



Office of Transport Safety Investigations

FERRY SAFETY INVESTIGATION REPORT

CLOSE QUARTERS

SYDNEY HARBOUR

25 JULY 2012

FERRY SAFETY INVESTIGATION

CLOSE QUARTERS

SYDNEY HARBOUR

25 JULY 2012

Released under the provisions of
Section 45C (2) of the *Transport Administration Act 1988* and
46BA (2) of the *Passenger Transport Act 1990*

Investigation Reference: 04575

Published by: The Office of Transport Safety Investigations
Postal address: PO Box A2616, Sydney South, NSW 1235
Office location: Level 17, 201 Elizabeth Street, Sydney NSW 2000
Telephone: 02 9322 9200
Accident and incident notification: 1800 677 766
Facsimile: 02 9322 9299
E-mail: info@otsi.nsw.gov.au
Internet: www.otsi.nsw.gov.au

This Report is Copyright. In the interests of enhancing the value of the information contained in this Report, its contents may be copied, downloaded, displayed, printed, reproduced and distributed, but only in unaltered form (and retaining this notice). However, copyright in material contained in this Report which has been obtained by the Office of Transport Safety Investigations from other agencies, private individuals or organisations, belongs to those agencies, individuals or organisations. Where use of their material is sought, a direct approach will need to be made to the owning agencies, individuals or organisations.

Subject to the provisions of the *Copyright Act 1968*, no other use may be made of the material in this Report unless permission of the Office of Transport Safety Investigations has been obtained.

THE OFFICE OF TRANSPORT SAFETY INVESTIGATIONS

The Office of Transport Safety Investigations (OTSI) is an independent NSW agency whose purpose is to improve transport safety through the investigation of accidents and incidents in the rail, bus and ferry industries. OTSI investigations are independent of regulatory, operator or other external entities.

Established on 1 January 2004 by the Transport Administration Act 1988, and confirmed by amending legislation as an independent statutory office on 1 July 2005, OTSI is responsible for determining the causes and contributing factors of accidents and to make recommendations for the implementation of remedial safety action to prevent recurrence. Importantly, however, OTSI does not confine itself to the consideration of just those matters that caused or contributed to a particular accident; it also seeks to identify any transport safety matters which, if left unaddressed, might contribute to other accidents.

This OTSI investigations was conducted under powers conferred by the Transport Administration Act 1988 and the Passenger Transport Act 1990. OTSI investigators normally seek to obtain information cooperatively when conducting an accident investigation. However, where it is necessary to do so, OTSI investigators may exercise statutory powers to interview persons, enter premises and examine and retain physical and documentary evidence.

It is not within OTSI's jurisdiction, nor an object of its investigations, to apportion blame or determine liability. At all times, OTSI's investigation reports strive to reflect a "Just Culture" approach to the investigative process by balancing the presentation of potentially judgemental material in a manner that properly explains what happened, and why, in a fair and unbiased manner.

Once OTSI has completed an investigation, its report is provided to the NSW Minister for Transport for tabling in Parliament. The Minister is required to table the report in both Houses of the NSW Parliament within seven days of receiving it. Following tabling, the report is published on OTSI's website at www.otsi.nsw.gov.au.

OTSI cannot compel any party to implement its recommendations and its investigative responsibilities do not extend to overseeing the implementation of recommendations it makes in its investigation reports. However, OTSI takes a close interest in the extent to which its recommendations have been accepted and acted upon.

CONTENTS

TABLE OF PHOTOGRAPHS	ii
TABLE OF CHART EXTRACTS	ii
TABLE OF RADAR SCREENSHOTS	ii
ACRONYMS AND ABBREVIATIONS	iii
GLOSSARY OF TERMS	iv
EXECUTIVE SUMMARY	v
PART 1 FACTUAL INFORMATION	1
Introduction	1
Vessel and Crew Information	1
Sydney Harbour	5
Sydney Ports Corporation's Vessel Traffic Service	6
Environmental Conditions	7
Vessel Movements	7
Sequence of Events	10
Bradleys Head Fog Signal	17
PART 2 ANALYSIS	19
Introduction	19
Visibility	19
Navigation	20
Sydney Ports Corporation	20
<i>Francesca</i>	21
<i>Narrabeen</i>	22
<i>Palm Cat</i>	22
<i>HMAS Yarra</i>	23
Close Quarters	24
Other Safety Matters	25
Fog Signals	25
Shipping Control on Sydney Harbour	26
RAN Survey Operations	28
Automatic Identification System	29
<i>Francesca's</i> Lights	31
PART 3 FINDINGS	32
Contributing Factors	32
Other Safety Matters	33
PART 4 RECOMMENDATIONS	35
PART 5 APPENDICES	36
Appendix 1: Vessel Information - <i>Francesca</i>	36
Appendix 2: Vessel Information - <i>Narrabeen</i>	37
Appendix 3: Vessel Information - <i>Palm Cat</i>	38
Appendix 4: Vessel Information - <i>HMAS Yarra</i>	39
Appendix 5: Events and Conditions	40
Appendix 6: Sources, Submissions and Acknowledgements	41

TABLE OF PHOTOGRAPHS

Photograph 1: <i>Francesca</i>	2
Photograph 2: <i>Narrabeen</i>	3
Photograph 3: <i>Palm Cat</i>	4
Photograph 4: <i>HMAS Yarra</i>	5

TABLE OF CHART EXTRACTS

Chart Extract 1: Locations within Sydney Harbour	6
Chart Extract 2: <i>HMAS Yarra</i> track	24

TABLE OF RADAR SCREENSHOTS

Radar Screenshot 1: <i>Narrabeen</i> altering course across <i>Francesca</i>	11
Radar Screenshot 2: <i>Palm Cat</i> close to <i>Francesca</i> 's port quarter	12
Radar Screenshot 3: <i>Palm Cat</i> after close quarter with	13
Radar Screenshot 4: <i>Palm Cat</i> commences 105 ⁰ starboard turn	14
Radar Screenshot 5: <i>Palm Cat</i> turns towards <i>HMAS Yarra</i>	15
Radar Screenshot 6: <i>Narrabeen</i> stationary	16
Radar Screenshot 7: VTS notifies <i>HMAS Yarra</i> of Safe Water Buoy	18

ACRONYMS AND ABBREVIATIONS

AIS	Automatic Identification System
ATSB	Australian Transport Safety Bureau
COLREGS	International Regulations for Preventing Collisions at Sea, 1972
DIP	Directly Involved Party
FLIR	Forward Looking Infrared
HMAS	Her Majesty's Australian Ship
HCF	Harbour City Ferries
GPH	General Purpose Hand
LFB	Licensed Fishing Boat
MED II	Certificate of Competency as a Marine Engine Driver Grade 2
OTSI	Office of Transport Safety Investigations
RAN	Royal Australian Navy
RMS	Roads and Maritime Services
SOLAS	International Convention for the Safety of Life at Sea
SFF	Sydney Fast Ferries
SMS	Safety Management System
SPC	Sydney Ports Corporation
SFC	Sydney Ferries Corporation
USL	Uniform Shipping Laws
VTs	Vessel Traffic Service

GLOSSARY OF TERMS

Automatic Identification System	The Automatic Identification System (AIS) is an automatic tracking system used on ships and by the Vessel Traffic Service (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships and AIS base stations. AIS information is relayed to other vessels and shore based stations by transponder sending a GPS signal. AIS supplements marine radar, which continues to be the primary method of collision avoidance for water transport.
COLREGs	Convention on the International Regulations for Preventing Collisions at Sea. COLREGs are published by the International Maritime Organisation (IMO) and set out the navigation rules for vessels at sea in order to prevent collisions between vessels.
Ferry	A vessel designed and surveyed to carry passengers for payment or reward.
Harbour Control	Sydney Ports Harbour Radio Control Station operates from Port Botany covering traffic in both Sydney and Botany Ports.
Line ‘Zulu’	An imaginary line extending between Outer North Head Light and Macquarie Light which is used as a reporting position for commercial vessels entering and departing Sydney Harbour.
Occulting light	An occulting light is a rhythmic light in which the total duration of light in each period is clearly longer than the total duration of darkness and in which the intervals of darkness (occultations) are all of equal duration.
Port	The left hand side of a vessel when looking forward from the stern. The side where a red light is exhibited at night.
SOLAS	International Convention for the Safety of Life at Sea (SOLAS), 1974, to which Australia is a signatory. The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety.
Starboard	The right hand side of a vessel when looking forward from the stern. The side where a green light is exhibited at night.
Vessel Traffic Service (VTS)	VTS is a marine traffic system, similar in concept to air traffic control, which uses information from radar, close circuit television, a vessel’s automatic identification system and VHF radio to provide active monitoring and navigational advice to vessels. It is “ <i>a service designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area</i> ”. (IMO Resolution A.857 (20))
Survey Class	The figure in a Survey Class designation identifies the type of vessel e.g., “1” identifies the vessel as passenger carrying, “3” identifies the vessel as a Licensed Fishing Boat. The letter defines the permitted area of operation: A = unlimited offshore operation; B = offshore operation to 200 nautical miles seaward of the coast; C = restricted offshore operations up to 30 nautical miles seaward of the coast; D = sheltered operations (partially smooth water operations); and E = sheltered waters (smooth water operations).

EXECUTIVE SUMMARY

Shortly after 6:00am¹ on 25 July 2012, a series of close quarter situations developed on Sydney Harbour involving Sydney Ferries Corporation's ferry *Narrabeen*, licensed fishing boat *Francesca*, Sydney Fast Ferries' ferry *Palm Cat* and the Royal Australian Navy minehunter *HMAS Yarra*. Fortunately, none of the situations resulted in a collision.

At the time *Narrabeen*, *Francesca* and *Palm Cat* were travelling in an easterly direction from west of the Harbour Bridge before turning to the north around the safe water buoy off Bradley's Head. The two ferries were proceeding to Manly and the *Francesca* heading to sea. *HMAS Yarra* was conducting underwater route survey operations and was travelling in a reciprocal southerly direction on the eastern side of the western main shipping navigation channel towards the safe water buoy.

The primary factor contributing to the close quarters was the significant reduction in visibility due to changeable fog conditions, particularly on approaches to and in the vicinity of Bradleys Head. This is evidenced by the assessments made by the majority of the parties concerned and their responses to the conditions. Non-compliance with regulations and imprudent navigation, considering the prevailing conditions, also contributed in some cases.

Narrabeen, *Palm Cat* and *Francesca* did not sound any overtaking signals or fog signals at regular intervals and the Bradleys Head fog signal was not operating, unbeknown to Sydney Ports Corporation. The Vessel Traffic Service did not identify any close quarter situations among the vessels from its monitoring of their positions by radar and automatic identification system tracking.

A number of other safety matters came to light in the course of the investigation. These included:

- Sydney Fast Ferries' Safety Management System not containing precautions to be taken when operating in conditions of restricted visibility, a matter which has now been rectified.

¹ All times are in Australian Eastern Standard Time, 10 hours ahead of Coordinated Universal Time (UTC +10).

- Sydney Ports Corporation not issuing a Notice to Mariners advising of *HMAS Yarra's* operations in Sydney Harbour and the Vessel Traffic Service not advising of her presence during information broadcasts.
- It being deemed appropriate for *HMAS Yarra* while on survey operations to exhibit lights signifying it was conducting mine clearance operations.
- Vessels having ineffective, inappropriate or not using fog signals.

Evidence of anomalies in the tracking of vessels using the Automatic Identification System Class B was identified which tends to support previous findings by the Defence Science and Technology Organisation and the Australian Transport Safety Bureau.

In the interests of contributing to a safe maritime environment on Sydney Harbour, it is recommended that:

- Sydney Ports Corporation reviews, with the staff of the Vessel Traffic Service, the processes and procedures associated with identifying and giving warning of developing close quarters and other potentially unsafe navigation situations regardless of the size of the vessel.
- Roads and Maritime Services and Sydney Ports Corporation investigate measures to provide greater clarity of operational responsibility for safety management on Sydney Harbour.
- The Royal Australian Navy discontinues the practice of classifying survey operations as mine clearance unless towed equipment is actually deployed.

PART 1 FACTUAL INFORMATION

Introduction

- 1.1 On 27 July 2012, OTSI received a report alleging that a series of close quarter situations had developed on Sydney Harbour shortly after 6am on 25 July 2012 in conditions of restricted visibility due to heavy fog. The vessels involved were reported as being the Sydney Ferries Corporation (SFC) ferry *Narrabeen*, the licensed fishing boat (LFB) *Francesca*, the Sydney Fast Ferries (SFF) ferry *Palm Cat* and the Royal Australian Navy (RAN) vessel *HMAS Yarra*.
- 1.2 In response, the Chief Investigator appointed an investigator to verify the substance of the reported incident. Initial enquiries by the investigator revealed that the alleged event had occurred as reported and that the safe operation of the vessels involved may have been placed in jeopardy. An investigation in accordance with the provisions of section 46BA(2) of the *Passenger Transport Act 1990* was then initiated.

Vessel and Crew Information

LFB Francesca

- 1.3 *Francesca* is a privately owned trawler fishing vessel of timber construction. It is 22.4 metres in length, has a beam of 6.95 metres and is powered by twin Iveco 373 kW engines. It was operating in current NSW 3B survey, Identifying Number 6850. *Francesca* was equipped with radar and VHF and HF radio but did not have an automatic identification system (AIS). For more details refer to *Appendix 1*.
- 1.4 At the time, it was manned by a crew of three: the Master, holding a current Master 5 certificate of competency and a MED 2 certificate of competency both issued in 1989; the First Mate, also the holder of current Master 5 and MED 2 certificates of competency; and a deck hand holding a General Purpose Hand (GPH) certificate. The Master had 23 years experience operating along the NSW coast and within Sydney Harbour.
- 1.5 *Francesca* was exhibiting the prescribed lights for a power-driven vessel less than 50 metres in length in accordance with COLREGs Rule 23 (a) (i), (iii) and

(iv). Additionally, it was exhibiting bright white floodlights on top of the trawl gantry aft of the wheelhouse. The crew was using a compressed air operated horn at arbitrary intervals in lieu of the regulation sound signal that is required to be used in conditions of reduced visibility. These sound signals were not heard from the *Narrabeen* or *Palm Cat*.



Photograph 1: *Francesca*

(Photograph courtesy of Ebroh)

Narrabeen

- 1.6 *Narrabeen* is one of four monohull Freshwater Class, 70 metre long, double-ended ferries. It has a steel hull with an aluminium superstructure, displaces 1184 gross tonnes and is powered by two 2238 kW engines. It was in current NSW 1D survey, Identifying Number 15528. Both bridges of the *Narrabeen* were equipped with radar, AIS Class A (refer to discussion in Part 2 Analysis), forward looking infrared (FLIR) cameras, VHF radio and a SFC internal radio network. At the time, the vessel was owned and operated by SFC.² For more details refer to *Appendix 2*.
- 1.7 The ferry had a crew of six, consisting of the Master, Engineer and four GPHs. The Master held a current Master 4 certificate of competency as well as a

² Harbour City Ferries took over Sydney Ferries' operations on 28 July 2012.

local knowledge certificate issued under section 29 of the *Marine Safety Act 1998* to operate vessels over 30 metres within the Port of Sydney. The Master had 19 years experience operating within Sydney Harbour.

- 1.8 *Narrabeen* was exhibiting the prescribed lights for a power-driven vessel over 50 metres in length in accordance with COLREGS Rule 23 (a) (i) to (iv).



Photograph 2: *Narrabeen*

Palm Cat

- 1.9 Sydney Fast Ferries vessel *Palm Cat* is a 30.2 metre long catamaran constructed of aluminium and powered by two 895 kW engines. It was equipped with radar, AIS Class B and VHF radio. The ferry was in current Queensland Survey Class 1C and 1E, carrying the Identifying Number T29008QC, but held a current NSW Recognition Certificate for 1D survey. For more details refer to *Appendix 3*.
- 1.10 The ferry had a crew of four: the Master, holding a current Master 4 certificate of competency issued initially in 1992 but reissued in 2008; a First Mate, holding a Restricted³ Master 5 certificate of competency; and two deck hands holding GPH certificates. The Master had 20 years experience and also held

³ In this case restricted to operating within Sydney Harbour.

a certificate of local knowledge. The First Mate had six months experience as a Master 5.

- 1.11 *Palm Cat* was exhibiting the prescribed lights for a power-driven vessel less than 50 metres in length as required under COLREGs Rule 23 (a) (i), (iii) and (iv).



Photograph 3: *Palm Cat*

HMAS Yarra

- 1.12 The Royal Australian Navy (RAN) Mine Hunter Coastal vessel *HMAS Yarra* was commissioned on 1 March 2003 and is the last of six “Huon” Class minehunters built in Newcastle, Australia. It is a monohull vessel, 52.5 metres in length and displacing 720 tonnes. It is powered by a Fincantieri diesel driving a controllable pitch propeller and three Riva Calzoni auxiliary propulsion units. The vessel was equipped with radar and VHF and HF radio. It was not equipped with AIS. For more details refer to *Appendix 4*.
- 1.13 *HMAS Yarra* had a full complement of crew with a Commanding Officer of lieutenant commander rank.
- 1.14 *HMAS Yarra* was exhibiting the appropriate navigation lights for a power-driven vessel over 50 metres in length. In addition, it was exhibiting three all-round green lights signifying it was engaged in mine clearance operations (COLREGs Rule 27 (f) refers).



Photograph 4: HMAS Yarra

Sydney Harbour

- 1.15 At its entrance, Sydney Harbour is flanked by two sandstone headlands, approximately 3.2 km apart, known as North Head and South Head. It has irregular foreshores of over 240 km in length with port facilities located principally to the west of the Sydney Harbour Bridge. Circular Quay acts as the main hub for ferry services which operate both east and west to provide services to commuters from the two rivers which feed into the Harbour, and also to the suburbs of Manly to the north-east and Rose Bay and Watson's Bay to the east. Key points within Sydney Harbour are shown on *Chart Extract 1*.
- 1.16 There are two main shipping channels in the Harbour; the Eastern Channel, and the main shipping channel, the Western Channel, which is maintained to a maximum depth of 13.7 metres. Near the entrance to the Harbour the channels are separated by an area of rocks and shoal known as the "Sow and Pigs". They then converge between Shark Island to the east and Bradleys Head to the west.

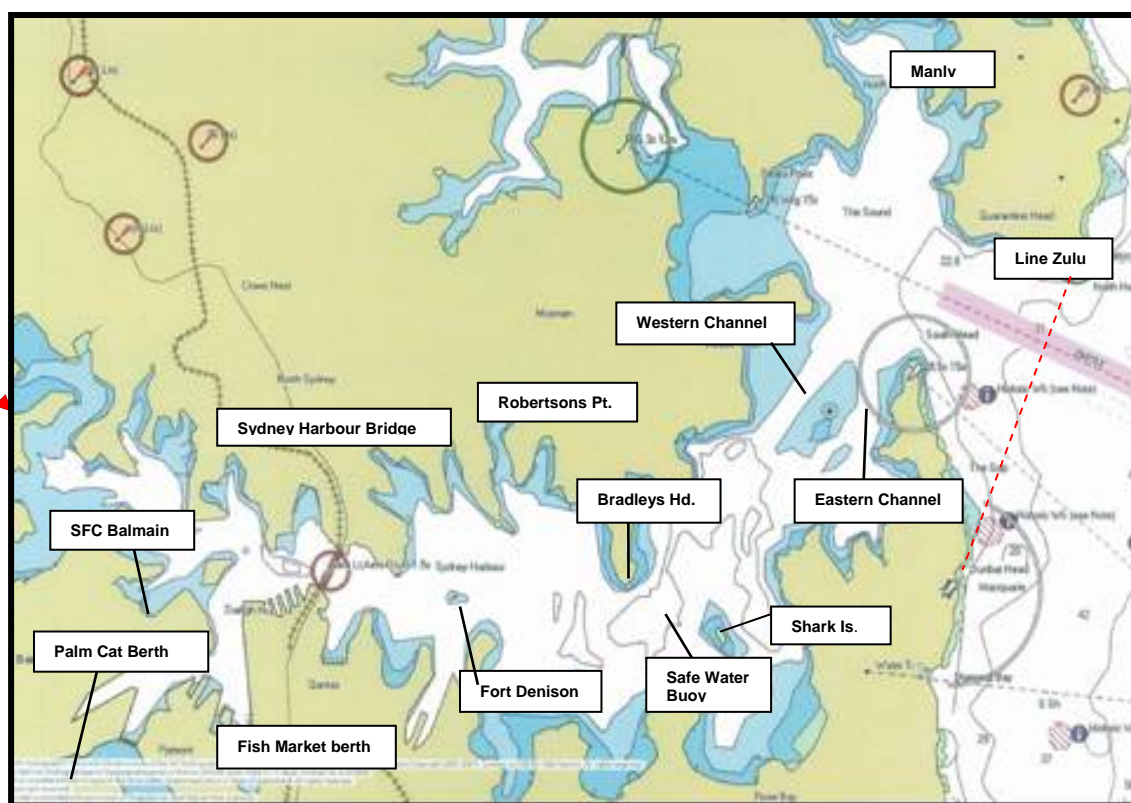


Chart Extract 1: Locations within Sydney Harbour

- 1.17 In addition to being a major commercial and naval port, Sydney Harbour also has the largest daily movement in Australia of small commercial trading vessels, as well as small recreational vessels including fishing, kayaking, keel yachts, sailing dinghies and rowing craft. During the summer months, the waterways are congested with small vessels which are often transiting the Harbour from the numerous bays and inlets and often during darkness. This large concentration of vessel movements requires appropriate caution by all vessels in navigation within the Harbour.

Sydney Ports Corporation's Vessel Traffic Service

- 1.18 The *Ports and Maritime Administration Act 1995* requires Sydney Ports Corporation (SPC) to carry out port safety functions, one of which is the provision of Vessel Traffic Services (VTS). Sydney Ports VTS operates under the control of the Harbour Master. The VTS centre is located at Port Botany in Botany Bay, some 13 nautical miles (24 kilometres) south of Sydney Harbour by sea. It is responsible for monitoring and controlling the movement of vessels 30 metres or over in length within the ports of Sydney Harbour and

Botany Bay. Vessel movements are tracked by the VTS system using inputs from radar, CCTV and a vessel's automatic identification system (AIS). Communication is by VHF marine band radios.

- 1.19 All Masters operating commercial vessels in both ports must maintain radio communications with VTS on VHF Channel 13. At approximately five minutes after each hour, the Harbour Master uses VTS to advise all commercial vessels of shipping movements, and to broadcast navigational warnings. All commercial vessels over 30 metres within the ports are required to report their positions at specific locations when navigating both into and out of the ports.

Environmental Conditions

- 1.20 Sunrise on 25 July 2012 was at 6:53am. The minimum temperature in Sydney was 8.7°C and at 9:00am the temperature was recorded as 10°C. At the time of the incidents, thick fog was reported by commercial vessels at many locations on the Harbour. At times the visibility was reported to be 10 metres or less in some areas and 100 metres at other locations. The wind was reported to be 6-8 knots⁴ from the west which is unusual when there is a fog on Sydney Harbour.
- 1.21 Tidal predictions for Sydney Harbour are calculated from daily tide recordings made at Fort Denison which is a standard port.⁵ The close quarters' sequence of events commenced approximately two miles⁶ to the east and north of the Fort. The tidal prediction issued for 25 July 2012 indicated low tide would occur at 6:19am and measure 0.37 metres. The next high tide was at 12:45pm and was predicted to measure 1.52 metres. As the incidents occurred close to the slack water, tidal influence was not considered to be a contributing factor.

Vessel Movements

Francesca

- 1.22 The *Francesca* departed its berth at the Sydney Fish Markets in Blackwattle Bay at approximately 5:40am making to sea to conduct trawl fishing off the

⁴ One knot, or one nautical mile per hour, equals 1.85 kilometres per hour.

⁵ A place for which independent daily predictions are given in the tide or stream tables, from which corresponding predictions are obtained for other locations, known as secondary ports, by means of differences or factors.

⁶ Miles referred to in this report are nautical miles; one nautical mile equals 2025 yards or 1852 metres.

NSW coast. When north of Darling Harbour, the *Francesca* encountered what the Master described as thick fog with about 30 metres visibility at the most. After passing Sydney Cove the *Francesca* maintained a constant heading of 097°⁷ towards the southern side of the safe water buoy off Bradleys Head. It was travelling at 6.7 knots, the speed having been reduced accordingly as the fog intensity increased on approach to Bradleys Head. The Master was utilising his radar and had a lookout posted on deck. Port Procedures did not require the *Francesca*'s movements to be reported to Sydney Harbour VTS.⁸

Narrabeen

- 1.23 On receipt of clearance from VTS, the *Narrabeen* departed Balmain Shipyard at approximately 5:55am for Manly where it would begin passenger services for the day commencing at 6:35am. The Master received information relating to fog conditions on the Harbour from VTS and other vessels on the Harbour including ferries, some of which had secured to wharves due to the fog.
- 1.24 Normally a GPH would take the helm acting on the Master's instructions. However, as a precaution due to the reduced visibility, the Master retained physical control of the vessel from the console position amidships on the bridge. He tasked the most experienced GPH with monitoring the radar which was located on the starboard side of the bridge. Although not qualified on radar, this GPH had some understanding of its use and had received some instruction from the Master during previous sailings together. In the Master's opinion, he was the only available crew member with the knowledge and ability to identify other vessels, navigation buoys and markers.
- 1.25 As a further precaution, he stationed his other three GPHs on the bridge as additional lookouts. One was stationed on the port side wing and one on the starboard side wing, both having unimpeded views. The other was engaged in lookout duties from inside the wheelhouse on the opposite side of the bridge to the radar.
- 1.26 At the Harbour Bridge, control of the *Narrabeen* was switched from manoeuvre mode to sailing mode. While proceeding outbound and when approximately abeam of Robertson Point, the fog intensified. In response, the

⁷ All bearings in this report are TRUE.

⁸ Sydney Ports Corporation, *Port Procedures Guide for Sydney Harbour & Port Botany, April 2009*, Paragraph 3.8c.

Master reduced speed to 6 knots and, as a further precaution, disengaged sailing mode and engaged manoeuvre mode. In this mode of operation, due to the complexity of operating the control systems and back-up procedures, the Master is the only person able to operate the controls and is required to do so from centre bridge console.

- 1.27 *Narrabeen's* Master described the visibility as “*about 10 metres at this time*”, a description supported by the Master of *Francesca*. The Master switched on the automatic fog signal⁹, but instead of sounding the required one prolonged blast at intervals of not more than two minutes, the device malfunctioned and sounded continuously. As continuous sounding is a distress signal, the Master switched off the unit.

Palm Cat

- 1.28 On receipt of clearance from VTS at 5:43am, the *Palm Cat* departed its berth in Rozelle Bay at 5:45am to travel to Manly to commence regular passenger services between Manly and Circular Quay. The exact time it departed the berth was initially recorded in the log as 06:40 but this was crossed out and 05:45 entered. (The initial entry of departure had not been filled in by the Master as was the normal practice.) Normally the *Palm Cat* would arrive at Manly around 6:10am to depart on the first passenger carrying run to Circular Quay at 6:30am.
- 1.29 After passing under the Harbour Bridge, and when clear of the 15 knot speed restriction area between Miller's Point and the Opera House, the *Palm Cat's* speed was increased to 26.6 knots. It was travelling east on a course of 085° towards the safe water buoy at Bradleys Head and towards the *Francesca* and the *Narrabeen*. The Master was utilising his radar and following his chart plotter.

HMAS Yarra

- 1.30 *HMAS Yarra* had been conducting underwater route survey operations in Sydney Harbour overnight on 24 and 25 July 2012 and was returning to its base at *HMAS Waterhen* via the western channel. It had previously been undertaking similar operations in Botany Bay. VTS gave clearance to *HMAS*

⁹ The term 'fog signal' is used throughout this report to refer to a sound signal in conditions of restricted visibility.

Yarra as no trading vessel movements were scheduled or expected in the port. *HMAS Yarra* would maintain listening watch on VHF Channel 13 and keep well clear of all traffic if necessary.

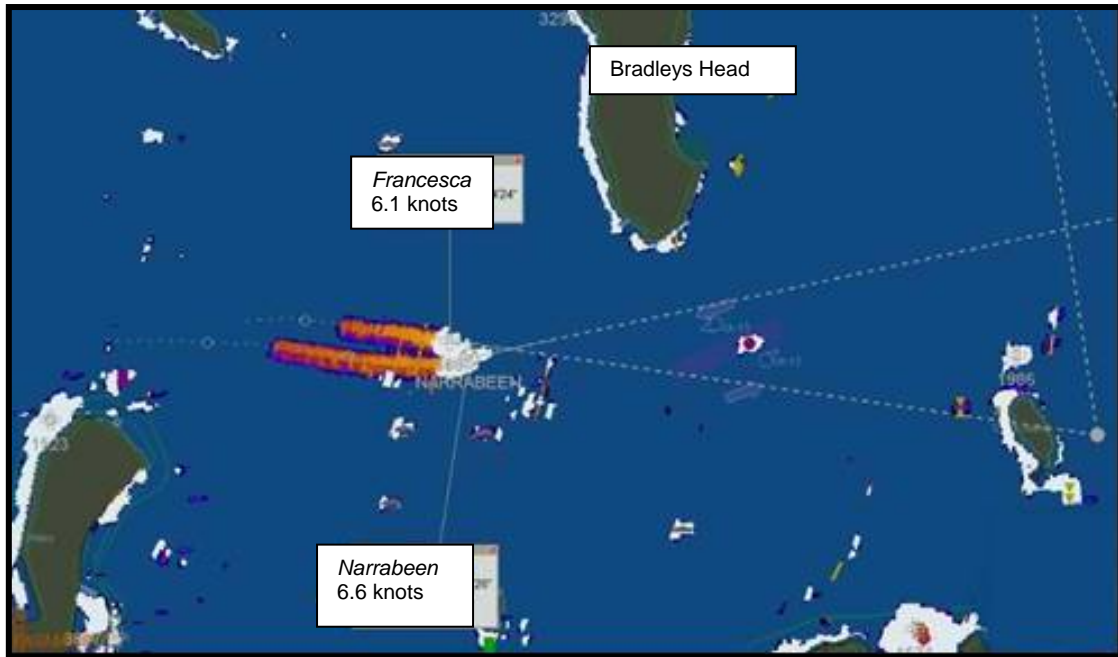
- 1.31 After crossing line 'Zulu' at 5:35am, *HMAS Yarra* turned into the western channel when it was abeam of the north cardinal mark between the eastern and western channel. *HMAS Yarra* then proceeded on the eastern side of the channel on a steady course of 217° and speed of 2.4 knots, heading towards the safe water mark off Bradleys Head. *HMAS Yarra* had been made aware of outbound vessels ahead by VTS.
- 1.32 *HMAS Yarra* acknowledged the reports of fog given to *Narrabeen* by VTS at 5:37am but reported visibility as clear east of Bradleys Head at the time. However, at about 6.00am, *HMAS Yarra* advised VTS that visibility had reduced from three nautical miles "to less than 2000 yards and shortly after reduced to 500 yards within the space of a few minutes".¹⁰
- 1.33 When abeam of the port lateral navigation marker (colloquially referred to as the wedding cake), *HMAS Yarra* commenced sounding the signal for a vessel restricted in ability to manoeuvre, consisting of one prolonged blast followed by two short blasts at intervals of not greater than two minutes ('D' in Morse Code).

Sequence of Events

- 1.34 After clearing the Circular Quay area, *Narrabeen* was astern of *Francesca* on a course of 094° at a speed of 13.4 knots. At this time *Palm Cat* was still west of the Harbour Bridge.
- 1.35 At 6:02:19am *Narrabeen* overtook *Francesca* which was abeam on *Narrabeen's* port side. At 6:02:40am *Narrabeen* reduced speed to 8.9 knots and altered course 10° to port to a heading of 084°.
- 1.36 At 6:03:33am *Narrabeen* had reduced speed further and was now travelling at 6.6 knots on a heading of 074°, a heading which would take it across *Francesca's* bow. *Francesca* had now also reduced speed to 6.1 knots (see *Screenshot 1*). At 6:03:53am the *Narrabeen* crossed ahead of *Francesca* at a

¹⁰ 2000 yards = 1828 metres, 0.98 nautical miles or 9.8 cables (a cable being 1/10th of a nautical mile). 500 yards = 457 metres or 0.25 nautical miles (2.5 cables).

clearing distance estimated by *Francesca*'s Master to be only 10 to 15 metres. *Narrabeen* altered course slightly to port on a course of 077° travelling at 6.4 knots while *Francesca* was steady on a course of 096° travelling at 5.8 knots. The *Narrabeen* was now on a course which would pass on the wrong (north) side of the safe water buoy heading into the Western Channel.

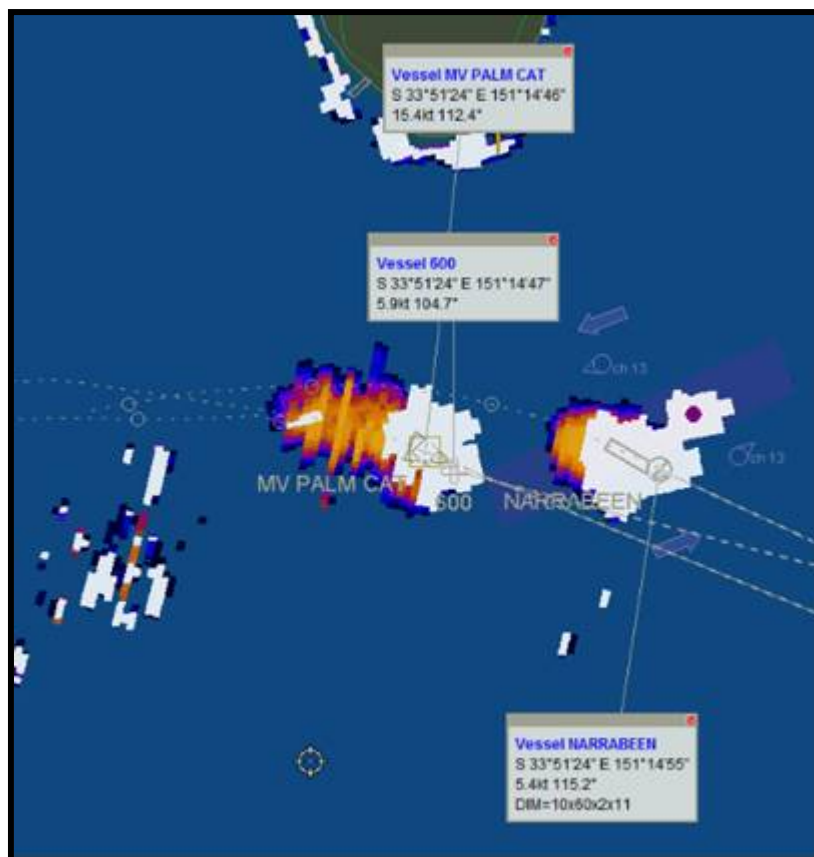


Radar Screenshot 1: *Narrabeen* altering course across *Francesca*

- 1.37 At about this time *Narrabeen* became visible to *HMAS Yarra* on radar. Prior to this, *Narrabeen*, and any vessels due west of it, would have been obscured as a radar target by the Bradley's Head land mass.
- 1.38 At 6:04:42 *HMAS Yarra* called *Narrabeen* on VHF Channel 13 requesting that they pass "green to green" i.e., starboard to starboard. The *Narrabeen* acknowledged and agreed and then adjusted course, back across the path of *Francesca*, to round the safe water mark on the southern side.
- 1.39 At 6:05:23am *Narrabeen* was now on a course of 095° at 6 knots having turned to starboard back towards *Francesca*. *Francesca* was then slowed to 4.5 knots and took up a position astern of *Narrabeen* on a course of 090°. At this time *Palm Cat* was still astern of both vessels on a course of 093° at 26.3 knots. Subsequent minor course and speed adjustments were such that, at 6:06:18am, *Narrabeen* was on a course of 108° at 6.1 knots, *Francesca* was

on a course of 101° at 5.6 knots and *Palm Cat* was off the port quarter of *Francesca* on a heading of 085° maintaining a speed of 26.5 knots.¹¹

- 1.40 At 6:06:56am *Narrabeen* altered course to 115° at 5.4 knots, *Francesca* was on a course of 104° maintaining 5.6 knots and *Palm Cat* was very close to the port quarter of *Francesca* on a heading of 112° but having just reduced its speed to 15.4 knots.
- 1.41 At 6:07:10am *Narrabeen* was south of the Bradleys Head safe water buoy on a course to 107° at 5.2 knots (see *Screenshot 2*). *Francesca* and *Palm Cat* were maintaining course and speed as *Palm Cat* overtook *Francesca* on its port side at a distance estimated by the Master of the *Francesca* to be no more than 5 to 10 metres. The crew of *Palm Cat* described the distance as close enough to call out to the crew on the aft deck of *Francesca*. Both the Master and Mate of *Francesca* reported hearing someone call out from *Palm Cat* at the time.

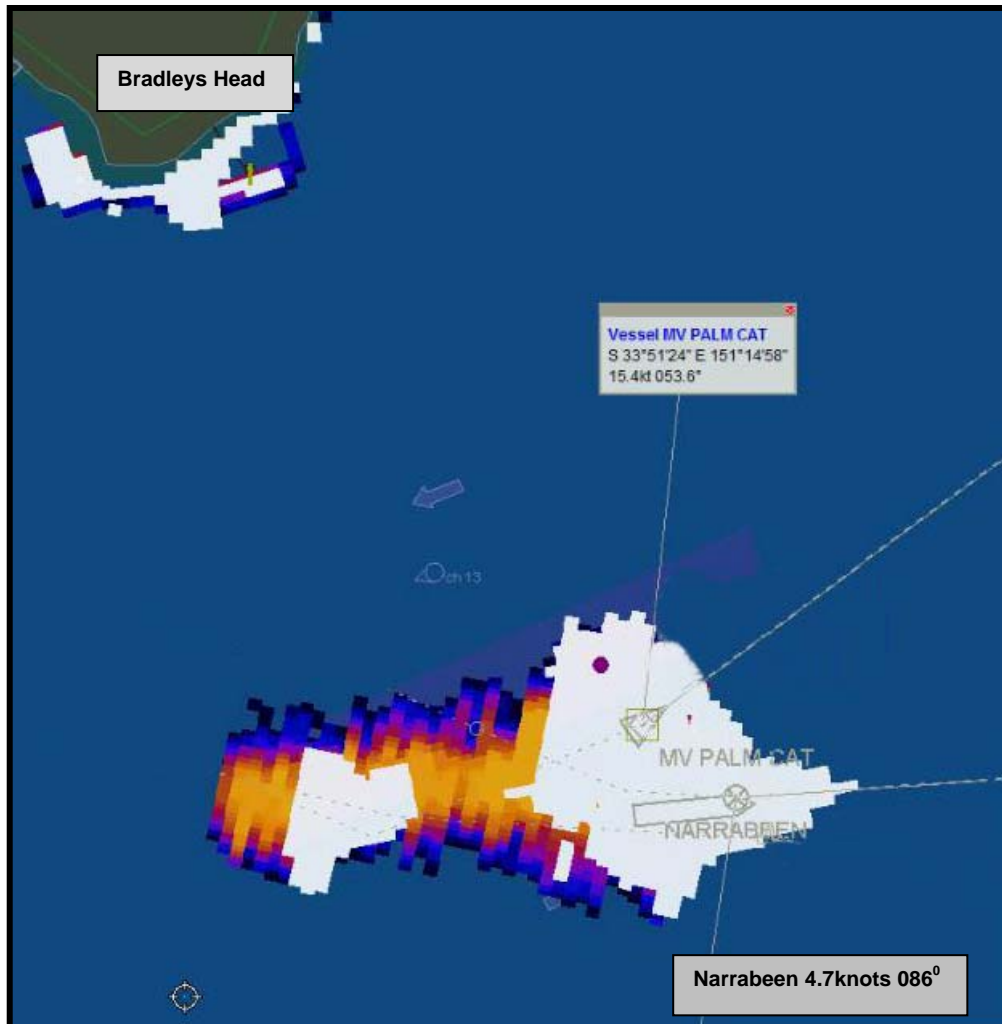


Radar Screenshot 2: *Palm Cat* close to *Francesca*'s port quarter¹²

¹¹ A speed of 26.5 knots equates to 818.5 metres per minute or 13.6 metres per second.

¹² The *Francesca* shows on these plots as 'Vessel 600', a number allocated by VTS for tracking purposes.

- 1.42 *Palm Cat* passed *Francesca* and continued on maintaining course and speed. At 6:07:43am *Palm Cat* altered course to 053° and overtook *Narrabeen* very close on the port side (see Screenshot 3). *Narrabeen* was then on a heading of 086° at 4.7 knots. The Master of *Francesca* stated that he slowed further expecting to hear the sound of a collision between *Palm Cat* and *Narrabeen*. He estimated the distance between *Palm Cat* and *Narrabeen* as “no more than 5 to 10 metres with the *Palm Cat* travelling far too fast”. The *Palm Cat* then continued south of the safe water mark and turned to port on a course of 014° heading towards the shore line at the north-eastern end of Chowder Bay at 14.5 knots.

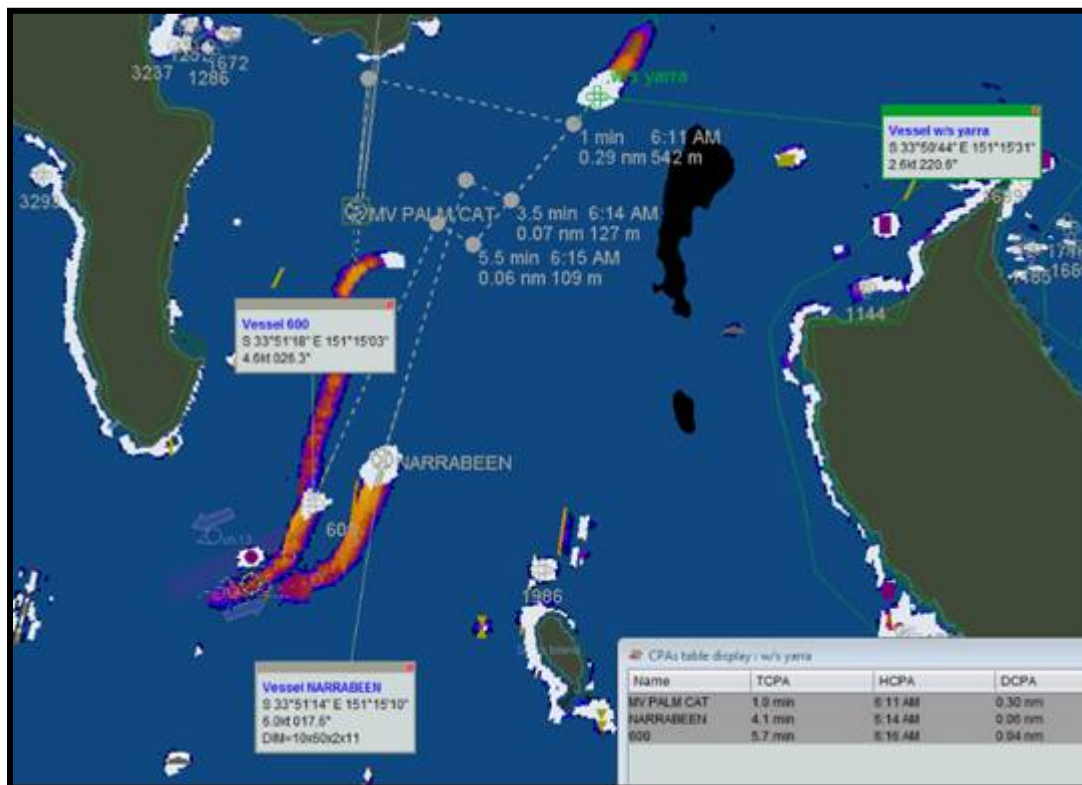


Radar Screenshot 3: *Palm Cat* after close quarter with *Narrabeen*

- 1.43 At 6:09:18am *Narrabeen* was on a course to 031° at 5.3 knots and had turned the safe water mark. *Francesca* was east of the safe water mark on a course

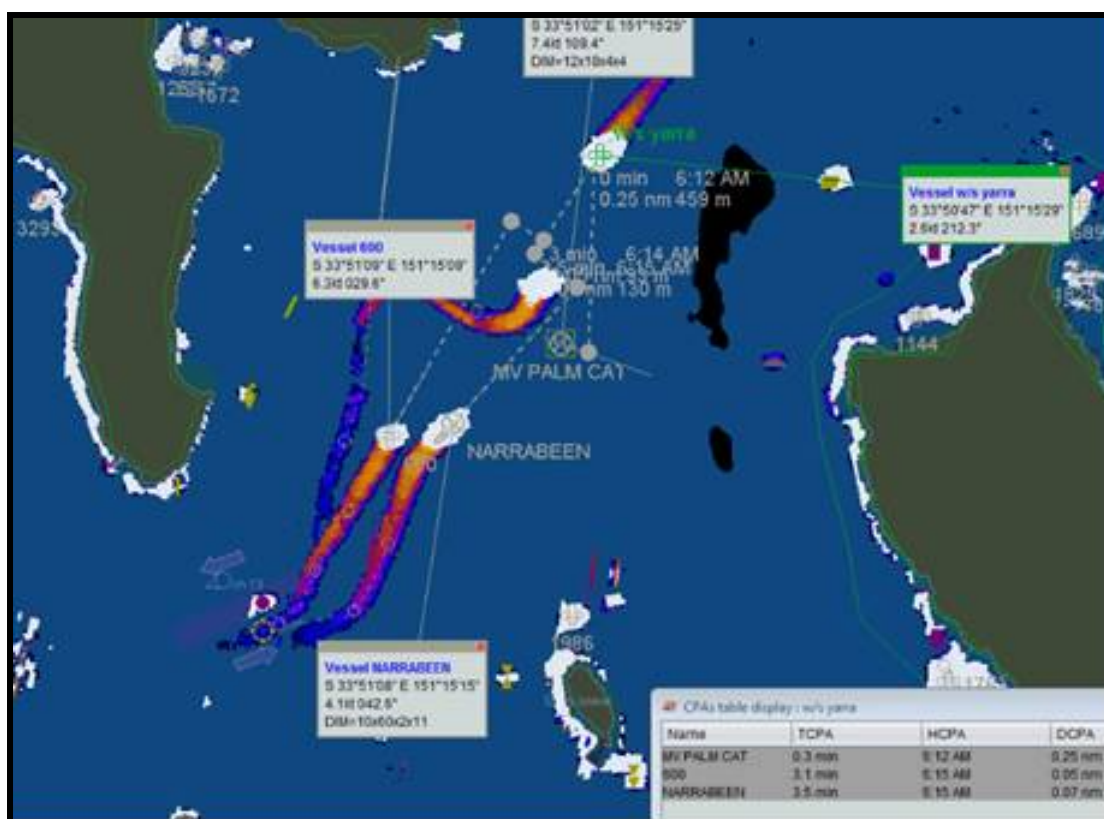
of 061° at 5.9 knots. *Palm Cat* was on a course of 018° at 13.8 knots still heading towards Chowder Bay which was not a normal course to take on the way to Manly. From commencement of operations *HMAS Yarra* maintained a relatively steady course and speed and was continuing down the eastern side of the channel on a heading of 208° at 2.8 knots.

- 1.44 At 6:10:29am, in the words of the Master of *Palm Cat* at interview, “we altered course slightly to starboard”. However, the radar track showed this turn to be 105° (see Screenshot 4).



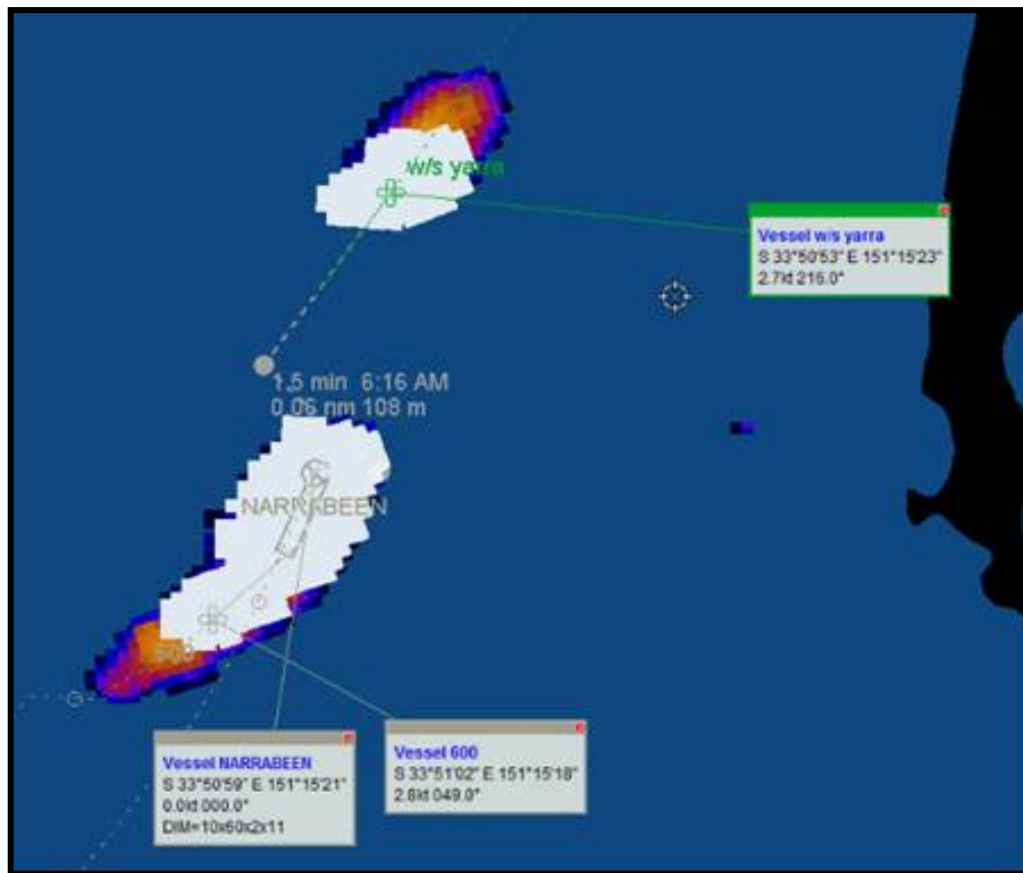
Radar Screenshot 4: *Palm Cat* commences 105° starboard turn

- 1.45 At 6:11:17am *Palm Cat* crossed the path of *HMAS Yarra* which was on a course of 215° at 2.2 knots. *Narrabeen* was on a course of 036° at 4.5 knots and *Francesca* was on a course of 029° at 6.1 knots.
- 1.46 At 6:11:35am *Palm Cat* altered course 85° to port towards *HMAS Yarra* which was keeping a steady course and speed. In this manoeuvre, *Palm Cat* had made a turn to port towards a vessel forward of her beam in restricted visibility. At this stage, *Narrabeen* was on a course of 043° at 4.3 knots and *Francesca* was on a course of 030° at 6.3 knots (see Screenshot 5). *Palm Cat* passed *HMAS Yarra* port to port then continued on to Manly.



Radar Screenshot 5: *Palm Cat* turns towards *HMAS Yarra*

- 1.47 After rounding Bradley's Head at 6:14:15am the Master of *Narrabeen* was not comfortable with the situation which had developed. At interview he stated: "*I could see all the holes in the Swiss cheese coming together so I stopped. I went astern and stopped, sounding three short blasts*".
- 1.48 At 6:14:20am *Narrabeen* called *HMAS Yarra* advising "*I think I have sighted you ahead of me. You have three green lights and one white light*". *HMAS Yarra* replied: "*Yes I have you off my port bow passing red to red*". *Narrabeen* at this time was not able to see the port or starboard side navigation lights on *HMAS Yarra*.
- 1.49 At 6:14:48am *Narrabeen* broadcast a call: "*Francesca and all vessels in the western channel. I have stopped and am not making way. I am unsure of traffic ahead of me*". *HMAS Yarra* acknowledged "*Roger that*".
- 1.50 At 6:14:50am *Narrabeen* was stationary, *Francesca* was astern of *Narrabeen* on a heading of 051° at 3.3 knots and *HMAS Yarra* was still closing *Narrabeen* and *Francesca* on a heading of 217° at 2.7 knots (see Screenshot 6).



Radar Screenshot 6: *Narrabeen* stationary

- 1.51 At 6:15:20am, out of concern about how the situation might further develop, the Master of the *Narrabeen* initiated radio communications with *HMAS Yarra* to which the *Francisca* then joined. The following table provides a transcript of those radio communications.

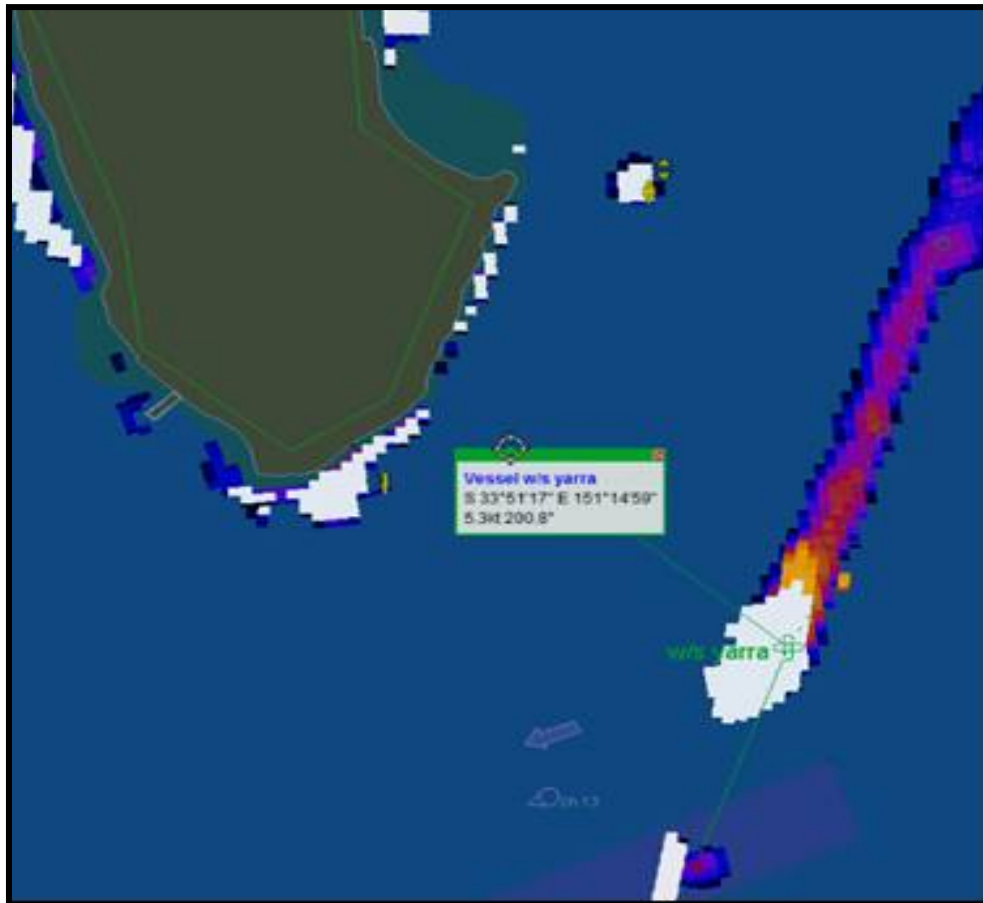
Time	Originator	Transcript
6:15:20	Narrabeen	Yarra, this is Narrabeen. (Yarra responds: 'Yarra') I am unsure of your exact position and I am in very close proximity to another vessel. (It may be you.) I've just hove to.
6:15:27	Yarra	Roger, I have you off my port bow. I see you heave to not making way. I am currently doing course 222 and at 3 knots, passing red to red.
6:15:50	Francisca	Behind you Narrabeen, behind you. Just take it easy going backwards.
6:15:56	Narrabeen	OK Yarra, Narrabeen. I am uncomfortable with our present position. I think if that is you, we are too close together.
6:15:59	Yarra	Roger, I'll come to starboard to open up and give you more room.
	Narrabeen	Romeo.
	Francisca	Just alongside Narrabeen, now alongside, now be careful of us too.
6:16:11	Yarra	Warship Yarra, coming to starboard.

6:16:20	Narrabeen	Francesca, copy that. Look I've hove to. I believe you are very close to me on my port side, as well.
6:16:25	Francisca	Yeah, roger that, I can't go, I can't go too much back: I might hit him. I am watching you, you are alright next to the Navy ship.
6:16:28	Narrabeen	Roger, copy that.
6:16:35	Narrabeen	Yarra, Yarra, Narrabeen. I have you in sight. We are extremely close and that fishing vessel is off my port stern.
6:16:45	Yarra	Sorry Narrabeen. This is warship Yarra. I missed most of that.
6:16:48	Narrabeen	Warship Yarra, I've got you sighted now and we are extremely close. Off my stern, off my port side, ahead of you is the Francesca, about 10 metres.
6:16:55	Yarra	Yeah, roger. I've come round to starboard and I'll alter away.
6:17:01	ACTION	Yarra changes course.
6:17:20	Narrabeen	Yarra, this is Narrabeen. On your present course, do you have that Francesca sighted?
6:17:26	Yarra	I have Francesca sighted on my port beam, also on your port beam. I'm coming to starboard and altering around it.
6:17:35	Narrabeen	Copy that. Francesca and Yarra, this is Narrabeen. I am going to get underway and clear this area.

- 1.52 At 6:22:39 the VTS operator called *HMAS Yarra* advising: *"I have you close quarters with the mid channel buoy"* to which *HMAS Yarra* acknowledged: *"Affirmative, we are just coming around now"* (see Screenshot 7).

Bradleys Head Fog Signal

- 1.53 Bradleys Head Light is a major navigational mark for all vessels entering, leaving and navigating within Sydney Harbour, which makes the fog signal associated with it of particular importance. The fog signal sounds one long blast followed by two short blasts ('D' in Morse Code).
- 1.54 Due to an electrical power cut at 6:00pm on 24 July 2012, the light was operating at reduced power but the fog signal was not operating. The Harbour Master and VTS were unaware that the power had not been fully restored at 04:00am as expected, nor were they aware that the fog signal was not sounding due to the reduction in the power supply. Hence, there was no mention of the fog signal being inoperative in the VTS routine information broadcast at 6:07am.



Radar Screenshot 7: VTS notifies *HMAS Yarra* of Safe Water Buoy

- 1.55 At 6:02am VTS had informed *Narrabeen* that they had “*activated the fog sirens here for Bradleys Head*” and asked *Narrabeen* to confirm that the sirens were working, if in a position to do so. No response was ever forthcoming. At interview, Masters from *Narrabeen*, *Palm Cat* and *Francesca* confirmed they did not hear a fog signal from Bradleys Head.

PART 2 ANALYSIS

Introduction

- 2.1 The investigation involved detailed examination of the relevant AIS, radar and communications recordings captured by the SPC VTS integrated vessel tracking system. Masters of *Francesca*, *Narrabeen* and *Palm Cat* were interviewed as were the first mates of *Francesca* and *Palm Cat*. All key people, other than RAN personnel, viewed the VTS recordings in conjunction with interviews held at OTSI's office. The RAN declined an invitation for the Commanding Officer of *HMAS Yarra* to be interviewed but provided a copy of his report.
- 2.2 Vessel Safety Management Systems (SMS), logs, operating procedures and documentation were examined for the vessels involved, with the exception of *HMAS Yarra*.
- 2.3 The RAN generously provided OTSI investigators with the opportunity to examine the sequence of events through simulation on their Bridge Simulator at *HMAS Watson* and Garden Island Naval Bases using the recorded vessel positions, courses and speeds. Vessel courses were observed from various positions in varying degrees of visibility up to 95% restriction to enable investigators to gain a better perspective and appreciation of the events.

Visibility

- 2.4 On departing Balmain Shipyard, the Master of *Narrabeen* observed foggy conditions. He was also advised of the conditions by VTS and overheard radio conversations from other vessels which had left their berths but were subsequently forced to secure at other wharves when the fog intensified. One such vessel sought refuge at Fort Denison wharf. Some 20 minutes later, at the other end of the Harbour, *HMAS Yarra* reported visibility as having initially been clear but then reducing from three nautical miles to less than 2000 yards then quickly down to 500 yards.
- 2.5 *Francesca* encountered thick fog off Circular Quay with visibility being described as reduced to about 30 metres at the most, and intensifying on

approach to Bradleys Head. *Narrabeen* encountered similar intensification down to an estimated 10 metres visibility in the vicinity of Bradleys Head, an estimate supported by the Master of *Francesca*.

- 2.6 Although operating in the same area, the Master of *Palm Cat* disagreed with this estimate stating that he had clear visibility from Fort Denison to the safe water mark at Bradleys Head, a distance of approximately 1.15 nautical miles, and that he could clearly see the other vessels. This is contradictory to the log entry, “*heavy fog to W.Chan*”, inserted between the departure and arrival times by the Master. At interview he described the worst visibility as about 200 metres around Bradleys Head, improving to about 300 metres after passing the safe water buoy.
- 2.7 It is clear that there was a significant degree of fog on Sydney Harbour between 5:45am and 6:30am on 25 July 2012, at least in some locations including the general vicinity of Bradleys Head and approaches to it. At interview, the *Narrabeen*’s Master stated that he would not have taken the ferry out if he had known the fog was going to be as thick as that which he encountered, although it appears that the conditions may have been quite variable in time and place.
- 2.8 The extent of impairment to visibility is evidenced by the fact that the masters of *Narrabeen*, *Francesca*, and *HMAS Yarra*, and the operator at VTS, acting on information received about fog on the Harbour, considered it necessary to take precautions by attempting to activate fog signals or some like means of indicating their presence. *Narrabeen* and *Francesca* also reduced speed appreciably while *HMAS Yarra* remained on task albeit at a very low speed. The *Palm Cat* reduced speed on approaching *Francesca*’s port quarter but to a still comparatively fast 15.4 knots.

Navigation

Sydney Ports Corporation

- 2.9 The Harbour Master issued Notice to Mariners No. 11 of 2012 on 11 July 2012 advising of *HMAS Yarra* surveying in Botany Bay commencing on 16 July 2012 and expected to be completed by 27 July 2012. No Notice to

Mariners was issued for the survey operation in Sydney Harbour which included the operations being undertaken overnight 24/25 July 2012.

- 2.10 The routine information broadcast by VTS on VHF Channel 13 issued at 6:07am on 25 July 2012 did not mention *HMAS Yarra* operating inbound and on the eastern side of the main western shipping channel. Yet, VTS had given clearance for the operations at approximately 7:00pm the evening before and had been apprised of the intention to return to *HMAS Waterhen* less than half an hour earlier.
- 2.11 The operator delivering the broadcast described the Bradleys Head Light as a white light operating with reduced luminous intensity. This is incorrect as the Bradleys Head Light is a green occulting light.
- 2.12 In accordance with Section 1.6c of the *Port Procedures Guide*, Harbour Control, through VTS monitoring, discharges the responsibility that: “*Advises on the initiation, continuation and termination of activities within the port areas which may affect the safe passage of vessels*”. VTS advised *HMAS Yarra* of its close quarters with the safe water mark after *Narrabeen* and *Francesca* had passed and continued their passage. VTS did not make a call on any of the previous close quarter situations nor did it question or advise on *HMAS Yarra*’s navigation of the port side of the Western Channel.

Francesca

- 2.13 For most of the time after being passed by *Narrabeen*, *Francesca* maintained visual contact with *Narrabeen* close in on its port quarter and so was masked by *Narrabeen* from *HMAS Yarra* for a lengthy period of time. It is probably because of this and the fact that *Francesca* is of timber construction that *HMAS Yarra* acquired only two radar targets when the three vessels came up to round the safe water mark. As evidenced by the radio communications recorded by SPC and the report of the incident submitted by the Commanding Officer of *HMAS Yarra*, *Palm Cat* was misidentified as the *Francesca* from *HMAS Yarra*’s radar. However, VTS had full visibility of all vessels involved from its radar and AIS resources throughout.

Narrabeen

- 2.14 Sydney Ferries' Safety Management System (SMS) contained comprehensive instructions for the operation of *Narrabeen* in conditions of reduced visibility. The Master followed the instructions and the log entries were recorded correctly by him.
- 2.15 When the Master of *Narrabeen* sighted the masthead lights (but not the side navigation lights) of *HMAS Yarra*, he stopped his vessel because of uncertainty about "*traffic ahead*". At interview, he described *HMAS Yarra* as being "*just full in my windscreen*". In three radio transmissions with *HMAS Yarra* between 6:15:20am and 6:16:48am, he indicated concern with the proximity of their two vessels.
- 2.16 *HMAS Yarra* was approximately 200 metres ahead on *Narrabeen*'s port bow when *Narrabeen* stopped. *Francesca* was on *Narrabeen*'s port quarter and almost dead ahead of *HMAS Yarra*'s course. *HMAS Yarra* was closing on the two vessels at a steady 2.7 knots.

Palm Cat

- 2.17 Sydney Fast Ferries' SMS did not contain any reference to vessel operation or precautions to be taken in conditions of reduced visibility. The Master had to rely on his own knowledge and experience in assessing the risks associated with navigating in an area of high traffic density, with the possible presence of small recreational vessels, under the prevailing weather conditions.
- 2.18 *Palm Cat* log entries for 25 July 2012 showed departure from the berth in Blackwattle Bay initially as "06:40" but this had been crossed out and "05:45" entered above. An examination of the log for that day showed that entries for crew, departure and arrival details were made by other than the Master. This was inconsistent with his normal practice of making all entries in the log personally. However, the Master did make two entries in the log on the day; a description of the fog and, at the bottom of the log, "*0745 VTS Sydney requested report regarding HMAS Yarra*".
- 2.19 The Master of *Palm Cat* stated he had followed a normal course towards Manly which he had recorded on his chart plotter as a guide. The AIS and radar tracking showed that the actual course steered was in towards Chowder

Bay, then easterly across the western channel and then north to Manly. This is not a normal course steered by any ferry travelling to Manly.

- 2.20 The action of *Palm Cat* altering course to port towards a vessel forward of her beam in restricted visibility may have contravened clauses (d) (i) and (ii) of COLREGS Rule 19 *Conduct of Vessels in Restricted Visibility*.

HMAS Yarra

- 2.21 *HMAS Yarra* was following the survey plan which took it down the port side of the channel (see *Chart Extract 2*). Normal shipping was required to keep to the starboard side in accordance with COLREGS: Rule 9 (a) “A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable”.
- 2.22 On the third occasion *Narrabeen’s* Master expressed concern at their proximity, *HMAS Yarra* agreed to alter course to starboard. At this point the vessels were 199 metres apart with *HMAS Yarra* reportedly on a course of 222° (whereas the radar track showed a steady course of 217°). *HMAS Yarra’s* closest point of approach (CPA) to *Francesca* was identified on the SPC radar as being one metre in the time to closest point of approach (TCPA) of 3.4 minutes.¹³ Two minutes and 18 seconds later *HMAS Yarra* changed course to 239° having closed to a distance of 73 metres.
- 2.23 In the conditions, and with *Francesca* unsighted, a 22° alteration of course might not be considered to be fully compliant with Rule 8 (b) of the COLREGS: “Any alteration of course and/or speed to avoid collision shall, if the circumstances of the case admit, be large enough to be readily apparent to another vessel observing visually or by radar ...”. Determining what is a “large enough” alteration is a matter of personal interpretation.

¹³ CPA: A calculated prediction as to the closest distance at which two vessels will pass if they maintain their current course and speed. TCPA: The predicted time at which CPA will occur.

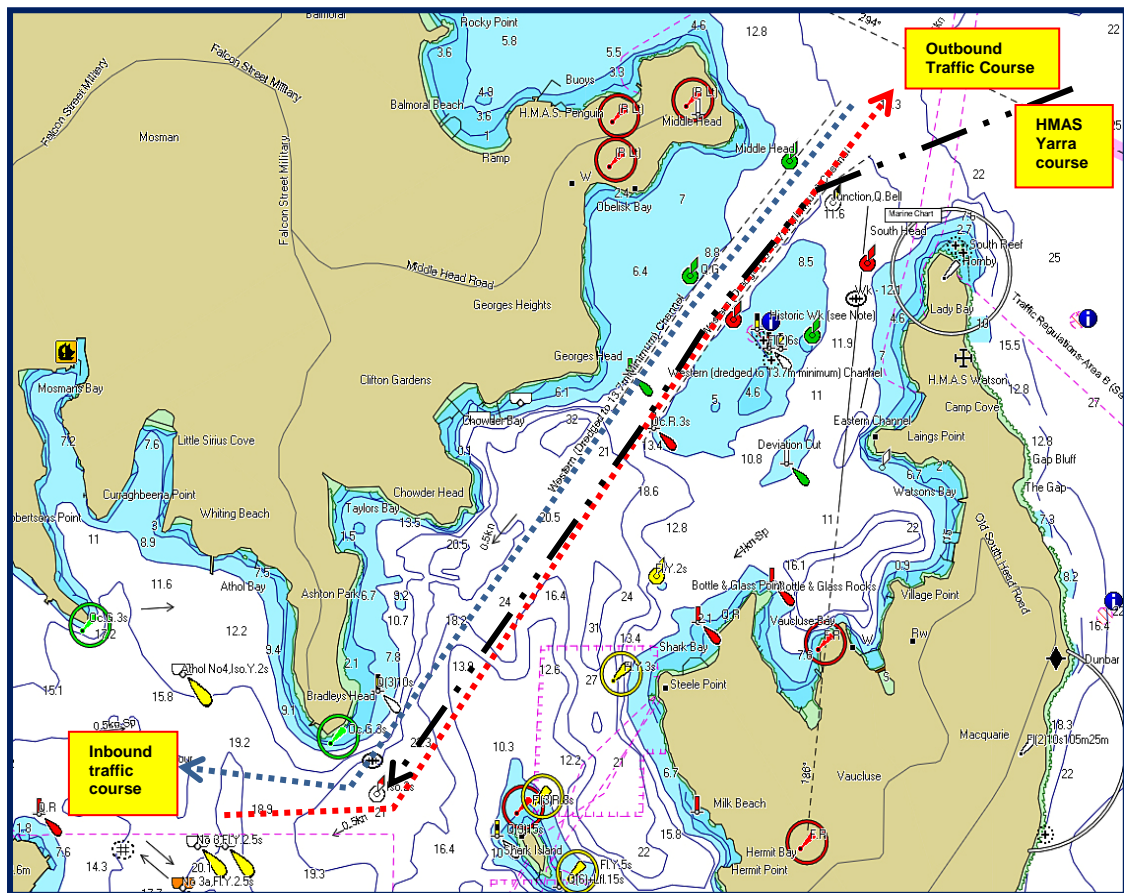


Chart Extract 2: HMAS Yarra track

Close Quarters

- 2.24 The on-line Oxford Dictionary defines ‘close quarters’ as “*a situation of being very or uncomfortably close to someone or something*”. It is clearly a subjective measure dependent on a set of influencing factors or conditions prevailing at the time. The United Kingdom’s maritime regulator, the Maritime Coastguard Agency, identifies “*closing speeds of the vessels involved, manoeuvring characteristics, visibility, weather, traffic density, restricted or open waters, will all have an influence on determining at what distance a close-quarters situation begins to exist*”.
- 2.25 On approaching the safe water mark, *Narrabeen* is estimated to have come to within 10-15 metres of *Francesca* as it manoeuvred across the bows of *Francesca*. *Francesca* made several reductions in speed during this time. *Francesca* then took up a position close in on *Narrabeen*’s port quarter and later, when *Narrabeen* stopped on approaching *HMAS Yarra*, made an urgent call to *Narrabeen* to be careful when going astern after sounding three short blasts and stopping.

- 2.26 *Palm Cat* overtook *Francesca* at a distance estimated to be no more than 5 to 10 metres. *Palm Cat* then came to within the same estimated distance when passing *Narrabeen*. The Master of *Francesca* considered this was very close and “*expected to hear the sound of a collision*”. He considered the *Palm Cat* was “*travelling far too fast*” (for the conditions). The *Palm Cat* had slowed considerably but was still travelling at least three times faster than the other vessels. The Master of *Palm Cat* did not have the same opinion of the visibility conditions as the other masters and, additionally, had a vessel with superior manoeuvrability.
- 2.27 In the interchange on radio between *Narrabeen* and *HMAS Yarra*, the Master of *Narrabeen* described their juxtaposition progressively as “*very close*”, “*uncomfortable*”, “*too close together*” and “*extremely close*” (twice).
- 2.28 In his report, *HMAS Yarra*’s Commanding Officer describes his vessel as having been involved in a “*navigation incident (possible development of close quarters collision)*”.
- 2.29 VTS adjudged *HMAS Yarra* to have approached the mid channel buoy at “*close quarters*”.

Other Safety Matters

Fog Signals

- 2.30 Rule 35 of the COLREGs prescribes the requirement for sound signals in conditions of restricted visibility, specifically that power-driven vessels making way “*shall sound at intervals of not more than 2 minutes one prolonged blast*”. *Francesca* employed the makeshift arrangement of a compressed air operated horn sounded at arbitrary intervals which proved to be ineffective. *Narrabeen*’s automatic fog signal malfunctioned and had to be kept switched off. The Master of *Palm Cat* saw no necessity to sound a signal. *HMAS Yarra* sounded the signal for a vessel restricted in ability to manoeuvre. Bradleys Head fog signal was not operating due to a power outage.
- 2.31 SPC did not have in place an efficient means of confirming if the fog signal at Bradleys Head was functioning and had to rely on reports to VTS from vessels in the vicinity. None were forthcoming during the time period under consideration.

- 2.32 Both the Bradleys Head fog signal and the restricted ability to manoeuvre signal (used by *HMAS Yarra*) sound 'D' in Morse Code, although the fog signal is sounded by a siren. However, if the fog signal had been working, there would have been some potential for confusion in the minds of crew of vessels operating in thick fog in the area as to what the origins of the signals were.
- 2.33 SPC reports having "*already initiated a process of reviewing the requirement/operation and characteristics of all fog signals*". This review should satisfy the need to find a more reliable system for determining whether or not the Bradleys Head fog signal is operating. It will also include the assessment of options for an alternative fog signal sounding at Bradleys Head which would give less chance of misinterpretation than the existing sounding.

Shipping Control on Sydney Harbour

- 2.34 Responsibility for safety and control of vessels in Sydney Harbour and Botany Bay lies with the Harbour Master and a number of government agencies. In general terms, the NSW Roads and Maritime Services (RMS) is responsible for the safe operation of both commercial and recreational vessels and the Harbour Master controls seagoing ships. VTS has the task of managing the interaction between recreational and commercial vessels safely. However, it should be noted that, at all times, decisions concerning navigation and manoeuvring of a vessel remain with its Master.
- 2.35 The general powers of a harbour master are detailed in section 88 of the *Marine Safety Act 1998* and include power to direct and control:
- the time and manner in which any vessel may enter or leave the port, and
 - the navigation and other movements of any vessel within the port.
- Under a delegation from the Minister, RMS has responsibility for enforcing on-water safety requirements such as speed limits, safety equipment, separation distance, boat licensing, vessel registration, vessel wash, drugs and alcohol, and 'policing' reckless, dangerous and negligent navigation.
- 2.36 Over the years the sharing of responsibility for safety on the Harbour has given rise to a number of anomalies relating to speed zones, traffic regulations and certificates of local knowledge. In relation to speed, regulations 24 to 26 of *the Marine Safety (General) Regulations 2009* dictate

speed limits for vessels of 30 metres or more in length in three defined Port of Sydney areas.¹⁴ The *Regulations* do not prescribe any speed limits for vessels less than 30 metres in length.

- 2.37 At the time of the incident, vessels were operating to the SPC *Port Procedures Guide for Sydney and Port Botany* which described four speed zones in the Harbour, but this was changed to conform with the *Regulations* when the Guide was revised and re-issued as the *Harbour Master's Directions December 2012*.
- 2.38 VTS has no prerogative in relation to control over speed of vessels less than 30 metres in length which, by regulation, also have no obligation to report to VTS. The VTS operator was under the impression *Palm Cat* was under 30 metres in length and hence was not a vessel within its jurisdiction. Additionally, unless vessels have an operational AIS, VTS will not necessarily know whether or not they are greater than or less than 30 metres in length. Therefore, the control the Harbour Master and VTS can exercise within the Harbour is effectively limited to the operation of sea-going commercial shipping.
- 2.39 Under the *Marine Safety Act 1998*, RMS may impose speed restrictions, establish no wash zones and grant exceptions from compliance with speed restrictions. The potential for confusion can be seen from the example of recreational vessels being subject to an 8 knot speed restriction in Darling Harbour while ferries have an exemption from this restriction.
- 2.40 As the Maritime Regulator, RMS is the issuing authority for vessel surveys and certificates of competency for masters, engineers, coxswains and GPHs. However, SPC requires all masters of vessels 30 metres or greater to hold a certificate of local knowledge or marine pilotage exemption certificate¹⁵ for the operation of vessels within both Port Botany and Sydney Harbour.
- 2.41 The SPC Port Procedures Guide required that “*all vessels navigating in the vicinity of the safe water mark buoy bearing 143°, 350 metres from Bradleys Head Lighthouse, shall pass to the north of the buoy when proceeding westward, and shall pass to the south of the buoy when proceeding*

¹⁴ Ferry, Police and RMS vessels are the only vessels that are currently exempt by legislation.

¹⁵ Marine Pilotage Exemption Certificate provides exemption from the requirement to take a marine pilot in the pilotage area to which the certificate applies.

eastwards". (The same requirement is contained in the *Harbour Master's Directions December 2012*.) However, RMS does not require recreational vessels to comply with this requirement.

- 2.42 In accordance with Clause 28 (b) of the *Marine Safety (General) Regulation 2009*, administered by RMS, all vessels when travelling at a speed of or exceeding 10 knots are required to maintain a distance of not less than 30 metres from another power-driven vessel, a structure or the shore. *Francesca*, *Narrabeen*, and *HMAS Yarra* all operated at speeds less than 10 knots which was self-imposed due to the restricted visibility. The slow speed of *HMAS Yarra* was dictated by the nature of the underwater survey. However, *Palm Cat* did not comply with this regulation when overtaking *Francesca* and *Narrabeen*.

RAN Survey Operations

- 2.43 The discussion notes from a meeting initiated by *HMAS Yarra* to brief SPC on the survey tasking in Botany Bay recorded that "*Yarra will show lights and day shapes for minesweeper*", "*Yarra would not be towing any equipment*" and "*Yarra can move sideways to clear channel*".
- 2.44 The RAN deems survey operations to be mine clearance operations. Vessels so engaged are thus required to show lights in accordance with COLREGs Rule 27 (f), with which *HMAS Yarra* was complying. Rule 27 (f) states that the lights "*indicate that it is dangerous for another vessel to approach within 1000 metres of the mine clearance vessel*". Further, the 2012 Annual Summary of Notices to Mariners contains the warning to vessels to "keep well clear" of survey vessels as they "*may often be run across the normal shipping lanes*" and "*may be towing instruments up to 300 metres astern*" which will restrict manoeuvrability.
- 2.45 Since such leeways are clearly not occurring, concurrent operations by other vessels on the Harbour are in technical breach of international regulatory guidelines with the knowledge of the Maritime Regulator and the SPC. This ambiguous regulatory situation has the potential to generate a hazardous operating environment should there be a time when a mine clearance

operation of any sort actually involves the deployment of towed or other arrays.

- 2.46 *HMAS Yarra* was operating depth sounding equipment which did not require abnormal clearances by other vessels as there was no outlying gear extending in any direction from the vessel. At no time in the period under consideration was *HMAS Yarra* restricted in its ability to manoeuvre, other than by the self-imposed, task-oriented requirement to hold a steady course while sounding depths.

Automatic Identification System

- 2.47 During the investigation, it was observed that when *Palm Cat* was passing *Francesca* rounding the safe water mark off Bradleys Head, the AIS track for *Palm Cat* jumped suddenly across *Francesca* from the starboard side to the port side; the true track of the vessel was lost momentarily. Later, just after *Palm Cat* turned to head north after it had crossed the path of *HMAS Yarra*, its AIS track disappeared as no further data was received.
- 2.48 AIS is a radio broadcasting system that transfers packets of data over a very high frequency (VHF) data link. The system enables AIS equipped vessels, and shore-based AIS stations, to send and receive identification information that can be displayed on an electronic chart, computer display or compatible radar.¹⁶
- 2.49 AIS Class A was developed for use by international commercial shipping and operators of large ships began fitting the units from mid 2002. The SOLAS requires a Class A unit to be fitted on board vessels of 300 gross tonnes and upwards engaged on international voyages, cargo ships of 500 gross tonnes and upwards not engaged on international voyages and passenger ships (more than 12 passengers) irrespective of size.
- 2.50 Fitting of AIS to ferries is not a requirement in NSW because SOLAS requirements have not been adopted for NSW sheltered waters. Nevertheless, as an outcome of its risk assessment processes, Sydney

¹⁶ Australian Maritime Safety Authority, Brochure: *Automatic Identification System (AIS)*, AMSA 249 (5/08) accessible at www.amsa.gov.au

Ferries fitted all of its vessels with SOLAS-accepted radar combined with AIS Class A.

- 2.51 The equipment provides large commercial vessels with the ability to identify instantly details of ferries in range including name, location, course, speed, CPA and TCPA. Conversely, the ferry masters have access to the same information about AIS-fitted vessels of interest to their navigation.
- 2.52 A Class B AIS has been developed for commercial and recreational vessels not covered under the SOLAS. Class B units are less expensive than Class A units, provide limited functionality and are designed with a ‘politeness factor’ meaning that they will not interfere with, or cause degradation of, the effectiveness of Class A units.
- 2.53 In 2008, the Australian Defence Science and Technology Organisation (DSTO) carried out an assessment of the performance of AIS Class B (AIS-B) for the Australian Maritime Safety Authority (AMSA).¹⁷ The task was prompted primarily by reports that signals from AIS-B units were not always being detected by commercial vessels with AIS Class A (AIS-A). A three month study, based on a survey of vessels entering Newcastle Port, found that *“of the vessels ... capable of receiving and decoding an AIS-B signal, 17% reported no AIS-B detections”*. It was indicated that this was more likely to occur when the ship’s AIS-A unit only displayed the AIS-B equipped vessel’s Maritime Mobile Service Identity (MMSI) number¹⁸ because the AIS-A unit was not capable of decoding and displaying the name of the vessel. Lack of detection could also be attributed to some extent to masters not recognising the detection on their AIS-A displays because, *“even where the name of the AIS-B vessel was displayed”, the “AIS-A displays do not distinguish AIS-A detections from AIS-B detections”*.
- 2.54 While investigating a collision between a sailing yacht and a large bulk carrier, the Australian Transport Safety Bureau (ATSB) identified that the signals sent by the yacht’s AIS Class B unit were only being detected intermittently. On 15 October 2009, while the yacht was berthed in the Harbour, ATSB

¹⁷ DSTO, *Automatic Identification System: AIS-A Reception of AIS-B, 2008 Study*, Maritime Operations Division, December 2008.

¹⁸ MMSI – a unique nine-digit code set into a direct service calling-capable radio transceiver and/or AIS transceiver to identify a vessel or coast station.

investigators contacted Harbour Control to ascertain whether or not the yacht's AIS was being detected by their shore based AIS Class A station. They also sought to test whether or not the yacht was being detected by other vessels working in the Harbour. Harbour Control confirmed that the yacht was detected by their AIS, but that it was not being detected by any of four vessels they contacted (a pilot boat and three ferries, all fitted with AIS Class A).

- 2.55 The investigators considered that the yacht may not have been detected by the four vessels because their skippers were looking for its name and not its MMSI number so they sought to repeat the test the next day. On 16 October, Harbour Control was provided with the yacht's number. Again, Harbour Control detected the yacht but it was not detected by any of five vessels contacted (a passenger ship berthed at Darling Harbour, three ferries and a cargo ship due to berth that day, all of which were fitted with AIS Class A). However, the cargo ship did detect the yacht's MMSI number for a short period of time later that afternoon.

Francesca's Lights

- 2.56 The bright white working lights mounted on *Francesca's* trawl gantry were of concern to *Narrabeen* and *Palm Cat* as they tended to obscure *Francesca's* port, starboard, stern and mast running lights. This made it difficult to accurately determine the vessel's course by visual observation. The lights were extinguished at the request of the Master of the *Narrabeen* after the vessels had rounded the safe water buoy and were heading north.

PART 3 FINDINGS

- 3.1 There is sufficient evidence to establish that a series of close quarter situations developed on Sydney Harbour between 6:07am and 6:22am on 25 July 2012 which variously involved the vessels *Francesca*, *Narrabeen*, *Palm Cat* and *HMAS Yarra*.

Contributing Factors

- 3.2 The primary contributing factor was the significant reduction in visibility due to changeable fog conditions, particularly on approaches to and in the vicinity of Bradleys Head. With the exception of the Master of *Palm Cat*, this is evidenced by the assessments made by the masters of the vessels and their actions in response to the conditions.
- 3.3 *Narrabeen's* navigational error on approaching the safe water mark brought it into close quarters with *Francesca*.
- 3.4 The manner in which the *Palm Cat* was navigated may not have been prudent in the prevailing conditions. In comparison to the normal courses steered by Manly ferries, the course changes made by *Palm Cat* were erratic and brought it into close quarters with each of the other vessels in turn. Its navigation around Bradleys Head contravened Clause 28 (b) of the *Marine Safety (General) Regulation 2009* in terms of speed and separation from other power-driven vessels.
- 3.5 *HMAS Yarra* came into close quarters with *Narrabeen* and *Francesca* when approaching them in the western channel when they maintained near reciprocal headings.
- 3.6 With the exception of *HMAS Yarra* approaching the mid channel buoy, the Vessel Traffic Service did not identify any close quarter situations as a result of its monitoring the positions of the four vessels by radar and automatic identification system tracking. If it had, then it would have had to broadcast alerts to vessels in accordance with Section 1.6c of the *Port Procedures Guide*.

- 3.7 *Narrabeen*, *Palm Cat* and *Francesca* did not sound any overtaking signals or fog signals at regular intervals.

Other Safety Matters

- 3.8 There were no instructions in the Sydney Fast Ferries' Safety Management System which addressed the precautions to be taken by masters and crew operating in conditions of restricted visibility. Sydney Fast Ferries has subsequently incorporated a comprehensive procedure in its SMS.
- 3.9 Sydney Ports Corporation did not issue a Notice to Mariners advising of the operation of *HMAS Yarra* in Sydney Harbour, nor did the Vessel Traffic Service in its general broadcast shortly after 6:00am mention the presence of *HMAS Yarra* inbound and operating on the port side of the channel contrary to normal navigational practice.
- 3.10 No vessels were sounding an appropriate fog signal and the Bradleys Head fog signal was not operating unbeknown to the Sydney Ports Corporation. Harbour City Ferries has advised it has introduced regular testing of its ferry's automatic fog signals by incorporating it as part of mandatory drill training. Sydney Ports Corporation has initiated a process of reviewing the requirement/operation and characteristics of all fog signals.
- 3.11 *HMAS Yarra* sounded 'D' in Morse Code inappropriately as it indicates a restricted ability to manoeuvre. In this situation, it could have inadvertently indicated a false position of Bradleys Head to vessels not equipped with radar.
- 3.12 The current division of responsibilities for control on Sydney Harbour based upon vessel types introduces potential for doubt when it is not known or clear if a vessel is 30 metres or more in length. In part, this may explain the lack of positive advisory action from the Vessel Traffic Service when considering the various vessels involved in the incident.
- 3.13 Deeming route survey as mine clearance operations has lead to a situation where vessels may become accustomed to ignoring international regulatory guidelines.

- 3.14 Operators of small vessels fitted with AIS Class B should be aware that they cannot rely on the AIS alone to warn other ships of their presence, and collision avoidance should not be determined by the information displayed on AIS Class B as false projected images can be displayed. Only radar should be used in restricted visibility situations for navigation and collision avoidance.

PART 4 RECOMMENDATIONS

The following recommendations are made in the interests of contributing to a safe maritime environment on Sydney Harbour.

- 4.1 It is recommended that Sydney Ports Corporation reviews, with the staff of the Vessel Traffic Service, the processes and procedures associated with identifying and giving warning of developing close quarters and other potentially unsafe navigation situations regardless of the size of the vessel.
- 4.2 It is recommended that Roads and Maritime Services and Sydney Ports Corporation investigate measures to provide greater clarity of operational responsibility for safety management on Sydney Harbour.
- 4.3 It is recommended that the Royal Australian Navy discontinues the practice of classifying survey operations as mine clearance unless towed equipment is actually deployed.

PART 5 APPENDICES

Appendix 1: Vessel Information - *Francesca*

Name	<i>Francesca</i>
Vessel Type	Licensed fishing vessel
Registered owner	Austar Fishing Pty. Ltd
Construction	Timber
Launched	Ballina NSW 1981
Length	22.46 metres
Breadth	6.95 metres
Draught	3.07 metres
Engine	Twin Iveco diesel engines
Power	2 x 373 (kw)
Propeller	Conventional
Crew	3 Master –Mate-Deckhand
Equipment	Radar, VHF and HF Radio, No AIS

Appendix 2: Vessel Information - *Narrabeen*

Name	<i>Narrabeen</i>
Vessel Type	Freshwater class ferry
Registered owner	NSW Government
Manager / Operator	Sydney Ferries Corporation
Construction	Steel with aluminium superstructure
Builder	State Dockyard (Carrington Slipway) in Newcastle NSW
Launched	1984
Length	70m
Breadth	12.4m
Draught	3.35m
Displacement	1184 tonnes
Engine	Two Daihatsu marine diesel engines
Power	2238kW
Service speed	14 knots
Propeller	Variable pitch propellers
Crew	6
Equipment	AIS type A, FLIR, VHF Radio

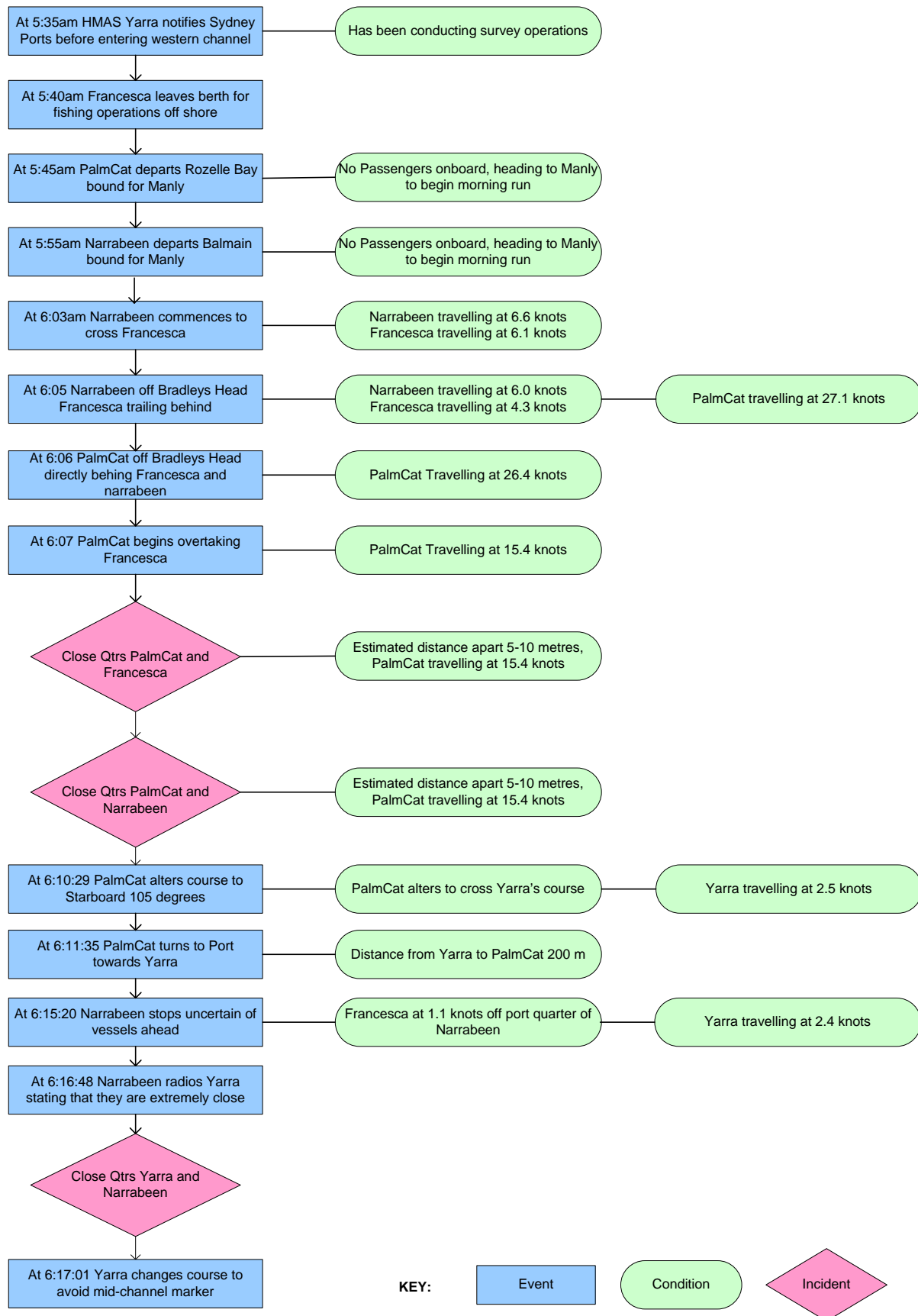
Appendix 3: Vessel Information - *Palm Cat*

Name	<i>Palm Cat</i>
Vessel Type	Fast ferry
Registered owner	Sunferries Pty Ltd
Manager / Operator	Sydney Fast Ferries
Construction	Aluminium
Length	30.13 metres
Breadth	8.0 metres
Draught	2.70 metres
Engine	2 x Caterpillar
Power	2 x 895 (kw)
Service speed	28 knots
Propeller	Conventional
Crew	4 Master Mate 2 GPH
Equipment	AIS type B, Radar, VHF Radio

Appendix 4: Vessel Information - *HMAS Yarra*

Name	<i>HMAS Yarra</i>
Vessel Type	Huon Class Minehunter
Registered owner	Royal Australian Navy
Manager / Operator	Royal Australian Navy
Construction	Fibre reinforced plastic
Builder	Australian Defence Industries, Newcastle, NSW
Launched	January 19, 2002
Length	52.5m
Breadth	9.9m
Draught	4.87 m
Displacement	720 tonnes
Engine	Single Fincantieri diesel and three Riva Calzoni auxiliary propulsion units.
Service speed	14 knots (main engine) 6 knots (auxiliary propulsion units)
Propeller	Controllable pitch propeller
Crew	36

Appendix 5: Events and Conditions



Appendix 6: Sources, Submissions and Acknowledgements

Sources of Information

- Austar Fishing Pty. Ltd.
- Australian Transport Safety Bureau
- Harbour City Ferries
- Roads and Maritime Services
- Royal Australian Navy
- Sydney Fast Ferries
- Sydney Ferries Corporation
- Sydney Ports Corporation

References

- Australian Transport Safety Bureau (ATSB) Marine Occurrence Investigation MO-2009-008 No 268
- Charts AUS 200, AUS 201 and Aus 202
- Marine Safety Act 1998
- Marine Safety (General) Regulation 2009
- NSW Navigation (Collision) Regulations 1983 (which incorporates the International Regulations for Preventing Collisions at Sea)
- *Passenger Transport Act 1990* (NSW)
- Sydney Ports Corporation –Port Procedures Guide for Sydney Harbour and Port Botany

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:

- Austar Fishing Pty. Ltd.
- Harbour City Ferries
- Royal Australian Navy
- Roads and Maritime Services NSW
- Sydney Fast Ferries
- Sydney Ports Corporation
- Transport for NSW

The NSW Water Police Marine Area Command was also offered the opportunity to comment on the Draft Report.

Written responses were received from all but Transport for NSW and Marine Area Command. The Chief Investigator considered all representations made by DIPs and responded to the author of each of the submissions advising which of their recommended amendments would be incorporated in the Final Report, and those that would not. Where any recommended amendment was excluded, the reasons for doing so were explained.

Acknowledgements

The Chart Extracts contained in the Report are used with the permission of Garman MapSource Blue Chart ^(R) Asia, Australia and New Zealand.

Screen shots included in this report are taken from SPC VTS capture of Radar and AIS recordings reproduced with permission of Sydney Port Corporation.