Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Marine Occurrence Investigation No.231
Final

Independent investigation into the grounding
of the Vanuatu registered offshore tug/supply ship

Massive Tide

on Rosemary Island, Western Australia

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Independent investigation into the grounding of the Vanuatu registered offshore tug/supply ship *Massive Tide* on Rosemary Island, Western Australia on 29 August 2006.

Prepared by

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Acknowledgements

Abstract

At 1400 on 28 August, *Massive Tide* departed Dampier with a load of bulk cargo for the drill rig Ensco 106. After clearing the berth, the master handed over the watch to the second mate who then remained in charge of the watch for the transit to the drill rig.

The master took over the watch when the ship reached the drill rig at 1950 and the second mate remained on the bridge to operate the bulk-board for the cargo transfer. After the completion of cargo operations, the master handed the watch back to the second mate, and then went to bed.

At 0100 on 29 August, the ship departed the drill rig. The second mate checked the global positioning system (GPS) unit, and then set the autopilot to follow a course of 129° (T). The weather was good with light winds, slight seas and visibility of about eight miles.

At 0200 and 0400, the second mate recorded the ship's GPS position in the deck log book, but did not plot either position on the navigational chart. At about 0400, the bridge lookouts changed watches but the second mate decided to leave the chief mate in bed until the ship reached the Dampier Sea Buoy.

At 0445, *Massive Tide* was making good a speed of 9.8 knots when it grounded on the shoals approaching the western shore of Rosemary Island.

The crew were called out and checks of the ship, its machinery and the surrounding area revealed that no damage or pollution had occurred. Immediate attempts to refloat the ship were unsuccessful and plans were put in place to try again on the next high tide. At 1035, *Massive Tide* floated free without assistance.

The report identifies a number of contributing factors and makes recommendations 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 Transport and Regional Services. 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: the occurrence would probably not have occurred; or 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

During August 2006, the offshore tug/supply ship *Massive Tide* was operating as a support vessel for the drill rig Ensco 106, located about 58 miles[1] west-northwest of Dampier, Western Australia.

At 1400 on 28 August, *Massive Tide* departed the Dampier cargo wharf with a load of bulk cargo for the drill rig. After clearing the berth, the master handed over the watch to the second mate who then remained in charge of the watch for the transit to the drill rig. Before arriving at the drill rig at 1950, the second mate called the master to relieve him as planned.

The master took over the watch and the second mate remained on the bridge to operate the bulk-board for the transfer of the bulk cargo. After the completion of cargo operations at 2315, the master suggested that the second mate get some rest. However, the second mate could not see the sense in doing so for a short period of time, as he was required on watch at 2400 for the trip back to Dampier. The master agreed with the second mate's view. He handed over the watch to the second mate, suggesting that he call the chief mate before 0400, his planned watch handover time, if he needed to.

At 0100 on 29 August, the ship was released from the drill rig and departed. The second mate and a lookout were on the bridge. The second mate checked the global positioning system (GPS) unit, and then set the autopilot to follow a course of 129° (T). The weather was good with light winds, slight seas and visibility of about eight miles.

At 0200 and 0400, the second mate recorded the ship's GPS position in the deck log book but did not plot either position on the navigational chart. At about 0400, the bridge lookouts changed over but the second mate decided to leave the chief mate in bed until the ship reached the Dampier Sea Buoy.

Both the second mate and the lookout recalled thinking that the ship was in a different position than it had been during previous transits from the drill rig to Dampier but thought nothing more of it.

At 0445, *Massive Tide* was making good a speed of 9.8 knots[2] when it grounded on the shoals approaching the western shore of Rosemary Island. The second mate brought the engines to stop and sent the lookout to call the master.

The rest of the crew were called out and checks of the ship, its machinery and the surrounding area revealed that no damage or pollution had occurred. Immediate attempts to refloat the ship were unsuccessful and plans were put in place to try again on the next high tide. At 1035, the ship floated free without assistance.

The investigation found that:

- At about 0100 on 29 August, the second mate set the autopilot to follow a course of 129° (T) without checking the information he had obtained from

1 Mile refers to a nautical mile (1852 metres).

2 One knot, or one nautical mile per hour = 1.852 kilometres per hour.

the GPS unit against any independent source. This course would take the ship directly to Rosemary Island, rather than the Dampier Sea Buoy as intended.

- The second mate did not monitor the ship's track during the voyage from the drill rig Ensco 106 to Dampier. He did not plot the ship's position on the navigational chart and he did not check the information that he had obtained from the GPS unit against independent sources.
- The ship's master did not ensure that the bridge watchkeepers routinely followed his instructions and the company's procedures.
- The performance of both the master and the second mate was probably adversely affected by fatigue.
- The procedures and practices in place on board *Massive Tide* did not ensure that the levels of watchkeeper fatigue were effectively managed.

The report recommends that:

- Tidewater Marine should review the procedures and practices on board *Massive Tide*, and other ships in their fleet, to ensure that the watchkeepers comply with the instructions, relating to navigational practices, issued by the company and the ship's master.
- Tidewater Marine should review the procedures and practices on board *Massive Tide*, and other ships in their fleet, to ensure that watchkeepers meet the requirements of STCW 95[3] and are fit for duty.

3 Seafarers' Training, Certification and Watchkeeping Code, Chapter VIII, International Maritime Organization, 1995.

1 FACTUAL INFORMATION

1.1 *Massive Tide*

Massive Tide is a Vanuatu registered offshore tug/supply ship. The ship is owned by Gulf Fleet Middle East, Cayman Islands, managed by Tidewater Marine, Australia, and classed with the American Bureau of Shipping (ABS).

The ship was built in 1982 by Aker Vindholmen, Arendal, Norway. It has an overall length of 64.40 m, a beam of 13.80 m, a depth of 6.91 m and a deadweight of 1898 tonnes at a draught of 4.72 m.

Figure 1: ***Massive Tide*** **berthed at the Dampier cargo wharf**

Massive Tide was designed primarily as an anchor handling tug and supply ship for offshore oil rigs and platforms. It was constructed so that it had a large number of tanks that could be used to carry liquid products such as fuel, potable water and drill water. The ship has a large main deck, which is used for the carriage of general cargo and anchor handling operations. Its hull also contains four bulk pods, which can be loaded with bulk products for delivery to a drill rig or platform. The discharge of bulk cargoes requires two people on the bridge, one manoeuvring the ship and one controlling the bulk-board[4].

Propulsive power is provided by two 18 cylinder Bergens KVMB, four stroke, single acting, vee configuration engines, each developing 3001 kW. Each engine drives a controllable pitch propeller through a clutch and a reduction gearbox. Together, the engines give the ship a service speed of 12 knots.

The ship was equipped with navigational equipment consistent with SOLAS[5] requirements. This included two radars, a Koden MD-3840 mounted on the forward bridge console, and a Furuno FR-7100D mounted next to the chart table. Two global positioning system (GPS) units, a Furuno GP-90 and a Furuno GP-50, were located above the chart table. The forward bridge console was also fitted with

4 The panel used for the control of bulk discharge from the ship's bulk cargo pods.

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

a Robertson AP9 Mk II autopilot, an echo sounder and an automatic identification system (AIS) unit.

At the time of the incident, *Massive Tide*'s crew consisted of the master, two mates, two engineers and five integrated ratings. All ten crew members were Australian nationals.

The master held a certificate of competency as master, restricted to vessels less than 3000 gross tonnes. He had 21 years seagoing experience, initially in fishing vessels before spending seven years working on sailing ships. He joined Tidewater Marine in 1995 and had been sailing as master of offshore tug/supply ships for four years. He first joined *Massive Tide* in January 2005 and had completed eight, five week, assignments on the ship. He had rejoined the ship two weeks prior to the incident.

The chief mate started his sea going career with the Royal Australian Navy (RAN). After seven years with the RAN, he spent almost 20 years working on small vessels around the Australian coast. Between 1993 and 1998, he worked on small barges and harbour tugs in and around Dampier. He joined Tidewater Marine in 1998. In 2006, he gained his chief mate certificate, restricted to vessels less than 3000 gross tonnes. He had sailed on *Massive Tide* many times before. However, when he joined the ship on 16 August it was a year since he had last sailed on it.

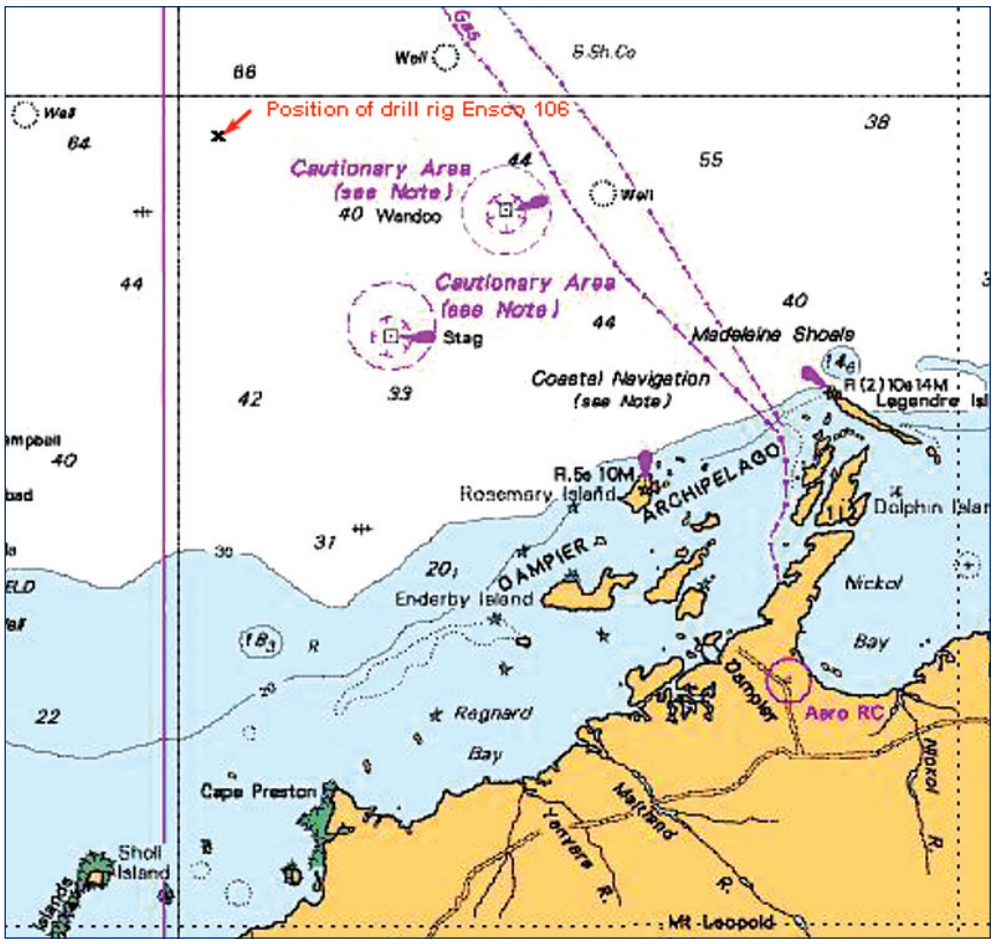
The second mate held a master class one certificate of competency, issued in Australia in March 2006. He started his sea going career with the RAN and spent the next 22 years serving on minor war vessels. On leaving the RAN in 1994, he gained his master class five certificate and joined an offshore tug/supply ship. In the following years he served on a number of offshore ships, with most of this sea time spent on seismic research ships. On 22 August, he joined *Massive Tide* for the first time.

The master and two mates were not operating a defined watchkeeping rotation because the second mate had limited experience in handling a tug/supply ship. In general, the second mate was keeping watch during the transits to and from the jack-up drill rig Ensco 106 while the master and chief mate shared the ship handling and watchkeeping duties while the ship was alongside the drill rig and in port. In addition, the second mate undertook some ship handling understudy and training while the ship was alongside the drill rig.

1.2 Area of operation

At the time of the incident and for the two weeks leading up to the incident *Massive Tide* was operating as a supply/support ship to the jack-up drill rig Ensco 106 (the drill rig). The drill rig was located off the port of Dampier on the northwest coast of Western Australia (Figure 2). The nature of the drilling operations meant that *Massive Tide* was required to make frequent transits between the Dampier cargo wharf and the drill rig. A distance of about 58 miles.

Figure 2: Section of navigational chart Aus 415



1.3 The incident

On 16 August 2006, *Massive Tide*'s crew changed while the ship was alongside in Dampier. All of the crew were relieved except for the second mate, who was relieved on 22 August when the ship was again alongside in Dampier.

The ship sailed from Dampier at 1620[6] on 22 August and by the time it reached the drill rig the second mate was showing signs of being ill. He was suffering from nausea and diarrhoea and was unwell for the next 24 hours, after which time his health slowly improved. Over the next few days, a number of other crew members fell ill with similar symptoms. The ship continued to operate normally and between 22 and 27 August two return voyages to the drill rig and the associated cargo operations were completed.

At 0030 on 28 August, *Massive Tide* departed the drill rig with the second mate on watch. The intention was for him to remain on watch until he was relieved by the chief mate just before the ship reached the Dampier Sea Buoy. At about 0500, the chief mate took over the watch and, once relieved, the second mate went to bed. The chief mate navigated the ship into Dampier, before calling the master for berthing at the Dampier cargo wharf. The ship was all fast alongside the berth at 0710.

6 All times referred to in this report are in local time, Coordinated Universal Time (UTC) + 8 hours.

While in port, the crew loaded the supplies required by the drill rig and carried out some routine maintenance. The second mate was left to sleep. He woke of his own accord and started work at 1200, assisting the chief mate with cargo loading operations.

At 1400, the ship departed the berth. After clearing the berth, the master, who was now feeling ill, went to bed. The second mate navigated *Massive Tide* out of the harbour and by 1600 the ship was clear of the sea buoy. The second mate remained in charge of the watch for the transit to the drill rig. Before the ship arrived at the drill rig, he called the master as planned.

The ship arrived off the drill rig at 1950 and the master took over the watch. Rather than calling the chief mate as planned, the master asked the second mate to remain on the bridge to operate the bulk-board for the transfer of barite[7]. The second mate told the master that he was tired and that he wished to go to bed, but after a short discussion he agreed with the master's request and remained on the bridge.

The cargo transfer was completed by 2315, at which time *Massive Tide* was required to standby the drill rig. The master suggested that the second mate get some rest, but the second mate could not see the sense in doing so for a short time, as he was required on watch at 2400 for the trip back to Dampier. The master agreed with the second mate's view. He handed over the watch to the second mate, suggesting that he call the chief mate before 0400, his planned watch handover time, if he needed to. The master went to his cabin to complete his midnight reports and then went to bed at about 2340.

The ship was cleared to depart from the drill rig at 0100 on 29 August, giving it a berthing time of 0700 at the Dampier cargo wharf. The second mate and the lookout were both on the bridge. The second mate checked the Furuno GP-90 GPS unit for the course he needed to steer, which he read as 129° (T), and then set the autopilot on that course (Figure 3). The weather was good with light winds, slight seas and visibility of about eight miles.

At 0200 and 0400, the second mate recorded the ship's GPS position in the deck log book, but he did not plot either position on the navigational chart. At 0330, the bridge lookout went to call his relief and asked if he should call the chief mate. The second mate said that the chief mate should be left in bed and that he would be called before the ship reached the sea buoy.

At about 0405, the bridge lookouts changed over. The new lookout was on the bridge for five minutes before he left to go to the toilet. He returned to the bridge about five minutes later. The second mate recalled thinking that the ship was in a different area than it had been during previous transits from the drill rig to Dampier, but thought nothing more of it. The lookout had the same thoughts and assumed that they were using an alternate route, but he did not discuss this with the second mate.

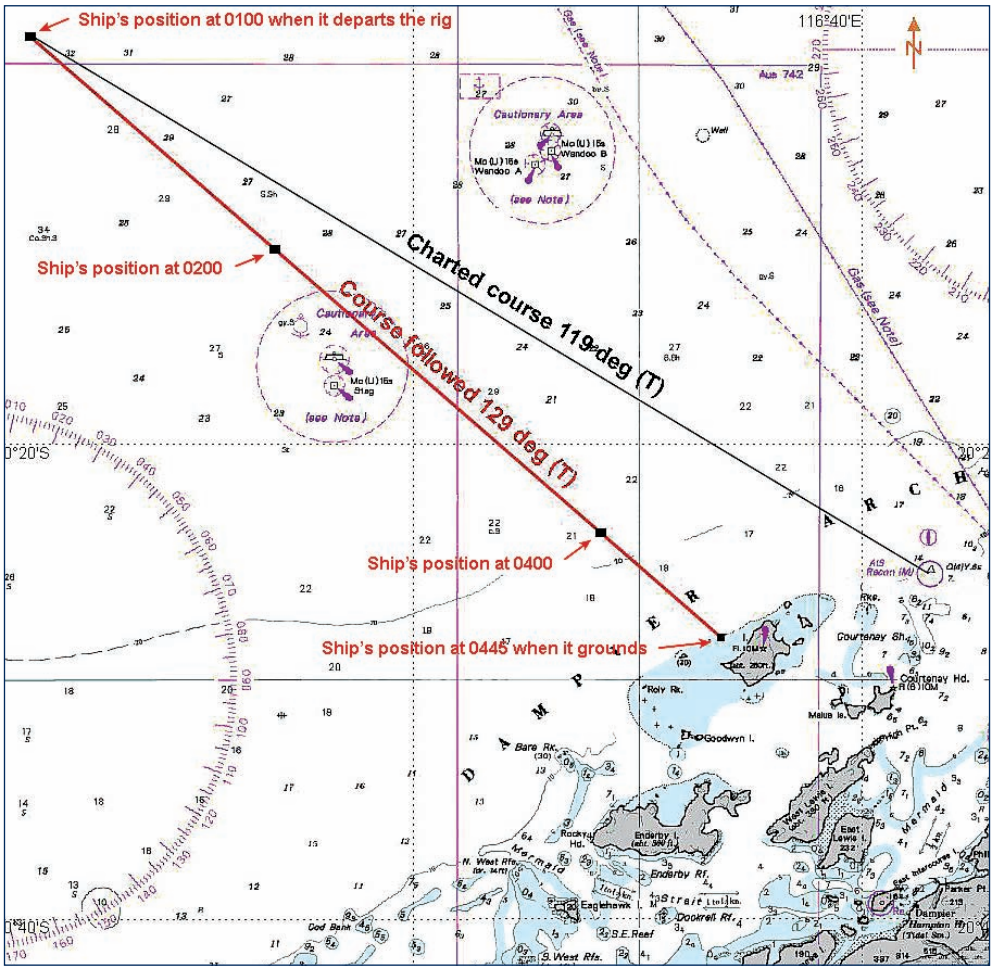
At 0445, *Massive Tide* was making good a speed of 9.8 knots when it grounded on the shoals approaching the western shore of Rosemary Island. The second mate brought the engines to stop and sent the lookout to call the master. The grounding

7 Barium sulphate, a powder that is mixed on the drill rig with drill water to increase its density.

had already woken the master and he met the lookout in the alleyway. The master instructed the lookout to call the chief mate and the engineers.

When the master arrived on the bridge he immediately saw Rosemary Island Light fine on the port bow. He checked the ship's position and plotted it on the navigational chart. He also noted that the GPS unit, which was operating in the 'highway' display mode, showed the ship on track. The ship's position was 20° 28'S 116° 33.7'E, about nine miles from the charted course line.

Figure 3: ***Massive Tide*'s track between 0100 and 0445 on 29 August 2006**



The master ordered the engineers to check the machinery and to start de-ballasting the ship. At the same time he ordered the chief mate to check the tank soundings, organise the crew, and carry out a general inspection of the ship and the surrounding area.

The crew broke out the salvage pump and hoses, and unlashed the fast rescue craft. At about 0515, the chief mate telephoned the master on the bridge and informed him that the tank soundings indicated that the hull was not breached. They also discussed the need to close the watertight doors, but decided that it was not necessary at this stage, and that they could be quickly closed if required later.

The tide was ebbing with low water predicted at 0735. By 0600, the master had determined that the de-ballasting was not assisting in refloating the ship. The

master decided to re-ballast the ship, make it secure in position, and to try to refloat it on the next high tide. The engines, propellers and rudders all appeared to be operating normally, with no signs of damage, and the crew could see no signs of pollution in the water.

The crew launched the fast rescue craft and took soundings around the ship. The soundings indicated that the ship had grounded on a shelving sandy bottom. They also showed that the water depth was shallowest around the starboard midships area of the ship.

The master notified the ship's managers, the drill rig and the Dampier Port Authority. Through discussions with the ship's managers it was agreed that another tug/supply ship, *OSA Voyager*, would be in position to assist *Massive Tide* at about 1000.

The master briefed the crew about the plans for the next attempt to refloat the ship and at 0910 de-ballasting of the ship began, starting with the forward tanks. The ship's potable water was transferred from the forepeak tank to the number four port wing tank in an attempt to list the ship slightly to port. At about 0915, *Massive Tide*'s tow wire was connected to a messenger rope and the fast rescue craft was readied to pass the wire across to *OSA Voyager* if required.

OSA Voyager arrived at 1000 and the two masters discussed the plans for the refloating of *Massive Tide*. They agreed that they should first attempt to refloat the ship without the assistance of *OSA Voyager*, and that the tow wire should only be used if this did not work.

The master set *Massive Tide*'s propellers at 40 per cent astern pitch to help prevent the small swell, which was coming from astern, pushing the ship further aground. At about 1025, when the de-ballasting was almost complete, the ship started to rotate, head to starboard, through about ten degrees. The master surmised that the ship was coming off the shoal but was still aground at the starboard midship section of the ship.

At 1035, the ship came free without assistance. Once in deep enough water to turn the ship around, the master set a course to clear the shallow water.

The crew again checked the tank soundings and tested the operation of the engines, propellers and rudders. The engineers also cleaned the seawater cooling suction strainers. At 1050, after these checks had revealed no problems, the master set a course for the Dampier Sea Buoy.

Massive Tide was all fast alongside the Dampier cargo wharf at 1300. Between 1430 and 1730, divers carried out an inspection of the ship which revealed no damage other than some scratches in the under water paintwork.

2 ANALYSIS

2.1 Evidence

On 30 August 2006, two investigators from the Australian Transport Safety Bureau (ATSB) attended *Massive Tide* in Dampier. The master and directly involved crew members were interviewed, and provided accounts of the incident. Copies of relevant documents were obtained including navigational charts, log books, operating manuals, procedures and statutory certificates.

Information including automatic identification system (AIS) data was obtained from the Dampier Port Authority. Copies of procedures and other documents were also obtained from Tidewater Marine.

2.1.1 The grounding

At 0100 on 29 August, *Massive Tide* departed the drill rig Ensco 106 at a speed of 9.8 knots and was set to follow a course of 129° (T), a course that would take it directly to Rosemary Island, rather than the Dampier Sea Buoy as intended. This error was not detected or rectified and, at 0445, the ship grounded on the shoals approaching the western shore of Rosemary Island.

2.2 Navigation

Navigation is the art of conducting a vessel from one place on the earth's surface to another by sea, safely, expeditiously, and efficiently[8]. With regard to navigation, the Bridge Procedures Guide[9], section 3.3 states:

> It is important that the officer of the watch executes the passage plan as prepared and monitors the progress of the ship relative to that plan.
>
> Good navigation practice demands that the officer of the watch:
>
> - understands the capabilities and limitations of the navigation aids and system being used and continually monitors their performance;
> - uses the echo sounder to monitor changes in water depth;
> - uses dead reckoning techniques to check position fixes;
> - cross checks position fixes using independent sources of information: this is particularly important when electronic position-fixing systems such as GPS or Loran-C are used as the primary means of fixing the position of the ship;
> - use visual aids to support electronic position fixing methods ie. landmarks in coastal areas and celestial navigation in open waters;
> - does not become over reliant on automated navigation equipment, including electronic chart systems, thereby failing to make proper navigation use of visual information.

8 The Oxford Companion to Ships and the Sea.

9 Bridge Procedures Guide, Third edition 1998, International Chamber of Shipping.

Good navigational practices were not routinely followed by the second mate on the morning of 29 August or over the preceding days. In fact, on the morning of 29 August, he had not implemented any of the points listed above. He relied on information that he had obtained from the GPS unit without cross checking it against other sources of information. Furthermore, he did not plot the ship's position on the navigational chart. *Massive Tide*'s track was not monitored and, consequently, the ship grounded at 0445 on 29 August.

2.2.1 Management and oversight

The company had issued safety management system (SMS) procedures relating to navigation to ensure that the bridge watchkeepers on board *Massive Tide* were fully briefed and informed of their responsibilities and duties. The master was also required to issue both standing orders and night orders.

The SMS procedures gave the following guidance to officers of the watch in relation to navigational practices;

> The person keeping the bridge watch shall check and record the position of the vessel at intervals such that the vessel cannot be set appreciably off the planned track or into danger…
>
> The ship's position to be checked by other means other than GPS
>
> As a cross reference, position fixing will be done by more than one method where possible.
>
> Any specific instructions issued by the master concerning the safe navigation of the vessel shall be given in writing in the night order book…

The master's standing orders, in relation to the use of the GPS unit, stated:

> When at sea use all means available to you for the safe navigation of the vessel, ie do not rely on GPS alone for positions.

Contrary to company instructions, the master had not issued night orders on the evening of 28 August. It was his normal practice to only issue night orders when he considered operations were out of the ordinary. He relied on his standing orders to give the necessary guidance to the officers of the watch at all other times.

The second mate had joined *Massive Tide* seven days before the grounding and it had been six years since he had sailed on a Tidewater Marine ship. It is likely that, in the short period of time available, he had not fully re-familiarised himself with the requirements of the SMS. He had, however, read and signed the master's standing orders and was therefore aware of the master's requirements.

According to the ship's SMS, the master should have issued night orders on the evening of 28 August. However, in all likelihood, they would have given the second mate little more guidance than the master's verbal handover of the watch at about 2315.

The master's responsibilities include reviewing the deck log book on a daily basis and checking the charts in use. A review of the information recorded in the log book and on the charts should have indicated to him whether the ship was being navigated according to the company's procedures, his requirements, and good navigational practice.

If the master's review of the charts and the deck log book had been more thorough prior to 28 August, he would have been aware that the second mate had been using the GPS unit alone for position fixing, and that he was not regularly plotting the ship's position on the chart.

It appears that the master had presumed that the second mate was more than appropriately qualified and experienced and, as such, guidance, instruction and monitoring of his navigational practices was not necessary.

The master had not ensured that the navigational practices of the bridge watchkeepers were appropriately monitored and that the second mate was adequately informed of his responsibilities in relation to the safe navigation of the ship. Had the master counselled the second mate and reinforced his requirements and the company's procedures prior to 29 August, the ship may not have grounded.

2.2.2 Passage planning and preparation

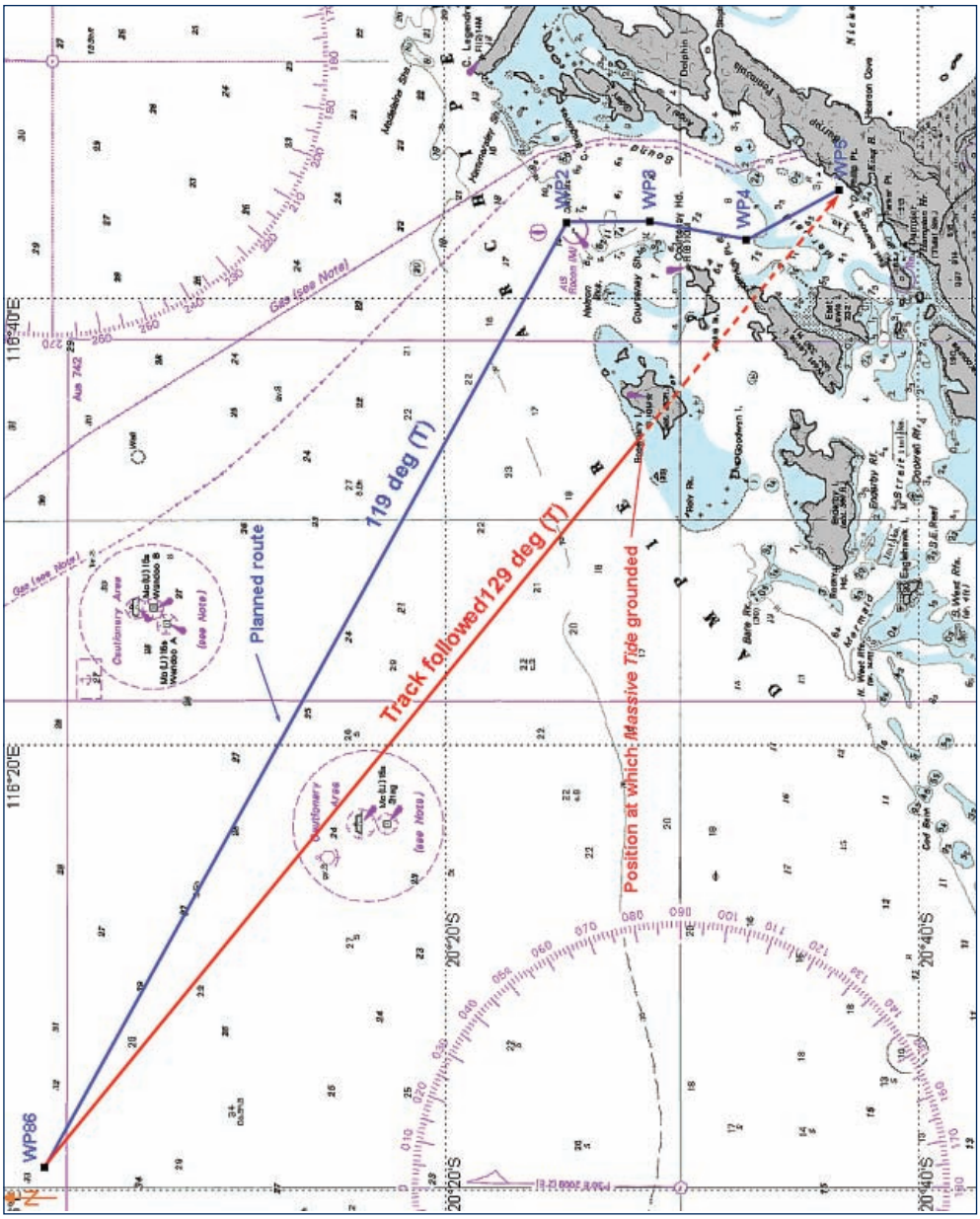
It was normal practice on board *Massive Tide* to prepare a passage plan, have it signed by the master, and then display the plan adjacent to the chart table. A passage plan titled 'DCW to LIBRIS' was prepared on 16 August and it was in use during the voyages between the Dampier cargo wharf and the drill rig Ensco 106, at the drilling location known as Libris. The five course alteration points (waypoints) were numbered and noted on the passage plan. They were then saved in the Furuno GP-90 GPS unit. These waypoints were then grouped and saved as route 13 (Figure 4).

The navigating officers were using the GPS unit as their primary means of position fixing. The unit's graphic display showed what looked like a highway leading from the bottom, to the top of the display. In the centre of the highway, at the bottom of the display, was a graphic representing the ship at its current position. At the top of the display, in the centre of the highway, was a graphic representing the next waypoint. The display also showed the ship's current position in latitude and longitude, the number of the next waypoint, and the distance and course to steer.

When the ship departed the Dampier cargo wharf, the GPS unit was set to follow route 13 in the forward direction. The route ran from waypoint five, just off the Dampier cargo wharf, to waypoint 86, just off the drill rig, via waypoints four, three and two. When the ship was to return to Dampier, the route was reversed. This process required five key strokes of the GPS unit's keypad. The process was well described in the GPS unit's operating manual, which was kept on the chart table. Once reversed, the route ran from waypoint 86, just off the drill rig, to waypoint five, just off the Dampier cargo wharf, via waypoints two, three and four.

At about 0100 on 29 August, the morning of the grounding, the second mate recalls reversing the route in the GPS unit. However, the course he read off the GPS unit was 129° (T). This was not the course from his current position, in the vicinity of waypoint 86, to the Dampier Sea Buoy, waypoint two. It was the course directly to the Dampier cargo wharf, waypoint five (Figure 4).

Figure 4: **Section of navigational chart Aus 327 showing *Massive Tide*'s planned route and the course followed on the morning of 29 August 2006**



The second mate had only navigated the ship from the drill rig to Dampier on one occasion before the morning of the grounding and he may have been confused by the similarity in the course that he obtained from the GPS unit, 129° (T), and the charted course, 119° (T). However, good navigational practice dictates that he should have cross checked the information he obtained from the GPS unit against independent sources of information. He could have checked the course against the charted course or the passage plan. However, he did not and, as a consequence, at 0100 on 29 August, the ship departed the drill rig and was set to follow a course of 129° (T).

2.2.3 Monitoring the ship's passage

Preparing and executing the passage plan and then monitoring the progress of the ship relative to the plan are the basic activities which constitute good navigational practice.

During the voyage from the drill rig to Dampier on the morning of 28 August, the day before the grounding, the second mate checked the ship's position twice on the GPS unit and recorded both in the deck log book. Only one of these positions was plotted on the chart.

On the return voyage, later on the same day, the second mate checked the ship's position once on the GPS unit, recorded the position in the deck log book, and plotted it on the chart.

On the next voyage from the drill rig to Dampier on 29 August, the morning of the grounding, the second mate checked the ship's position twice, and neither of these positions was plotted on the chart.

On three consecutive voyages between the Dampier cargo wharf and the drill rig, the second mate had only checked and recorded the ship's position on five occasions. Just two of these positions were plotted on the chart, and none of them were cross checked using independent sources of information.

On the morning of 29 August, the second mate did not compare the information he had obtained from the GPS unit against an independent source, or plot the ship's positions on the chart. Contrary to the master's standing orders, the ship's SMS and good navigational practice, the second mate was routinely relying on the GPS unit alone for position fixing. Furthermore, by not regularly plotting the ship's position on the chart, he was not checking the ship's position or monitoring its progress, he was merely carrying out the clerical exercise of recording the positions.

The radar mounted next to the chart table was not working on 29 August or over the preceding days. Consequently, the forward bridge console mounted Koden MD-3840 radar was in use on the morning of the grounding. The second mate set the radar in the north up mode and on the 12 mile range scale. He was accustomed to using more modern radars and electronic charting systems; consequently, he was only using the radar for collision avoidance. During the voyage, the second mate had found the echoes of some targets were hard to read so he increased the radar's clutter and gain controls. There was some 'clutter' showing on the screen but as he was not using the radar for navigation it did not seem important to him. When the master arrived on the bridge after the grounding, he reduced the radar range scale and adjusted the clutter and gain controls. What had appeared to the second mate to be 'clutter' was, in fact, Rosemary Island.

The second mate did not use dead reckoning techniques to monitor the ship's progress. If he had built a mental model of the voyage from the drill rig to the sea buoy, he would have had an idea of where and when he expected to see or pass local landmarks, oil platforms, anchored ships or lights. Had he used these visual references to cross check against the ship's position, it would have been readily apparent to him that the ship was not where it should have been.

Just prior to the grounding, both the second mate and the lookout thought the ship was in a different area to that which it had been on previous voyages. The lights of the ships at anchor seaward of the Dampier Sea Buoy appeared to be in a different place than usual. The second mate thought nothing more of it and the lookout assumed that the ship was heading to Dampier via the southern Mermaid Strait route. Neither man consulted the other or checked the chart.

A complete lack of passage monitoring allowed the simple error of setting the ship on an incorrect course to go unnoticed. Had the second mate plotted either of the positions he recorded in the deck log on the chart he may have alerted himself to his earlier error and the grounding could have been averted.

2.3 Fatigue

The effects of fatigue on the performance of an individual or team can be quite damaging. The ability to integrate information efficiently is lost and the ability to reason logically becomes impaired[10]. Often, people are unaware that fatigue is affecting their performance and, consequently, lower standards of performance can become unconsciously acceptable.

The work/rest hours of *Massive Tide*'s navigating officers were analysed using the Fatigue Audit InterDyne (FAID) computer program. FAID was developed by the Centre of Sleep Research at the University of South Australia to assist in designing rosters that reduce the potential for excessive work induced fatigue. The program takes into account the time of day that work and breaks occur, their duration, work history and the biological limits on recovery sleep.

The results from FAID are numeric and indicate the amount of fatigue experienced by an individual at a given point in time. The results are categorised into groups as standard, moderate, high or very high. The standard level of fatigue is described as the fatigue accumulated after a five day 0900 to 1700 working week. Individuals working in the high to very high fatigue region are considered to have equivalent performance impairment to those with a blood alcohol reading of 0.05 per cent[11].

From the 22 to 29 August, the FAID analysis indicates that the master was experiencing high levels of fatigue during 10 of the 12 work periods he completed and at certain times during these periods he was very highly fatigued. Furthermore, during the evening of 28 August he suffered from an illness that prevented him from navigating the ship out of Dampier. The overall pattern indicates that when *Massive Tide* was alongside the drill rig, and the master was manoeuvring the ship and training the second mate, his performance was probably adversely affected by fatigue.

On 22 August, the day the second mate joined the ship, he experienced an illness that prevented him from fulfilling his role, in its entirety, for the following 24 hours. He did not fully recover from the illness until about two days before the grounding. He then worked for about 36 hours over the next two days (18 hours per day) and had been working for almost 17 hours straight when the ship grounded at 0445 on

10 Caldwell, J.A. & Caldwell, J.L. (2003). Fatigue in aviation: A guide to staying awake at the stick.

11 Dawson, D. & Reid, K. (1997). Fatigue, alcohol and performance impairment, Nature - 388: 235.

29 August. The second mate stated that he felt fatigued, was unable to sit down for any length of time and that his eyes were watering.

The FAID analysis indicates that fatigue would not have had a significant impact on the second mate's performance between the time when he joined the ship and about 0100 on 28 August. However, from about 0100 on 28 August onwards, his fatigue levels were probably high. He had an opportunity to sleep, between 0600 and 1200, but he had difficulty sleeping. He started work at 1200 and continued working until the time of the grounding. During the morning of 29 August, the second mate's performance was probably affected by high to very high levels of fatigue. At 0445 on 29 August, the time of the grounding, the second mate's fatigue score was in excess of the upper limit of the very high fatigue range.

Setting the ship on an incorrect heading at 0100 on 29 August and not monitoring its progress were critical errors on the part of the second mate. However, it is probable that, due to the effects of fatigue, his efforts in navigating the ship were poorer than usual because of an unconscious acceptance of lower performance standards.

The second mate saw the lighthouse on Rosemary Island and the lights of the ships anchored off Dampier, and recalled that they were not in the position he expected them to be. Despite detecting these critical cues, the second mate either did not understand their significance or was averse to the mental effort involved in concluding that the ship was not in the correct position. It is likely that fatigue decreased the second mate's ability to comprehend and respond to the warning cues he had received.

2.3.1 Fatigue management

The STCW Code[12] outlines the standards that should apply to watchkeepers with respect to their fitness for duty. The code aims to give guidance to ship operators and masters to ensure that the work/rest balance of watchkeepers is managed in such a way as to avoid fatigue. The Code states that:

- All persons who are assigned duty as the officer in charge of a watch or as a rating forming part of a watch shall be provided a minimum 10 hours of rest in any 24 hour period.
- The hours of rest may be divided into no more than two periods, one of which shall be at least 6 hours in length.
- The requirements for rest periods laid down in paragraphs 1 and 2 need not be maintained in the case of an emergency or drill or in other overriding operational conditions.
- Notwithstanding the provisions of paragraph 1 and 2, the minimum period of ten hours may be reduced to not less than six hours provided that any such reduction shall not extend beyond two days and not less than 70 hours of rest are provided each seven-day period.
- Administrations shall require that watch schedules be posted where they are easily accessible.

12 Seafarers' Training, Certification and Watchkeeping Code, Chapter VIII, International Maritime Organization, 1995.

Massive Tide's watchkeeping roster was clearly displayed on the ship's bridge and the watchkeepers maintained records of their working hours and rest periods. However, the master did not refer to these records when he approved the roster. Furthermore, he did not monitor the actual hours that each watchkeeper was working by regularly checking their records.

While recording the hours of work and rest for each watchkeeper is an important part of a fatigue management system, it is only part of a system. The recorded data should be used when formulating the roster and regularly referenced when checking if each watchkeeper is sufficiently rested to ensure they are fit for duty.

The second mate stated that he felt fatigued in the time leading up to the grounding but he chose not to call his relief. While it is the responsibility of every ship operator and master to ensure that the work/rest balance of the watchkeepers is managed, each watchkeeper also has the responsibility to monitor their own performance. Watchkeepers should ensure that they are either fit for duty or, if not, take appropriate action.

When *Massive Tide* grounded at 0445 on 29 August, the second mate had been working for almost 17 hours without a rest. The FAID analysis indicates that he was probably very highly fatigued and his work/rest balance on 29 August, and the preceding days, had been insufficient to ensure that he met the STCW 95 requirements relating to fitness for duty.

2.4 Pilotage

Pilotage within the Dampier port limits is compulsory for all vessels over 150 gross tonnes and all commercial fishing vessels over 35 metres in length, except for those that have been granted an exemption by the port authority.

At the time of the incident, *Massive Tide*'s master held a pilotage exemption certificate for the port of Dampier. This enabled him to navigate *Massive Tide* in and out of the port without the services of a pilot. The exemption was granted to the master after the port authority was satisfied that he had acquired the necessary knowledge of the port, and its operations, to enable him to safely navigate his ship within the port's limits. The exemption was only valid for the master and did not apply to any other watchkeepers that may be sailing on board the ship.

At the time of the incident, no other navigators on board the ship held a pilotage exemption certificate for the port of Dampier.

Massive Tide was navigated into Dampier on the morning of 28 August 2006 by the chief mate and in the evening of 28 August the second mate navigated the ship out of the port. In fact, it was routine practice for the watchkeepers to navigate the ship in and out of the port without the master being present on the bridge.

The exempt master not being on the bridge of *Massive Tide* while it transits the port is a breach of the port's regulations and may also be indicative of a less than ideal safety culture on board the ship. More importantly, the lack of local knowledge and experience on the bridge increased the likelihood of the ship being involved in an incident.

3 FINDINGS

From the evidence available, the following findings are made with respect to the grounding of *Massive Tide* at 0445 on 29 August 2006 on the shoals approaching the western shore of Rosemary Island. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

3.1 Contributing safety factors

1. At about 0100 on 29 August, the second mate set the autopilot to follow a course of 129° (T) without checking the information he had obtained from the GPS unit against any independent source. This course would take the ship directly to Rosemary Island, rather than the Dampier Sea Buoy as intended.
2. The second mate did not monitor the ship's track during the voyage from the drill rig Ensco 106 to Dampier. He did not plot the ship's position on the navigational chart and he did not check the information that he had obtained from the GPS unit against independent sources.
3. The ship's master did not ensure that the bridge watchkeepers routinely followed his instructions and the company's procedures.
4. The performance of both the master and the second mate was probably adversely affected by fatigue.
5. The procedures and practices in place on board *Massive Tide* did not ensure that the levels of watchkeeper fatigue were effectively managed.

3.2 Other key findings

Massive Tide's master held a pilotage exemption certificate for the port of Dampier. However, he routinely breached the conditions of the exemption certificate by allowing the ship to be navigated in and out of the port when he was not present on the bridge.

4 SAFETY ACTIONS

4.1 Safety action by Tidewater Marine

The ATSB has been advised that the following safety action has been taken by Tidewater Marine as a result of the grounding of *Massive Tide*.

A fleet memo was forwarded to the 'Australia area fleet'. The memo highlighted failures in bridge team management, passage planning and navigational methods and practises. The memo also reinforced the need to have procedures in place to ensure efficient bridge organisation.

4.2 ATSB recommendations

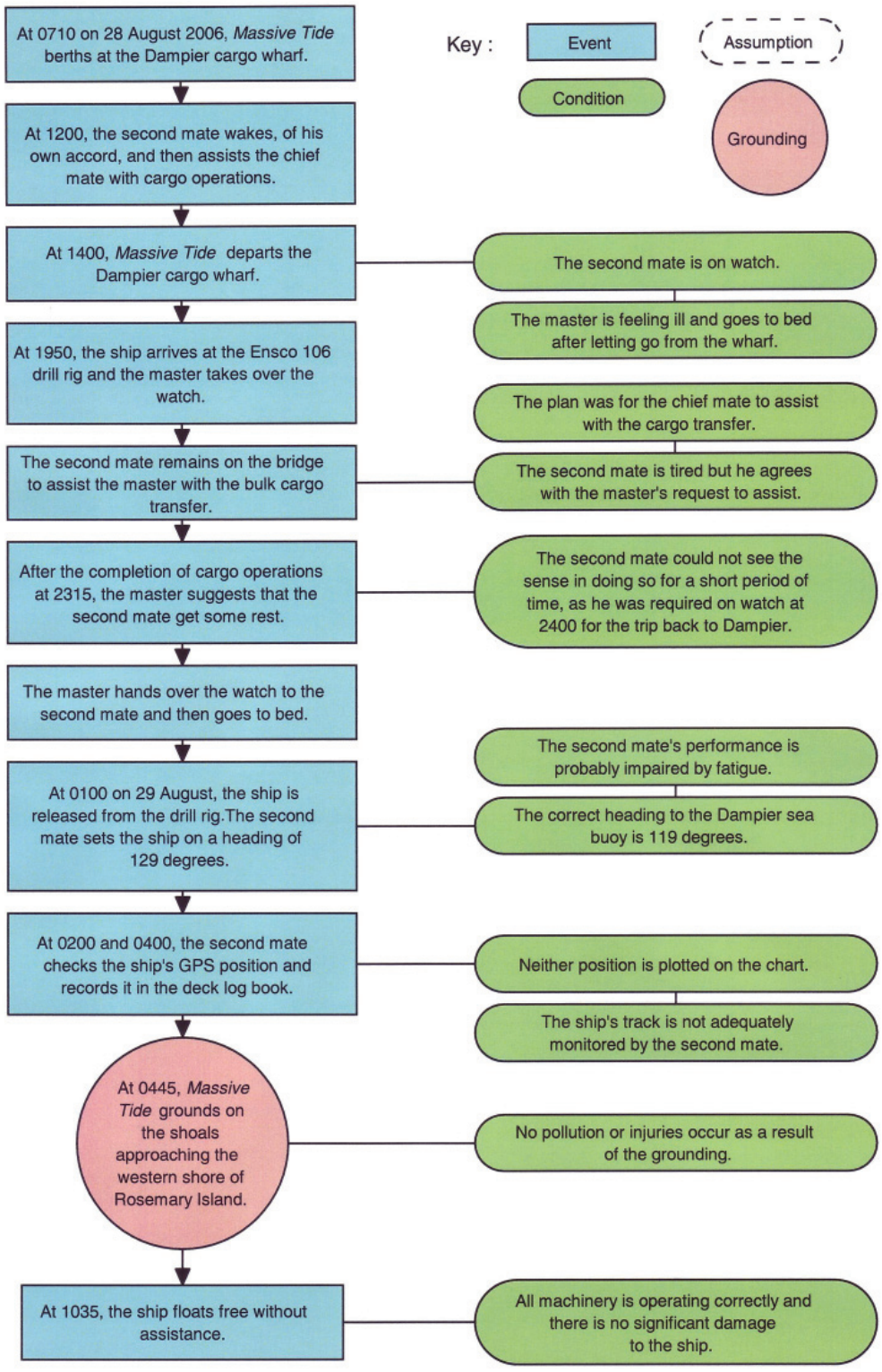
MR20070007

Tidewater Marine should review the procedures and practices on board *Massive Tide*, and other ships in their fleet, to ensure that the watchkeepers comply with the instructions, relating to navigational practices, issued by the company and the ship's master.

MR20070008

Tidewater Marine should review the procedures and practices on board *Massive Tide*, and other ships in their fleet, to ensure that watchkeepers meet the requirements of STCW 95 and are fit for duty.

5 APPENDIX A: EVENTS AND CONDITIONS



6 APPENDIX B: SHIP INFORMATION

6.1 *Massive Tide*

IMO Number	8102531
Call sign	VJZW8
Flag	Vanuatu
Port of Registry	Port Vila
Classification society	American Bureau of Shipping
Ship Type	Offshore tug/supply ship
Builder	Aker Vindholmen, Arendal, Norway
Year built	1982
Owners	Gulf Fleet Middle East
Ship managers	Tidewater International
Gross tonnage	1316
Deadweight (summer)	1898
Summer draught	4.72 m
Length overall	64.40 m
Moulded breadth	13.80 m
Moulded depth	6.91 m
Engine	2 x Bergens KVMB18
Total power	6002 kW
Crew	10

7 APPENDIX C: SOURCES AND SUBMISSIONS

7.1 Sources of information

The master and crew of *Massive Tide*

Tidewater Marine

Port of Dampier Authority

7.2 References

The International Convention for the Safety of Life at Sea, 1974, and its Protocol of 1988 (SOLAS), the International Maritime Organization.

Seafarers' Training, Certification and Watchkeeping Code, International Maritime Organization, 1995.

Caldwell, J.A. & Caldwell, J.L. (2003). Fatigue in aviation: A guide to staying awake at the stick.

Dawson, D. & Reid, K. (1997). Fatigue, alcohol and performance impairment, Nature - 388: 235.

The Oxford Companion to Ships and the Sea.

Bridge Procedures Guide, Third edition 1998, International Chamber of Shipping.

7.3 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 *Massive Tide*'s master, chief mate, second mate and lookout; Tidewater Marine, the Port of Dampier Authority and the Australian Maritime Safety Authority.

Submissions were received from the second mate and Tidewater Marine. The submissions have been included and/or the text of the report was amended where appropriate.

8 APPENDIX D: MEDIA RELEASE

Offshore supply ship grounding on 29 August 2006

The ATSB has found that a lack of passage monitoring resulted in the Vanuatu registered offshore tug/supply ship *Massive Tide* grounding on Rosemary Island, off Dampier Western Australia, at 0445 on 29 August 2006.

The Australian Transport Safety Bureau investigation found that fatigue probably impaired the performance of both the master and the officer of the watch and that the officer of the watch did not adequately monitor the ship's progress during the voyage from the jack-up drill rig Ensco 106 to Dampier on the morning of 29 August.

At 0100 on 29 August, *Massive Tide* departed the drill rig Ensco 106 at a speed of 9.8 knots and on a heading of 129 degrees, a heading that would take it directly to Rosemary Island, rather than the Dampier Sea Buoy as intended.

At 0200 and 0400, the officer of the watch recorded the ship's GPS position in the deck log book, but did not plot either position on the navigational chart.

At 0445, *Massive Tide* grounded on the shoals approaching the western shore of Rosemary Island. The rest of the crew were called out and checks of the ship, its machinery and the surrounding area revealed that no damage or pollution had occurred.

Immediate attempts to refloat the ship were unsuccessful and plans were put in place to try again on the next high tide. At 1035, the ship floated free without assistance.

The ATSB report further concludes that the ship's master did not ensure that the bridge watchkeepers routinely followed his instructions and the company's procedures; and that the procedures and practices in place on board *Massive Tide* did not ensure that the levels of watchkeeper fatigue were effectively managed.

The ATSB has made two safety recommendations with the aim of preventing further incidents of this type.

Independent investigation into the grounding of the Vanuatu registered offshore tug/supply ship *Massive Tide* on Rosemary Island, Western Australia 29 August 2006