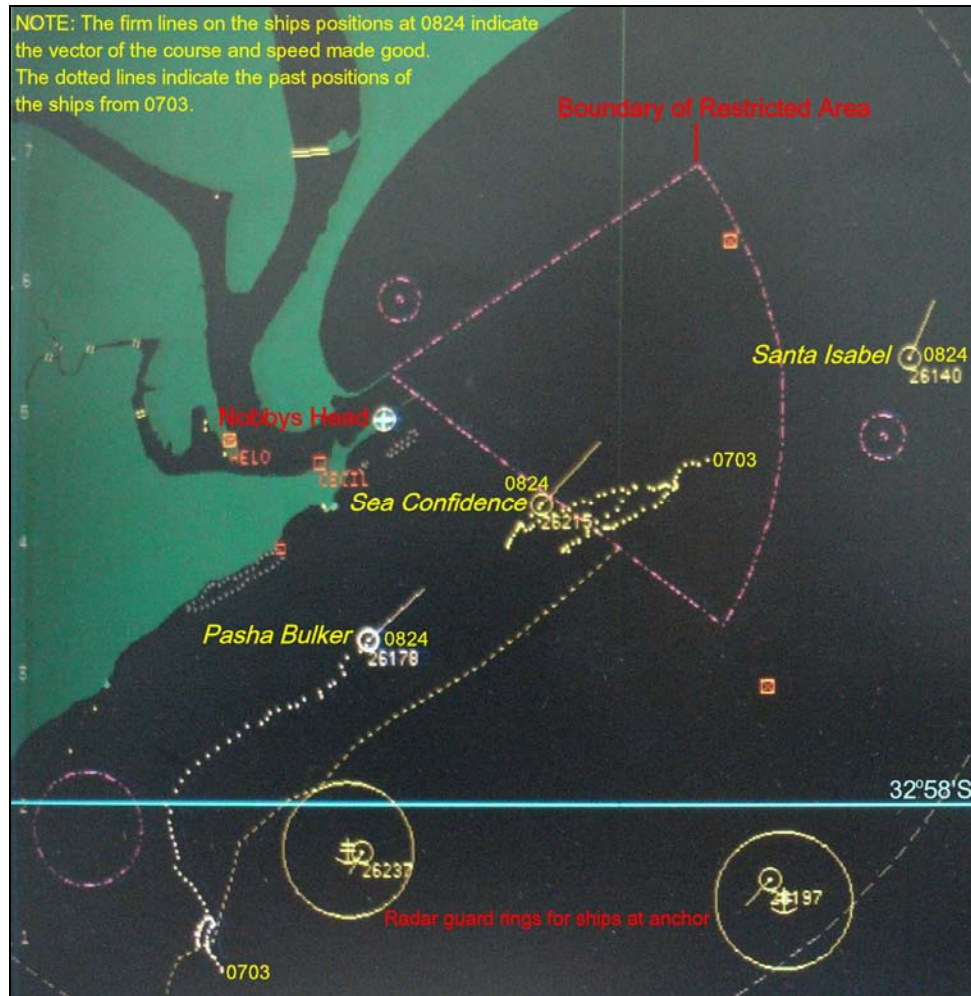
By 0817, the engine was again at full ahead manoeuvring speed. The ship's heading, which had swung to 080°, began to return to 120°. The coast was, once again, less than one mile away.

At 0820, *Pasha Bulker* was making good a course of 050° (T) at 3.5 knots. The chief mate, after his breakfast, had come up to the bridge in case he was required. The master remarked to him that the sea was very rough and that ships may have serious problems weighing anchor.

Soon after 0824, VTIC informed the master of *Sea Confidence* that the ship was inside the restricted area off the port entrance and requested that, if possible, it should keep clear of the area (Figure 6). The master replied that the ship was light, not steering well and taking on more ballast to improve its condition.

¹⁵ All ship's headings in the report are in degrees by gyro compass with negligible error.

Figure 6: Section of VTIC radar screen at 0824 with relevant notations



Pasha Bulker's master listened to the conversation and remarked to the chief mate that his 'own ship's GM¹⁶ was good with no slack¹⁷ tanks'. The ship's ballast condition had remained unchanged since its arrival. The aft peak tank was empty, the fore peak tank one-quarter full and the other water ballast tanks were full.

At 0826, the master ordered a course change to a heading of 140°. After the ship was steadied on this heading, he called the chief engineer and spoke about having breakfast. He then left, leaving the chief mate and the third mate on the bridge.

The helmsman kept the ship's heading between 130° and 140°. The wind was fine on the starboard bow. At 0830, the ship was making good 080° (T) at 2.5 knots and its distance from the coast was 1.2 miles and increasing. The two mates spoke about the rough weather and listened to the frequent VHF radio communications.

At VTIC, both duty officers were busy with communications. At about 0830, the harbour master ordered the 'incident control system' activated so that appropriate internal notifications could be made. The duty pilot was present at VTIC to provide advice to the duty officers, if required.

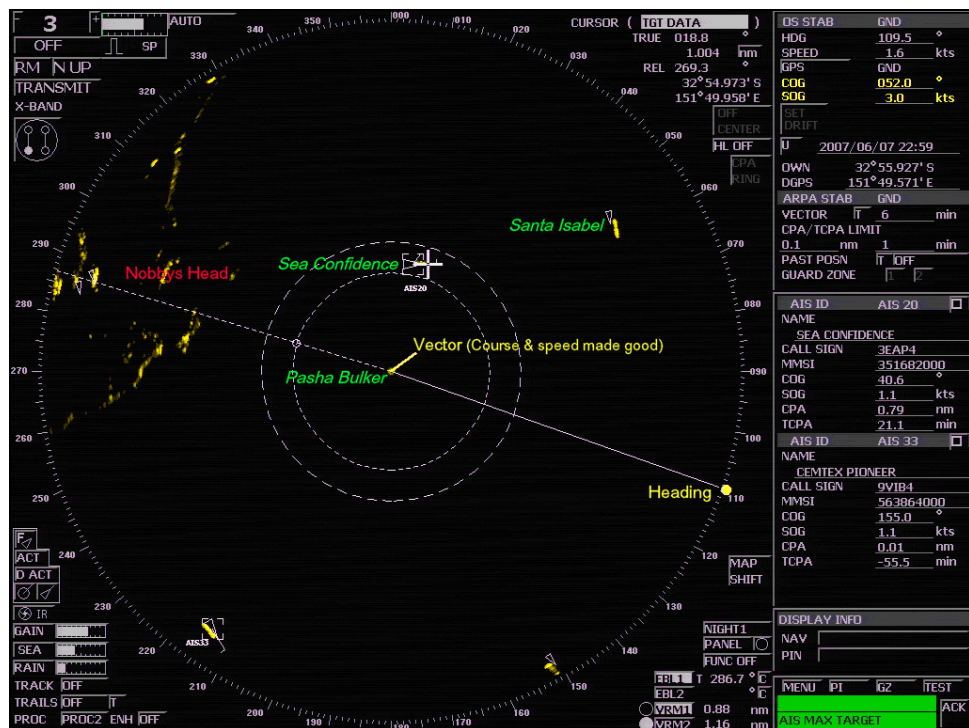
¹⁶ Refers to metacentric height, one of the measures used to determine a ship's stability.

¹⁷ Refers to tanks which are partly full resulting in free surface effect which reduces a ship's stability.

At 0844, *Pasha Bulker*'s master returned to the bridge with the chief engineer. The ship's heading was 125° and slowly falling away from the storm force wind, now gusting to 55 knots. The two men talked about the weather and the master observed that the ship was not turning to starboard even with the maximum 35° rudder that was being applied.

Sea Confidence had turned around in the restricted area at about 0850 and was now making good a south-easterly course. *Pasha Bulker*'s radar indicated that the ship would pass clear on the port side. At 0858, when *Sea Confidence* was one mile away on *Pasha Bulker*'s port beam, it turned again and its distance off began to open as the ship started making good a north-easterly course (Figure 7).

Figure 7: *Pasha Bulker*'s radar screen at 0859

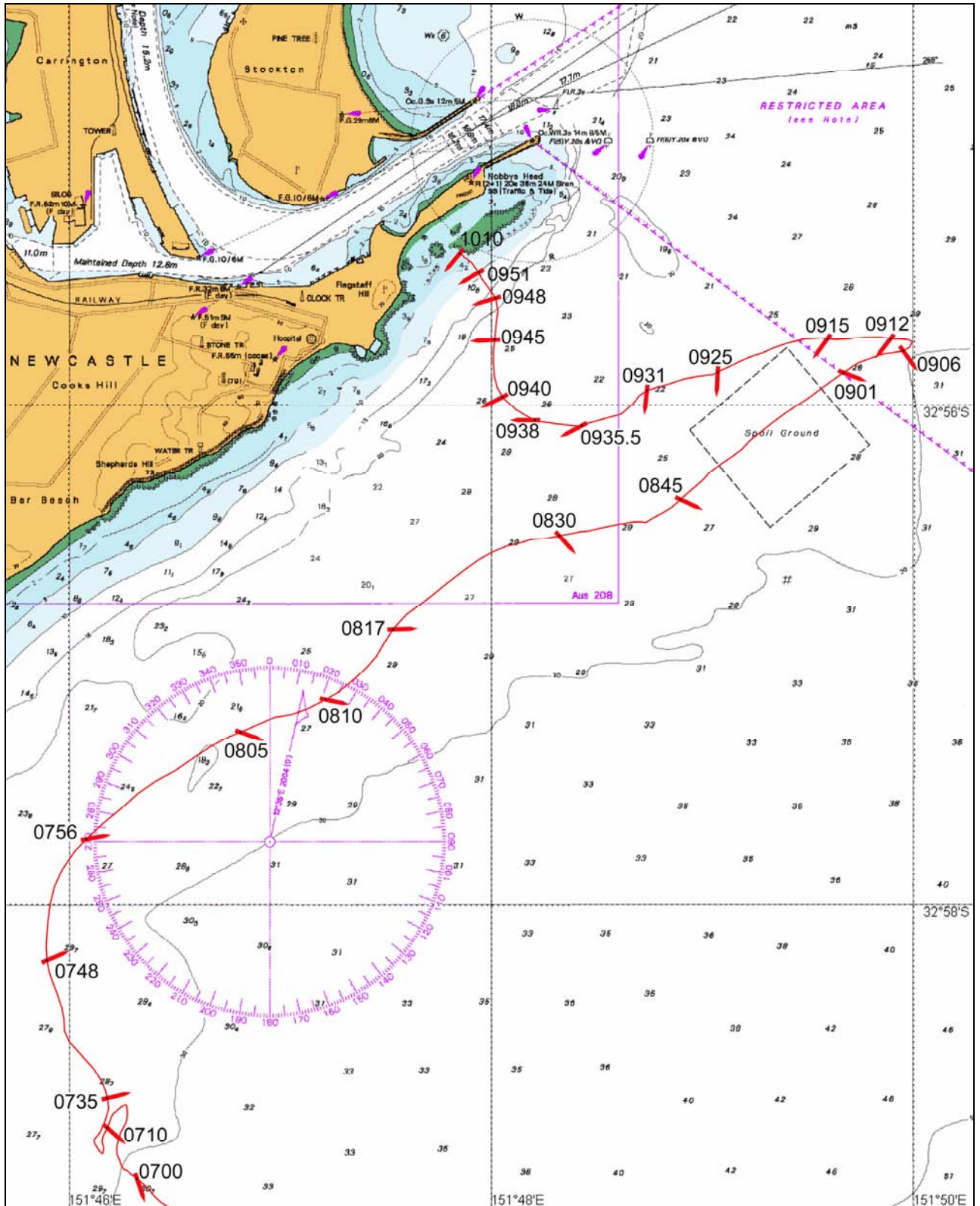


At this time, VTIC provided ships in the area with information about the prevailing weather conditions via VHF radio. The maximum height of the southeast swell outside the harbour entrance was 10.72 m. Some of the nine ships remaining at anchor prepared to get underway.

Pasha Bulker's master and chief engineer continued to discuss the weather, engine speed and the ship's heading. At 0900, the ship's heading was 110° when the chief engineer telephoned the duty engineer and told him to increase the engine speed by five or, if possible, ten rpm.

At 0901, *Pasha Bulker* entered the restricted area making good 050° (T) at 3.6 knots (Figure 8). As the engine speed increased, the ship responded to the starboard rudder that the helmsman was applying to return to the last ordered ship's heading of 140°. The master observed that the ship was turning and advised the chief engineer that the speed increase, five rpm, was sufficient. The engine speed was then set at 72 rpm.

Figure 8: Section of navigational chart Aus 207 indicating *Pasha Bulker's* track on 8 June 2007. Images (to scale) of the ship, aligned to its heading at various positions, have been superimposed on its track



At 0906, just as the ship's heading returned to 140°, the master ordered it to 160°. In response, the helmsman applied nearly full starboard rudder and the ship's head started to swing rapidly to starboard. The wind which had been ahead was now on the port bow. At the time, the master remarked to the chief engineer that a ship's heading of 140° was 'face to face' with the wind and 'not good'.

As the ship's heading approached 160°, the helmsman put the rudder amidships then gradually applied port rudder as the ship continued to turn. By 0908, the ship's heading was 180° and still turning to starboard with the rudder 27° to port.

At 0909, with the ship's heading at 200° and the rudder hard-over to port, the helmsman informed the master that the ship was still turning to starboard. The master told him that he should 'take action quickly' when steering. The ship's course made good had now become westerly, towards the coast.

At 0910, VTIC informed *Santa Isabel*'s master that the ship was approaching the restricted area which it should clear if it was safe to do so. The ship's master was also advised that *Sea Confidence* nearby was experiencing difficulties. *Santa Isabel*'s master advised VTIC that the cable fouling his ship's anchor would need to be cut to clear it. *Pasha Bulker*'s master heard this communication and remarked that both of these ships were not close to *Pasha Bulker*.

At 0912, VTIC informed *Pasha Bulker*'s master that the ship should leave the restricted area and go to sea. The master thanked VTIC saying that he was 'proceeding to sea' and 'don't worry'. On its 220° heading, the ship was rolling heavily, beam-on to the large swell and the wind and it began to approach the coast at more than 2.5 knots.

From his cabin's porthole on the ship's starboard side, the second mate could see the coast. He had been unable to sleep since earlier that morning because of the heavy rolling. When the ship got underway, he had, briefly, been on the bridge and knew the ship was headed to sea. He did not understand why the coast was now on the ship's starboard side so he went up to the bridge.

At 0915, the ship's heading was still south-westerly and it was making good a westerly course at 3.7 knots towards Nobbys Beach, which was only 1.2 miles away. The master asked for an increase of engine speed and the chief engineer then left the bridge and went to the engine room to oversee engine room operations.

As the engine speed was gradually increased to 77 rpm, the ship's head finally swung to port with the maximum port rudder being applied. At 0923, the ship's heading was approaching 180° when the helmsman reduced the rudder applied to 23° for a few seconds. The swing to port stopped and he immediately put the rudder hard-over to port again.

By 0925, the ship's head was turning slowly to starboard despite the maximum port rudder being applied and the engine speed at 80 rpm. The wind, at times, was now gusting to more than 55 knots. The master telephoned the chief engineer and asked for maximum possible engine speed.

At 0927, VTIC called *Pasha Bulker*'s master to advise that the ship was getting closer to the coast and asked if any assistance was required. The master declined assistance, stating that in 'about 10 minutes' the situation should improve.

As the engine speed increased, the ship's heading, which had reached 205°, started to return slowly to port. At 0931, the ship's heading was 185° with the main engine at 91 rpm and Nobbys Beach was eight cables (about 1500 m) away. One of the

mates suggested to the master that 'if it was so difficult' he should ask for assistance. The master replied that a turn to starboard may be better. He then ordered the rudder 'midships' followed by 'starboard 20' and 'hard-a-starboard'.

By 0932, maximum starboard rudder had been applied and the ship began turning to starboard. At 0935, *Pasha Bulker* was on a heading of 240° but making good about 270° (T) at 5.5 knots. At 94 rpm, the engine speed continued to fluctuate as the propeller immersion changed constantly with the ship's movement in the heavy swell as it inexorably approached the coast.

At 0935½, the engine raced to 115 rpm, its over-speed limit, and automatically shutdown. The chief engineer quickly restarted the engine and within a minute it was running ahead at 67 rpm. The ship's heading was 255° but the starboard turn had slowed. Just after 0937, the master stopped the engine and ordered full astern.

At 0938, Nobbys Beach was about seven cables (about 1300 m) away. The ship, on a heading of 270°, was approaching the beach at 5.6 knots with its engine at full astern.

At 0939, VTIC again offered *Pasha Bulker*'s master assistance and asked for all efforts to be made to clear the coast. The master declined assistance advising that the ship's heading was 270° and turning to starboard with the engine at full astern.

Soon after, the ship began to turn to port. At 0940, the ship's heading reached 240° before turning to starboard again. The ship, with the weather on its port beam, was approaching Nobbys Beach, five cables (about 900 m) away on the starboard beam, at 3.5 knots.

At the time, there were six ships remaining at anchor. Some of these were maintaining their position by using their engines. Two, including *Betis*, had windlass problems. VTIC began contacting the masters of each of the other four ships to advise them that the harbour master requested that they weigh anchor and go to sea.

At 0945, *Pasha Bulker* was near the 20 m depth contour with Nobbys Beach less than three cables (555 m) away on the starboard beam. The ship's head was 270° when the starboard turn slowed and it began to swing to port. The master told the third mate to call VTIC and ask for assistance.

At 0946, the third mate called VTIC while the duty officer had been communicating the harbour master's earlier request to the ships remaining at anchor. At 0947, VTIC responded to the call from *Pasha Bulker* and advised that tugs were being arranged. The third mate informed VTIC that the ship was 1.5 cables, just over a ship's length, from the shore. The master put the engine to full ahead with the rudder still hard-over to starboard but the ship's heading of 255° changed little.

Pasha Bulker was nearly on Nobbys Beach and approaching it at 3.1 knots. The master thought aloud that it might be better to go astern. At 0949, with the engine at full astern, he ordered 'hard-a-port'.

At 0951, *Pasha Bulker*, on a heading of 240°, grounded on Nobbys Beach in position 32°55.46'S 151°47.93'E. The ship's movement changed and dull thumping noises could be heard on the bridge as its momentum, and the weather on its port beam, carried it further onto the beach (Figure 9). One of the mates told the master that the ship had 'touched bottom'. The master stopped the engine and asked the mates to warn the crew and ask VTIC when the tugs would arrive.

Figure 9: *Pasha Bulker* seen from Nobbys Beach after grounding on 8 June



At 0952, the chief mate used the public address system to tell the crew to prepare their lifejackets and come up to the bridge. At 0953, the master put the engine to full astern while the third mate called VTIC.

The third mate informed VTIC that the ship had grounded and asked when the tugs would arrive. He was advised that a tug was being prepared and was asked if both the anchors were still in their hawse pipes¹⁸. The third mate confirmed that the anchors had not been deployed and that the engine was operating astern.

At 0955, the master heard the propeller making a ‘clanging’ sound. He stopped the engine and ordered full ahead but stopped it when he heard the clanging sound again. The ship had been moving sideways across the beach towards the rock ledges indicated on the chart. One of the mates confirmed with the master whether a crew evacuation could be requested and then advised VTIC that the ‘lifeboats cannot be lowered’ and requested an ‘immediate evacuation of crew’. A VTIC duty officer acknowledged that an ‘immediate evacuation of crew’ was requested.

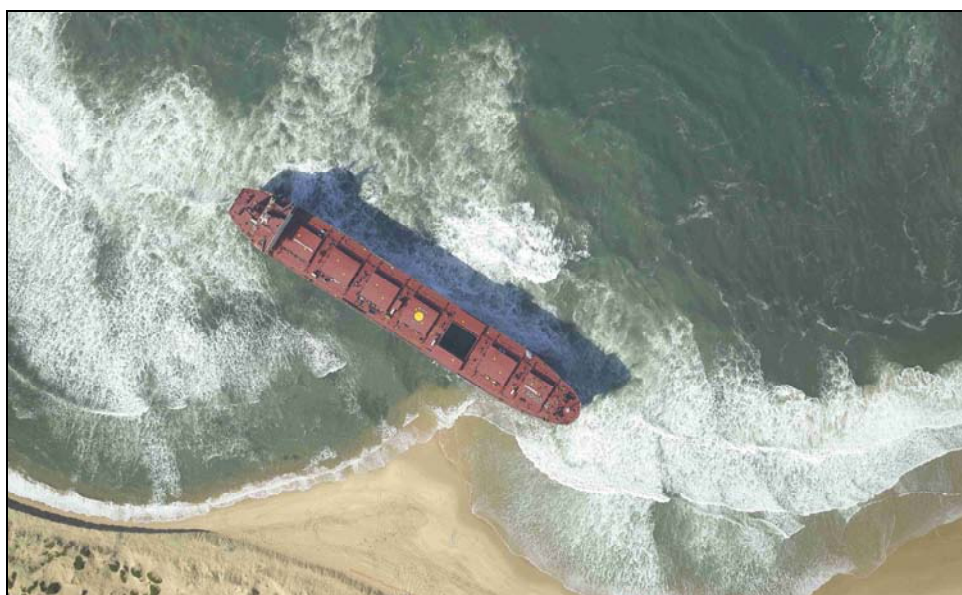
The master telephoned the chief engineer and told him that the ship had grounded (Figures 9 and 10). He asked for the main engine to be secured and for the engine room to be evacuated. He then told one of the mates to make another announcement for the crew to standby on the bridge for evacuation.

At 1000, the chief engineer was on the bridge when a large wave struck the ship making it shudder. He told the master that the ship was coming off the beach. The master replied that the ship was not moving and that he needed to inform the ship’s managers. The master then telephoned the ship’s managers in Japan advising them that the ship had grounded off Newcastle in ‘very rough weather’.

Wickham, one of the six tugs used in Newcastle for berthing and harbour towage, had been directed by VTIC to assist *Pasha Bulker*. The tug made its way toward the harbour entrance but was then directed not to leave the harbour due to the dangerous swell of more than 9 m outside the entrance.

¹⁸ A pipe leading from the forecastle head to the outside of the ship’s hull, through which the anchor chain passes.

Figure 10: An aerial view of *Pasha Bulker* aground on Nobbys Beach



Pasha Bulker's fuel oil tanks had not been breached. A small quantity of oil had escaped from a fuel tank air vent pipe onto the deck but no pollution in the water was observed. Newcastle VTIC called on the VHF radio and obtained a variety of information including the quantity and disposition of fuel and other oils on board the ship. The centre had also been communicating with other authorities, including the local police who had enquired about the number of ship's crew to arrange a rescue helicopter for an evacuation.

Later that morning, *Pasha Bulker*'s managers and operator entered into a Lloyd's Standard Form of Salvage Agreement (LOF 2000) with Svitzer Salvage (Svitzer).

At 1150, a rescue helicopter made its first trip to the ship to evacuate *Pasha Bulker*'s crew. The master had arranged for the collection of necessary documents and information including the data card from the ship's voyage data recorder.

Communications between VTIC and the remaining ships off the port continued. *Santa Isabel* cleared its fouled anchor and put to sea. *Sea Confidence* was manoeuvring off Stockton Beach, north of the harbour entrance. Another ship's windlass had failed while weighing anchor, and including *Betis*, there were now three ships unable to weigh their anchors. *Betis*, being much closer to the coast than the other two, was of more immediate concern.

At 1200, *Betis* was 2.8 miles from the coast and dragging its anchor in winds gusting to 60 knots. A short time later, the ship's master asked VTIC for tug assistance.

At 1205, *Sea Confidence* was less than one mile from Stockton Beach when the master let go its port anchor. At 1240, the ship was five cables from the 5 m depth contour off the beach when its starboard anchor was also let go. The anchors and the engine were used to prevent the ship from being driven ashore while the crew continued to fill the heavy weather ballast hold.

At 1315, the tug *Wickham* was able to depart the harbour to assist *Betis*. The tug *Watagan* prepared to depart to assist *Sea Confidence*, which was now about five cables from Stockton Beach. Tug assistance was offered to the ship's master but he declined.

At 1330, after several trips by the rescue helicopter, all of *Pasha Bulker*'s crew had been safely winched off the ship.

At 1400, with the weather moderating, *Betis*'s master cancelled his request for tug assistance. The tug *Wickham* then returned to the harbour.

Sea Confidence's anchor cables had fouled each other and the ship had not been able to move further off the coast. At 1413, the chief executive of NSW Maritime exercised his powers as the state's marine pollution controller and, through Newcastle VTIC, directed the master to accept tug assistance. The tug *Watagan* was dispatched to assist and by 1515, it was near the ship and attempting to connect a tow line.

Betis's master, noting that the weather was forecast to deteriorate again, obtained the ship's managers' approval to cut the anchor cable. At 1610, the cable was cut and the ship headed to sea. The master also began filling the ship's heavy weather ballast hold.

At 1640, *Watagan*'s master abandoned the unsuccessful attempts to connect a tow line to *Sea Confidence* and left the ship to return to the harbour. The tug was experiencing engine problems and two of its crew had been injured. While trying to connect a tow line, one crew member had suffered a crushed thumb while the other had mild concussion after being knocked down to the deck in the heavy weather.

At 1942, in improved weather conditions, *Sea Confidence*'s master started weighing the anchors. At 2006, the ship was underway and, having taken heavy weather ballast, successfully put to sea. The weather deteriorated subsequently and by the early hours of 9 June, there were gale to storm force winds with gusts of up to 66 knots.

At 0205 on 9 June, one of the two remaining ships with windlass problems cut its anchor cable and headed to sea. At 1236, the last ship to depart the anchorage also slipped its anchor cable.

At 1252, Svitzer personnel boarded *Pasha Bulker* by helicopter to begin salvage operations.

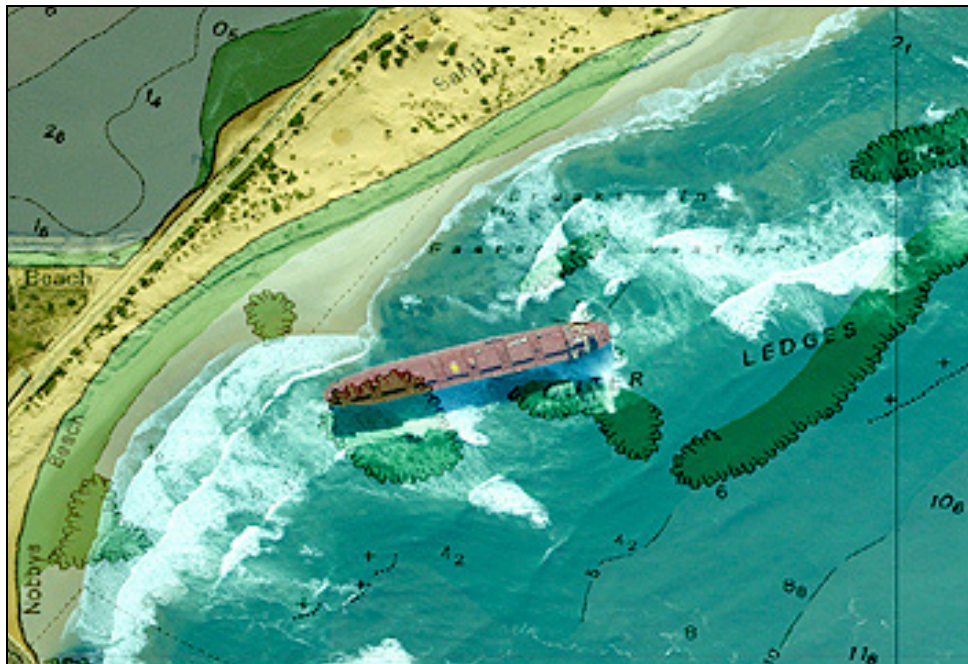
Newcastle anchorage remained vacant until the weather improved. On 11 June, ships began returning to the anchorage.

1.3.1 Salvaging *Pasha Bulker*

After the grounding, *Pasha Bulker* was pushed further onto Nobbys Beach by the heavy seas with the severe weather reaching its peak during the early hours of 9 June at about the same time as the high tide. The ship was heavily aground on the rock ledges on the beach (Figure 11).

Pasha Bulker was seriously damaged when it grounded and its condition continued to deteriorate while it remained on the beach. The main damage to the hull extended aft from number two cargo hold to the stern. The bottom plating was generally set up and heavily indented with many tears, splits and fractures. The largest was a gash about nine metres long and up to 25 cm wide under the number three cargo hold. Oil tanks in the double bottom were not breached and no oil was lost overboard. The rudder was badly damaged as was the propeller, with all of its blades bent.

Figure 11: A visualisation of *Pasha Bulker's* position on Nobbys Beach



The Australian Maritime Safety Authority (AMSA), in co-operation with NPC, local and state authorities, prepared to respond to any pollution from the ship. Pollution response personnel and equipment remained on standby while the ship remained aground on Nobbys Beach (Figure 12).

Figure 12: *Pasha Bulker* aground on Nobbys Beach



Refloating the ship was planned for the highest tides and most suitable weather and swell conditions to assist the operations. The plan included connecting three tugs to the ship using their towlines with another tug standing by. Three sets of ground tackle, anchors laid on the seabed, connected to the ship provided additional pull. On 28 and 29 June, the salvors succeeded in shifting the ship's bow slightly but the operations were suspended when several of the tugs' lines parted.

On 1 July, operations to refloat *Pasha Bulker* succeeded in swinging the bow through about 70° to port. The ship had been pivoted around on its stern and was pointing seawards. The operation was then suspended to wait for more suitable tide and swell conditions.

At 2138 on 2 July, *Pasha Bulker* was refloat. The ship, freed from the beach after 24 days, was then towed about 11 miles off Newcastle. Svitzer used divers to make a thorough assessment of the damage and the ship's condition. On 4 July, the ship was towed into Newcastle port (Figure 13) to carry out necessary temporary repairs before Svitzer could re-deliver the salvaged ship to its owners.

Figure 13: *Pasha Bulker* being towed into Newcastle



On 26 July, *Pasha Bulker* was towed out of Newcastle after the temporary repairs. Outside the port, a salvage tug took the ship in tow for its ocean passage to Vietnam, where permanent repairs were carried out.

On 25 March 2008, after being repaired, *Pasha Bulker* re-entered service with a different name and still managed and operated by Fukujin Kisen Company, Japan.

2.1 Evidence

From 9 to 12 June 2007, two investigators from the Australian Transport Safety Bureau (ATSB) collected relevant evidence.

The investigators attended the grounded *Pasha Bulker* and the offices of the legal representative of the ship's owners. The master, all three mates, helmsman and chief engineer were interviewed and provided their accounts of the incident. The data card from the ship's voyage data recorder (VDR) was obtained. Copies of log books, bell book, the engine movement logger, weather reports, ship's certificates, plans, stability information and other relevant documents were also collected.

At Newcastle Port Corporation (NPC), the harbour master was interviewed. At Newcastle Vessel Traffic Information Centre (VTIC), the three involved VTIC officers were interviewed. Copies of radar and weather monitoring records, events log, procedures and documents from the centre were also taken.

On 18 June, whilst *Sea Confidence* was berthed in Newcastle, the investigators interviewed the ship's master.

On 8 July, the master of *Betis* was also interviewed by the investigators after the ship had berthed in Newcastle.

On 23-24 August, the investigators obtained further relevant information through meetings and interviews with Port Waratah Coal Services (PWCS) staff, ships agents in Newcastle, NPC and its pilots.

During the course of the investigation, information was also obtained from several other sources including Svitzer Salvage.

Salvage operations to refloat *Pasha Bulker* were also attended by the ATSB.

During the investigation, the ATSB conducted a survey of the masters of ships in the Newcastle anchorage at the time of the incident. The results of the survey are included in the report (Appendix E).

On 19 December, at a meeting with ATSB investigators, further information was provided by NPC and PWCS staff.

2.2 Decisions made on board *Pasha Bulker*

The grounding of *Pasha Bulker* occurred in extreme weather conditions. However, there were a number of decisions that were made on board the ship from 7 June onwards which, in the circumstances and the weather, contributed significantly to its grounding.

2.2.1 At anchor

When the ship arrived off Newcastle on 23 May, *Pasha Bulker*'s master anchored the ship in a position consistent with the standard anchoring advice from VTIC. At the time, the weather was good, the ship's distance from the shore was more than

the recommended minimum and there was sufficient swinging room. The master did, therefore, consider some of the appropriate relevant factors when anchoring.

The passage plan for the voyage to Newcastle had been prepared by the second mate in the form prescribed by the ship's safety management system (SMS). The passage plan form required the necessary charts and publications to be listed. While the charts were listed, the Australia Pilot and other publications were not. The port information section in the plan provided general information about Newcastle but did not include any reference to the local weather. The master had not signed his approval of the plan and the chief mate had not acknowledged reading it.

The master had consulted the chart and stated at interview that the anchorage was 'good' with 'good holding ground'. He appears not to have sufficiently considered the risks due to the weather exposed location of the anchorage which is readily apparent from the chart. Neither was he aware of the guidance provided in the Australia Pilot or other publications on board the ship with regard to the Newcastle anchorage and the local weather.

On the morning of 7 June, the master noted the weather forecast and gale warning but apparently did not note the caveat in the forecast which stated that wind gusts could be 40 per cent stronger than the average wind speed forecast and that maximum waves could be twice as high as forecast. However, as a precaution, he veered additional anchor cable and confirmed that the main engine could be used at short notice. He also rested by sleeping for an hour each in the afternoon and the evening in anticipation of being awake during the night to monitor the weather.

The master believed that because *Pasha Bulker* was new, the anchor's holding power was particularly good and with 11 shackles of cable deployed, the anchor would hold in winds of up to 50 knots. Having not noted the caveat in the weather report, the forecast maximum wind was, according to him, only 45 knots. It is possible that the master's reference to the ship's anchor being 'new' related to its type, i.e. an Admiralty Class (AC) 14 anchor, a high holding power (HHP¹⁹) anchor, as opposed to a standard stockless anchor.

The ship's SMS required the master to specify limits with regard to, amongst other items, the wind, yawing and the ship's position and an anchor watch checklist to be completed by the mates. There were a number of errors in the checklists completed on 7-8 June, indicating that some items were not understood by either the master or the mates. However, the master had supplemented his instructions to the mates in his night order book. The master stated, at interview, that he believed it was 'best' to remain at anchor. The ship's SMS did not provide him with any specific guidance with regard to safely putting to sea in adverse weather or general guidance about the risks at a weather exposed anchorage.

The master was concerned about putting to sea because it might be difficult to manoeuvre in heavy weather. However, he did not consider taking additional ballast in number four cargo hold for the heavy weather that was forecast or filling the ship's fore and aft peak tanks. He believed that it was safer to remain at anchor and monitor the weather and the ship's position. He had no plan to depart the anchorage at any particular time or if the wind reached a particular speed. He had made an early decision to take no further action unless he was compelled to or in case the

19 An anchor defined as having a holding power at least twice that of an ordinary stockless anchor of the same weight.

anchor dragged. The decision was based on his inadequate understanding of anchor holding power, heavy weather ballast and the limitations of the Newcastle anchorage in adverse weather.

Not only had the master not carried out an appropriate risk assessment of any rigour, the situation in the anchorage predisposed him to confirmation bias²⁰. Very few of the other ships in the anchorage put to sea during the evening of 7 June and this probably reinforced, in the master's mind, his decision to stay at anchor. He assumed, incorrectly, that VTIC would, if necessary, instruct ships to put to sea and this expectation probably served to further confirm his own initial decision not to put to sea.

By 0100 on 8 June, the wind was at gale force and increasing. *Pasha Bulker's* yawing had increased. The sea and swell had increased and the atmospheric pressure had fallen markedly. The weather reports and gale warnings continued to confirm the deteriorating conditions and a number of ships started dragging their anchors. The situation was becoming significantly worse and the master appears to have ignored these warning signs further suggesting a confirmation bias.

By 0500, the wind was at strong gale force. During the next hour, the ship nearest to *Pasha Bulker* started dragging its anchor. Other ships were also getting underway and more than half of the ships in the anchorage had already departed. These events prompted *Pasha Bulker's* master to remain on the bridge but not to weigh anchor and put to sea at this point in time.

At 0625, *Pasha Bulker's* anchor, predictably, started to drag. It was only when the master was certain that the anchor was dragging that he decided to weigh it.

After 0710, as the anchor was weighed in the difficult conditions, the master's frequent use of the main engine and helm indicated that he took adequate measures to prevent damage to the windlass and other equipment. However, he appears to have not been concerned by the ship's progress towards the coast as the anchor dragged more rapidly when the cable shortened while it was being heaved in.

By this time, the master had been awake most of the night monitoring the weather. Clearly he was concerned, and as the weather deteriorated the difficulties and risks associated with weighing the anchor and clearing the coast increased. Rather than wait for the anchor to drag, the master should have taken the decision to leave the anchorage earlier. There was also a knock-on effect in that the master had had little sleep and hence his later actions and decisions may have been influenced to some degree by fatigue.

2.2.2 After getting underway

By the time *Pasha Bulker's* anchor was reported to be aweigh, the ship was 1.2 miles from the coast. The weather was severe and the master ordered the crew to secure the anchors. At 0756 on 8 June, when the crew had cleared the deck after securing the anchors, the ship was only nine cables from the coast.

The master appears to have been untroubled by the high risk situation his ship was now facing and it is possible that this overconfidence was related in some degree to

²⁰ Confirmation bias, in human factor terms, involves a person seeking information to confirm an expectation or assumption and rejecting that information which conflicts with an expectation.

his level of fatigue. He had decided to remain awake during the night to monitor the weather rather than defining limits, such as wind speed or time. Consequently, since waking up on the morning of 7 June, he had had only two hours of sleep in the 24 hours leading up to the time that the anchor was weighed. Therefore, it is likely that his ability to make appropriate decisions under stress was compromised.

At about 0809, the master asking the third mate if the harbour was closed indicates that he was uncertain about the status of the port and the situation off it. However, he turned the ship away from the coast, changing its heading from 060° to 120° through a series of 10° or 20° course alterations. To maintain steerage, the main engine speed was increased to manoeuvring full ahead although its speed fluctuated in the heavy sea conditions. At 0820, *Pasha Bulker* was making good a course of about 050° (T), indicating a leeway of 70°, but at least it was slowly moving away from the coast.

The master did note that *Sea Confidence* was in difficulty at the time and taking additional ballast. While he commented that the weather was ‘very rough’, his remark to the chief mate that *Pasha Bulker*’s GM was ‘good’ with no slack tanks indicates that he still believed that the ship was suitably ballasted. Not only had heavy ballast not been taken, taking additional ballast in the fore and aft peak tanks had also not been considered. The aft draught, slightly less than that required to fully submerge the propeller in still water, in particular could have been increased relatively easily by filling these tanks.

At 0826, the master ordered a course change to a gyro heading of 140°, probably to make better progress away from the coast (Figure 14). However, as soon as the ship was steadied on this heading, he left the bridge for breakfast. Under the circumstances, leaving the bridge without even confirming the effect of the course alteration suggests a lack of caution on the master’s part. It also indicates that he was not fully aware of the possible danger that the ship was in with a dangerous lee shore only about one mile off. He may have been coping with the situation by denying or rejecting information which conflicted with his expectations and decisions.

The chief mate and third mate were on the bridge during the 15 minutes the master was at breakfast. Only during this time was there any evidence that they were involved in monitoring the ship’s navigation. For the most part they merely watched as the events unfolded and had little input or interaction with the master other than responding to his orders.

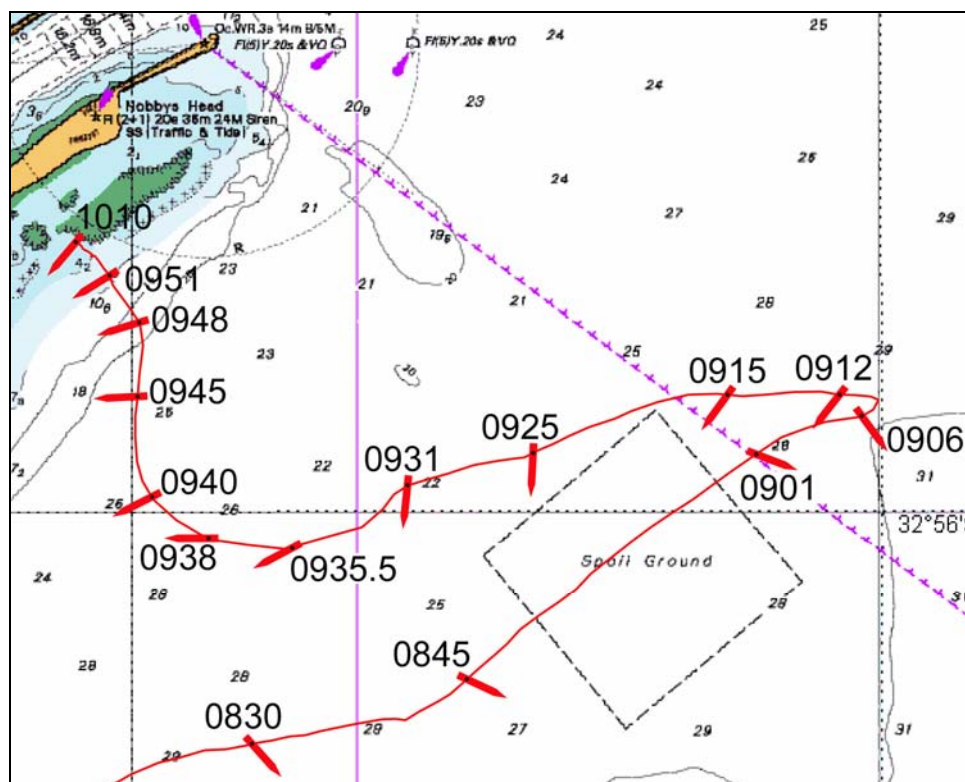
Shortly after returning to the bridge following breakfast, the master did become more concerned. The ship’s head had fallen away from the wind and was continuing to turn gradually to port. His conversation with the chief engineer during this period indicates some frustration with the situation, possibly a sign of anxiety.

By 0900, with the ship’s heading about 110°, the master was sufficiently alarmed to ask for an increase in engine speed. As soon as this had the desired effect, he appeared to relax, telling the chief engineer that a further increase in speed was unnecessary. The helmsman brought the ship back to a heading of 140° and the wind was ahead. Had this heading been maintained, *Pasha Bulker* would probably have cleared the coast in an easterly direction.

However, the master decided to put the wind on the port bow as he did not want the ship to make further leeway to the north. While the leeway earlier had been significant, he did not allow the ship to be steadied on a heading of 140° for long

enough and ascertain the effect of the changes of course and speed during the previous five minutes. The 30° change in the ship's heading and increased engine speed had, in fact, had a positive effect. At 0906, the ship was making good a course of 080° (T) at 2.5 knots when the master ordered a course change to a gyro heading of 160°.

Figure 14: Pasha Bulker's progress towards Nobbys Beach



The master told the chief engineer that he did not want the ship facing directly into the wind. A course change to a gyro heading of 160° at that time might have been a feasible alternative. However, it did involve bringing the ship's head 20° through the wind to put it on the port bow. The change should have been a carefully controlled manoeuvre, particularly in view of the earlier difficulties keeping the ship's head up to the wind. However, the master, probably encouraged by the improved control at the increased engine speed, once again gave the helmsman a course to steer rather than controlling the turn himself with rudder orders.

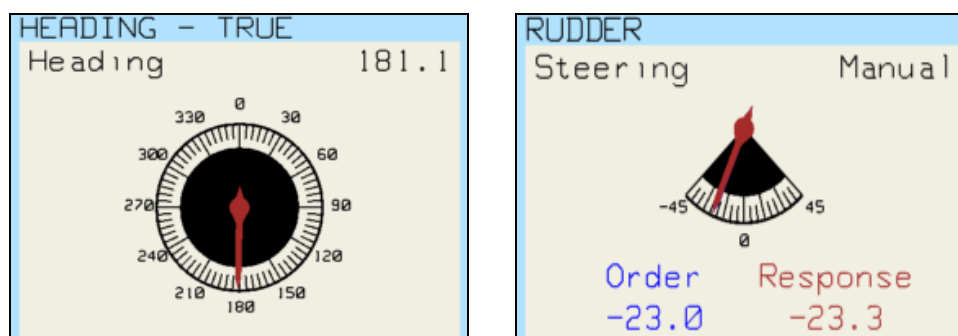
In response to the 160° order, the helmsman applied maximum starboard rudder and the ship's head went through the wind and rapidly to starboard. At 0909, after the ship's heading had gone well past 160°, the helmsman informed the master when he could no longer control the ship's heading even with maximum port rudder. In response, the master told him that he should 'take action quickly'. However, even then the master did not, as he should have, change the way he was conning the ship by either giving rudder orders, monitoring the helmsman's actions closely or delegating a mate to monitor the helm. The helmsman was probably steering to the best of his ability and may have been confused by the master's remark.

Soon after, when the ship was approaching the coast on a south-westerly heading, the master responded to a query from VTIC with 'don't worry'. However, he was now more concerned because, shortly thereafter, he asked the chief engineer to increase the engine speed further. Meanwhile, the helmsman continued to attempt

to return to a gyro heading of 160°, the last course he had been ordered to steer, by applying maximum port rudder.

The master was probably relieved as the ship's head started to swing to port when the engine speed increased. At 0923, the ship's heading was approaching 180° when the helmsman briefly reduced port rudder from hard-over to 23° (Figure 15). It is possible that he was keen to not overshoot the ordered gyro heading again after the master's earlier remark. The master probably did not observe the brief reduction of applied rudder. However, he became very concerned soon after when a swing to starboard developed and asked for the maximum engine speed possible.

Figure 15: Ship's heading and rudder angle at 0923 (VDR display)



At 0927, the master declined an offer of assistance by VTIC advising that the situation would improve after '10 minutes'. He was worried and completely focussed on turning the ship to port. It is likely that fatigue, anxiety and uncertainty were overloading him. This was probably aggravated by the fact that he had little effective support from the bridge team as indicated by the communications on the bridge. While the chief engineer had been on the bridge, the master had conversed with him at length. In comparison, his communication with bridge team members was minimal with no discussion about the situation at hand.

The mates on the bridge were not actively involved with the ship's navigation. One stood by the VHF radio and the other near the engine telegraph. No one was effectively monitoring either the helmsman's actions or the master's orders. After the second mate came up to the bridge, he stood near the chart table and the radars. The ship's position was plotted on the chart three times, the last time at 0840, and there were no entries made in the movement book from the time the anchor was aweigh until the grounding. However, the chart plotter was in use.

At 0931, the ship's heading was 185° and turning slowly to port. For the first time, one of the mates, apparently worried, suggested to the master that he should accept assistance. This possibly confused the master because he decided instead to turn the ship to starboard towards the lee shore. It is unlikely that he considered, or indeed had the time to consider, all of the risks involved. The master was overloaded and making ill-conceived decisions in a hurry, and possibly in panic, as the situation was getting further out of his control.

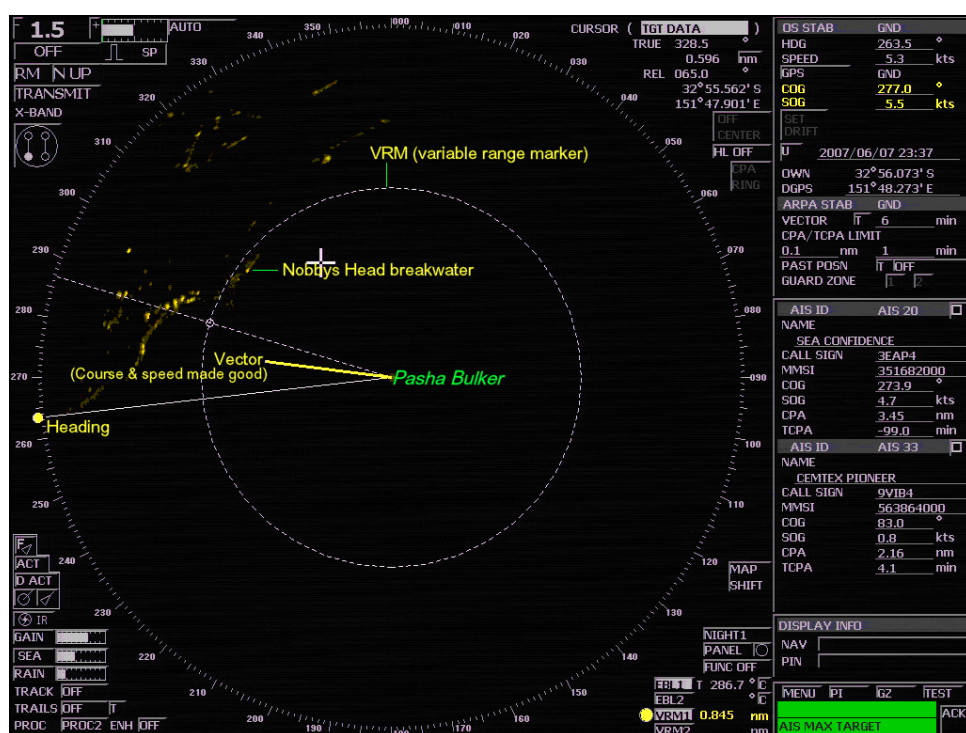
The starboard turn would involve, for a period of time, approaching the coast rapidly. It would also involve moving the ship's stern through the wind. At the time, Nobbys Beach was eight cables (about 1500 m) away and getting closer. The ship's manoeuvring characteristics indicate that, in calm weather, it could make a turn in less than four cables. However, in the extreme weather on a lee shore the attempted turn was a very high risk manoeuvre with little prospect of success.

No one on the bridge, at any time, discussed the emergency deployment of the anchors. It is unlikely that anyone considered using the anchors to turn the ship's head into the wind and thereby arrest or reduce its progress towards the coast.

When the master decided to turn to starboard, for the first time since the ship got underway, he gave rudder orders only because he could not order a course to steer. As the ship turned, it also closed on the coast rapidly. At 0935½, the engine shutdown almost certainly increased the master's anxiety and his speech, recorded by the VDR, started to sound distressed.

While the engine shutdown did not assist the turn, it is unlikely that it prevented the stern passing through the wind. The shutdown probably did bring to the master's attention that the ship was approaching Nobbys Beach, seven cables (about 1300 m) away, at 5.5 knots (Figure 16) because soon after he ordered the engine full astern.

Figure 16: Pasha Bulker's radar display at 0937



At 0939, the master declined another offer of assistance from VTIC. He advised that the ship was turning to starboard with the engine operating full astern. It is possible that he thought going astern would assist the starboard turn. However, neither the transverse thrust from the right-hand turning propeller nor the stern seeking the wind under sternway could realistically, in the circumstances, be expected to assist the manoeuvre. The ship's headway and the extreme weather made success very unlikely.

It was only after the ship's heading started to oscillate between 240° and 270° that the master realised that the starboard turn would not succeed. At 0945, the ship was rapidly approaching Nobbys Beach, less than three cables (555 m) away, and grounding was imminent. The master would have seen a view similar to that photographed from the ship's bridge on 11 June (Figure 17). The howling wind, driving rain, sea spray and the ship uncontrollably approaching the beach, would have made the unmanageable situation even more distressing for him. At 0946, he

decided to ask VTIC for assistance. However, it was far too late for any assistance to prevent the grounding.

Figure 17: Newcastle seen from *Pasha Bulker's* bridge



At 0947, VTIC acknowledged the request for assistance while the master, in desperation, tried to prevent the grounding. His actions in the hopeless situation were totally confused and probably driven by panic. He first attempted to turn the ship to starboard with the engine full ahead and then, in a strained voice he told the mates to ask VTIC to ‘please help’. At 0949, after thinking aloud that ‘astern may be better’ he ordered full astern and ‘hard-a-port’.

At 0951, one of the mates informed the master that the ship had grounded. Confused, the master stopped the engine before ordering full astern again. It is possible that he hoped that he could manoeuvre the ship off the beach. At 0955, he stopped the engine when he heard the propeller blades striking the rock ledges and asked if the ship was ‘aground’. Then, in panic, he put the engine ahead briefly before stopping it after hearing the ‘clanging’ sound of the propeller again.

It is likely that the query from VTIC after the grounding asking if the ship’s anchors were still in their hawse pipes made the master realise that he had not considered deploying them. The following remarks were probably then recorded in the log book. The underlined parts below were, apparently, in the master’s handwriting.

0900: Contacted Newcastle Harbour for assistance, but never received assistance due to too much traffic.

0910-0950: Master tried “Emergency drop anchor” but never prepared due heavy weather.

These apparent retrospective log book entries are not consistent with the audio data recorded by the ship’s VDR. The request for assistance was made at 0946, not at 0900 as entered in the log book. Moreover, there is no audio data that indicates that deploying the anchors was considered at any stage.

While the master spoke in Korean to the chief engineer, he communicated with the bridge team members and with VTIC in English. There were no misunderstandings or difficulties, on the bridge of *Pasha Bulker*, that can be attributed to language.

2.2.3 The critical decisions

A number of decisions made by the master were contrary to the principles and practice of good seamanship. Unaware of the guidance available to him in the Australia Pilot and without undertaking an appropriate risk assessment at any stage, the master progressively made a number of poor decisions. Had some of these decisions been different, the grounding probably would not have occurred. In summary, the critical decisions included:

- Failing to ballast the ship appropriately for the forecast heavy weather.
- Failing to leave the anchorage at an appropriately early stage.
- Not preparing appropriately for the emergency deployment of the anchors and not deploying the anchors.
- Conning the ship inappropriately at critical times, including ordering the 20° course alteration to put the ship's head through strong gale force winds without controlling the turn himself by giving appropriate rudder orders or monitoring the helm subsequently.
- Attempting the final turn to starboard towards the lee shore that was less than a mile away.

The master's decisions when the ship was at anchor were probably made on risky assumptions that the weather forecast was not significant enough to be of real concern and that the anchor would hold in the weather which was forecast. These ill founded assumptions were due to his poor understanding of anchor holding power and local weather conditions and the limitations of the Newcastle anchorage. He did not consider the risks due to factors such as the distance to the lee shore, other ships dragging, difficulties in weighing anchor and manoeuvring *Pasha Bulker* when it was not appropriately ballasted for heavy weather.

The master had no plan to put to sea, assumed that VTIC would instruct ships to leave the anchorage and apparently ignored the signs that a dangerous situation was developing. Furthermore, after getting underway, he did not put in place any short term plan or strategy to manage the situation and safely clear the coast. As a result, he became increasingly prone to the effects of fatigue and overload with no effective support from the other members of the bridge team.

2.2.4 Bridge resource management

The decision making processes on board *Pasha Bulker* were not based on recognised principles of bridge resource management (BRM). Nijjer, R defines BRM as:

The use and coordination of all the skills and resources available to the bridge team to achieve the established goal of optimum safety and efficiency²¹.

Planning is essential if BRM is to be effective. Priorities must be set, acceptable limits defined and tasks delegated to each team member. The aim of involving the entire bridge team is to manage the workload to avoid overload or stress as well as inattention or boredom of the team members. Monitoring the progress of the plan is necessary in order to detect and challenge deviations from it so that 'single person

²¹ Nijjer, R 2000, Bridge Resource Management: The Missing Link, Sea Australia, Sydney.

errors' can be corrected early. Therefore, if the state of the bridge is optimal and the master has adequate support, the team can effectively execute the plan.

Pasha Bulker's bridge team did not employ any of the recognised BRM techniques. There was no plan to safely put to sea. The master made decisions with little interaction or input from the mates. The combination of inadequate planning and a number of unwise decisions, for example attempting to ride out the heavy weather at anchor, not taking heavy weather ballast and not defining any limits, resulted in the ship being placed in a dangerous situation.

While the master and mates' qualifications included BRM or bridge team management training, there was little evidence of them using their training. The passage plan had no reference to BRM such as briefing, debriefing and contingency plans. The plan had not been signed by the master or the chief mate indicating that it had not been discussed. The master's standing orders posted on the bridge, in a standard format copied from the ship's SMS, made no mention of BRM and nothing in the orders encouraged the use of recognised BRM techniques such as challenge and response.

After deciding to weigh anchor, no short term plan or strategy was discussed or put in place to manage the situation. This resulted in the state of the bridge not being optimal at critical times after the ship got underway. Ineffective BRM and indecisiveness had already contributed to a higher level of fatigue for the master. With no plan or defined priorities there was no delegation of duties and the worsening situation became more stressful for the master. The higher workload during the hour before the grounding undoubtedly must have overloaded him.

At 0931 on 8 June, for the first time and probably too late, one of the mates suggested to the master that he ask VTIC for assistance. While this focussed the master's attention on the perilous situation, it probably added to his confusion and he decided to make the risky turn to starboard. None of his decisions, even as the ship closed on the coast, were challenged by the bridge team nor was he offered any advice. Essentially, there was an absence of BRM on *Pasha Bulker's* bridge.

2.3 Actions of masters at Newcastle anchorage

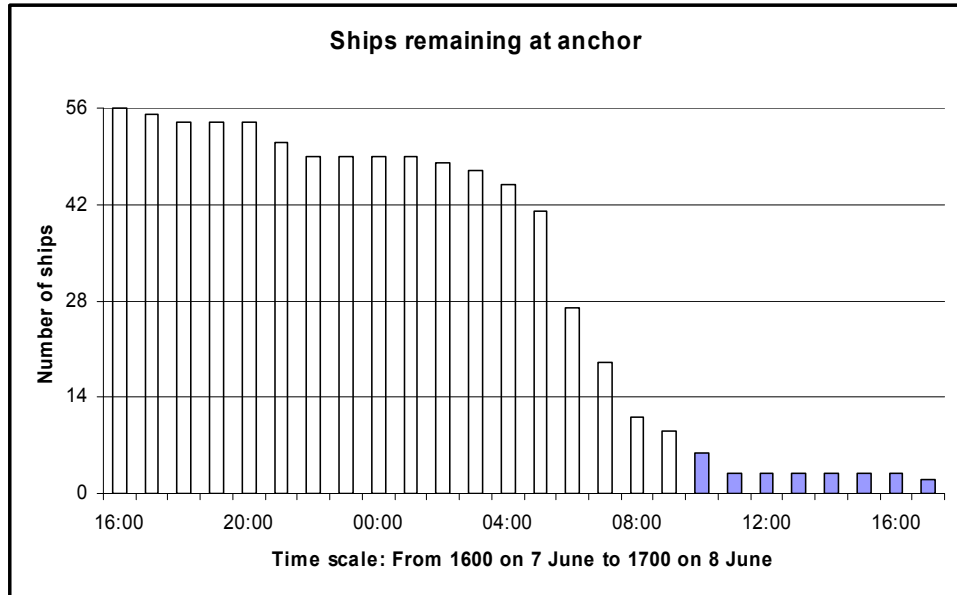
The actions of some masters of ships at Newcastle anchorage on 7 June 2007, with regard to putting to sea and heavy weather ballast, were similar to those of *Pasha Bulker's* master. This suggests that some of the reasons for their decisions were common and not restricted just to *Pasha Bulker's* master. The survey (Appendix E) indicates some of the possible reasons.

As the wind speed increased on the evening of 7 June, the number of ships remaining in the anchorage started to decrease. This suggests that some of the 57 ships put to sea, as recommended in the Australia Pilot, in view of the deteriorating weather and the gale warning. However, only seven ships departed the anchorage before the onset of gale force winds. Another ship, the last to enter port before the severe weather, berthed and is excluded from the chart of ships that were at anchor at the time of the incident (Figure 18).

At 0100 on 8 June, when the winds were consistently at gale force, 49 ships remained at anchor. Of these, the masters of only 11 indicated that they did not drag their anchors. In the case of another six ships, for which dragging could not be confirmed, one got underway at 0330 on 8 June and the others after 0630. Given the

severe weather at the time, it is likely that some of these six ships dragged their anchors or used their engines to maintain position. Therefore, the majority of the ships remaining at anchor in the gale did drag their anchors.

Figure 18: Chart of ships at anchor and time underway during the incident



Most of the ships got underway only after dragging their anchors (Appendix E, Other results). While almost all of the masters surveyed indicated that weather was a factor in deciding to get underway, more than half of them also indicated dragging anchor as a factor (Appendix E, Question 7). The evidence strongly suggests that dragging anchor was the main reason for most masters deciding to get underway. Similarly, less than a third of the masters indicated that they already had, or took, heavy weather ballast (Appendix E, Question 5).

The gale warning, weather related guidance in shipboard publications about Newcastle anchorage, the ordinary practice of good seamanship and their level of responsibility and experience would suggest that most masters should have left the anchorage before the onset of gale force winds. However, it appears that many did not consider the risks involved or take the gale warning seriously enough to precipitate appropriate action at an early stage. In fact, at 0500 on 8 June, when there were strong gale force winds, 41 ships were still at anchor.

The survey results do not indicate that the actions of masters were related to their experience, either as masters, in general, or specifically at Newcastle anchorage (Appendix E, Comparisons).

In general, the actions of masters indicate that they were reacting to events rather than planning or setting limiting criteria upon which to make critical decisions. The survey responses suggest that some masters may have been more comfortable attributing their decisions and actions to a factor, such as the anchor dragging or guidance received from VTIC. It is possible that they were avoiding a situation where they might need to explain their independent decisions to their ships' managers. None of the masters surveyed indicated that their place in the queue was a factor that influenced any of their decisions.

While the consideration of operational and commercial aspects of a ship's voyage are necessary and valid, masters must carefully weigh such considerations in light

of the prevailing circumstances and always avoid undermining safety. Appropriate support from ship operators, managers, ports and terminals can assist masters in this regard. However, masters are ultimately responsible for ensuring the safety of their ships and crew as well as preventing damage to the environment.

Not taking early and appropriate action on 7 June exposed many ships to the risks of being caught on a dangerous lee shore with little sea room, heavy traffic and manoeuvring difficulties in heavy weather. This resulted in some of these ships experiencing serious difficulties.

2.3.1 *Betis* and *Sea Confidence*

Both *Betis* and *Sea Confidence* were not appropriately ballasted for heavy weather and got underway after 0500 on 8 June, when the wind was strong gale force. While both encountered serious difficulties, fortunately neither became a casualty.

Sea Confidence's master used the ship's anchors and main engine effectively to prevent it from grounding. He also took heavy weather ballast but at a dangerously late stage. Ballast water sloshing in the ship's partially filled heavy weather ballast hold in the severe weather could have damaged the ship's structure.

Betis's master also used the ship's engine effectively to relieve the tension in the anchor cable and maintain its position. He requested tug assistance and finally, when he realised that the weather would deteriorate even further, cut the anchor cable and put to sea. The ship was anchored more than three miles from the coast and this provided more time for the master to consider the available options.

Therefore, circumstances and some positive actions taken by the masters of *Betis* and *Sea Confidence* helped counter the adverse effects of some of their earlier decisions. It was also fortunate that during the afternoon and evening of 8 June, the weather abated sufficiently to allow both ships to successfully put to sea.

2.3.2 Other ships

The following are other known events that occurred on 8-9 June:

- *Santa Isabel* fouled its anchor and had related problems.
- A ship dragged its anchor and closed to within two cables of another anchored ship.
- A number of ships experienced difficulties in weighing anchor of which two, besides *Betis*, had windlass breakdowns and subsequently lost their anchors.
- A number of close-quarters situations developed between ships as they manoeuvred in the severe weather when departing the congested anchorage to put to sea.

Considering these events, *Pasha Bulker*'s grounding and the serious difficulties encountered by *Betis* and *Sea Confidence*, the consequences of the period of severe weather on 8-9 June could have been much more severe. Unlike the masters of the seven ships that wisely put to sea on 7 June, the ones that remained in the anchorage placed themselves in a situation where they had to rely on their seamanship and a large measure of good fortune to avoid an incident involving their ships.

While a number of masters probably displayed good seamanship to clear the coast after the onset of gale force winds, the seven that put to sea earlier demonstrated the highest levels of seamanship. These masters ensured that their ships, crew and the environment were not exposed to unnecessary risks. They did not put themselves in a situation, with the predictably adverse weather that was forecast, where they might have had to rely on other skills and hope for favourable conditions to recover, something that *Pasha Bulker*'s master was unable to do.

2.4 Newcastle anchorage

Newcastle anchorage is fully exposed to the weather with onshore winds regularly creating a dangerous lee shore. The relatively deep water near the coast compels ships to anchor fairly close to the coast. The sea-room is limited, particularly when the anchorage is congested. Consequently, in adverse weather, ships have no shelter and limited sea-room in which to manoeuvre. Weather conditions, particularly the swell, are known to deteriorate rapidly. This reduces the time available to masters in which to take appropriate action. The high risks associated with the anchorage, including ships dragging their anchors, have resulted in a number of serious incidents in the past.

2.4.1 Previous incidents

Amongst the previous incidents at Newcastle anchorage, the grounding of *Sygna* on 26 May 1974 had remarkable similarities to the grounding of *Pasha Bulker*.

On 25 May, *Sygna*, a large bulk carrier, was one of at least six ships anchored off Newcastle. At 1530, the strong wind warning in place was upgraded to a gale warning. By 2100 the south-southeast wind was gusting to 50 knots.

Sygna was anchored 2.5 miles east of the harbour entrance and about three miles from the lee shore of Stockton Beach. At 2210, the master read the latest gale warning and went to bed leaving orders to be called if the ship's anchor dragged. As the weather deteriorated, ships began to put to sea. By midnight, only *Sygna* and two other ships, one with fouled anchor cables, remained at anchor.

At about 0100 on 26 May, *Sygna*'s master was called. The anchor had started to drag and he ordered that it be weighed. During the 45 minutes it took to get underway, the ship, with the wind on its port beam, continued to drag towards Stockton Beach. After the ship got underway, maximum port rudder with the main engine at full ahead was used, unsuccessfully, to turn the ship's head into the wind.

As the ship approached the coast, the wind was gusting to 90 knots and the master decided to turn to starboard. Engine speed was increased but the attempt did not succeed. At about 0200, *Sygna* grounded on Stockton Beach.

Of the other two ships, one rode out the storm at anchor by using its engine to reduce the tension on its fouled anchor cables. The other ship got underway but then had serious difficulties clearing the coast, passing only about 60 m from the ship with the fouled anchor cables.

At about 0800, the stress on the hull of the grounded *Sygna*, aggravated by the low tide, resulted in the ship breaking in two near its mid-section. The wind had dropped to 10 knots and the crew were evacuated by helicopter.

The ship's bow section was later successfully freed from the beach. However, the ship was not successfully salvaged and the wreck of its stern still lies on Stockton Beach. The storm became known as the "Sygna storm".

Two other noteworthy and more recent incidents in the Newcastle anchorage have been collisions. On 23 November 1995, *New Noble* dragged its anchor and collided with the anchored *Goonzaran* (Marine Incident Investigation Unit report number 86). On 24 June 2005, in a similar incident, *Pilsum* collided with *China Steel Growth* after dragging its anchor (ATSB marine investigation report number 216). The weather during both of these incidents was poor with gale force winds.

The exposure to adverse weather at the Newcastle anchorage and the consequential risks, including anchors dragging and difficulties weighing them, are recognised. This has resulted in appropriate guidance being promulgated in publications such as the Australia Pilot. The guidance includes the recommendation for ships to weigh their anchors and put to sea until the weather moderates.

2.4.2 Weather

The Australia Pilot describes the extreme weather that an East Coast Low can generate off Newcastle and provides adequate guidance for masters. Locally, more is known about these weather systems and the BoM describes them as follows:

East Coast Lows (ECL) are intense low-pressure systems which occur on average several times a year off the eastern coast of Australia, in particular southern Queensland, NSW and eastern Victoria. Although they can occur at any time of the year, they are common during autumn and winter with a maximum frequency in June. East Coast Lows will often intensify rapidly overnight making them one of the more dangerous weather systems to affect the NSW coast.

Each year there are about ten 'significant impact' maritime lows. Generally, only once per year do we see 'explosive development'. Looking at all the lows between 1973-2004, there is no evidence of a trend.

The BoM notes that an ECL brings gale or storm force winds with heavy coastal rain south of its centre. Very rough seas and prolonged heavy swells are generated. The challenge for forecasters is to accurately predict the location and movement of the centre of an ECL. The BoM issues warnings with the aim of giving sufficient advance notice to mariners (Appendix D, Wind warnings).

The weather conditions associated with the groundings of *Sygna* and *Pasha Bulker* are both instances when the sea area off Newcastle has been affected by an ECL.

The East Coast Low of 8-9 June 2007

The ECL of 8-9 June had been forecast accurately and was the first of five that occurred during June 2007. Five in a month is rare but not unprecedented, with 1974 being another notable year. The ECL of 8-9 June was not the most intense of the five that occurred but it had the most serious impact, both inland and offshore.

The ECL developed in a pre-existing low pressure trough in the northern Tasman Sea. As predicted on 6 June, a weak low formed off Coffs Harbour, about 150 miles north of Newcastle, on the morning of 7 June. It then moved south along the coast towards Newcastle. By evening, the low had deepened to 1009 hPa and was located just north of Newcastle. Gale force south-easterly winds started at about midnight

and continued for about 12 hours with gusts of over 56 knots generating very rough seas and heavy swells.

By about midday on 8 June, the low weakened and the winds eased. Later that afternoon, there were persistent thunderstorms and in the late evening, a second small scale low formed. This low crossed the coast over Newcastle in the early hours of 9 June bringing gale to storm force winds with gusts of over 66 knots.

Pasha Bulker's grounding and the difficulties encountered by other ships occurred on 8 June, during the first period of severe weather. Fortunately, most of the ships put to sea and during the period of more intense weather on 9 June, only two ships with windlass problems remained in the anchorage. Both ships later released their anchor cables and departed the anchorage.

Fair weather

The term 'fair weather' used in the Australia Pilot in relation to Newcastle anchorage is not defined. The term could be defined in various ways by different masters depending on their particular circumstances and ships. However, it is reasonable to expect that a prudent master would interpret a wind warning to mean that the weather was forecast not to be 'fair'.

The absence of a weather warning does not imply that the weather will not rapidly deteriorate. Observing weather conditions is standard practice for mariners and a wise master should make decisions based on these observations and all of the available information. Moreover, the forecast wind speeds, sea and swell can be higher than that forecast and this is clearly noted on all BoM weather reports.

Departing an anchorage safely and in good time, including preferable conditions such as daylight, should always be considered by masters when wind warnings are issued or deteriorating weather is observed. In this regard, consideration should also be given to having the ship ballasted for heavy weather, the delays and difficulties that may be encountered due to unforeseen circumstances such as fouled anchors, windlass problems and engine breakdowns, and manoeuvring in heavy traffic.

In essence, these considerations are just the ordinary practice of good seamanship and are consistent with the recommendation in the Australia Pilot for ships, at Newcastle anchorage, to weigh anchor and put to sea until the weather moderates. Had this recommendation been appropriately followed by all masters in the anchorage on 7 June, the dangerous situation that developed on 8 June and its consequences could have been avoided.

Newcastle anchorage can, therefore, only be considered good, or suitable, in fair weather conditions. In adverse weather, the risks associated with ships dragging their anchors or safely putting to sea are particularly high. Consequently, anchor holding power and heavy weather ballast are amongst the most important factors that masters should consider.

2.5 Anchor holding power

The requirements²² of the International Association of Classification Societies (IACS) state:

The anchoring equipment ... is intended for temporary mooring of a vessel within a harbour or sheltered area when the vessel is awaiting berth, tide, etc. The equipment is therefore not designed to hold a ship off fully exposed coasts in rough weather or to stop a ship which is moving or drifting.

An anchor should, therefore, not be expected to hold a ship in rough weather at Newcastle's fully exposed anchorage. The risks are highlighted by the history of incidents and ships dragging their anchors in adverse weather.

The IACS requirements specify the type and size of anchoring equipment for ships based on their size and certain other criteria. The aim is to ensure that the equipment, including suitably sized anchors and chain cable, is appropriate for its intended purpose. A 25 per cent weight reduction is allowed for high holding power (HHP) anchors in comparison to standard stockless anchors. For example, if the requirements for a certain size of ship specify a 10 tonne standard anchor, it may be fitted with a 7.5 tonne HHP anchor.

An increasing number of ships, including *Pasha Bulker*, *Betis* and *Sea Confidence*, are fitted with Admiralty Class (AC) 14 type cast steel HHP anchors (Figures 19 & 20) appropriate for their size. The type of chain cable fitted to the anchors of these ships is known as 'grade 3'. It is made from 'extra special quality steel', the strongest of the three materials commonly used for anchor chains.

Figure 19: AC 14 type anchor

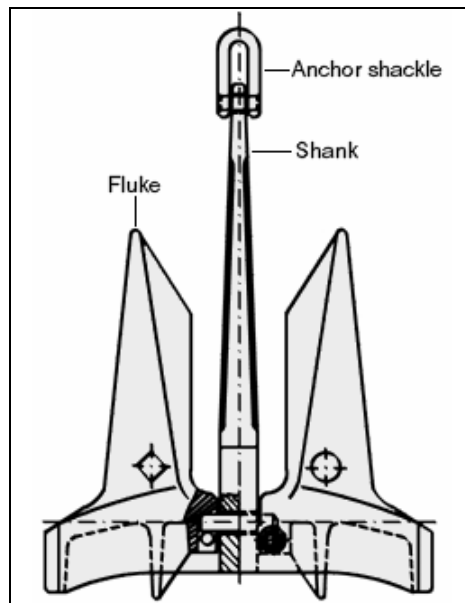
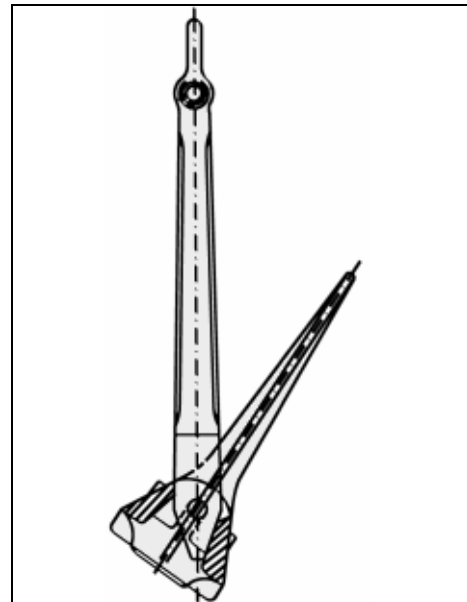


Figure 20: Profile of anchor

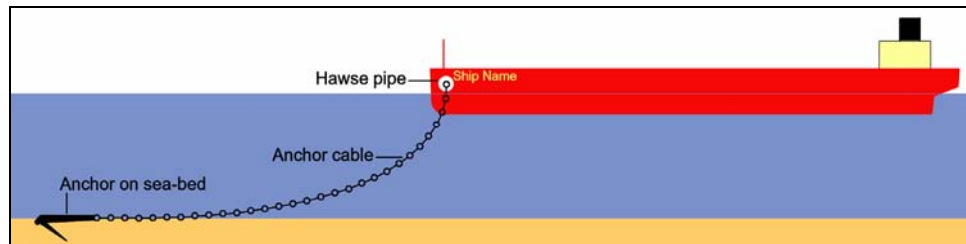


An anchor provides maximum holding power when its flukes are fully embedded in the sea-bed. This occurs when the anchor shank lies on the seabed and the anchor cable pulls horizontally at the anchor shackle (Figure 21). When the pull increases, the cable lying on the seabed is lifted off, creating an angle above the horizontal. As

²² Requirements concerning mooring, anchoring and towing, IACS Req. 2007.

the angle increases, the holding power reduces. A rule of thumb is that a pull at 5° above the horizontal reduces the holding power by 25 per cent and a pull at 15° reduces the power by 50 per cent²³.

Figure 21: An illustration of a ship at anchor



Therefore, to maximise an anchor's holding power, the scope²⁴ of cable should be sufficient to ensure that, in fair weather, a length of cable will lie along the sea-bed and thus pull horizontally at the anchor shackle. When this occurs, the cable rises gently in a curve to the hawse-pipe. The curve, or catenary, absorbs any shocks when forces on the ship due to wind, tide and current increase the pull on the cable. A catenary, therefore, is necessary to ensure that the cable exerts a horizontal pull on the anchor shackle.

According to the IACS requirements for HHP anchors, a scope of cable of ten is considered normal while a scope of not less than six is acceptable. Most large ships are fitted with about 12 shackles, approximately 330 m, of cable for each anchor. Consequently, in water depths exceeding about 45 m, the scope of cable achievable is less than six.

With regard to the scope of cable, Danton²⁵ states:

The Admiralty recommends the following lengths, which should be regarded as the minimum for calm weather and a 5-knot stream.

For special-steel cable, lay out $39 \times \sqrt{D}$ of cable [metres].

(Where D is the depth of water in metres.)

While this formula allows for the relatively lighter weight of the higher strength of a special-steel cable and is a useful guide, it indicates the minimum length of cable to deploy in calm weather. Newcastle anchorage, on the other hand, is particularly susceptible to adverse weather. Furthermore, water depths in the anchorage exceed 30 m and make it impossible to achieve a scope of ten and difficult to achieve one of six or more.

Pasha Bulker's master had initially deployed nine shackles of cable. In the 35 m deep water, this provided the Admiralty recommended minimum length for special-steel cable in calm weather. The scope of cable was slightly less than six but when the weather deteriorated, the additional cable veered on the master's orders made the scope nearly seven.

23 Danton's, *The Theory and Practice of Seamanship*, 11th Edition, 1996.

24 The length of the cable deployed, from the hawse pipe to the anchor, divided by the vertical distance between the hawse pipe and the sea-bed.

25 Danton's, *The Theory and Practice of Seamanship*, 11th Edition, 1996.

In comparison, *Sea Confidence* and *Betis* had deployed a scope of cable of a little over three and four, respectively. Neither had deployed the Admiralty recommended minimum length of cable. Most ships in the anchorage were anchored further offshore than *Pasha Bulker*. Consequently, few, if any, achieved a scope of six or more.

Therefore, the parts of Newcastle anchorage where an acceptable scope of cable, according to the IACS guidance, can be achieved are about three miles or less from the coast. Even the Admiralty recommended minimum cable length for calm weather is not achievable further than about five miles from the coast as the water becomes deeper than 60 m. As a result, a lee shore in adverse weather can be particularly close for anchored ships.

Increasing the distance to a lee shore by anchoring further away from the coast has, besides reducing the achievable scope of anchor cable, other limitations. Anchoring more than five miles off the coast is impractical as the water depths exceed 80 m. This is because an anchor windlass, in good condition, can generally only be expected to lift the dead weight of three shackles (82.5 m) of chain cable with the additional weight of the anchor hanging on it. Furthermore, in adverse weather, deep water is particularly unsuitable due to the increased risks of the anchor dragging and windlass failure.

The holding power of an anchor depends to a large extent on the nature of the sea-bed, or holding ground. Certain types of mud and clay provide the best holding ground while rock provides the worst. Newcastle anchorage has sand on the sea-bed which provides relatively good holding ground. However, this must be balanced with other factors, such as the water depth and the prevailing weather conditions.

In strong winds, an anchored ship will yaw and at higher wind speeds it is increasingly likely to surge rapidly from one extremity of the yaw to the other. This can place a shock load on the anchor cable, breaking the anchor's hold in the sea-bed. Increased yawing in strong winds, therefore, increases the risk of the anchor dragging.

Because of the large number of variables, the holding power of an anchor can vary significantly and, therefore, can only be estimated. Masters are not normally provided with information on the holding power of their anchors. However, the master of *Betis* did have, on board the ship, a sample calculation to estimate the wind speed that would cause an anchor to drag.

The sample calculation presented the various formulae and estimates used and noted that factors such as swell and waves were not taken into account. The sample ship data was not for *Betis*, but a much larger bulk carrier. The calculation was based on the principle that an anchor will drag when the tension in the anchor cable exceeded the total holding power of the anchor and the cable.

The holding power coefficient of an AC 14 type anchor in a holding ground of sand, according to the sample calculations, is seven. The anchor should, therefore, impart seven times its own weight to the total holding power in sand. Similarly, the coefficient for the cable is 0.75 in sand and its contribution to the total holding power should be three quarters of the weight of the cable that lies along the sea-bed.

For a bulk carrier, the tension in the cable is estimated in the sample calculations to be three times the force of resistance due to windage²⁶ on the front of the ship. With the wind directly ahead, ships like *Betis* or *Pasha Bulker* in ballast experience a force of about 13 tonnes at a wind speed of 35 knots and twice that at 50 knots. These forces result in a tension in the anchor cable of about 40 and 80 tonnes respectively. The increased tension can be significant with sudden higher loads due to wind gusts. Furthermore, yawing increases the forces because of the greater windage when the ship is not lying with the wind directly ahead.

Anchors and associated equipment are intended to work effectively in normal or good conditions. Therefore, anchor holding power calculations or estimates are not intended to, and should not, be used to determine the maximum wind speed or weather conditions in which a ship can safely remain at anchor. A master's experience and variables such as weather and the holding ground are far more important considerations.

At Newcastle anchorage, the close proximity of the coast and other ships, the likelihood of them dragging anchor if the weather deteriorates, as well as congestion in the anchorage should always be taken into account. Veering additional anchor cable to ensure sufficient cable is deployed may be an option in certain conditions. However, attempting to ride out heavy weather at the exposed anchorage is not recommended by the Australia Pilot and is not consistent with the practice of good seamanship.

2.6 Heavy weather ballast

In the normal light ballast condition, a ship's draught and trim should be sufficient to ensure that, in good weather, the propeller is fully immersed and slamming²⁷ forward is prevented. To achieve these conditions in adverse weather with bigger waves, a deeper draught is necessary. One or more large cargo holds, usually near the mid-length of a large bulk carrier are, therefore, designated for heavy weather ballast. When the ballast hold(s) are filled with water, the ship becomes more manageable and thus safer in adverse weather.

The deeper draught of a ship in a heavy ballast condition increases the propeller immersion. Consequently, engine power is used more efficiently because the propeller is more likely to remain fully submerged. When the propeller breaks out of the water in rough seas, not only does it not generate the thrust it is designed to when submerged, it also draws down air with its blades which further reduces its efficiency. Furthermore, the engine is less prone to over-speed and shutdown at increased propeller immersion. At a deeper draught, the likelihood of slamming forward and the risk of structural damage are also reduced.

On 8 June, *Pasha Bulker's* aft draught was no more than 7.10 m, about 7 cm less than that necessary to fully submerge the propeller in still water. In the heavy weather, even a two degree vertical movement about the ship's mid-length as it pitched would have exposed over half of its 6.60 m diameter propeller at times. Had the empty aft peak tank and the one quarter full fore peak tank been filled, the

²⁶ The surface area of a ship's hull and superstructure that is exposed to the wind.

²⁷ A ship's forefoot, or underside of the bow, being lifted out of the water by waves as it moves and slammed down.

ship's increased draught, particularly aft, would have been better in the prevailing conditions.

The ship's forward draught of 4.85 m was much less than the minimum 7.80 m, specified in the ship's stability book, necessary to avoid slamming forward. To put to sea, *Pasha Bulker* would have needed to head nearly into the southeast weather. With the draught it had at the time, the ship was much more likely to suffer damage forward. At the heavy weather ballast draught of about 8.50 m even keel, the ship would have been much more manageable and safer. These are critical issues that the master apparently did not consider.

Reduced windage at a deeper draught is also a significant advantage. Strong winds exert large forces on the hull and superstructure and, as explained, can cause an anchor to drag. When underway, these forces can make a ship difficult to manoeuvre and possibly unmanageable. A simple formula²⁸ that gives an approximation of wind force is:

$$W = (A \times V^2) / (1000 \times 18)$$

Where W is the wind force in tonnes, A is the area exposed to the wind in m², or the windage, and V is the relative wind speed in m/sec.

It is important to note that the force varies as the square of the wind speed. Therefore, small increases in wind speed translate into large increases in force. In stronger winds, gusting amplifies these forces significantly.

On 8 June, *Pasha Bulker's* windage, when the ship was facing the wind, was about 770 m² and with the wind abeam, it was about 3400 m². Had the ship's number four cargo hold been fully ballasted for heavy weather, the additional 13 680 tonnes of ballast would have increased the mean draught by about 2.50 m. This would have reduced the windage areas to about 690 m² and 2840 m² respectively. The table below shows the estimated wind forces for the ship with the figures in blue for reduced windage in a heavy ballast condition.

Table 1: Approximate wind forces for *Pasha Bulker*

Wind speed	<i>knots</i>	35	40	45	50	55
	<i>m/sec</i>	18	20.6	23.2	25.7	28.3
Force (relative wind ahead)		13.9	18.1	22.9	28.3	34.2
<i>tonnes</i>		12.4	16.2	20.5	25.4	30.7
Force (relative wind abeam)		61.2	80.0	101.2	125.0	151.2
<i>tonnes</i>		51.2	66.8	84.6	104.4	126.3

The lower wind forces due to reduced windage at the deeper heavy weather ballast draught, combined with the increased propeller immersion, can significantly improve the control of a ship. The greater underwater hull area at a deeper draught offers more resistance to waves thus reducing rolling and pitching. The reduced movement of the ship further increases the likelihood of the propeller remaining submerged.

²⁸ Ship Manoeuvring Simulator Centre, Trondheim, Norway, ship-handling training compendium Edition 3, 1998.

It is good practice for bulk carriers to be in a heavy ballast condition for ocean passages. This ensures that if the weather does deteriorate suddenly, ballasting is not undertaken in difficult or dangerous conditions. The sloshing of water ballast in a partially filled cargo hold due to the ship's motion magnifies the dynamic internal forces on the hold's boundaries. Therefore, there is the possibility of hull and structural damage when ballasting at sea. A ship's increased motion in adverse weather makes damage more likely.

On or before arrival at a loading port, the ballast condition of a ship is often changed to the normal light ballast condition with cargo holds ready for loading. This is commonly the case at Newcastle, even when ships expect to wait at anchor off the weather exposed coast for long periods. Because the weather can deteriorate rapidly, and the risks of ballasting in adverse weather, it is important that the time taken to take heavy weather ballast safely is carefully considered by masters.

2.6.1 Ballast related issues at Newcastle

In the weather conditions at the time of the incident, all ships should have been appropriately ballasted for heavy weather. However, less than a third of the masters surveyed indicated that they had, or later took, heavy weather ballast. By the time the wind was gale force, it was probably already too late to safely take heavy weather ballast.

Sea Confidence's master indicated that maintaining minimal ballast for berthing and avoiding corrosion in the heavy weather ballast cargo hold influenced his decision to not take additional ballast earlier. He also indicated his concerns about ballast with regard to the PWCS 'vessel suitability list' and the lack of sufficient notice for berthing (Appendix E, Question 12). Following the incident, he was given about 18 hours notice for the ship's berthing on 18 June. Two other ships' masters indicated similar concerns about ballasting and short notice for berthing, including a reference to the 'blacklist' of ships, as the 'vessel suitability list' has commonly been referred to by ship masters, agents, pilots and others in the industry.

On 25 May 2007, PWCS promulgated the 'vessel suitability list'. The list identified ships whose past 'poor performance' made them unsuitable for future loading at the coal terminals. This assessment was based on slow loading and de-ballasting²⁹ which caused excessive delays alongside the berth. The objective of the vessel suitability initiative was to improve the terminal's loading capacity in line with other measures to realise additional coal chain capacity and maximise throughput.

While the objectives of PWCS are commercially reasonable, ship masters and agents have felt pressured at Newcastle's coal terminals. Their concerns are mainly related to de-ballasting time and the perception that terminal personnel do not have adequate knowledge and experience of ship loading operations. De-ballasting rates depend on a number of factors, including the capacity of the ship's pumping system, its condition and handling by the ship's crew. Therefore, the vessel suitability initiative may have heightened the concerns of some masters at the time of the incident because their ships being assessed as unsuitable for loading would effectively penalise their ships.

²⁹ The process of emptying water ballast from a ballast tank or floodable cargo hold. A ship de-ballasts while loading cargo and so the ballast pump capacity can limit the loading rate.

In submission PWCS stated:

PWCS clearly does not penalise vessels, rather it either approves or does not approve an application based on a number of criteria including vessel rating and performance.

PWCS also does not have a 'vessel blacklist', although the media and other sources have used this term. PWCS does review all vessel loading performance at its terminals and approves or does not approve a vessel nomination based on the information contained in the application and other performance criteria.

It is acknowledged that PWCS has an approval process based on ship performance and other criteria. However, the effect of a ship being assessed as unsuitable imposes a commercial disadvantage, i.e. a penalty for the ship's owners, operators and charterers. To varying degrees this would result in pressure on the master and crew to provide explanations about an unsuitable assessment that their ship received.

The decision, with regard to taking heavy weather ballast, for the masters of the three ships whose berthing schedule on 7-8 June coincided with the deteriorating weather was probably more complicated. One of these ships berthed, and the other two, including *Santa Isabel*, put to sea in the heavy weather. However, the masters of these ships were not the three that, in the survey, indicated their concerns about ballast. Hence, the evidence does not confirm with certainty that the ships which got into the most difficulty on 8 June, including *Pasha Bulker*, *Betis* and *Sea Confidence*, were not appropriately ballasted for heavy weather due to concerns about the recent PWCS vessel suitability initiative.

Some other port stakeholders have expressed concerns about certain ballast related proposals by PWCS. However, there is no evidence to suggest that any unsafe measures have been introduced in the port. In fact, port regulations require masters to ensure that their ships are ballasted appropriately with the propeller fully immersed and that the ship's trim does not exceed a specified safe limit for berthing.

The concerns of masters and others with regard to loading operations at the coal terminals do suggest a certain perception of PWCS. However, the evidence does not confirm that, at the time of the incident, there were any compelling reasons, related to PWCS, which prevented masters from taking heavy weather ballast. In any case, the responsibility for ensuring a ship is appropriately and safely ballasted at all times rests with its master.

2.7 Newcastle Port Corporation (NPC)

Any incident in the waters off Newcastle has the potential to have adverse consequences for the port and therefore, for NPC. This was highlighted by the grounding of *Pasha Bulker* and related events. However, the consequences could have been much worse, for example pollution or blockage of the harbour entrance.

The risks at Newcastle anchorage are known to NPC. The corporation is familiar with past incidents, local weather including conditions associated with an ECL and has the resources and collective knowledge of experienced mariners in the form of the harbour master and the port's pilots to make appropriate and timely risk assessments.

Along with its safety functions, NPC has prime responsibility for pollution response in coastal waters between Fingal Head, about 20 miles along the coast to the north of Newcastle, and Catherine Hill Bay, a similar distance to the south of the port. The corporation is also responsible for relevant marine communications, including the provision of ‘marine warnings’ and port related reports and to this end operates a vessel traffic information centre. The corporation is, therefore, the most likely organisation to be able to identify and be aware of incidents or potential incidents in the area off the port, including the anchorage. With its resources, NPC can respond to incidents off Newcastle in the first instance through communications with the masters of ships and the Australian Maritime Safety Authority (AMSA) and/or NSW Maritime.

2.7.1 Role of the Vessel Traffic Information Centre (VTIC)

Newcastle VTIC is the interface between NPC and the masters of ships calling at the port and using the anchorage. The objectives of VTIC, according to NPC, are to improve the safety and efficiency of navigation, improve protection of the marine environment and respond to the business needs of the port’s customers by providing information services.

The VTIC aims to achieve its objectives by providing information to masters in a purely advisory role. However, the role of VTIC does not appear to be clearly understood by all masters (Appendix E, Questions 8-12). A number of survey responses indicated that there was a general expectation by masters that VTIC would provide them with guidance about the weather and an appropriate time to leave the anchorage.

The interaction of VTIC with the master of a ship from its arrival is similar to port or harbour control centres in many ports around the world which issue instructions. It is likely that many masters do not distinguish Newcastle VTIC as being any different. Neither does its commonly used radio call sign, ‘Newcastle Harbour’, positively indicate an advisory role. While the advice given is worded to indicate its advisory role, masters from non-English speaking backgrounds may not be able to clearly make this distinction.

The standard advice given by VTIC to masters with regard to anchoring or anchors dragging could also be interpreted as instructions. This advice is given individually and may reinforce the perception that instructions or directives are being issued.

On 7-8 June, the general interaction between masters and VTIC suggests that many of them expected, and waited, for weather related guidance which was not issued until the weather conditions were extreme. Furthermore, at least 21 masters requested ‘permission’ to weigh anchor and put to sea, which suggests that they believed that VTIC was a navigational control centre or at least the ‘authority’ responsible for Newcastle anchorage.

Pasha Bulker’s master also believed that VTIC issued instructions. He stated that had he been instructed to leave the anchorage, he would have complied. He suggested that VTIC should instruct the masters of all ships to leave the anchorage in gale force winds.

While masters of ships are responsible for making decisions about their ships, few heeded the gale warning or seriously considered the guidance in the Australia Pilot and its recommendation to put to sea in adverse weather. Information from any

source that resulted in masters taking such appropriate action, therefore, could have resulted in safer outcomes.

Nearly half of the masters surveyed indicated that VTIC was the most useful source of information for the Newcastle anchorage. Providing guidance similar to that provided in the Australia Pilot with regard to ships putting to sea until the weather moderated would have been consistent with the objectives of VTIC.

A number of masters surveyed also indicated that discarded anchors and cables in the anchorage were a hazard and their positions should be charted or promulgated (Appendix E, Questions 10 & 12). This included the master of *Santa Isabel* which fouled its anchor on 8 June which delayed the ship from putting to sea thereby increasing the risk to the ship.

Given that there are at least 40 discarded anchors and cables in the area and that NPC would be aware of the locations of a number of these, including the positions of the three reported lost at the time of the incident, it is reasonable to expect that, in the interests of safety, the port corporation should take the lead in initiating relevant action. While the anchorage is outside its legislative area of responsibility, the corporation can and should assist AMSA, NSW Maritime and the Australian Hydrographic Service by communicating the positions where anchors have been reported lost, including any approximate locations. This would enable the responsible agencies to appropriately indicate these hazards on charts or take any other action that they consider necessary.

2.7.2 Actions of Newcastle VTIC

Late in the evening on 7 June, the weather, as defined by VTIC, was 'bad'. This resulted in the cancellation of shipping movements due to 'unfavourable harbour entrance conditions'. It should have been evident to VTIC that ships would not be berthing for some time and, given the forecast, possibly for the next day or more. However, no changes to schedules were communicated to ships, for example *Santa Isabel*, which was scheduled to berth at 0630 on 8 June.

From the early hours of 8 June, the VTIC duty officer did his best to offer standard advice according to VTIC procedures. He individually advised the masters of the increasing number of ships dragging their anchors. The duty pilot on station was not involved in these communications, though he could have offered the duty officer relevant advice. The forecast and the deteriorating weather should have indicated to VTIC that the anchorage was increasingly unsafe for ships.

In submission NPC stated:

NPC's communication with a vessel that is dragging its anchor is primarily for the purpose of confirming with the vessel that it understands that its anchor is dragging and secondary to request confirmation from the vessel of its intentions having established that it is aware its anchor is dragging.

It is acknowledged that such communications with a ship dragging its anchor are intended to achieve a safe outcome. However, when an increasing number of ships drag their anchors in deteriorating weather, individual advice to the masters of only these ships has the potential to be misunderstood. For example, some masters may have assumed, incorrectly, that the appropriate time to weigh anchor was when VTIC informed them that their anchor was dragging or asked their intentions. This would also have encouraged a confirmation bias in the minds of masters who had

decided to remain anchored in adverse weather. Furthermore, masters who did not understand the purely advisory role of VTIC, such as some that requested permission to weigh anchor on 8 June, may have expected guidance from VTIC to leave the anchorage.

While the duty officer was authorised to only offer advice in accordance with VTIC procedures, some of his comments indicate that he did, to his credit, attempt to assist further. At 0325 on 8 June, he commented to the master of a ship dragging its anchor that the weather was 'unpleasant'. At 0546, in response to a master advising that he had decided to put to sea, the duty officer commented that the master's decision was 'wise'.

However, at 0600, the duty officer was only able to advise *Santa Isabel*'s master that its scheduled pilot boarding at 0630 for berthing was 'unlikely'. On one occasion, he also inadvertently acknowledged a master's request for permission to weigh anchor with 'permission granted'. Such communications may have reinforced the views of some masters with regard to the role of VTIC as being more than simply advisory. Not cancelling the berthing of all ships that day was also potentially confusing for masters.

In submission NPC advised that it accepted that particular affected vessels may face uncertainty if their berthing was not cancelled. However, NPC also stated:

NPC would not accept that the absence of specific communication about cancellation or deferment of vessel transit would create any confusion for any vessel not scheduled to enter Port at the time.

While in a normal situation, the confirmation or cancellation of a ship's berthing may not confuse the masters of other ships, the situation at the time of the incident was far from normal. Shortly before midnight on 7 June, VTIC confirmed the berthing of one ship waiting off the port for a pilot but cancelled the berthing of another waiting ship due to 'unfavourable harbour entrance conditions'. However, less than three hours later, when weather conditions were much worse, *Santa Isabel*'s master was advised that its pilot for berthing was still as scheduled. Even at 0600 on 8 June, just 30 minutes before the scheduled pilot boarding and when the weather was severe, VTIC was unable to confirm that the berthing was cancelled.

These communications by VTIC with regard to berthing, particularly when it could not communicate with certainty even at 0600, would have been very confusing for *Santa Isabel*'s master though somewhat less so for other masters. From their perspective, a reasonable assumption would be that even the port did not consider the weather conditions sufficiently severe to cancel the scheduled berthing of ships, let alone ask ships to leave the anchorage as some of them expected. This would have reaffirmed, in their minds, that it was reasonable to remain anchored. *Pasha Bulker*'s master asking the third mate, at about 0809, if the harbour was closed indicates that the situation was not clear to him even after the ship got underway.

Furthermore, decisions for some masters with regard to heavy weather ballast would, as discussed earlier, have been further complicated as a consequence of the berthing related communications from the evening of 7 June.

Between 0824 and 0910 on 8 June, the masters of *Pasha Bulker*, *Sea Confidence* and *Santa Isabel* were each asked by VTIC to clear the restricted area off the port entrance. As there were no scheduled traffic movements in the severe weather at the time, these communications provided no benefit. Furthermore, they had the potential to confuse masters attempting to clear the coast or influence their

decisions and may have done so. In any case, there is an explanatory note on the chart about the restricted area.

In submission NPC stated:

NPC does not accept that these communications may have adversely influenced the decisions of Masters. No evidence has been cited in the report that supports the contention that any Master altered course in an attempt to avoid the restricted area.

With regard to the role of VTIC, the master of *Pasha Bulker* believed it issued instructions. Similarly, *Sea Confidence*'s master thought the centre provided advice and *Santa Isabel*'s master believed it provided both, instructions and advice. When asked to leave the restricted area, each master immediately explained their respective situations. This indicates that they had taken sufficient note of the communication and had not disregarded or ignored it.

Pasha Bulker's master asked for an increase of engine speed when the ship was about to enter the restricted area at 0900 on 8 June, about 35 minutes after he had heard VTIC requesting *Sea Confidence* to keep clear of the area. As soon as the speed increase had the desired effect and the ship's steering improved, *Pasha Bulker*'s master ordered the critical course alteration at 0906 which would have taken the ship southwards and out of the restricted area had it been achieved as intended. This suggests the possibility that the master probably also considered clearing the restricted area in his decision to make the course alteration.

The communication by VTIC at 0910 asking for *Santa Isabel* to leave the restricted area and two minutes later for *Pasha Bulker* to also do so probably had some influence on the subsequent decisions of their masters, even though it could not be ascertained exactly what action they took and when they took it. Other masters in the area may at least have been distracted by these communications. In any case, given the difficult circumstances and the precarious situations some ships, including *Pasha Bulker*, were in, such unnecessary and irrelevant communications by VTIC could only cause confusion and were therefore inappropriate.

At about 0900, VTIC issued its first weather advisory when there were just nine ships still at anchor. A dangerous situation had already developed and a number of ships, including *Sea Confidence*, were experiencing difficulties in the extreme weather. Earlier advisories would have been more beneficial as they may have prompted a more timely departure from the anchorage for some ships.

The VTIC duty officer stated, at interview, that he had 'offered assistance' to *Pasha Bulker*'s master. Even the first 'offer' made 24 minutes before the grounding, was probably too late to allow the tug that had been readied to have assisted the ship before it grounded. In any case, it was improbable that the tug could have safely negotiated the harbour entrance in the extreme weather. Even if it had, it would have been very difficult to connect a tow line or provide towage assistance in the prevailing conditions. It is unlikely that VTIC could have offered the master any advice with regard to manoeuvring the ship. It is also unlikely, particularly in the stressful situation and limited time, that the master would have requested or accepted any such advice.

At 0940, the grounding of *Pasha Bulker* was imminent (Figure 22). A number of other ships were experiencing difficulty and two of the six remaining at anchor had windlass problems. It was not until this point in time, that the harbour master requested the masters of the other four ships to put to sea. The master of the ship that was anchored closest to the coast (indicated by the arrow) advised that he was

'afraid' because the 'wind was too strong' and that his 'empty' ship would get too 'close to the coast'. He was asked if he was able to weigh anchor before he reluctantly agreed. Though reluctant, in case the weather drove their ships onto the lee shore, all four masters took action to comply with the request. A similar request by the harbour master before the weather conditions became severe would have been prudent in the circumstances and would have been the most useful and practical assistance that masters could have been offered.

Figure 22: Section of VTIC radar screen at 0940



Even with the resources available to NPC, including the collective local knowledge of the harbour master and pilots and the weather monitoring equipment at VTIC, the port corporation was not sufficiently responsive to the increasing seriousness of the situation that developed from the evening of 7 June. By the early hours of 8 June, a dangerous situation had already developed but it appears not to have been recognised until the corporation's 'incident control system' was activated at about 0830. After this time, the situation was more closely monitored and weather advisories were provided. Consequently, the masters of those ships that were relying on guidance from VTIC probably did not assess the risks appropriately and eventually were surprised by the severity of the weather.

In comparison with visiting masters, NPC is much more familiar with local weather conditions, including those associated with an ECL, past incidents and the risks involved. While it is acknowledged that the corporation has no legislative jurisdiction in the Newcastle anchorage, it is in the best position to be able to anticipate a situation such as the one which developed on 8 June and can, through VTIC, provide masters with appropriate and relevant advice.

It is also reasonable for NPC to promulgate and reinforce the guidance in the Australia Pilot about the fair weather anchorage and the recommendation to put to sea until the weather moderates through relevant and timely communications. This would probably have prompted masters to take appropriate and early action and could have been of the most practical assistance to them.

Furthermore, in its important communications role, it is incumbent upon NPC to inform AMSA and/or NSW Maritime of a potential incident at an early stage, so that these authorities can prepare for and take the necessary action under NEMERA³⁰ and/or the National Plan³¹. It was not until about 0900 on 8 June that NPC notified AMSA of the situation.

2.8 Ship queue

In recent years, the demand for Hunter Valley coal has exceeded the amount that can be exported through Newcastle. This has resulted in the number of ships arriving to load exceeding the number that is loaded. Consequently, ships wait off the port, at anchor, and at times this queue has been large.

The risk of collision or grounding for a ship using Newcastle anchorage is known to be higher in adverse weather. The greater the number of ships at anchor, the higher the likelihood of more ships experiencing difficulties. This increases not only the risk but also the consequences of an incident. The events of 8-9 June and the potential for the consequences to have been far worse, highlight the risks involved.

For ships arriving or departing a congested anchorage, the risk of collision is higher because they must manoeuvre past many other ships when moving to or from their anchor positions. Congestion also increases the likelihood of ships anchoring in close proximity to each other, resulting in less time to take action if their anchors drag and thus a higher risk of collision.

Newcastle anchorage is particularly susceptible to the rapid deterioration of sea and swell conditions in adverse weather. Not only does this lead to an increased risk of anchors dragging, it reduces the time available to take action. Congestion in the anchorage, where a dangerous lee shore is relatively close, can make putting to sea complicated as many ships attempt to clear the coast at the same time. However, waiting for other traffic to clear may result in ships not departing early enough, being caught in extreme weather and being driven ashore. The weather can also cause other problems, such as difficulties in weighing anchor and manoeuvring safely out of the anchorage.

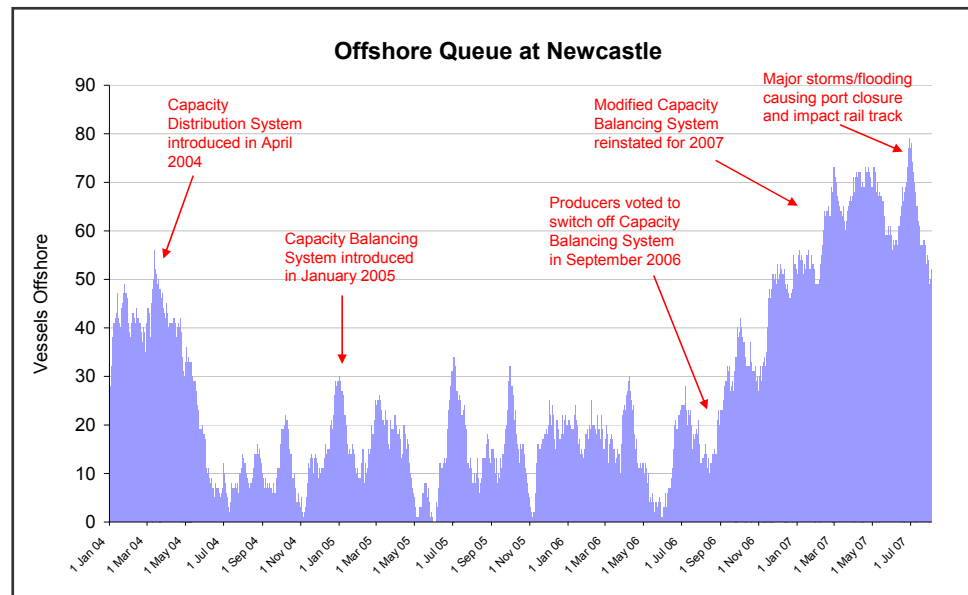
Therefore, any measure which effectively controls the congestion and reduces the number of ships, waiting at anchor, in the queue also reduces the risks to the ships, the port and the environment.

30 The National Maritime Emergency Response Arrangement (NEMERA) aims to deliver a coordinated and integrated approach to manage shipping incidents and protect Australia's marine environment from pollution. It is managed by AMSA on behalf of the federal, state and territory governments and includes powers of intervention and emergency towing arrangements.

31 The National Plan to Combat Pollution of the Sea by Oil and other Noxious and Hazardous Substances aims to effectively respond to marine pollution incidents in Australia. It is managed by AMSA working with state/territory governments and several maritime industry organisations.

In early 2004, when the ship queue increased significantly, PWCS, at the request of a number of coal producers, applied for the approval of a capacity allocation system to reduce and manage the queue. In April 2004, the Australian Competition & Consumer Commission (ACCC) authorised the system. Such an allocation system, operating under different names, has intermittently been in place since then. Whenever an allocation system has been in place, the ship queue has reduced as intended (Figure 23).

Figure 23: Historical ship queue numbers from 1 January 2004



The aim of a capacity allocation system is to match the demand for coal to the amount that can be exported through Newcastle. The total quantity of coal intended to be exported by all producers and the capacity of the coal chain is used to periodically calculate the proportional reduction applicable to each producer’s nominated quantity. The quantity of coal sold, therefore, should result in only the necessary number of ships arriving to load.

The objectives of the allocation systems, in general, have been to:

- reduce the ship queue and the associated demurrage³² costs
- maximise coal throughput
- not affect the coal handling facility adversely
- distribute coal chain capacity equitably amongst coal producers
- comply with all legal requirements.

Whenever PWCS has made applications, the ACCC has sought submissions from about 30 interested parties, including coal producers, before granting approval to the proposed capacity allocation system.

The ACCC approval process has been based on balancing ‘public benefit’ against ‘public detriment’ with regard to a proposed system. Both terms are taken to have the widest possible meanings. Thus, public benefit includes anything of value to the

³² The compensation paid to a shipowner whose ship is held up in port beyond a specified time.

community generally, while public detriment includes any impairment to the area generally. However, a principal element defining either term for this purpose has been related to the achievement of the economic goals of efficiency and progress.

With regard to public detriment, several interested parties have raised their concerns about the proposed allocation systems in their submissions, or comments in public forums, and these have included:

- reduced production and consequential loss of employment
- disproportionate and unfair on small producers
- tendency to remove pressure on investment to increase capacity.

On the other hand, the public benefits of the allocation systems according to PWCS submissions have included:

- avoiding, or substantially decreasing, the deadweight demurrage costs
- improving the international reputation and competitiveness of the port of Newcastle and the Hunter Valley coal industry
- certainty to producers regarding the coal volume they can ship, loading times and ship schedules so that they can manage production efficiently
- allowing a transition to a long term solution for Hunter Valley coal logistics operations.

2.8.1 Demurrage

Costs of demurrage are an often indicated factor by interested parties in their submissions. In early 2007, it was estimated by PWCS that if an average queue of about 60 ships was maintained, the demurrage costs for the year could be A\$460 million. In granting approval for the proposed allocation system at the time, the ACCC concluded that there was a significant public benefit, particularly by reducing these costs for the industry.

Demurrage is usually paid by a ship's charterer to its owner. The buyer or the seller of a cargo could be the charterer depending on the shipping terms. Commonly these terms are either, Cost Insurance and Freight (CIF) or Free On Board (FOB). Under CIF terms, the buyer pays the seller for the cost of the cargo and shipping it to the buyer. Consequently, the seller or shipper is responsible for the freight and charters a ship to transport the cargo and pays any demurrage. Under FOB terms, the seller is responsible only for the costs of transporting and loading the cargo onto a ship. Therefore, the buyer charters the ship and is responsible for any demurrage.

Almost all of the coal shipped from Newcastle is under FOB terms. The buyers charter ships and are responsible for any demurrage. However, under their contracts with coal producers, i.e. the sellers, it is agreed that demurrage, at certain rates, will be paid by the seller. Demurrage costs are initially paid by the buyer and then recovered from the seller at the agreed rates. In some cases, the buyer is bypassed and the demurrage is paid directly by the seller to the shipowner.

Therefore, demurrage costs are effectively borne by sellers, i.e. the coal producers. Consequently, buyers have little incentive to consider planning and scheduling ship arrivals to reduce demurrage costs. Hence, it is the coal producers who can benefit from reduced demurrage costs and may have an incentive in reducing the ship queue.

While the coal producers pay demurrage, not all of them perceive the proposed allocation systems as a benefit. These producers consider demurrage as just another cost of producing and exporting coal. They are prepared to bear these costs rather than the costs associated with reducing production and selling less coal. In submissions to the ACCC, some producers have argued that lost profits due to constraints imposed by the allocation system would be greater than the demurrage cost savings.

The reduced demurrage costs identified as a key saving by the ACCC are not necessarily perceived as such by all producers. Naturally, if the queue and ship waiting times increased to the extent that the demurrage costs exceeded those associated with selling less coal, the allocation systems could be perceived differently. However, there are no known figures for such a situation.

2.8.2 Public detriment due to ship queue related safety risks

The balancing of public benefit against public detriment in relation to a capacity allocation system has mainly focused on demurrage costs. The risks associated with an incident involving one or more ships in the anchorage and its consequences have not been specifically considered as a public detriment. The grounding of *Pasha Bulker* and related events highlight the serious consequences that such incidents can have, including the potential for major pollution or the blockage of the port resulting in enormous financial costs.

Coal producers can reasonably be expected to focus on the commercial aspects of a capacity allocation system. However, other interested parties and members of the Hunter Valley Coal Chain Logistics Team (HVCCLT), including PWCS and NPC, should be expected to identify the increased safety risk and the public detriment associated with a large number of ships at anchor off Newcastle.

In submission PWCS stated:

The capacity allocation systems do not control the vessel queue and therefore should not be relied upon for managing vessel safety. Notwithstanding the operation of these systems, the vessels queue can substantially increase due to other factors such as weather and performance issues of the Coal Chain. Whilst these systems seek to reduce the queue, any adjustments made to allocations may take months to have a flow on effect. The operational management of vessels off the port of Newcastle, from a safety perspective, should be addressed by vessel masters and the Newcastle Port Corporation as part of port operating protocols.

While it is recognised that capacity allocation systems are not intended to manage the safety of ships, they do, as acknowledged by PWCS, 'seek to reduce the queue'. A positive and direct consequence of their effectiveness in doing so is the enhanced ship safety which, in turn, also contributes to the general objective of improving Newcastle's international reputation.

Capacity allocations systems have proved effective in reducing the ship queue and, as a result, the safety risks associated with a queue. Therefore, when balancing public benefit and detriment with regard to these systems, enhanced safety should be recognised as the critically important issue that it is.

3.1 Context

On 23 May 2007, *Pasha Bulker* anchored off Newcastle in good weather and waited to load coal. At midday on 7 June, the ship's master veered additional anchor cable after a gale warning had been issued. At 0748 on 8 June, *Pasha Bulker* got underway after dragging its anchor in the strong gale. The ship was among the last 12 of 56 ships to get underway to put to sea.

At 0951, with both its anchors in their hawse pipes and all of its machinery operational, *Pasha Bulker* grounded on Nobbys Beach. All of the ship's crew were evacuated by helicopter that afternoon.

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

3.2 Contributing safety factors

- *Pasha Bulker*'s master did not have an adequate understanding of heavy weather ballast, the holding power of the ship's anchor, local weather conditions or the limitations of the Newcastle anchorage in adverse weather. Consequently, when adverse weather was forecast for the Newcastle area, he failed to ballast the ship for heavy weather and decided to leave the anchorage too late and after the anchor had dragged.
- The master's early and unwise decision to remain at anchor unless the anchor dragged was based on his assumption that the ship's anchor would hold in the prevailing conditions and his expectation that Newcastle port would, if required, issue instructions for ships in the anchorage to put to sea. Most other ships remaining at anchor, and his expectations, predisposed him to confirmation bias and probably reinforced, in his mind, the decision to stay at anchor.
- The master continued to ignore signs that a dangerous situation was developing and subsequently became affected, to varying degrees, by fatigue, anxiety, overload and panic. This was evidenced by his inappropriate control of the ship at critical times after the anchor was finally weighed, the fact that the anchors were not prepared, or deployed, as the emergency unfolded and by the final high risk turn towards the dangerous lee shore which had little prospect of success.
- The master's management of the available bridge resources on board *Pasha Bulker* was poor. There was no effective planning and little communication between the master and the mates on the bridge. Consequently, once the decision was made to leave the anchorage, the ship's progress and its response to the master's helm orders, were inadequately monitored. This was evident in the failure of the course alteration at 0906 when the ship's poor response to the helmsman's rudder inputs was not detected in time to prevent the course overshoot. The state of the bridge meant that it was highly likely that single person errors would occur once the master became overloaded and then not be detected and corrected.

- The safety management system on board *Pasha Bulker* did not provide the master with specific guidance about safely putting to sea in adverse weather. Neither the master's standing orders nor the passage plan form prescribed in the safety management system contained any guidance with regard to bridge resource or team management or encouraged its use. *[Safety issue]*
- Newcastle Vessel Traffic Information Centre's advisory role was not properly understood by the masters of a number of the ships in the Newcastle anchorage on 7 June 2007. *[Safety issue]*
- Newcastle Port Corporation's incident control system was activated at about 0830 on 8 June 2007, suggesting that the corporation was not sufficiently responsive to the increasing seriousness of the situation that developed off the port from the evening of 7 June. As a result, the Australian Maritime Safety Authority was not notified until about 0900 on 8 June. *[Safety issue]*
- Newcastle Vessel Traffic Information Centre did not provide weather advisories to ships off the port until about 0900 on 8 June 2007, after weather conditions had already become extreme. *[Safety issue]*
- Newcastle Vessel Traffic Information Centre's offers of assistance to *Pasha Bulker's* master were made at a late stage in extreme weather conditions when it was unlikely that any practical assistance could be provided. *[Safety issue]*
- Newcastle Vessel Traffic Information Centre requested the masters of four ships to leave the anchorage at a very late stage, when the weather conditions were extreme and just before *Pasha Bulker* grounded. The masters of several ships, including *Pasha Bulker*, had expected the centre to provide them with similar guidance earlier, when weather conditions warranted, enabling them to safely clear the coast. *[Safety issue]*
- On 8 June 2007, Newcastle Vessel Traffic Information Centre's advice was limited to the masters of only those ships that were dragging their anchors. Some masters assumed, incorrectly, that the appropriate time to weigh anchor was when the centre informed them that their anchor was dragging and may have waited for this guidance to leave the anchorage. *[Safety issue]*
- On 8 June 2007, Newcastle Vessel Traffic Information Centre did not cancel the scheduled berthing of any ship even after weather conditions had become severe. This may have compounded the confusion of some masters about the appropriate time to leave the anchorage. *[Safety issue]*
- On 8 June 2007, Newcastle Vessel Traffic Information Centre asked the masters of three ships, including *Pasha Bulker*, to leave the restricted area off the port's entrance. Given that all three ships were struggling to clear the coast and that there was no need to keep the area clear because there was no traffic into or out of the port, these communications were of no benefit and unnecessary, and may also have adversely influenced the decisions of masters, including *Pasha Bulker's*. *[Safety issue]*

3.3 Other safety factors

- Water depths in parts of Newcastle anchorage make it difficult for sufficient length of cable to be deployed to anchor a ship safely. On 7-8 June 2007, the masters of a number of ships in the anchorage had not deployed the Admiralty recommended minimum scope of anchor cable and fewer still had deployed the

minimum considered to be acceptable by the International Association of Classification Societies. *[Safety issue]*

- On 8 June 2007, a number of ships off Newcastle were inappropriately ballasted for the forecast weather and some took additional ballast after the onset of heavy weather. These ships were exposed not only to the risk of manoeuvring difficulties but also structural damage caused by the water ballast sloshing in partly filled cargo holds while they were ballasting their holds in the heavy weather. *[Safety issue]*
- A number of masters at Newcastle anchorage on 8 June 2007 had inadequate knowledge of the local weather and the limitations of the Newcastle anchorage. Operational, rather than safety considerations, may have been the priority in their decisions to remain anchored. Consequently, most of the ships remained at anchor in heavy weather and later dragged their anchors. *[Safety issue]*
- On 8 June 2007, one ship fouled its anchor on a discarded anchor cable which delayed it from safely putting to sea. At least 40 discarded anchors and cables lie on the seabed in the Newcastle anchorage but most are not charted. The position of some of these hazards and the approximate location of others is known to Newcastle Port Corporation. Such information could be used by the Australian Maritime Safety Authority, New South Wales Maritime and the Australian Hydrographic Service to take the necessary action to enhance maritime safety. *[Safety issue]*
- Port Waratah Coal Services' 'vessel suitability list' and related initiatives, which effectively penalise ships it has assessed as unsuitable for loading at Newcastle, primarily on the basis of long de-ballast periods, may have been misunderstood by the masters in the anchorage at the time of the incident. This misunderstanding may have influenced the decision of some masters not to appropriately ballast their ships when the adverse weather was forecast. *[Safety issue]*
- The queue of 57 ships off Newcastle on 7 June 2007 increased the risk of collisions, groundings and other difficulties in the subsequent heavy weather. Capacity allocations systems have proved effective in reducing the queue in the past and, consequently, reduced the risks to ships, the port and the environment. The significant public benefit of enhanced safety that results from a reduced queue had not been identified or recognised during the application process for the authorisation of these allocation systems. *[Safety issue]*

3.4 Other key findings

- Newcastle Vessel Traffic Information Centre was generally considered by the masters of ships at Newcastle anchorage on 7 June 2007 to be the most useful source of information for the anchorage.
- The masters of the seven ships that put to sea before the onset of gale force winds demonstrated the highest levels of seamanship. They ensured that their ships, crew and the environment were not exposed to unnecessary risks in the accurately forecast adverse weather later.
- The emergency deployment of both anchors, use of the main engine and taking heavy weather ballast probably prevented the grounding of *Sea Confidence* on Stockton Beach.

- Almost all of the coal shipped from Newcastle is under Free On Board terms but demurrage costs, under another agreement, are also paid by the coal producers. Hence, a reduction in the ship queue can benefit the producers through reduced demurrage while enhancing maritime safety at the same time.

4.1 Safety action by Newcastle Port Corporation

The ATSB has been advised that the following safety actions have been taken by Newcastle Port Corporation as a result of the grounding of *Pasha Bulker* on 8 June 2007 and related events.

- Recommending that masters of ships arriving off Newcastle anchor not less than three miles from the shore.
- Providing masters of ships at Newcastle anchorage with regular weather broadcasts when a Bureau of Meteorology weather warning is in place.
- Enhanced monitoring of ships off Newcastle with Automatic Identification System equipment.
- Increased monitoring of the draughts of ships entering port with the aim of ensuring they are appropriately ballasted.
- Procedural checks of the audio recording equipment at the Vessel Traffic Information Centre.

4.2 Safety action by Port Waratah Coal Services

The ATSB has been advised that the following safety actions that have been taken by Port Waratah Coal Services (PWCS) as a result of the grounding of *Pasha Bulker* on 8 June 2007 and related events. In submission PWCS stated:

The following are details of PWCS initiatives to assist Vessel Master/Owners and Operators to understand Vessel Suitability List:

- Modification of the PWCS Coal Terminals Information Handbook to expand the vessel suitability criteria selection;
- Modification of the PWCS Coal Terminal Handbook to reinforce vessel port entry requirements;
- In conjunction with NPC, issued a general notice to industry on port entry requirements and ongoing radio communication with each vessel prior to entry;
- Commenced bi-annual workshops with vessel agents and local industry representatives to review/discuss improvement initiatives;
- Ongoing dialogue/communications with all vessel owners/operators and masters on vessel performance including any safety issues; and
- Bi-annual meetings with senior management of large vessel owner groups to discuss safety performance and how to work together. Examples include NYK, Mitsui, K Line and Shinwa.

4.3 ATSB recommendations

MR20080009

The safety management system on board *Pasha Bulker* did not provide the master with specific guidance about safely putting to sea in adverse weather. Neither the master's standing orders nor the passage plan form prescribed in the safety management system contained any guidance with regard to bridge resource or team management or encouraged its use.

The Australian Transport Safety Bureau recommends that Fukujin Kisen Company take action to address this safety issue.

MR20080010

Newcastle Vessel Traffic Information Centre's advisory role was not properly understood by the masters of a number of the ships in the Newcastle anchorage on 7 June 2007.

The Australian Transport Safety Bureau recommends that Newcastle Port Corporation take action to address this safety issue.

MR20080011

Newcastle Port Corporation's incident control system was activated at about 0830 on 8 June 2007, suggesting that the corporation was not sufficiently responsive to the increasing seriousness of the situation that developed off the port from the evening of 7 June. As a result, the Australian Maritime Safety Authority was not notified until about 0900 on 8 June.

The Australian Transport Safety Bureau recommends that Newcastle Port Corporation take action to address this safety issue.

MR20080012

Newcastle Vessel Traffic Information Centre's offers of assistance to *Pasha Bulker*'s master were made at a late stage in extreme weather conditions when it was unlikely that any practical assistance could be provided.

The Australian Transport Safety Bureau recommends that Newcastle Port Corporation take action to address this safety issue.

MR20080013

Newcastle Vessel Traffic Information Centre requested the masters of four ships to leave the anchorage at a very late stage, when the weather conditions were extreme and just before *Pasha Bulker* grounded. The masters of several ships, including *Pasha Bulker*, had expected the centre to provide them with similar guidance earlier, when weather conditions warranted, enabling them to safely clear the coast.

The Australian Transport Safety Bureau recommends that Newcastle Port Corporation take action to address this safety issue.

MR20080014

On 8 June 2007, Newcastle Vessel Traffic Information Centre's advice was limited to the masters of only those ships that were dragging their anchors. Some masters

assumed, incorrectly, that the appropriate time to weigh anchor was when the centre informed them that their anchor was dragging and may have waited for this guidance to leave the anchorage.

The Australian Transport Safety Bureau recommends that Newcastle Port Corporation take action to address this safety issue.

MR20080015

On 8 June 2007, Newcastle Vessel Traffic Information Centre did not cancel the scheduled berthing of any ship even after weather conditions had become severe. This may have compounded the confusion of some masters about the appropriate time to leave the anchorage.

The Australian Transport Safety Bureau recommends that Newcastle Port Corporation take action to address this safety issue.

MR20080016

On 8 June 2007, Newcastle Vessel Traffic Information Centre asked the masters of three ships, including *Pasha Bulker*, to leave the restricted area off the port's entrance. Given that all three ships were struggling to clear the coast and that there was no need to keep the area clear because there was no traffic into or out of the port, these communications were of no benefit and unnecessary, and may also have adversely influenced the decisions of masters, including *Pasha Bulker*'s.

The Australian Transport Safety Bureau recommends that Newcastle Port Corporation take action to address this safety issue.

MR20080017

On 8 June 2007, one ship fouled its anchor on a discarded anchor cable which delayed it from safely putting to sea. At least 40 discarded anchors and cables lie on the seabed in the Newcastle anchorage but most are not charted. The position of some of these hazards and the approximate location of others is known to Newcastle Port Corporation. Such information could be used by the Australian Maritime Safety Authority, New South Wales Maritime and the Australian Hydrographic Service to take the necessary action to enhance maritime safety.

The Australian Transport Safety Bureau recommends that Newcastle Port Corporation take action to address this safety issue.

MR20080018

The queue of 57 ships off Newcastle on 7 June 2007 increased the risk of collisions, groundings and other difficulties in the subsequent heavy weather. Capacity allocations systems have proved effective in reducing the queue in the past and, consequently, reduced the risks to ships, the port and the environment. The significant public benefit of enhanced safety that results from a reduced queue had not been identified or recognised during the application process for the authorisation of these allocation systems.

The Australian Transport Safety Bureau recommends that Newcastle Port Corporation, individually and as a member of the Hunter Valley Coal Chain Logistics Team, take action to address this safety issue.

MR20080019

The queue of 57 ships off Newcastle on 7 June 2007 increased the risk of collisions, groundings and other difficulties in the subsequent heavy weather. Capacity allocations systems have proved effective in reducing the queue in the past and, consequently, reduced the risks to ships, the port and the environment. The significant public benefit of enhanced safety that results from a reduced queue had not been identified or recognised during the application process for the authorisation of these allocation systems.

The Australian Transport Safety Bureau recommends that Port Waratah Coal Services, individually and as a member of the Hunter Valley Coal Chain Logistics Team, take action to address this safety issue.

4.4 ATSB safety advisory notices

MS20080015

The safety management system on board *Pasha Bulker* did not provide the master with specific guidance about safely putting to sea in adverse weather. Neither the master's standing orders nor the passage plan form prescribed in the safety management system contained any guidance with regard to bridge resource or team management or encouraged its use.

The Australian Transport Safety Bureau advises that the owners, operators and masters of ships should consider the safety implications of this safety issue and take action when considered appropriate.

MS20080016

Water depths in parts of Newcastle anchorage make it difficult for sufficient length of cable to be deployed to anchor a ship safely. On 7-8 June 2007, the masters of a number of ships in the anchorage had not deployed the Admiralty recommended minimum scope of anchor cable and fewer still had deployed the minimum considered to be acceptable by the International Association of Classification Societies.

The Australian Transport Safety Bureau advises that the owners, operators and masters of ships should consider the safety implications of this safety issue and take action when considered appropriate.

MS20080017

On 8 June 2007, a number of ships off Newcastle were inappropriately ballasted for the forecast weather and some took additional ballast after the onset of heavy weather. These ships were exposed not only to the risk of manoeuvring difficulties but also structural damage caused by the water ballast sloshing in partly filled cargo holds while they were ballasting their holds in the heavy weather.

The Australian Transport Safety Bureau advises that the owners, operators and masters of ships should consider the safety implications of this safety issue and take action when considered appropriate.

MS20080018

A number of masters at Newcastle anchorage on 8 June 2007 had inadequate knowledge of the local weather and the limitations of the Newcastle anchorage. Operational, rather than safety considerations, may have been the priority in their decisions to remain anchored. Consequently, most of the ships remained at anchor in heavy weather and later dragged their anchors.

The Australian Transport Safety Bureau advises that the owners, operators and masters of ships should consider the safety implications of this safety issue and take action when considered appropriate.

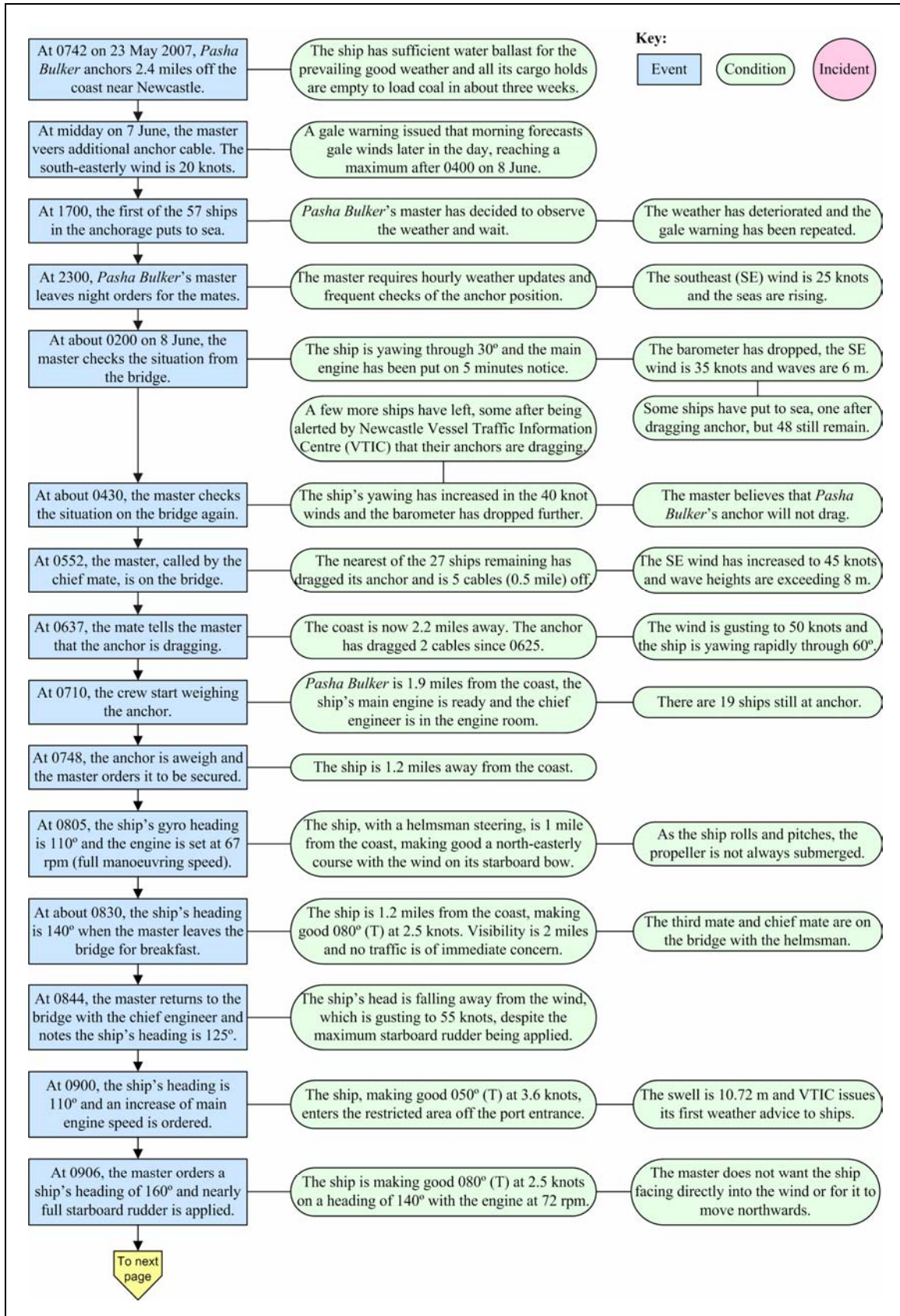
4.5 Response by *Pasha Bulker's* owners

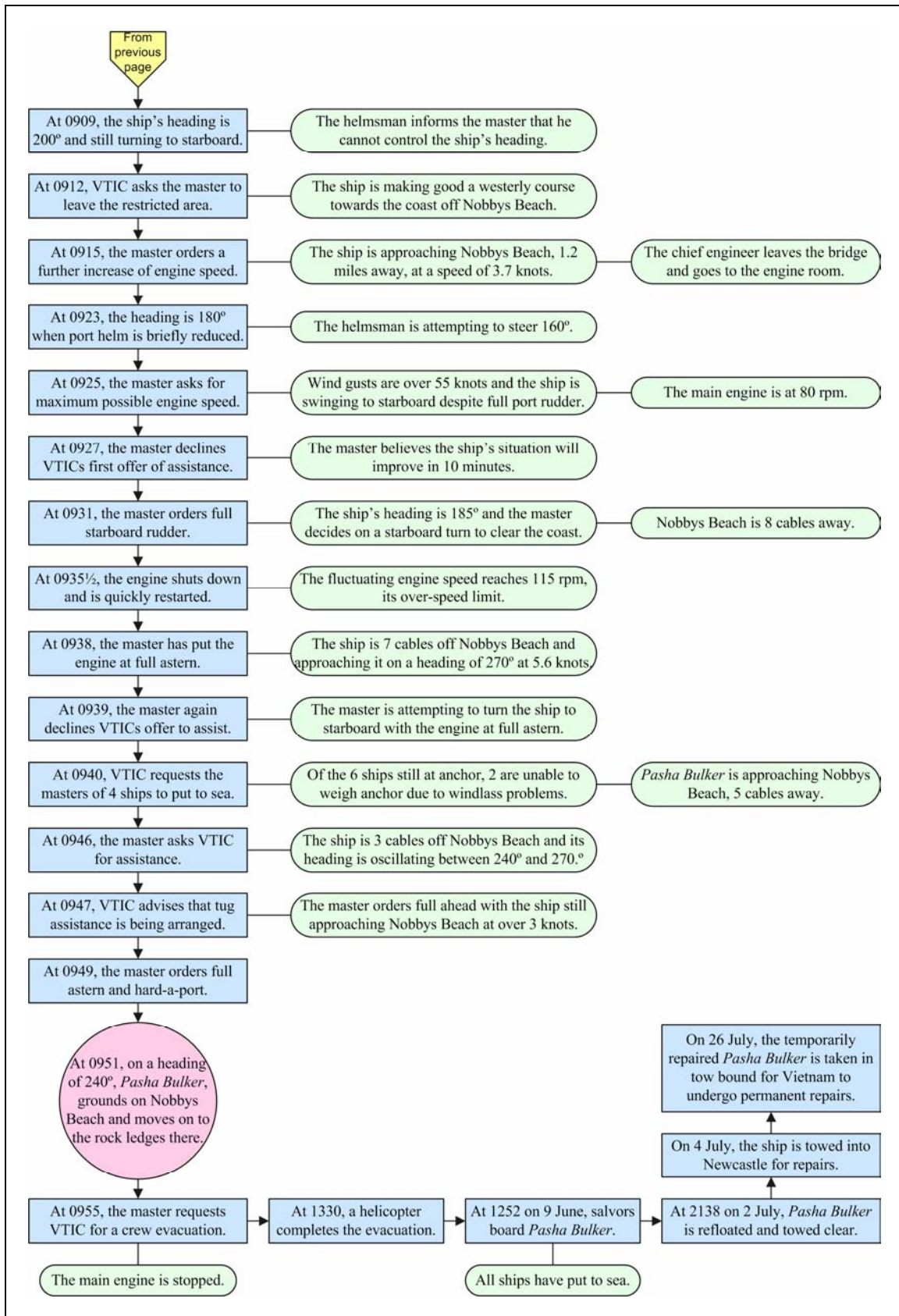
The ATSB has been advised by the legal representative of the owners of *Pasha Bulker* that, in submission to the draft report, the owners stated:

The Owners do not accept that the comments and recommendations contained in the report are valid.

The Australian Transport Safety Bureau was not provided with any evidence or argument by the owners to support their submission. The ATSB was unable to determine what, if any, safety actions have been taken by the owners and managers of *Pasha Bulker* to address the relevant safety issues identified in the report.

APPENDIX A: EVENTS AND CONDITIONS





APPENDIX B: SHIP INFORMATION

Pasha Bulker

IMO Number	9317729
Call sign	3EGK5
Flag	Panama
Port of Registry	Panama
Classification society	ClassNK
Ship Type	Bulk Carrier
Builder	Sasebo Heavy Industries Company, Japan
Year built	2006
Owners	Wealth Line, Panama
Ship managers	Fukujin Kisen Company, Japan
Gross tonnage	40 042
Net tonnage	25 259
Deadweight (summer)	76 781 tonnes
Summer draught	14.221 m
Length overall	225 m
Length between perpendiculars	218 m
Moulded breadth	32.20 m
Moulded depth	19.80 m
Engine	B&W 7S50MC-C
Total power	9230 kW
Crew	21

APPENDIX C: SOURCES AND SUBMISSIONS

Sources of information

Master and crew of *Pasha Bulker*

Newcastle Port Corporation

Port Waratah Coal Services

Australian Maritime Safety Authority

New South Wales Maritime

Svitzer Salvage

Master of *Sea Confidence*

Master of *Betis*

Masters of ships that participated in the survey (Appendix E)

Maritime Union of Australia

Australian Ship Handling Centre (Port Ash)

Clark Shipping Newcastle

NYK Line Newcastle

Sydney Ports Corporation

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Submissions

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

The final draft of this report was sent to the master and chief mate of *Pasha Bulker*, the owners and managers of *Pasha Bulker*, the Australian Maritime Safety Authority, New South Wales Maritime, the Panama Maritime Authority, the masters of *Betis* and *Sea Confidence*, Newcastle Port Corporation and relevant officers of the corporation, Port Waratah Coal Services and Svitzer Salvage.

Submissions were received from the owners of *Pasha Bulker*, the Australian Maritime Safety Authority, New South Wales Maritime, Newcastle Port Corporation and three of its officers, Port Waratah Coal Services and Svitzer Salvage. The submissions have been included and/or the text of the report was amended where appropriate.

APPENDIX D: METEOROLOGICAL INFORMATION

General information

The information presented here includes terminology and descriptions used in marine weather reports. Such information is the recognised standard for mariners.

Beaufort wind scale

The Beaufort scale of wind force, developed in 1805 by Admiral Sir Francis Beaufort, enables sailors to estimate wind speeds through visual observations of sea states. The table below is reproduced from the Admiralty Mariner's Handbook.

Table 2: Beaufort wind scale and sea state

(For an effective height of 10 m above sea level)					
Beaufort Number	Descriptive Term	Mean wind speed equivalent		Deep Sea Criterion	Probable mean wave height* in metres
		Knots	m/sec		
0	Calm	<1	0-0.2	Sea like a mirror	—
1	Light air	1-3	0.3-1.5	Ripples with the appearance of scales are formed, but without foam crests	0.1 (0.1)
2	Light breeze	4-6	1.6-3.3	Small wavelets, still short but more pronounced; crests have a glassy appearance and do not break	0.2 (0.3)
3	Gentle breeze	7-10	3.4-5.4	Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses	0.6 (1)
4	Moderate breeze	11-16	5.5-7.9	Small waves, becoming longer; fairly frequent white horses	1 (1.5)
5	Fresh breeze	17-21	8.0-10.7	Moderate waves, taking a more pronounced long form; many white horses are formed (chance of some spray)	2 (2.5)
6	Strong breeze	22-27	10.8-13.8	Large waves begin to form; the white foam crests are extensive everywhere (probably some spray)	3 (4)
7	Near gale	28-33	13.9-17.1	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind	4 (5.5)
8	Gale	34-40	17.2-20.7	Moderately high waves of greater length; edges of crests begin to break into spindrift; foam is blown in well-marked streaks along the direction of the wind	5.5 (7.5)
9	Strong gale	41-47	20.8-24.4	High waves; dense streaks of foam along the direction of the wind; crests of waves begin to topple, tumble and roll over; spray may affect visibility	7 (10)
10	Storm	48-55	24.5-28.4	Very high waves with long overhanging crests; the resulting foam, in great patches, is blown in dense white streaks along the direction of the wind; on the whole, the surface of the sea takes a white appearance; the tumbling of the sea becomes heavy and shock-like; visibility affected	9 (12.5)
11	Violent storm	56-63	28.5-32.6	Exceptionally high waves (small and medium sized ships might be for a time lost to view behind the waves); the sea is completely covered with long white patches of foam lying along the direction of the wind; everywhere the edges of the wave crests are blown into froth; visibility affected	11.5 (16)
12	Hurricane	64 and over	32.7 and over	The air is filled with foam and spray; sea completely white with driving spray; visibility seriously affected	14 (—)

* This table is only intended as a guide to show roughly what may be expected in the open sea, remote from land. It should never be used in the reverse way, i.e. for logging or reporting the state of the sea. In enclosed waters, or when near land, with an off-shore wind, wave heights will be smaller and the waves steeper. Figures in brackets indicate the probable maximum height of waves.

Wind warnings

The Australian Bureau of Meteorology (BoM) website provides the following information:

Definitions of wind strength used in coastal and high seas warnings

- Strong Wind Warning (Coastal Waters only): from 26 knots and up to 33 knots
- Gale Warning: from 34 knots and up to 47 knots
- Storm Force Wind Warning: from 48 knots and up to 63 knots
- Hurricane Force Wind Warning: 64 knots or more

Note: These wind speeds are 10-minute averages

Coastal waters wind warnings attempt to provide an initial warning about 24 hours in advance (sometimes 32 hours) and are normally renewed every six hours. All BoM weather reports are prefixed with the following note:

Please be aware:

Wind gusts may be a further 40 per cent stronger than the average given here, and maximum waves may be up to twice the height.

Sea and swell

Information provided on the BoM website is reproduced in the tables below.

Table 3: Sea condition (in open sea)

Description	Height (metres)	Effect
Calm (glassy)	0	No waves breaking on beach
Calm (rippled)	0 - 0.1	No waves breaking on beach
Smooth	0.1 - 0.5	Slight waves breaking on beach
Slight	0.5 - 1.25	Waves rock buoys and small craft
Moderate	1.25 - 2.5	Sea becoming furrowed
Rough	2.5 - 4	Sea deeply furrowed
Very rough	4-6	Sea much disturbed with rollers having steep fronts
High	6-9	Sea much disturbed with rollers having steep fronts (damage to foreshore)
Very High	9-14	Towering seas
Phenomenal	Over 14	Precipitous seas (experienced only in cyclones)

Table 4: Swell condition

Description	Wave length (metres)	Period (seconds)	Wave height (metres)
Low swell of short or average length	0-200	Less than 11	0-2
Long, low swell	over 200	Greater than 11	0-2
Short swell of moderate height	0-100	Less than 8	2-4
Average swell of moderate height	100-200	Greater than 8, less than 11	2-4
Long swell of moderate height	over 200	Greater than 11	2-4
Short heavy swell	0-100	Less than 8	over 4
Average length heavy swell	100-200	Greater than 8, less than 11	over 4
Long heavy swell	over 200	Greater than 11	over 4

APPENDIX E: SURVEY INFORMATION AND RESULTS

General information

During the investigation, the ATSB conducted a survey to obtain the views and actions of the masters of ships anchored off Newcastle at the time of the incident. For the survey, all the masters were asked the same questions. Their responses were charted, including re-categorising where necessary, and compared to analyse the incident with the aim of identifying relevant safety issues.

Pasha Bulker was excluded from the survey sample, as was a ship that berthed during the night before the grounding. Therefore, the sample consisted of the masters of the other 55 ships anchored off Newcastle on the afternoon of 7 June 2007.

Some of the masters declined to participate in the voluntary survey. A further two, who took command after the incident, advised that they were unable to participate. The survey was conducted through interviews, telephone interviews, fax and email. The masters of 42 ships, or 76 per cent of the survey sample, provided responses to survey questions.

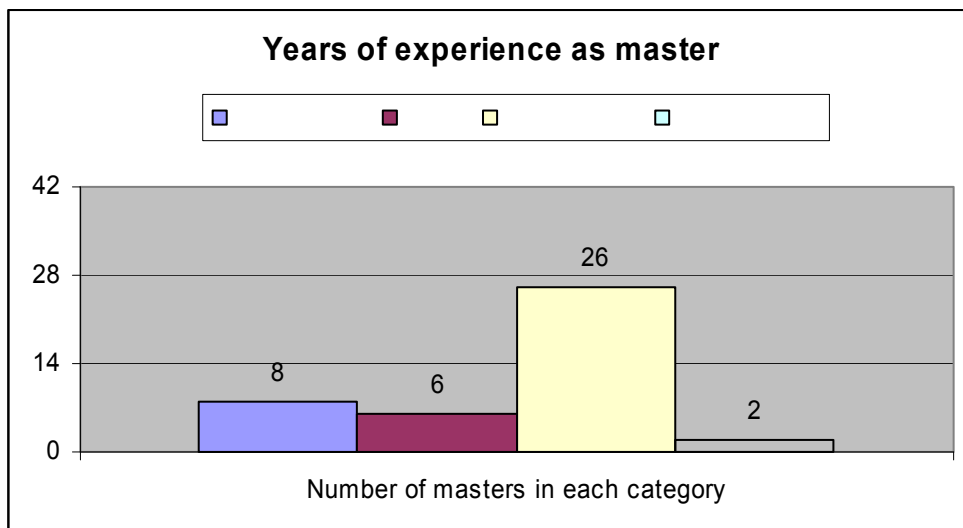
Where relevant, survey questions were in the context of the incident. Responses to the questions and some comparisons are presented. *Pasha Bulker's* VDR audio data was used to confirm responses, resolve ambiguities and compare responses.

Responses

The responses to survey questions take into account all 42 respondents. The bar charts represent each response appropriately. Notes included with each response provide a comparison with *Pasha Bulker*.

Question 1: How many years have you been master?

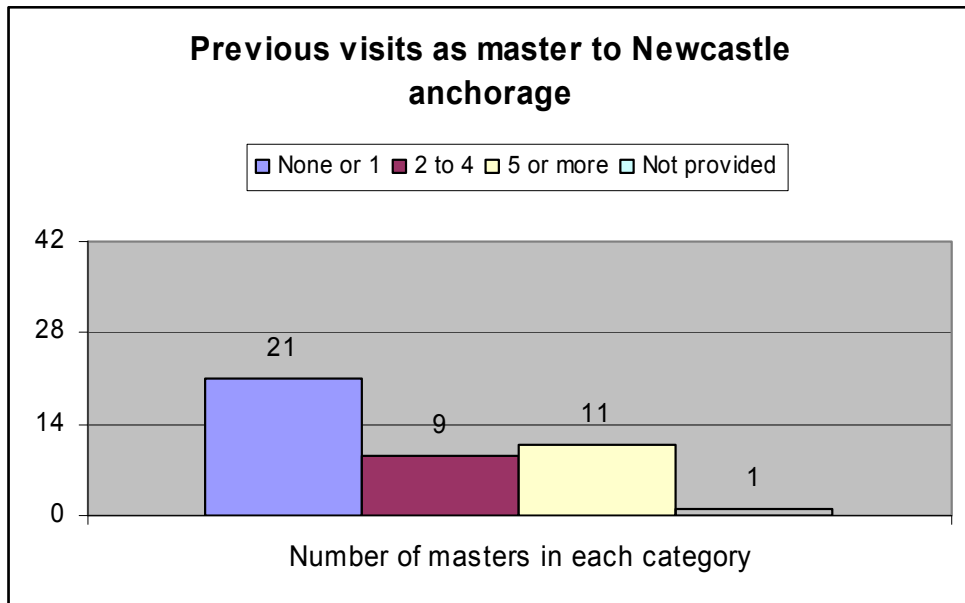
Response:



Note: *Pasha Bulker's* master had seven years experience as master.

Question 2: Before June 2007, how many times as master had you been to Newcastle anchorage?

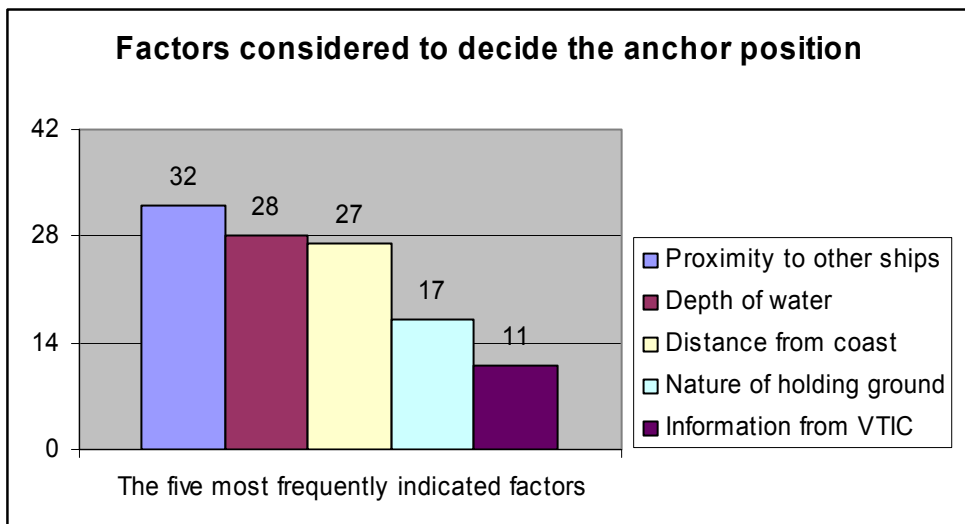
Response:



Note: *Pasha Bulker's* master was visiting Newcastle anchorage as master for the first time.

Question 3: How did you decide your ship's anchor position?

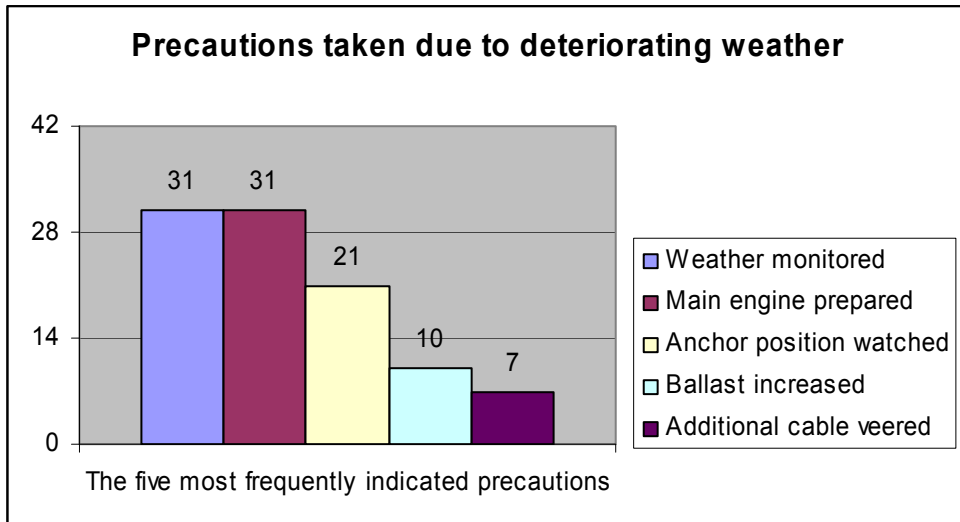
Response: Multiple responses could be provided to this question. A total of 165 responses were received and categorised into 13 groups of factors. The order of importance of the factors was not provided and the five most frequently indicated ones are shown.



Note: *Pasha Bulker's* master indicated all these factors except 'distance from coast'.

Question 4: When the weather worsened on 6-7 June, did you take any precautions?

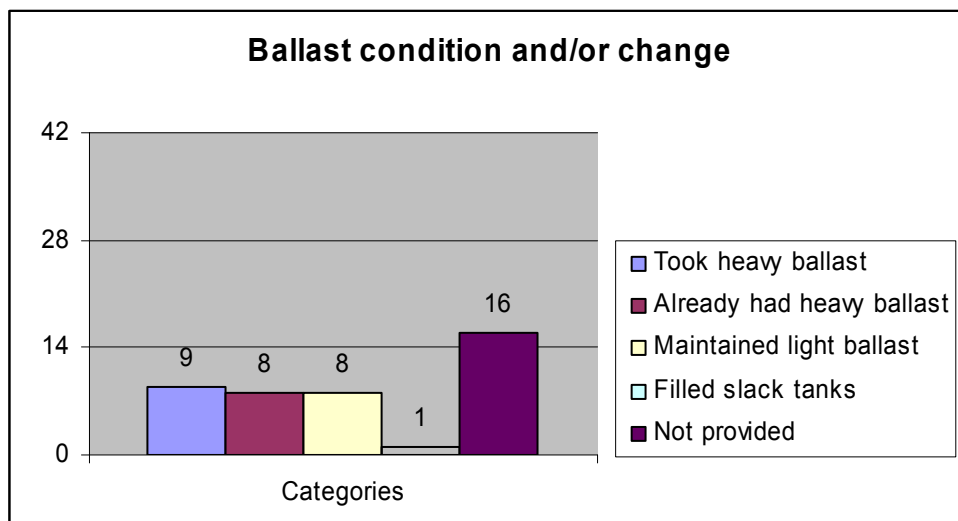
Response: Multiple responses could be provided to this question. A total of 120 responses were received and categorised into eight groups of precautions. The order of importance of the precautions was not provided and the five most frequently indicated ones are shown.



Note: *Pasha Bulker*'s master indicated all these precautions except for 'ballast increased'.

Question 5: Did you change your ballast condition and [if so] to what?

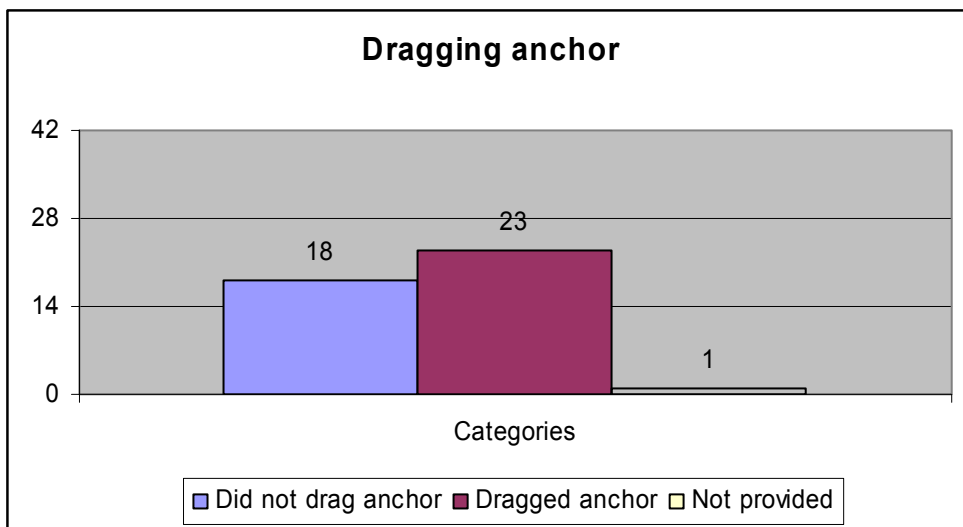
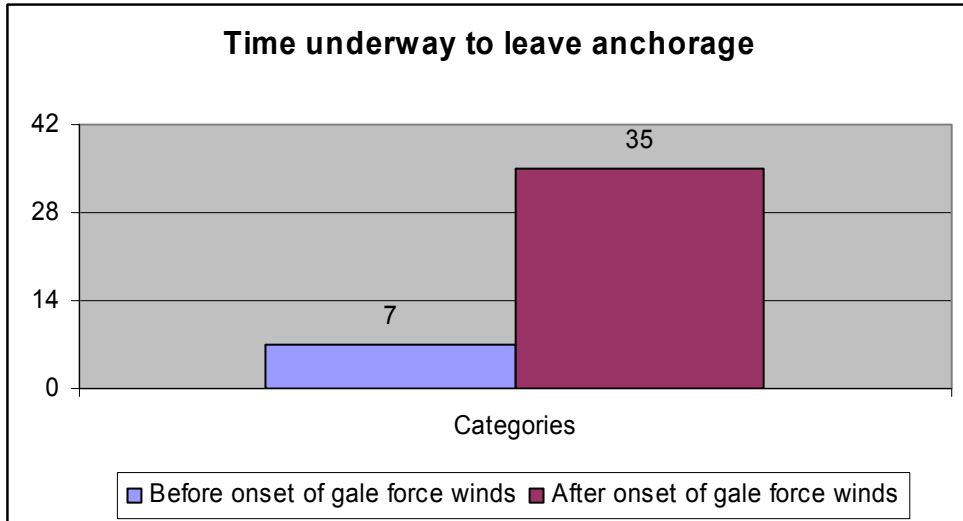
Response: In general, masters did not respond to the question as intended. Some provided this information in response to other survey questions. The chart below shows the information that was provided.



Note: *Pasha Bulker*'s master maintained the ship in light ballast condition.

Question 6: When did you leave Newcastle anchorage and did your ship’s anchor drag before you started heaving it up?

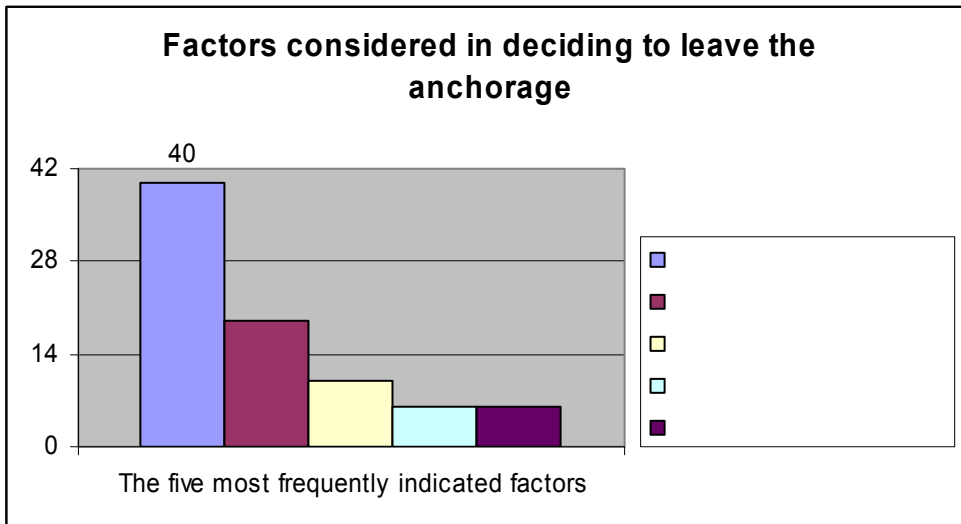
Response: Masters provided the time their ships got underway and if their anchors dragged before being weighed. Where possible, VDR audio data was used to confirm responses and resolve any ambiguities. The wind speed increased to a consistent gale force by 0100 on 8 June. This time has been used as the determinant for before or after the wind increased to gale force.



Note: *Pasha Bulker* got underway at 0748 on 8 June after its anchor had dragged. At the time, there were 11 ships in the anchorage which were not underway.

Question 7: How did you decide to leave the anchorage?

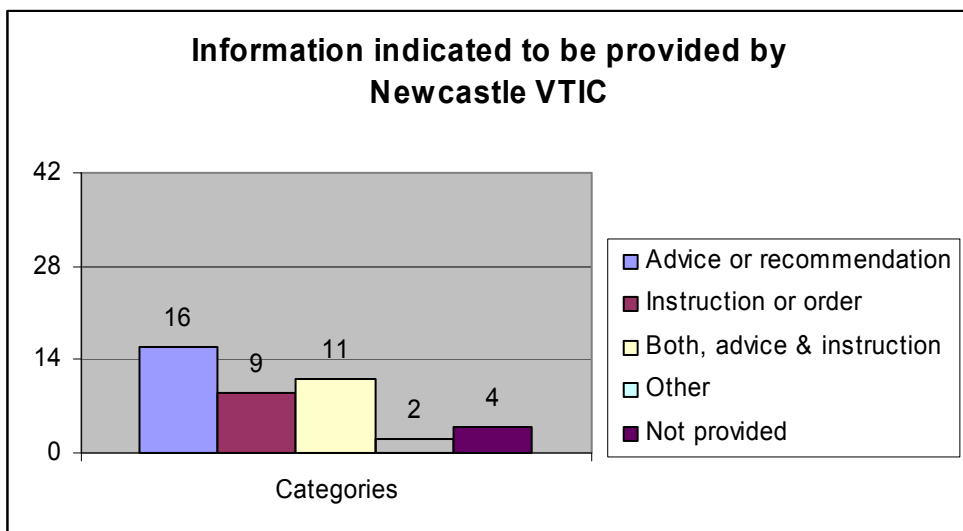
Response: Multiple responses could be provided to this question. A total of 100 responses were received and categorised into 13 groups of factors. The order of importance of the factors was not provided and the five most frequently indicated ones are shown.



Note: *Pasha Bulker*'s master indicated all of the factors except for 'other ships dragging' and 'exposed anchorage'.

Question 8: What information does Newcastle Harbour Vessel Traffic Information Centre (VTIC) provide to ships?

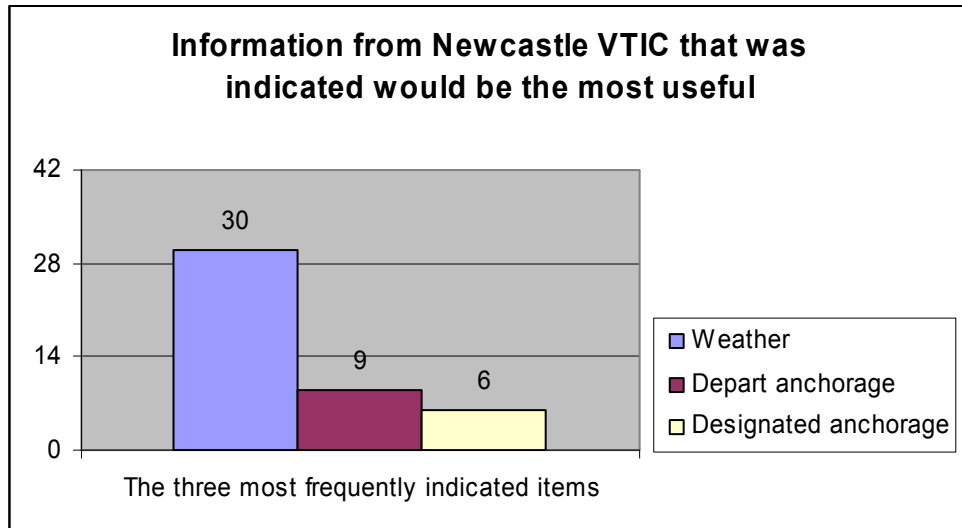
Response: Responses for this question could include advice/recommendation, order/instruction and/or other. A total of 63 responses were received, with 11 indicating both main categories. The bar chart shows one response from each of the 42 respondents which fall under five categories. Of the remaining 10 responses, four indicated that weather information was provided. Five responses in the two main categories specified VTIC provided advice or instructions to leave anchorage.



Note: *Pasha Bulker*'s master indicated Newcastle VTIC instructs ships to leave the anchorage.

Question 9: What information from Newcastle Harbour (VTIC) would be most useful for you?

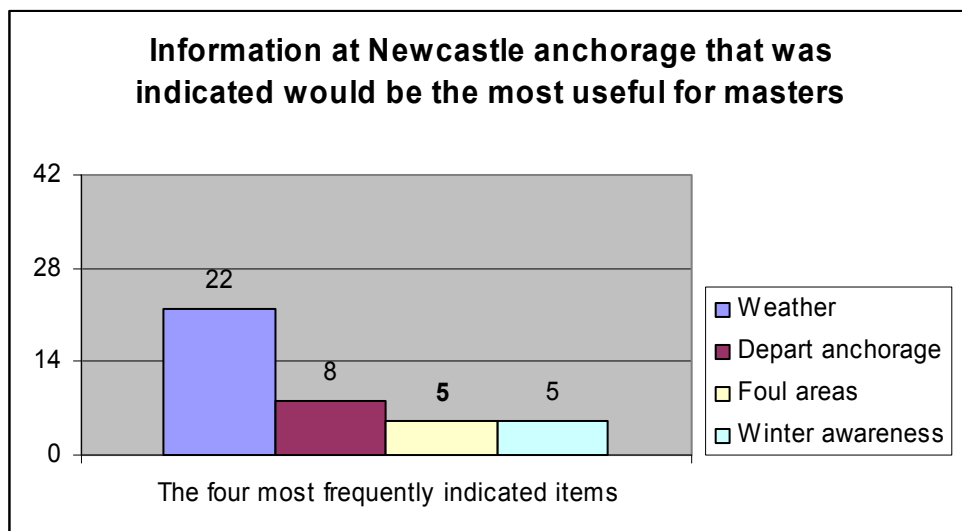
Response: Multiple responses could be provided to this question. A total of 60 responses was received and categorised into eight groups of items. The order of importance of the items was not provided and the three most frequently indicated ones are shown.



Note: *Pasha Bulker*'s master stated that Newcastle VTIC should instruct ships to depart the anchorage in gale force winds.

Question 10: What would be useful information for shipmasters at Newcastle anchorage?

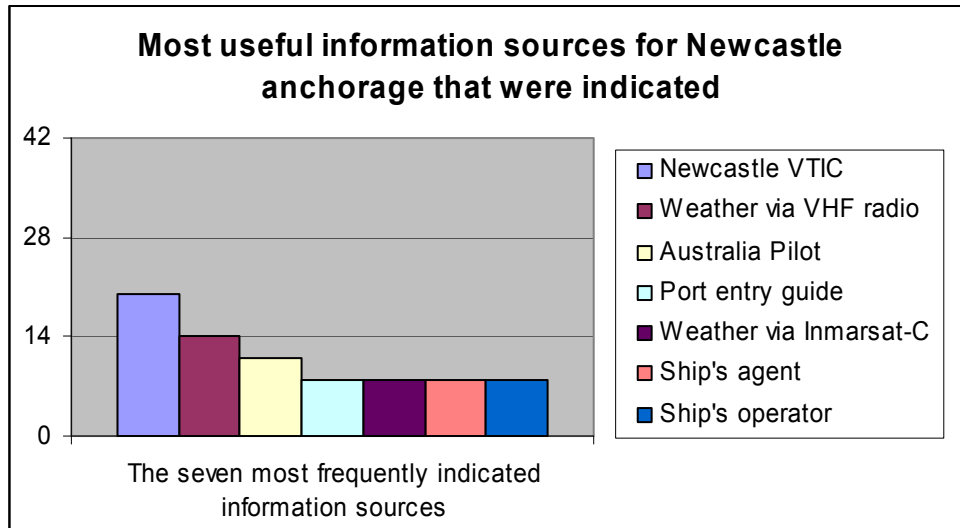
Response: Multiple responses could be provided to this question. A total of 64 responses were received and categorised into 11 groups of items. The order of importance of the items was not provided and the four most frequently indicated ones are shown.



Note: *Pasha Bulker*'s master stated that Newcastle VTIC should instruct ships to depart the anchorage in gale force winds.

Question 11: Where can you get the most useful information for Newcastle anchorage?

Response: Multiple responses could be provided to this question. A total of 90 responses were received and categorised into 10 groups of information sources. The order of importance of the sources was not provided and the seven most frequently indicated ones are shown.



Note: *Pasha Bulker*'s master indicated only that the navigational chart for the anchorage was the most useful information source.

Question 12: Any other relevant information you wish to provide?

Response: Multiple responses could be provided to this question. Eight masters provided no responses while three provided responses which were applicable to other survey questions. The remaining 30 masters provided a total of 46 responses which were categorised into eight general groups as shown in the table below.

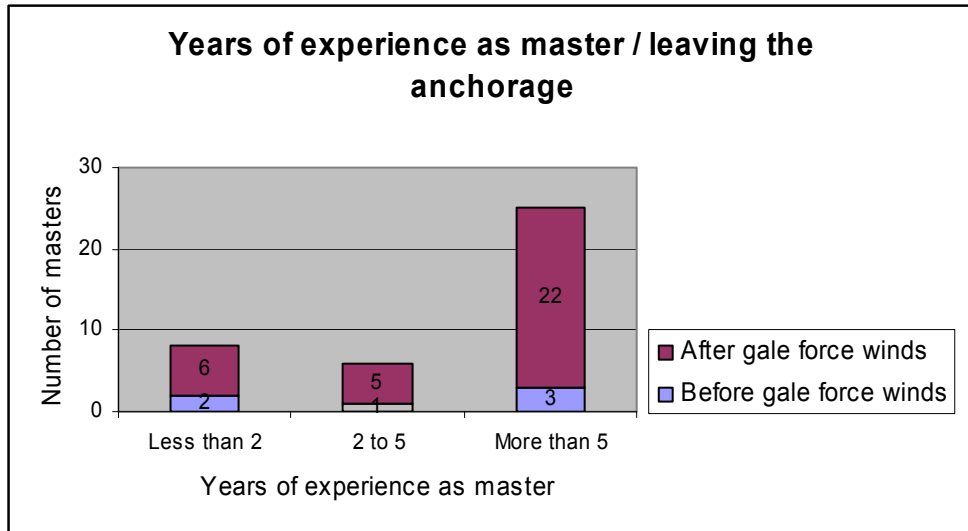
General groups of responses	Responses
Masters should monitor weather and leave the anchorage early	15
VTIC should provide guidance to masters to leave the anchorage	10
Position of foul areas and lost anchors should be promulgated	7
Designated anchorages should be charted and allocated	4
Ballast and heavy ballast concerns associated with coal terminals	3
VTIC control of anchorage for safety and to avoid congestion	3
Port working beyond capacity/anchorage dangerously congested	2
VTIC should provide traffic information	2
Total	46

Comparisons

The responses from different survey questions were used to make comparisons. The charts below show some of the results.

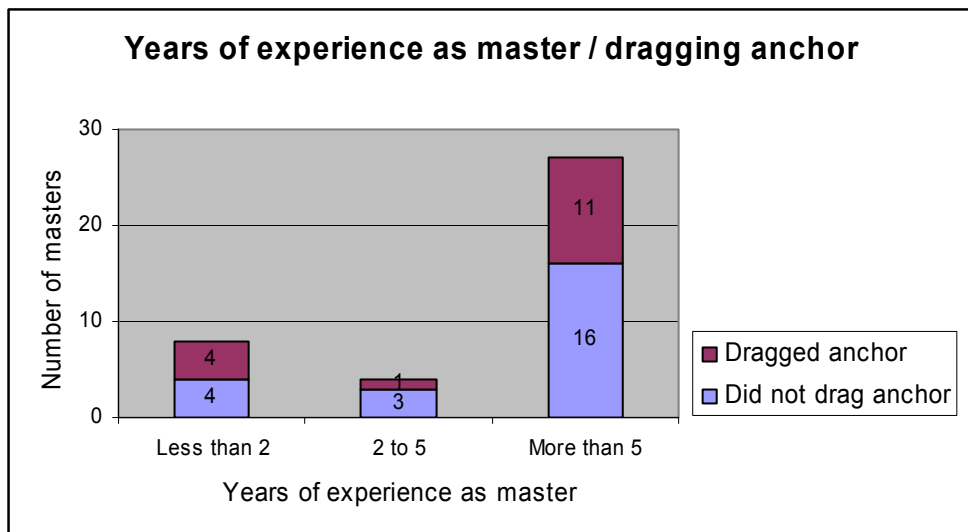
Comparison 1a

Three of the 42 masters did not provide the information to make this comparison.



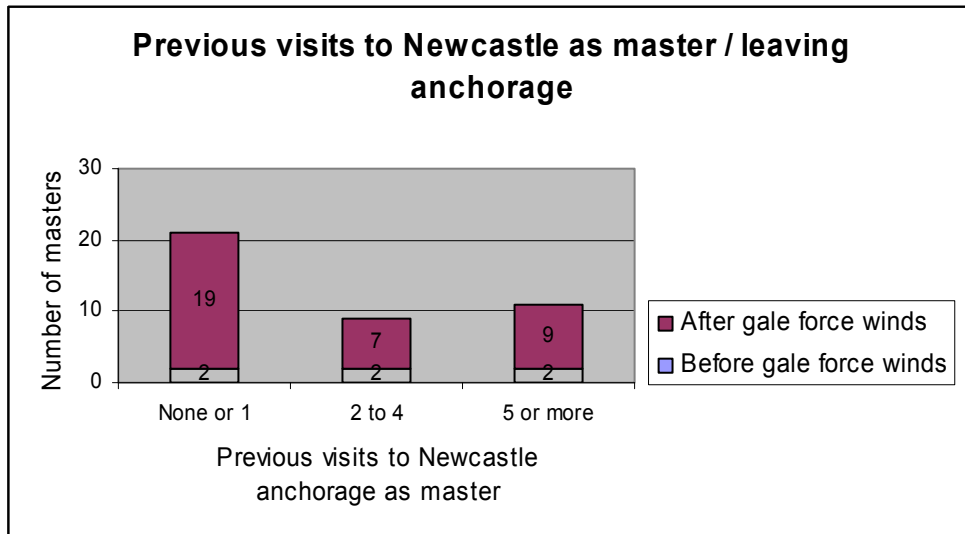
Comparison 1b

Three of the 42 masters did not provide the information to make this comparison.



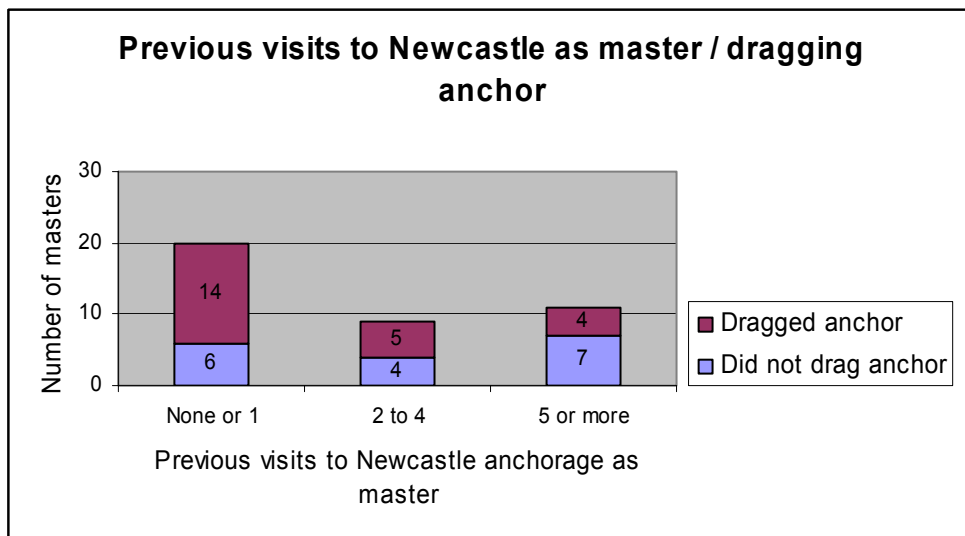
Comparison 2a

One of the 42 masters did not provide the information to make this comparison.



Comparison 2b

Two of the 42 masters did not provide the information to make this comparison.



Other results

The survey data and *Pasha Bulker's* VDR audio data were used to obtain the following charts as well as the times that ships in the anchorage got underway, as shown in Figure 18. These results include *Pasha Bulker*.

Chart 1

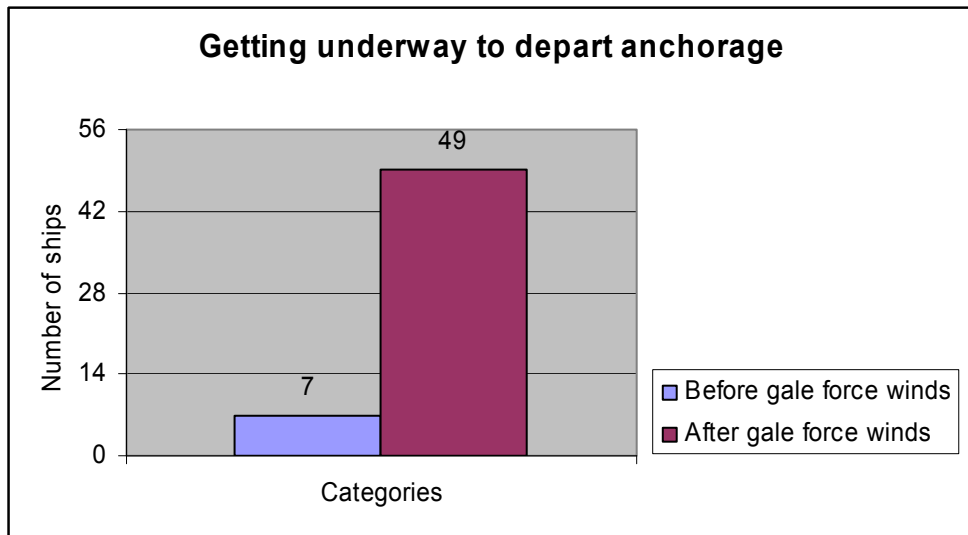
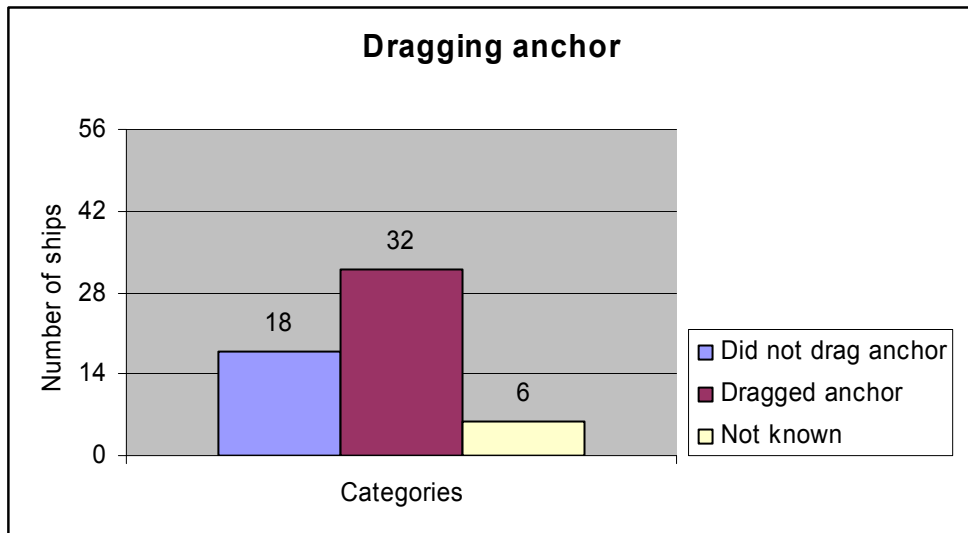


Chart 2



Note: Of the six ships in the 'not known' category one got underway at 0330 on 8 June and the other five after 0630.

APPENDIX F: MEDIA RELEASE

ATSB releases final *Pasha Bulker* report

The ATSB has found that the grounding of *Pasha Bulker* on Nobbys Beach on 8 June 2007 occurred despite a gale warning that should have prompted the master to ballast the ship for heavy weather and take it to sea. A number of other ships also failed to take to sea.

The Australian Transport Safety Bureau investigation found that *Pasha Bulker*'s master had an inadequate understanding of heavy weather ballast, anchor holding power and the limitations of Newcastle's weather exposed anchorage.

The investigation also found that a number of other ships attempted to ride out the gale at anchor and the majority dragged their anchors. A number of masters did not appropriately ballast their ships and many did not understand Newcastle Vessel Traffic Information Centre's purely advisory role, expecting that it would instruct or inform them to put to sea at an appropriate time. It was also found that the substantial ship queue increased the risks in the anchorage and resulted in another near grounding, a near collision and a number of close-quarters situations at the time.

On 23 May, the Panamanian registered bulk carrier *Pasha Bulker* anchored about two miles off the coast near Newcastle and joined the queue of 57 ships to wait its turn for loading coal. The ship was ballasted for the good weather conditions. Newcastle anchorage is suitable only in good weather and nautical publications contain warnings about the local weather conditions and recommend that masters put to sea before conditions become severe.

On the morning of 7 June, the Bureau of Meteorology issued a gale warning for the area. Winds were expected to increase to 45 knots, with gusts up to 63 knots, after 0400 on 8 June with high seas and a heavy swell. At midday, *Pasha Bulker*'s master deployed additional anchor cable and decided to monitor the weather and the ship's anchor position.

By midnight, the southeast wind was gusting to 30 knots and ships began dragging their anchors. Newcastle Vessel Traffic Information Centre advised those ships that were dragging their anchors. Only seven ships had put to sea in the deteriorating weather while another had weighed anchor to berth in the port.

By 0600 on 8 June, the wind was gusting to nearly 50 knots and *Pasha Bulker* was amongst 27 ships still at anchor. At 0637, when the master was certain that the anchor was dragging, he decided to weigh anchor. At 0748, the ship got underway and for more than an hour, moved in a northeast direction parallel to the coast about one mile away with the wind on its starboard bow.

At 0906, the master decided to alter course to put the wind on the ship's port bow and clear the coast in a southerly direction. The course change in the extreme weather was poorly controlled and *Pasha Bulker*'s heading became south-westerly instead of south-southeast as intended. The ship then rapidly approached Nobbys Beach and the master's desperate attempt to turn the ship to starboard to clear the coast inevitably led to its grounding at 0951 with both anchors in their hawse pipes.

The ATSB is pleased to report that safety actions have already been taken following the incident but has issued a number of other recommendations and safety advisory notices with the aim of preventing similar incidents in the future.

Independent investigation into the grounding of the Panamanian registered bulk carrier *Pasha Bulker* on Nobbys Beach, Newcastle, New South Wales on 8 June 2007.