FERRY SAFETY INVESTIGATION
REPORT

OCEAN WAVE COLLISION WITH MANLY WHARF
SYDNEY HARBOUR
13 SEPTEMBER 2017
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EXECUTIVE SUMMARY

On 13 September 2017, the Manly Fast Ferry (MFF) vessel Ocean Wave collided with Manly Wharf. The vessel, carrying 73 passengers, was berthing following a scheduled service from Circular Quay to Manly. The vessel was approaching Manly Wharf when its engine control system failed to respond when the master engaged astern\(^1\). As a result, the vessel collided with the southern face of Manly Wharf. A number of passengers suffered injuries. Ocean Wave suffered damage to the bow.

The investigation determined that the collision was due to an improper transfer of engine control by the master. By the time the master identified the loss of control, the collision was imminent.

Full details of the Findings and Recommendations of this ferry safety investigation are contained in Parts 3 and 4 respectively.

\(^1\) “Engaged astern” is the action of placing the engine thrust into reverse.
PART 1  FACTUAL INFORMATION

Introduction

1.1 At 1210\(^2\) on Wednesday 13 September 2017, the ferry *Ocean Wave* departed Circular Quay on a passenger service to Manly. Aboard the ferry were the master, two general purpose hands (GPH) and 73 passengers.

1.2 As the ferry approached Manly Wharf, the master moved to the port\(^3\) control station. The master steered the ferry from this station until approximately two or three boat lengths from the wharf, where he placed both engine control levers into astern.

1.3 The engines failed to respond to the master’s command input. Realising that he did not have engine control, the master attempted to steer the vessel away from the wharf. The master then attempted to re-enter the wheelhouse to utilise the main control station. Before he could regain control, the ferry collided with the wharf.

1.4 The impact resulted in standing passengers falling to the deck and seated passengers being thrown against the backrest of the seats in front.

Location

1.5 The Manly ferry wharf is north of the main entrance to Port Jackson (more commonly known as Sydney Harbour). This major commuter destination comprises a two-sided wharf with a secondary smaller single faced wharf to the east. The wharves are located on the northern shore of Manly Cove, located within North Harbour.

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\(^2\) All times referred to in this report are Australian Eastern Standard Time.

\(^3\) Port is the left side of the vessel when viewed from behind.
1.6 North Harbour is a relatively sheltered anchorage, protected from most ocean swells with only a large south-east storm adversely affecting operations. Manly Wharf is nestled close to the north head peninsular, which shelters it from north and easterly winds. Manly Wharf is exposed to both southerly and westerly winds (see Figure 1).

Environmental information

1.7 Conditions at the time of the incident as recorded by the Bureau of Meteorology were:

Tide: Fort Denison high tide at 1343 (1.58m). It was a flood tide at the time of the incident.

Swell: The swell off Sydney Heads was 1 to 1.5 metres from the north-east and did not affect the incident.

Wind: A moderate north-westerly 20 knot wind.

Vessel information

1.8 Ocean Wave was a 23.95-metre catamaran-type ferry with an 8.1-metre beam. It was built in Tasmania by INCAT in 2015. The vessel was powered by two V12 749 kW MAN diesel engines and the ferry’s main propulsion was
provided through gearboxes attached to conventional drive shafts and propellers.

1.9 The vessel offers passenger seating on two decks, the lower with a weathertight cabin and the upper with partial weather protection from screens and roof (see Figure 2).

![Figure 2: Ocean Wave following collision](image)

1.10 The ferry was in survey with the Australian Marine Safety Authority (AMSA)\(^4\) issued with number ID 5610, and certified to carry 263 passengers in Class 1D and 163 in class 1C survey\(^5\).

1.11 The crew consisted of the master and two GPH. The crew held the appropriate Certificates of Competency\(^6\) issued by AMSA applicable to the Ocean Wave operation.

**The crew**

1.12 The master held a Master <24 m and Marine Engine Driver 2 (M.E.D. 2) certificates of competence. The master had been operating the company’s smaller Sea Cat class of ferries. Following the successful completion of an

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\(^4\) AMSA is a statutory authority and Corporate Commonwealth Entity and was established under the *Australian Maritime Safety Authority Act 1990* (the AMSA Act). It is a legislative requirement that a domestic commercial vessel in Australia have a current survey applicable for its intended operations.


\(^6\) A Certificate of Competency issued by AMSA shows a seafarer’s capability to master a vessel and its passengers. It is a legislative requirement that a seafarer have a Certificate of Competency before they can work on a domestic commercial vessel in Australia.
upgrade from a M.E.D. 3 to M.E.D. 2; he had recently been inducted into operating the larger Ocean Wave.

1.13 The master had operated the Ocean Wave for approximately three and a half weeks prior to the incident.

Manly Fast Ferry

1.14 MFF was a privately owned company, which operated regular timetabled fast ferry commuter services between Circular Quay to Manly. MFF also operated seasonal offshore whale watching trips and timetabled tourist services to a number of locations in the harbour.

The incident

1.15 The master described the day as clear with a moderate westerly breeze (16 – 20 knots) and the vessel was operating normally. At approximately 1230 as the ferry was approaching Manly Wharf, the master, using the main (wheelhouse) control, slowed the vessel to idle ahead (approximately 8 to 9 knots). The master noted that a Freshwater class ferry was approaching the western side of Manly Wharf (see Figure 3).

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7 1 knot, or 1 nautical mile per hour equals 1.852 km/h.
1.16 The master decided to make a wider than normal approach to the wharf in order to stay well away from the larger vessel.

1.17 The master walked to the port wing station leaving the wheelhouse vacant. As he left the wheelhouse, the port wheelhouse door closed and locked behind him.

1.18 He then attempted to activate the port EC300 engine control station by pushing the station select button (see Figure 4).
1.19 The master made a number of subsequent course corrections as the ferry neared the wharf, due to the wide approach angle. The final course change left the ferry aiming directly at the wharf.

1.20 The master was under the assumption that the port control station had both engine and rudder control active. In fact, only the rudder control was active.

1.21 Nearing the wharf, the master engaged astern propulsion and noted that both engines did not respond to the command input. The master pushed the EC300 station select button again but was unsuccessful in activating the port EC300 engine control.

1.22 With a collision with the wharf imminent, the master turned the vessel to port in an attempt to avoid impact. The master then attempted to re-enter the wheelhouse but found the door was locked.

1.23 The master then entered the access code into the key coded door but was initially unsuccessful (see Figure 5). As the vessel continued towards the
wharf, the master successfully entered the door access code, then entered the wheelhouse and went to the main controls.

Figure 5: Wheelhouse door

1.24 The master pressed the main EC300 engine control station select button and placed both engine control levers to astern. Before the vessel could respond, the starboard bow collided with the southern face of Manly Wharf.

1.25 The force of the impact caught many passengers unaware, as there was no verbal warning of the collision. A number of seated passengers were thrown from their seats, while some standing passengers fell over.

1.26 The master, having regained control at the main station, engaged astern and backed the ferry off the wharf. The master then manoeuvred the ferry alongside the berth. The master successfully transferred to the port wing control to finalise the berthing operation.
1.27 Following the impact, the crew attended to passengers and then secured the vessel to the wharf. Once the vessel was secure, the crew, aided by wharf staff, provided first aid to injured passengers.

1.28 The crew recorded passenger details, while the master contacted management and checked damage to the vessel. There were five reported passenger injuries all of a minor nature (grazes and bruises). No ambulance was required.

1.29 The collision resulted in a breach to the number 1 starboard void above the waterline (see Figure 6). The crew withdrew the vessel from service and returned at low speed to their base at Pyrmont. During the return journey, the master stopped at the Water Police base in Balmain to undergo breath testing for alcohol. The crew returned negative results.

![Figure 6: Damaged starboard bow](image)
PART 2 ANALYSIS

Introduction

2.1 The investigation focussed principally on the factors that contributed to *Ocean Wave*’s loss of control and the eventual collision with Manly Wharf.

Crew actions

Master

2.2 The master said that as the vessel approached the vicinity of the moorings to the east of Manly Cove, he reduced power to idle ahead\(^8\) on the main EC300 (wheelhouse) control. The master then said that he placed both main EC300 engine control levers in neutral before stepping out to the port wing. Review of the Close Circuit Television (CCTV) post incident revealed that both wheelhouse levers remained in idle ahead and the wheelhouse was unattended.

2.3 When the master reached the port wing control, he confirmed that both levers were in neutral and pushed the station select button on the EC300 controller. The master did not confirm the EC300 engine controls were active by checking the controllers LED status indicator lights or engaging the control levers.

2.4 The master then proceeded to make a number of course alterations utilising the rudder steering control (see Figure 4) which was active. The vessel continued to make way towards the wharf and the steering responded to his input.

2.5 CCTV from the incident shows the master move from the main control to the port control at 11:46:13\(^9\). The CCTV shows the vessel turn to port at 11:46:22, a small turn to starboard\(^10\) at 11:46:33 and a significant turn to port at 11:46:49. This indicates that for a period of more than 36 seconds, the master

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\(^8\) Idle ahead is the lowest throttle increment with the engines in gear.

\(^9\) Time given in 24 hour clock with HH:MM:SS as format.

\(^10\) The right hand side of the boat looking from the rear.
was under the assumption that he was in control of both the rudder and engines on the port wing. However, the master had only steering control and not throttle control.

2.6 At 11:47:09 the CCTV shows the master re-entering the wheelhouse. The vessel struck the wharf at 11:47:12. For 59 seconds, taken from the time the master stepped away from the main controls until the collision, the master had not been in control of the engines.

**Lookout**

2.7 At 11:46:11 CCTV shows the GPH leave the wheelhouse just prior to the master’s departure. The GPH made his way to the main deck in preparation for mooring the vessel as per normal practice.

2.8 The departure of the GPH prior to the master moving to the wing station, left the master alone at the controls as the vessel approached a dead end wharf.

2.9 The continued presence of the GPH, combined with a procedure promoting teamwork and closed loop communication, would offer improved resilience in error identification and management.

**Steering controls**

2.10 Steering controls are located at three positions on *Ocean Wave*: the main (wheelhouse) helm position, the port and starboard wing stations. The main position is always active. Activation or isolation of the wing station’s steering is through a switch on the dash at the main position (see *Figure 7*).
2.11 The wing stations are normally in the active position while the ferry is operating. During the incident, the wing steering controls were active and responded to the master’s input.

**Engine controls – EC300 Twin Disc Power Commander**

2.12 Three EC300 Power Commander units control the main engines. These are located next to the steering controls at the main, port and starboard wing stations. Each of the EC300 controllers has two levers, one for each engine. The EC300 controllers are a separate system to the steering controls and only one EC300 station is active at a given time.

2.13 To activate, a master first selects the desired control station using the ‘Station Select’ button. The master moves the engine controllers on the EC300 through their range to produce an input command to the engine. The left side lever for the port engine and the right side for the starboard (refer Figure 8).
2.14 The engine controller provides input for forward and astern thrust, and centres in a neutral position. The EC300 controller enables the selection of opposing thrust commands on the port and starboard engines. Moving the engine controller away from or back towards the neutral position increases or decreases thrust respectively.

2.15 The EC300 controllers on the Ocean Wave have 3mm LED indicator lights that illuminate when the master pushes the station select button. The lights continue to flash for a period of approximately 30 seconds, or until the station becomes active.

2.16 The LED lights will also illuminate to signal system status. When the system identifies a fault within the controller or control system, the light flashes in set sequences to indicate a fault code and to assist in troubleshooting a failure.

2.17 The 3mm LED lights are challenging to see, especially during the transition from a relatively shaded wheelhouse into bright sunlight (see Figure 9). Scrutiny of the small lights is further compromised by the necessity to maintain a proper lookout.
2.18 The system on the Ocean Wave did not have an audible alarm accompanying these lights. The master focuses their attention outside the vessel when manoeuvring. If a failure occurs in the control system or the system fails to transfer successfully, the poor luminosity of the LED lights often does not attract the master’s attention.

2.19 Research has demonstrated that reaction times to visual indications are shorter when supported by an auditory warning signal (Selcon, Taylor, & McKenna, 1995: Stokes & Wickens, 1988). The addition of an audible alarm in conjunction with effective indicator lights would most likely improve a master’s awareness of vessel status and facilitate faster response times.

2.20 Auditory warnings reduce the need to continuously monitor visual displays. This allows a master to focus on their surrounds improving situational awareness (Stanton & Edworthy, 1999).

**EC300 station transfer process – Ocean Wave**

2.21 For transfer to occur, a master must ensure that the position of the engine controllers on both the newly selected and previously active stations match. For example, if the main EC300 controller is active and in idle ahead, the
following must occur to transfer to the port EC300. The newly selected (port) EC300 select button must be pressed and the engine controllers must match the active (main) controller (idle ahead).

2.22 The controller’s LED will flash for approximately 30 seconds after the station select button is pressed. During this time, the master must match the levers of the intended station to the previously active station for the transfer to be successful.

2.23 The EC300 controller can be programmed to activate in a number of ways. One way involves the controller having the levers in neutral when pressing the station select button. Regardless of the previous controller’s lever positions, the new controller becomes active and the engines will follow the station’s command.

2.24 During the incident, the master selected the port station select button and assumed that control had transferred. He did not notice the flashing LED lights informing him that the station transfer was unsuccessful due to the mismatch of the engine control levers.

Wheelhouse and wing control access

2.25 Between the main control station and the wing stations are a pair of self-locking doors. These doors can be opened either by a key or with an access code on a key pad. The doors have latches to secure them open on the deck heads above them (see Figure 5).

2.26 The master said that it was his normal practice to allow the door to swing back, remain unlatched, and rest ajar behind him. On the day of the incident, the reported fresh 20 knot north-westerly wind (on the port side of the vessel) may have placed a closing force on the door. This may have resulted in the door not remaining ajar and actually closing and locking.

2.27 The area around the wheelhouse offers access and seating to passengers. The seating is directly in front of the wheelhouse and standing passengers impede the master’s line of sight. Passengers can access this area either by
stairs from the foredeck or from either side of the wheelhouse from the rear upper deck.

2.28 Passengers who enter this area from the rear upper deck must pass close to the wing controls. If the wheelhouse doors are latched open, passage is hindered (see Figure 10).

2.29 The master said that distraction from passengers passing in close proximity to the wing station was one reason he did not latch the door open. More room was available for passing passengers when the door was closed.

![Figure 10: Passenger access past controls](source)

2.30 Navigating a vessel in a busy waterway like Sydney Harbour requires the full attention of the master. The master is required to maintain a proper lookout, especially so when travelling at high speed. Likewise, the master must be attentive when conducting critical berthing manoeuvres.
2.31 On *Ocean Wave*, there is a risk that standing passengers in the area directly in front of the wheelhouse may obstruct the master’s line of sight. Requiring passengers to remain seated would mitigate the likelihood of this occurring.

![Standing passengers obstructing master's line of sight](image)

Source: CCTV from *Ocean Wave* wheelhouse

*Figure 11: Passengers in the master's line of sight*

2.32 The passage of passengers in close proximity to the master and controls during vessel navigation introduces the risk of distraction to the master. Isolating the control station from the passengers would mitigate the likelihood of this occurring. This is especially important during berthing operations.

2.33 *Ocean Wave* is fitted with barrier doors either side of the wheelhouse (see *Figure 12*). When the doors are in latched-open position, they prevent access to the wing control stations from the upper main passenger deck. At the time of the incident, the door was in the stowed position and gave clear access past the wing control station.
MFF berthing instructions

2.34 Following *Ocean Rider’s* collision with wharf 6 Circular Quay in May 2016\(^\text{11}\), the company issued revised instructions by email to all masters on 2 June 2016 regarding berthing at wharves.

2.35 The emailed procedures highlight the role of speed as a factor in wharf collisions. The procedure requires a master to;

- Approach any wharf at a speed slow enough to stop the vessel with one deck line. This should be under 5 knots for all vessels.
- Not steer the vessels with engines unless the other engine is in neutral. The procedure explicitly states “…DO NOT drive vessel ahead on one and astern on the other while travelling at any significant speed (over 3 knots)”.  

• If it is necessary to engage one engine ahead and one astern, then the utilisation of extra engine revs (800 – 1000rpm) to avoid stalling is suggested.

• To avoid stall situations at speeds above 6 knots, engines should be first touched into astern then disengaged immediately, followed by re-engaging the gearbox astern.

• To minimise abrupt gear changes from ahead to astern in order to minimise load on the drive train.

2.36 It reminded masters to be prepared with a ‘Plan B’, as means of minimising the consequence of any control failure.

2.37 Following the email, a senior master provided practical training sessions for the fleet. The senior master also confirmed that each master received and understood the new procedure.

2.38 The revised procedure instructed masters to have a plan, treat the boat gently and use a safe speed. The procedure did not specifically address the transfer of control stations nor did it require a master to check that they have transferred control successfully. However, it did require a master to engage astern for a moment, which if carried out would address the confirmation of control. It also did not instruct a master to ensure unhindered access between control stations by latching the door open.

2.39 Whenever a vessel approaches a wharf, the transfer of control station is critical, especially at a dead end berth. To be effective, a transfer of control must include a process to confirm that the transfer has in fact been successful.

2.40 If a transfer of control station is unsuccessful, to regain control a master needs to:

1. Realise that control station transfer has not occurred

2. Put into place a plan to regain control in a timely manner

3. Avoid collision.
2.41 These procedures lacked detail regarding effective communication and confirmation of control during a time critical phase of operation.

**Remedial actions taken**

2.42 Following the collision of *Ocean Wave* with Manly wharf, MFF have implemented a number of safety actions.

2.43 MFF have created new positions, including a senior master whose focus is operational safety, crew training and crew support. Additionally, MFF are reviewing existing risk controls to improve and develop the SMS.

2.44 MFF, in consultation with senior masters, revised their berthing procedure and emailed this to all company masters for comment. The procedure expanded on the then current SMS berthing instruction by requiring that a master;

- Confirm both control levers were in neutral and the LED neutral indicator lights active before transferring station
- Ensure secure and unhindered access between stations with doors latched open and passengers moved away from the control station
- Conduct the transfer early to allow time to respond to any problems
- Confirm all four LED indicator lights were active prior to engaging the controls to astern to ensure propulsion control.

2.45 MFF have reprogrammed the EC300 units, disabling lever matching. Transfer of control requires the station accepting control to have the levers positioned in neutral. An emergency transfer feature (double pressing the station select button) has been incorporated in to the training process for current and future masters.

2.46 MFF have implemented a programme to develop and expand a suite of documented induction and operational procedures. This programme has produced competency based training for the various vessel classes in the fleet.

2.47 MFF have instigated onboard observational safety audits. These audits aim to collect data in order to identify potential risks prior to actual incidents.

2.48 MFF have introduced an electronic onboard management system to provide crew with relevant safety and procedural information.
PART 3 FINDINGS

3.1 From the available evidence, the following findings are made with respect to the collision of Ocean Wave with Manly Wharf on 13 September 2017.

Contributory Factors

3.1 The wheelhouse was unattended as the vessel approached Manly Wharf.

3.2 There was no communication between the master and the GPH confirming that engine control had successfully transferred to the wing station.

3.3 The EC300 engine control system did not transfer due to control lever mismatch between the main control station and port wing station.

3.4 The master did not confirm that engine control transferred successfully from the wheelhouse main control station to the port wing station.

3.5 An audible alarm and an effective visual warning were not available to alert the crew that station transfer had not occurred. This significantly reduced the time available to allow for an effective response to the control loss.

3.6 The master did not secure open the access door to the wheelhouse which had closed and locked behind him. This delayed his re-entry into the wheelhouse and resulted in him being unable to regain control of the vessel before it collided with Manly Wharf.

3.7 The EC300 control station LED indicator lights are challenging for the master to notice in bright conditions.

3.8 There was no procedure in place in relation to the transfer of control stations.

Other Safety Factors

3.9 There was no warning to passengers to brace themselves.

3.10 The SMS contained a generic procedure for berthing vessels. The procedure contained little detail and relied on individual master experience.

3.11 Passengers were located in front of the wheelhouse, possibly distracting or impairing the master’s line of sight.
3.12 The movement of passengers in close proximity to the master during berthing operations increases the likelihood of distraction.

3.13 Programming for the transfer of control of the EC300 contributed to the master’s assumption that he had engine control on the port wing station.
PART 4 RECOMMENDATIONS

Ferry operators utilising EC300 controllers

4.1 Install an audible alarm and improve the effectiveness of visual warning lights to indicate engine control status on vessels utilising the EC300 controllers.

4.2 Assess EC300 programming to reduce the risks associated with the transfer control stations.

Manly Fast Ferries

4.3 Develop a procedure for berthing at dead end wharves that includes:
   • confirmation of engine control transfer
   • the isolation of the wheelhouse and active wing controls from passengers
   • and closed loop communication between crew.

4.4 Develop a procedure for ensuring the master has unhindered access between the wheelhouse and the wing stations.

4.5 Develop a procedure to ensure that the wheelhouse is attended until confirmation of successful transfer of engine control.

4.6 Assess the risks associated with passengers located in front of the wheelhouse that may obscure the master's line of sight, or provide a source of distraction for the master.
Submissions

The Chief Investigator forwarded a copy of the Draft Report to the Directly Involved Parties (DIPs) to provide them with the opportunity to contribute to the compilation of the Final Report by verifying the factual information, scrutinising the analysis, findings and recommendations, and to submit recommendations for amendments to the Draft Report that they believed would enhance the accuracy, logic, integrity and resilience of the Investigation Report. The following DIPs were invited to make submissions on the Draft Report:

- Transport for NSW
- Manly Fast Ferry
- Australian Maritime Safety Authority
- Roads & Maritime Services
- Port Authority NSW

References and reading material