



Office of Transport Safety Investigations

FERRY SAFETY INVESTIGATION REPORT

CLOSE QUARTERS INCIDENT INVOLVING

MV NARRABEEN AND BARQUENTINE *SOUTHERN SWAN*

SYDNEY HARBOUR

17 MAY 2013



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Released under the provisions of
Section 45C (2) of the *Transport Administration Act 1988* and
46BBA (1) of the *Passenger Transport Act 1990*

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CONTENTS

TABLE OF PHOTOGRAPHS	ii
TABLE OF FIGURES	ii
GLOSSARY OF TERMS	iv
EXECUTIVE SUMMARY	v
PART 1 FACTUAL INFORMATION	1
Overview	1
Vessel and crew information	1
Incident location	4
Sydney Ports Corporation's Vessel Traffic Service	5
Environmental conditions	7
Passage plans	7
Vessel movements	9
PART 2 ANALYSIS	12
Introduction	12
Navigation: close quarter sequence of events	12
Situational awareness	15
Close quarters	18
<i>Southern Swan's</i> crewing	20
<i>Southern Swan's</i> masthead light	21
Other safety matters	22
Safety management systems	26
Training and drills	27
Remedial action	29
PART 3 FINDINGS	31
Contributing factors	31
Other safety matters	31
PART 4 RECOMMENDATIONS	33
PART 5 APPENDICES	34
Appendix 1: Vessel Information – <i>Southern Swan</i>	34
Appendix 2: Vessel Information - <i>Narrabeen</i>	35
Appendix 3: Chart Extract 3	36
Appendix 4: Chart Extract 4	37
Appendix 5: Sources, Submissions and Acknowledgements	38

TABLE OF PHOTOGRAPHS

Photograph 1: <i>Southern Swan</i>	2
Photograph 2: <i>Narrabeen</i>	3
Photograph 3: Lookout position <i>Southern Swan</i>	16
Photograph 4: Barbeque and LPG bottles	23
Photograph 5: Unprotected anchor winch and steering chain	24
Photograph 6: Fuel shut-off cables	26

TABLE OF FIGURES

Figure 1: Incident location	5
Figure 2: Traffic routes	6
Figure 3: <i>Southern Swan</i> sail plan	9

ACRONYMS AND ABBREVIATIONS

AIS	Automatic Identification System
AMSA	Australian Maritime Safety Authority
CCF	Critical Control Failure
COLREGS	International Regulations for Preventing Collisions at Sea, 1972
CRM	Crew Resource Management
DIP	Directly Involved Party
FLIR	Forward Looking Infrared
GPH	General Purpose Hand
HCF	Harbour City Ferries
LPG	Liquefied Petroleum Gas
MED III	Certificate of Competency as a Marine Engine Driver Grade 3
OTSI	Office of Transport Safety Investigations
RMS	Roads and Maritime Services
SHTS	Sydney Harbour Tall Ships Pty Ltd
SMS	Safety Management System
SPC	Sydney Ports Corporation
VDR	Vessel Data Recorder
VTs	Vessel Traffic Service

GLOSSARY OF TERMS

Automatic Identification System (AIS)	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.
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.
Starboard	The right hand side of a vessel when looking forward from the stern. The side where a green light is exhibited at night.
Survey Class	The figure in a Survey Class designation identifies the type of vessel e.g., “1” identifies the vessel as passenger carrying. 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).
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))

EXECUTIVE SUMMARY

Shortly after 19:30¹ on 17 May 2013, a close quarter situation developed on Sydney Harbour involving the barquentine rigged sailing ship *Southern Swan* and the Harbour City Ferries' ferry *Narrabeen*. *Narrabeen* was on a scheduled passenger service from Circular Quay to Manly and *Southern Swan* was on a charter and under sail at the time.

After rounding Bennelong Point, *Narrabeen* sought to pass between Fort Denison and *Southern Swan* which was ahead sailing on a similar heading. However, *Southern Swan* unexpectedly increased speed and altered course across *Narrabeen's* intended path. As the overtaking vessel *Narrabeen* was required to give way to *Southern Swan*, so when *Southern Swan* did not go to starboard when told to do so and allow *Narrabeen* to pass to port, *Narrabeen's* Master took evasive action. A collision was avoided, although *Narrabeen* came close to grounding and colliding with a navigational mark on Fort Denison.

Southern Swan's Master experienced a loss of situational awareness and believed he was much closer to Fort Denison than he was. He was constrained by rigging impinging on his field of vision from the helm position, distracted by passenger activities and had to rely on spatial information provided by inexperienced crew members.

The report recommends that the Australian Maritime Safety Authority (AMSA) reviews the crew numbers and qualifications required to operate *Southern Swan*, taking into account the requirement for competent crew to set and trim sails and perform the lookout function. It also recommends that the Roads and Maritime Services (RMS) determine areas of operation where *Southern Swan* and other similar commercial sailing vessels can safely operate while under sail within Sydney Harbour, having regard to traffic densities and regular ferry routes.

It is also recommended that Sydney Harbour Tall Ships Pty Ltd (SHTS) replace all current equipment used as crew safety harnesses in the rigging with equipment that

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

complies with current Australian Standards. OTSI has raised its concern about the harnesses with AMSA as the national maritime safety regulator.

A number of additional and important safety issues concerning the *Southern Swan* were identified during the course of this investigation. It is recommended that SHTS expedite remedial action in relation to those matters which have not yet been rectified.

PART 1 FACTUAL INFORMATION

Overview

- 1.1 At approximately 19:30 on 17 May 2013, the Harbour City Ferries' MV *Narrabeen* and the Sydney Harbour Tall Ships' Barquentine *Southern Swan* came into a close quarters situation near the south-western side of Fort Denison in Sydney Harbour. Both vessels took emergency action to prevent a collision. However, in doing so, *Narrabeen* narrowly missed colliding with the starboard lateral pile marker on Fort Denison and came close to grounding.
- 1.2 At the time of the incident, *Narrabeen* was on a regular service run from Circular Quay to Manly with 141 passengers and a crew of six onboard. The *Southern Swan* was under sail on a charter cruise with 28 passengers. It had a crew of three in accordance with the minimum survey requirements and an additional seven volunteers onboard.
- 1.3 OTSI was alerted to the incident by the Sydney Ports Corporation Harbour Master on 18 May 2013. The incident was recorded by the Vessel Traffic Service using the automatic identification system (AIS), radar and VHF radio communications.

Vessel and crew information

Southern Swan

- 1.4 The *Southern Swan* is a barquentine rigged timber sailing ship with an overall length of 41 metres. Its beam is 6.66 metres and it has a draft of 2.52 metres. It is fitted with a single 187 kW diesel engine with a conventional drive shaft and fixed propeller. (For more details refer to *Appendix 1*.) The ship is fitted with VHF radio and radar although the radar was not operational on the day of the incident. At the time of the incident, *Southern Swan* was under sail with no mechanical propulsion but was exhibiting a masthead light to illuminate the lower topsail from behind. Such lighting denotes a power-driven vessel, not a sailing vessel.

1.5 *Southern Swan* was in current commercial 1E survey with the Roads and Maritime Services (RMS) with Identifying Number 17852. The survey permitted the vessel to be operated in smooth waters and carry 110 persons onboard with the number of passengers not to exceed 100. *Southern Swan*'s survey required a crew of four; a Master holding a Master Class Four (Trading) Certificate of Competency, an Engineer holding a Marine Engine Driver Grade Three (MED III) Certificate of Competency and two general purpose hands (GPH). If the Master held the required engineering qualification, the Engineer was not required thus allowing a minimum crew of three.

1.6 Another condition of the survey was the requirement that:

When the vessel is underway on enclosed waters a competent crew member is to be posted in the forepart of the vessel as a lookout. That person is to have a portable 2 way method of communication with the Master and helmsman for reporting any developing navigational danger ahead of the vessel.



Photograph 1: *Southern Swan*

1.7 At the time of the incident the ship was under the control of a Master holding a current Master Four qualification which he attained in 2005. He

also held a MED III Certificate. The Master had been onboard *Southern Swan* since 2008. He held the required 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 two GPH held GPH certificates but the seven volunteers performing crew roles had no marine qualifications and little to no maritime experience.

Narrabeen

- 1.8 *Narrabeen* is one of four monohull Freshwater Class, 70.4 metre long, double-ended ferries owned by the NSW Government and operated by Harbour City Ferries (HCF). It has a steel hull with an aluminium superstructure, displaces 1140 tonnes and is powered by two 2238 kW engines. It was in current NSW 1D survey, Identifying Number 15528. Both bridges of *Narrabeen* were equipped with radar, Class A AIS, forward looking infrared cameras (FLIR), VHF radio and a HCF internal radio network. (For more details refer to *Appendix 2*.) *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*

- 1.9 The ferry had a crew of six, consisting of the Master, Engineer and four GPHs. The Master had 35 years experience as a Master and 25 years experience operating within Sydney Harbour. From 1978 to 1988 he held a Foreign Going Master 1 Certificate which was converted to an AMSA Master 3 Certificate of Competency in 1988. Additionally, he held a local knowledge certificate to operate vessels over 30 metres within Sydney Harbour.

Incident location

- 1.10 Sydney Harbour has the highest density of ferry services as well as commercial and recreational vessel traffic on the Australian eastern seaboard. 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 Watsons Bay to the east. Relevant key points within Sydney Harbour are shown on the chart extract at *Figure 1*.
- 1.11 The incident occurred west-south-west of Fort Denison, which lies 450 metres to the north-west of the most northerly tip of Garden Island and 870 metres east of Bennelong Point (*Figure 1*).
- 1.12 The small island on which Fort Denison is situated divides the Harbour at this point into an inbound shipping channel to its north and an outbound channel to its south. Tidal predictions for Sydney Harbour are calculated from daily tide recordings made at Fort Denison which is a standard port.²
- 1.13 The outbound channel where the incident occurred is relatively narrow for larger ships. For vessels wishing to hold a steady course and avoid making several course changes, the effective width is only 145 metres at a point due south of the Fort Denison starboard lateral mark. The Garden Island Naval Base has an exclusion zone around its perimeter which adds a constraint to the available channel width.

² Standard Port: A place for which independent daily predictions are given in the tide or stream tables, from which corresponding predictions are obtained for other locations.

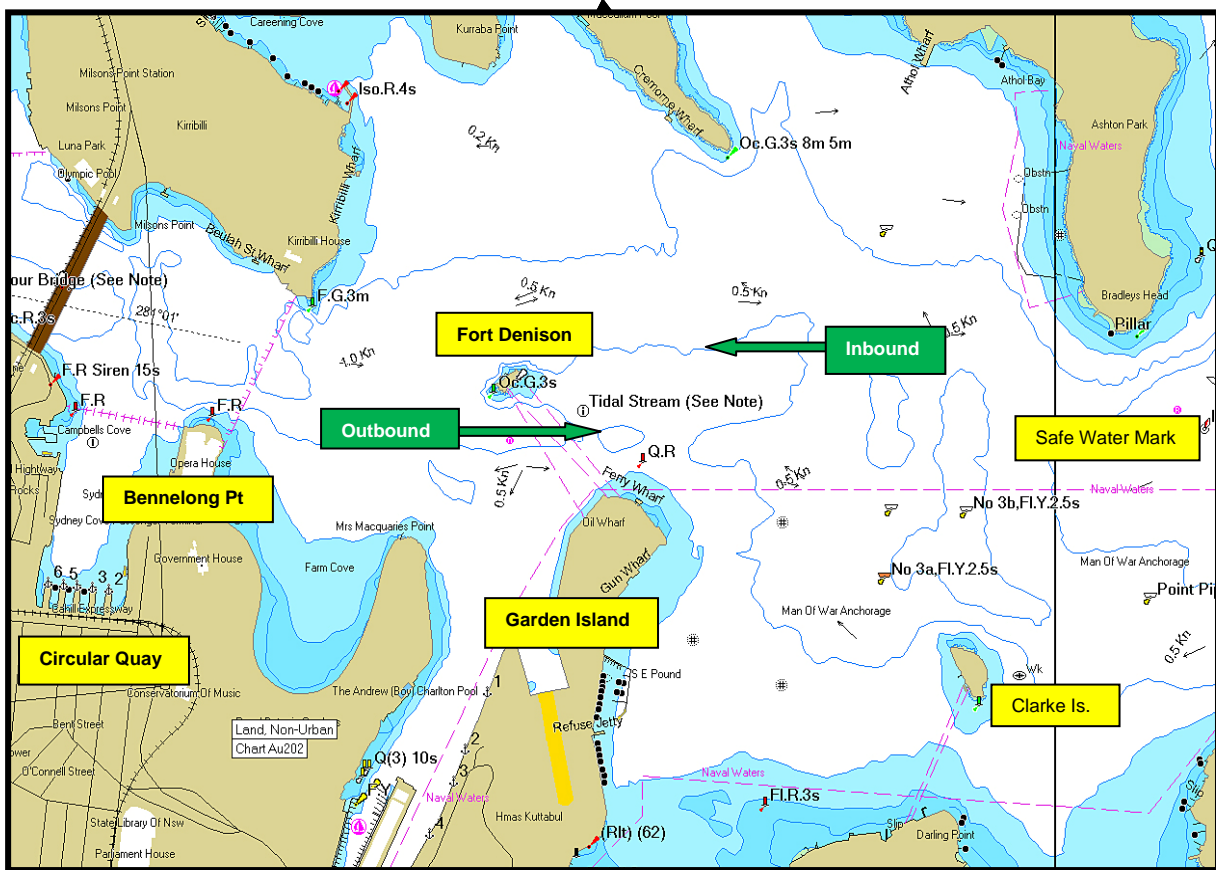


Figure 1: Chart Extract 1 - Incident location

- 1.14 Recreational and ferry traffic north of Garden Island can further constrict the manoeuvre room for outbound traffic. Additionally, a large fleet of commercial charter vessels operating within Sydney Port traverse this area to enable passengers to enjoy foreshore views including the Opera House, Botanic Gardens and the city beyond. These charter vessels keep to the south following the southern shore line as they travel east (see Figure 2).

Sydney Ports Corporation's Vessel Traffic Service

- 1.15 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 control which it provides under the Harbour Master's Guide as a vessel traffic service (VTS). The VTS operates under the control of the Harbour Master and is responsible for monitoring and controlling the movement of all 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 AIS.

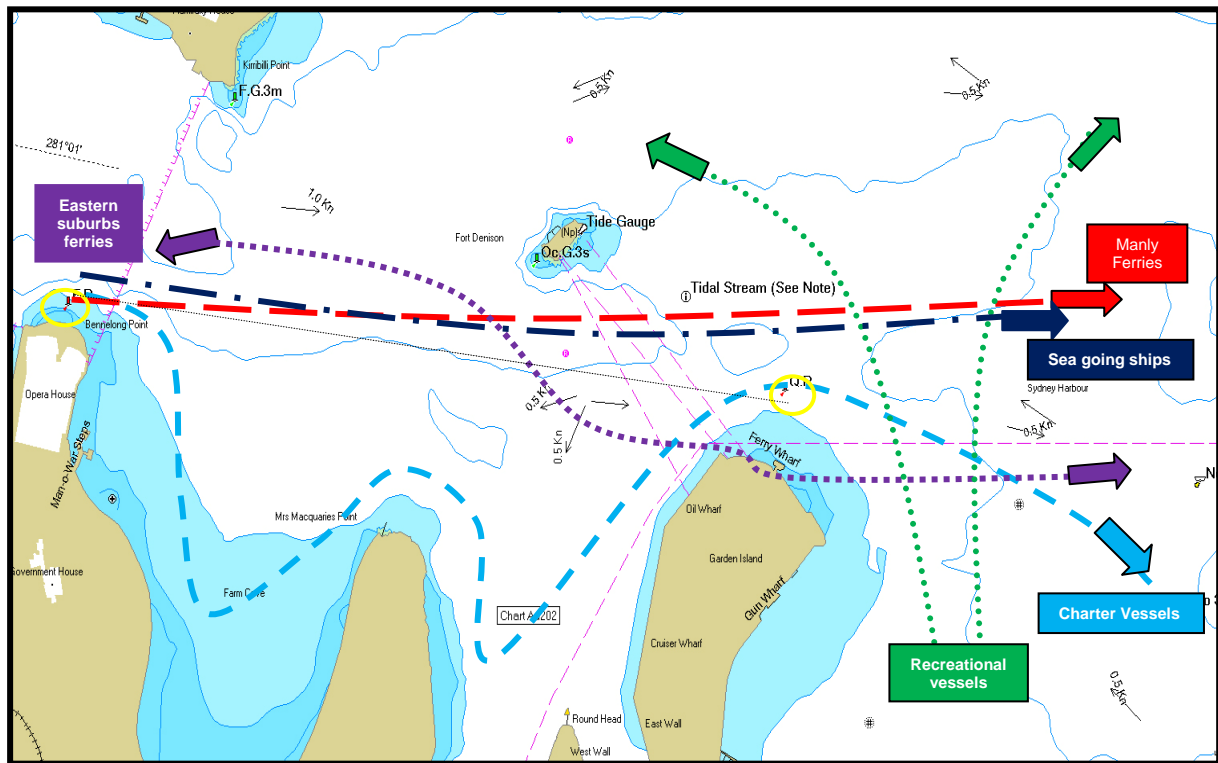


Figure 2: Chart Extract 2 - Traffic routes

1.16 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 within and into and out of the ports. Being over 41 metres in overall length, *Southern Swan* was required to participate in the VTS. Ferries on regular scheduled service runs are exempt. Such ferries must report to VTS at the commencement and finish of each day's regular scheduled services. Commercial vessels less than 30 metres in length are not required to report positions to VTS.

Environmental conditions

- 1.17 Around the time of the incident, the weather was reported as fine and clear with good visibility. Sunset was at 17:02 and nautical twilight ended at 17:59. Wind speeds at Fort Denison were recorded as:
- 13.01 knots from the west (268.59°) at 19:20
 - 13 knots from the west (270.24°) at 19:30
 - 10.63 knots from the west (269.55°) at 19:40.
- 1.18 The tide prediction on 17 May 2013 was for a low of 0.79 metres at 19:06 flooding to a high of 1.50 metres at 01:26 on 18 May 2013. However, the recorded high at 19:06 was 0.93 metres, 0.14 metres higher than predicted. At 19:30 the tide was recorded as 0.94 metres.
- 1.19 As the close quarter's sequence of events occurred in the immediate vicinity of Fort Denison and within the first twelfth of the tide,³ tidal influence is considered not to be a contributing factor.

Passage plans

Narrabeen

- 1.20 The four HCF Freshwater Class ferries have in place a comprehensive sailing plan for operating between Circular Quay and Manly wharves which has been in existence for over sixty years. All ferries travelling on the Manly service follow an established route as part of the sailing plan to enable regular passenger services to run to a timetable. Masters of commercial vessels operating within the port are aware of the normal passage taken by these Manly ferries as they operate both day and night services along the same corridors within the Harbour seven days a week.
- 1.21 The normal course from Circular Quay to Manly is for the ferry to turn to starboard after exiting Circular Quay and proceed east to pass south of Fort Denison, keeping the Garden Island port lateral mark to the south.

³ Tides change approximately every 6 hours in most places in the world. One reasonably accurate method to calculate tides is the rule of twelfths. It is based on the assumption that tides rise and fall with simple harmonic motion. That is, between one slack water (the time change of tide at HW or LW) and the next, the tide starts rising or falling slowly, runs strongly in the middle of the period and then slows when approaching the next slack water. The Rule assumes that the tide rises or falls each hour approximately in the proportions of 1:2:3:3:2:1.

This course keeps the ferry north and clear of naval moorings No.3, No.3.A and No.3B between Garden Island and Clarke Island to the east of the Fort. The ferry then proceeds south of the safe water mark off Bradley's Head, turns around the mark and proceeds northward along the starboard side of the Western Channel across the heads to Manly.

- 1.22 Travelling outbound from Circular Quay, if shipping or congestion is encountered in the channel south of Fort Denison, the ferry may proceed north of Fort Denison then to Bradley's Head safe water mark, provided there is no inbound shipping north of Fort Denison and permission to deviate from the normal passage plan has been obtained from VTS.

Southern Swan

- 1.23 There is no set passage plan for *Southern Swan* operating within Sydney Harbour under sail. Each passage is determined at the time the charter commences based on the direction of the prevailing wind. Should a change of wind occur during a charter, the intended passage is modified to suit the wind change.
- 1.24 The following guidance is provided in the 'Underway Procedures' section of SHTS's Safety Management System (SMS):

When operating in confined channels, such as at Glebe Island Bridge and between Dawes Point and Milsons Point, where the inability to start the engine would result in a compromise of the safety of the vessel (for example in a southerly wind) the engine is to be kept running in the event it is needed at short notice.

- 1.25 The only other reference to areas of passage in the SMS is:

If the wind is S or SE and the master determines that he should keep in the lee of the eastern suburbs, and if a large ship is scheduled for departure, the master is to avoid sailing westward by Garden Island while the ship is in that vicinity or is to contact Sydney Ports VTS on Channel 13 and request permission to sail westward by Garden Island. The master is to monitor the VHF and UHF radios closely at all times and is to keep well clear of commercial shipping.

- 1.26 The SMS does not identify the channel on the south side of Fort Denison between Bennelong Point port lateral marker and Garden Island port lateral marker as a narrow or confined traffic lane.

Vessel movements

- 1.27 The events and movements of the vessels, taken from the descriptions by the Masters, are set out below.
- 1.28 *Southern Swan* departed its berth in Campbells Cove at 17:45 and motored west then into Darling Harbour. After leaving Darling Harbour and when off Millers Point, the Master set sail consisting of inner jib, upper topsail, lower topsail and nock staysail (see *Figure 3*). The engine was then turned off and the ship was sailed downwind past Dawes Point and across Circular Quay to the area north of Farm Cove.

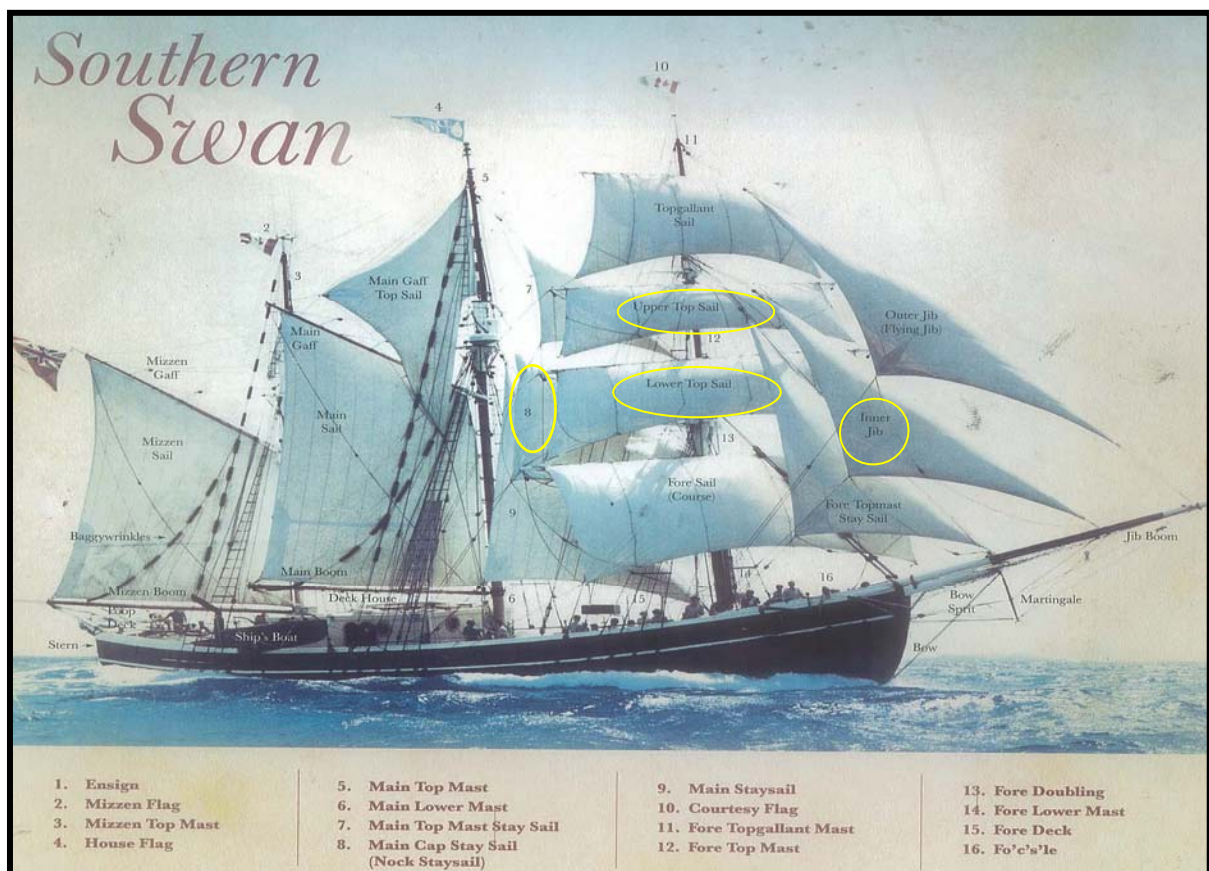


Figure 3: *Southern Swan* sail plan

- 1.29 *Southern Swan*'s Master said that he observed *Narrabeen* approach from Bennelong Point and presumed she would proceed south of *Southern Swan* since (as he believed) he was very close to the 'fortress' (Fort Denison). The Master estimated his position as 'approximately 5 metres south of the starboard lateral mark off Fort Denison'. He was 'heading east-nor-east under sail from Farm Cove towards the eastern side of the Fort ... making one or two knots before a westerly breeze of approximately 13 knots'.
- 1.30 *Narrabeen* departed Circular Quay at 19:25 on a scheduled Manly service. After turning the port lateral mark off Bennelong Point, the Master headed on an easterly course towards the southern side of Fort Denison thence outbound for Manly wharf.
- 1.31 At approximately 19:28 *Narrabeen*'s Master noticed *Southern Swan* on his starboard bow in the eastbound channel near Garden Island. She was heading east on a parallel course to the south of *Narrabeen*. Although *Narrabeen* was the overtaking vessel and so obliged to give way, the Master judged he had ample sea room to maintain his course and pass between *Southern Swan* and Fort Denison.
- 1.32 As *Narrabeen* approached Fort Denison, the Master observed *Southern Swan* alter course to port. He contacted *Southern Swan* on channel 13 (VHF) indicating he would pass on her port side. *Southern Swan*'s Master thought this was illogical, given his belief that he was only a few metres south-east of the lateral mark, thereby allowing plenty of space to the south for the ferry to overtake.
- 1.33 *Southern Swan*'s Master then replied to the call suggesting *Narrabeen* pass his stern. *Narrabeen*'s Master responded saying '... it's too late ...' and telling *Southern Swan* to go to starboard. *Southern Swan*'s Master then started his engine and complied: 'Seeing that she was keeping to the north and realising there was no time to argue, I took the helm hard to starboard and cleared away to the south as requested'. He did not communicate with *Narrabeen* by either VHF or sound signal to advise of this change of course.

- 1.34 Meanwhile, *Narrabeen's* Master had immediately reduced speed, sounded five short blasts, slowed, then went full astern sounding three short blasts. *Narrabeen* stopped approximately 0.5 metre from the Fort Denison starboard lateral mark.
- 1.35 *Narrabeen's* Master checked the vessel's watertight integrity and forward rudder. On finding no damage, he reported the incident to VTS then continued on to Manly.

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 and the *Narrabeen's* radar and vessel data recorder (VDR) recordings.
- 2.2 Both Masters were interviewed and were shown the captured radar from *Narrabeen* and VTS radar and AIS recordings. Four crew of *Southern Swan* and three from *Narrabeen* were also interviewed.
- 2.3 The Master of HCF's *Golden Grove* was interviewed as he witnessed the sequence of events from astern of *Narrabeen*. Also interviewed was a passenger onboard *Narrabeen* who recorded events on his mobile telephone and posted the recording on You Tube. Safety Management Systems (SMS), logs, crew rostering and training records for both vessels were examined.
- 2.4 On 5 and 12 June 2013, OTSI investigators conducted an inspection of *Southern Swan* and observed its operation while under sail and power. *Narrabeen* was inspected on 6 June 2013, and on 14 June 2013 trials were conducted onboard to determine the vessel's response and time taken to come to an emergency stop in sailing mode⁴. The time and distance to make 90° turns to both port and starboard in sailing mode were also tested.

Navigation: close quarter sequence of events

- 2.5 VTS AIS and radar capture, together with radar and VDR recordings from *Narrabeen*, were used to construct the following sequence of events

⁴ Freshwater Class ferries operate normally in 'Sailing Mode' when travelling between destinations. Sailing mode utilises the stern propeller and rudder only. When coming alongside wharves 'Manoeuvring Mode' is utilised. This provides for both propellers and rudders to operate concurrently which facilitates transverse movement.

showing positions, headings, distances to the Fort Denison starboard lateral spar mark⁵ and proximity of the two vessels.

- 2.6 At 19:28:10 *Narrabeen* had turned Bennelong Point and was heading east at a speed of 11.5 knots. She was 897 metres from the Fort Denison mark which bore 091° and was 785 metres from *Southern Swan* which bore 101°. *Southern Swan* was on a heading of 090° travelling at a speed of 2.2 knots and was 179 metres from the Fort Denison mark which bore 045°. *Narrabeen* was the overtaking vessel as defined by COLREGS Rule 13 and so was obliged to give way.
- 2.7 At 19:28:40 *Narrabeen* was maintaining her course while her speed had increased to 12.9 knots. She was 692 metres from the Fort Denison mark which bore 092° and was 635 metres from *Southern Swan* bearing 104°. *Southern Swan* was 147 metres from Fort Denison mark bearing 031°.
- 2.8 At 19:28:55 *Southern Swan* altered course to 054° from her previous steady course of 090°, and increased speed to 5.3 knots. This new course would intersect *Narrabeen's* current path. A plot of the relative positions of the two vessels up to this point is shown on Chart Extract 3 at Appendix 3.
- 2.9 At 19:29:00, after observing *Southern Swan's* course alteration, *Narrabeen's* Master called *Southern Swan* on CH 13 VHF: 'Calling the sailing boat off Fort Denison, this is the ferry Narrabeen. I am coming on your port side; I'll be passing you on your portside outbound'. *Southern Swan* replied: 'Narrabeen, this is Southern Swan. I just almost at the Fort. Do you want to go astern of me? Over.' to which *Narrabeen* responded: 'Mate, it's too late now, too late. Please go to starboard'.
- 2.10 At the time the call was made *Narrabeen* was 515 metres from *Southern Swan* on a bearing of 102°, and 566 metres from the Fort Denison mark bearing 090°. *Southern Swan* was 123 metres from the Fort Denison mark which bore 028°. During the call *Southern Swan* altered course again to 090°.

⁵ The starboard lateral spar mark on the south-western side of Fort Denison is referred to in this sequence of events as the mark.

- 2.11 At the completion of the call at 19:29:21, *Narrabeen's* Master sounded five short blasts on the horn indicating 'state your intentions' (Rule 34 (d)), reduced speed and selected full astern, and sounded three short blasts indicating he had selected astern propulsion (Rule 34 (a)). The Master also sounded the anchor alarm signal to immediately alert the crew to attend the bow. This signal also served to alert passengers to an emergency situation.
- 2.12 *Narrabeen's* VDR recorded full astern engaged at 19:29:33. At this time *Narrabeen* was 308 metres from the Fort Denison mark bearing 084° and 289 metres from *Southern Swan* which bore 102°. *Southern Swan* was 99 metres from the mark on a bearing of 014°.
- 2.13 At 19:29:40, after receiving the VHF call and hearing *Narrabeen's* sound signal, *Southern Swan* again altered course to 040° towards *Narrabeen's* path. Although her engine was at full astern, *Narrabeen* had closed the Fort Denison mark to 283 metres bearing 083° and was 272 metres from *Southern Swan* which bore 104°. *Southern Swan* was 96 metres on a bearing of 009° from the Fort Denison mark.
- 2.14 At 19:29:55 *Southern Swan* turned to the east steering 090° at a speed of 2.7 knots and was 65 metres due south of the Fort Denison mark. *Narrabeen* was 157 metres from *Southern Swan* and 156 metres from the Fort Denison mark bearing 077°.
- 2.15 At 19:30:25 the two vessels were 120 metres apart, the closest they came to one another. *Narrabeen* was still heading forward towards the Fort Denison mark while under full astern propulsion, while *Southern Swan* had acceded to the *Narrabeen's* request and turned to starboard.
- 2.16 At 19:30:40 *Narrabeen* had stopped with the starboard bow aft of the anchor gear 0.5 metres from the Fort Denison lateral mark. A plot of the relative positions of the two vessels up to this point is shown on Chart Extract 4 at *Appendix 4*.

Situational awareness

Narrabeen

- 2.17 *Narrabeen's* bridge provides the Master and the GPH on the bridge with good unobscured visibility forward and to the sides of the vessel. The bridge is at a height of approximately nine metres above the water surface which further enhances visual observation and recognition of other traffic and objects. The Master also has the benefit of operational radar, FLIR and GPS to assist in navigation. The Master was able to identify other traffic in the area including another ferry approaching from the east on the northern side of Fort Denison. This precluded his taking the inbound channel to the north of Fort Denison as an alternate route.
- 2.18 In addition to showing the correct navigation lights, all *Narrabeen's* interior and exterior passenger deck lighting was on.

Southern Swan

- 2.19 From the helm position on *Southern Swan*, the Master's field of vision forward is severely limited, being obstructed by the coach house, three masts, the bowsprit and rigging. When under sail, the field of vision is further restricted depending on the sails set. Additionally, passengers congregating around the helm position and on the forward deck further obscure vision to the sides as well as ahead. The Master is assisted significantly through the survey requirement to have a lookout, with 2-way portable communications, posted at the bow 'for reporting any developing navigational danger ahead of the vessel' (see *Photograph 3*). However, the preferred practice was to use hand signals to communicate between lookout and helmsman.
- 2.20 The Master stated that he nearly always helmed from the starboard side of the wheel, rarely helmed from the port side, as the starboard side was the danger side for vessels crossing. Investigators observed that vision of objects or vessels forward and to the port side was almost non-existent from the starboard helm position but was good from the port helm position.

- 2.21 In his Vessel Incident Report, the Master of *Southern Swan* reported his position at approximately 19:25 as being 'approximately 5 metres south of the starboard lateral mark off Fort Denison' and, shortly thereafter, as 'now only a few metres SE of the starboard lateral mark'. At the time he was helming from the starboard side of the wheel and was not able to see any part of the Fort due to the obstructions to his view forward and to port.



Photograph 3: Lookout position *Southern Swan*

- 2.22 At interview, the Master indicated that his report of distance off the Fort was based on information received after the incident from his crew. He suggested the crew determined the distances based on their knowledge of the length or beam of the *Southern Swan* as a guide. However, this was not confirmed by the crew members who were interviewed.
- 2.23 The lookout at the time of the incident was an unqualified crew member who had joined *Southern Swan* in August 2012. This member did not possess basic knowledge of vessel lights or navigation marks and had limited experience onboard any vessel. Another crew member who

advised the Master on the distance from the Fort was positioned on the starboard side just forward of the main mast, performing bar duties. From this position he would not have been able to judge distance off the Fort as his view was obscured by the bow rigging and the passengers on the foredeck.

- 2.24 *Southern Swan's* Master did not have the benefit of instrumentation to assist in determining course and speed, so had to rely on experience. There was no compass installed at the helming position as it had been removed; the Master explaining 'we don't need one as it is not necessary'. OTSI was subsequently advised that the compass has been removed for repairs.
- 2.25 The navigation of *Southern Swan* while under sail requires the Master to observe the angle of the wind and trim of the sails, which requires continual observation looking upwards at the masts and yards. This added responsibility decreases the available time for all-round observation of other traffic or obstacles.
- 2.26 The presence of passengers around the helm and the expectation that the Master will be "as sociable with passengers as the situation allows" presents a further distraction from the primary task of navigating the vessel. The brochure welcoming passengers onboard and explaining the history of the ship also states "... or let the captain know if you would like to have a trick at the wheel". This active encouragement of engagement with passengers is contrary to the practice with other passenger transport modes where passengers are separated from or specifically precluded from speaking with the driver while the vehicle is underway.
- 2.27 The preferred practice of the bow lookout indicating other vessels or objects by use of hand signals onboard *Southern Swan* further requires the Master's concentration to be divided between observing the sails, the lookout, the passengers, as well as his own observation of his location.
- 2.28 At interview *Southern Swan's* Master was shown the VTS recording and the recording of *Narrabeen's* radar. His response was: "That puts a different perspective on things. I can now see the *Narrabeen's* position".

- 2.29 In combination, the visual obstructions caused by the profile of *Southern Swan*, the lack of a compass, concentration on the set of sails and distraction caused by the passengers reduced the Master's ability to fully appreciate the proximity of his vessel relative to other traffic. Analysis of the VTS and radar shows that, at the time *Narrabeen* called *Southern Swan* on VHF, *Southern Swan* was 123 metres from the starboard lateral mark on the south-west part of the Fort bearing 028°. There was ample room for *Narrabeen* to continue her course had *Southern Swan* not altered course to port. At no time was *Southern Swan* only five metres from the starboard lateral mark as stated by the Master.
- 2.30 The necessity for the Master of *Southern Swan* to concentrate his attention looking forward diminished his attention to the approach and close proximity of *Narrabeen* astern. It is very likely he had no awareness of *Narrabeen* until he received the VHF call from her.

Close quarters

- 2.31 The common definition for 'close quarters' is 'a situation in which vessels pass each other, or a vessel passes another vessel, a person or an object, in such proximity that a reasonable person would conclude that in all the circumstances there was a risk of an imminent collision'.⁶
- 2.32 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'.
- 2.33 On entering the channel between the port lateral markers north of Bennelong Point and Garden Island and the starboard lateral mark on the south-western side of Fort Denison, *Narrabeen* observed *Southern Swan* ahead on the starboard side of the channel and on an almost parallel course proceeding at a slow speed. As the vessels proceeded eastward still on parallel courses, there was ample distance between the *Southern*

⁶ This definition was adopted for the *Marine Safety (Domestic Commercial Vessel) National Law 2012* which came into force on 1 September 2013.

Swan and Fort Denison for the *Narrabeen* to continue safely outbound to Manly on its regular passage.

- 2.34 *Southern Swan*'s course alteration to port and increase in speed brought the vessels on a converging course and possible collision. Identifying this potential for collision and being aware of the limitations of stopping and turning distances of his vessel, the Master of *Narrabeen* contacted the Master of *Southern Swan* by VHF radio and told him to go to starboard. The Master of *Southern Swan* disagreed with this course of action and continued closer into the path of the *Narrabeen*. The Master of *Narrabeen* assessed that the situation was dangerous and applied an emergency stop to prevent a collision, while simultaneously sounding the appropriate warning signals. After hearing the signals, the *Southern Swan*'s Master decided to accede to *Narrabeen*'s direction and turned to starboard. The Master of *Southern Swan* undertook the manoeuvre but did so without indicating his intention to *Narrabeen* by either sound signal or radio communication.
- 2.35 Under sail *Southern Swan* is slow, with speed depending on the sail area selected and the angle to the wind. Under power the *Southern Swan* can achieve a top speed of 9 knots although cruising speed is around 5 knots. The ship is quite manoeuvrable and readily turned when under way depending on the water flow along the hull across the large stern mounted rudder. The Master described the vessel as 'responsive'.
- 2.36 In the sailing mode on normal scheduled runs *Narrabeen* operates at a speed of between 13 and 14 knots. If the second engine is switched on line, it can achieve a top speed of 16 knots. However, the second engine is not used during normal operations and was not engaged on this occasion. The trials observed by OTSI investigators found that, with one steering pump engaged and travelling at 13 to 14 knots, *Narrabeen* took 51 seconds to turn 90° in either direction. With two steering pumps engaged, the turning time was only marginally reduced to 47 seconds. Over three trials, the average time to come to a stop from the time of engaging emergency stop was found to be 1 minute 24 seconds. The

distance required to stop was approximately 350 to 380 metres depending on tide and wind effects.

- 2.37 Based on the experience of OTSI investigators and an informal survey of a number of Masters of commercial vessels operating within Sydney Harbour, it was clear that experienced Masters have good knowledge of the operating procedures of other vessels on the Harbour. This includes basic knowledge of the limitations and manoeuvring capabilities of other vessels encountered in their day to day operations. They also have good knowledge of regular ferry routes and timetables, many carrying copies of ferry timetables onboard.
- 2.38 Although the Master of *Southern Swan* had over three years experience operating on Sydney Harbour and was the holder of a local knowledge certificate, he had very limited knowledge of the operation and manoeuvring capabilities of *Narrabeen*. For instance, he did not know the ferry operated in sailing mode on normal operation and could not engage the propeller at the forward end in this mode at any time to slow or stop.

***Southern Swan's* crewing**

- 2.39 On the day of the incident *Southern Swan* had the minimum number of qualified crew members permitted under its survey, a dual qualified Master and two GPHs. A competent crew member was required to be stationed as a lookout on the bow at all times when underway regardless of the mode of vessel propulsion. The seven 'volunteers' classified as crew members were unqualified and inexperienced.
- 2.40 The crewing survey requirement is in keeping with other commercial passenger carrying vessels under power. However, *Southern Swan* spends in the order of 50% of a charter under sail. If a GPH performs the lookout role then it leaves just one GPH and the 'volunteers' to handle all the setting and trimming of the sails. Alternatively, 'volunteers' have to perform the lookout role.
- 2.41 The 'volunteers' are mostly young backpackers who, in return for the adventure of working on a traditional sailing vessel, live onboard and

receive meals and a small monetary payment. The crew is constantly changing as their tenure is short because they get involved in the activity only as part of their travel around the country. This precludes a regular trained, competent and qualified crew from being assembled and maintained.

2.42 The volunteer crew members often have English only as a second language and mostly come from countries where they have grown up with the metric system of measurement. However, the imperial system is used onboard for all measurements as part of ‘recreating the atmosphere of the nineteenth century’.

2.43 A revised *National Standard for Commercial Vessels Part E Operations* came into effect on 1 July 2013. It significantly enhances the Safety Management System requirements on the operators of domestic commercial vessels, particularly in the area of resources and personnel. Specifically, the revised Part E requires vessel operators to comprehensively train crew and also determine the appropriate crew for the vessel’s operation by evaluating the operational risks. Compliance with the revised Part E for existing vessel operations is subject to prescribed transitional arrangements. *Southern Swan* must be compliant by 1 July 2014, having completed a risk assessment to determine the optimum number of qualified crew members required to safely operate the vessel.

***Southern Swan’s* masthead light**

2.44 At the time of the incident *Southern Swan* was under sail. COLREGS Rule 18 *Responsibilities between Vessels* requires a power-driven vessel to keep out of the way of a sailing vessel. This means that *Narrabeen* was obliged to give way to *Southern Swan*. However, in using a masthead light, albeit for the stated purpose of illuminating sails, *Southern Swan* was being misrepresented as a ‘Power-driven Vessel underway’ in accordance with COLREGS Rule 23.

Other safety matters

- 2.45 During the inspection of *Southern Swan*, the safety issues which are itemised below were identified as needing to be addressed.

Life jacket stowage and condition

- 2.46 During an inspection of the vessel OTSI investigators witnessed a pre-departure briefing which included a demonstration of donning a life jacket. The demonstration was performed by a crew member listed in the vessel's log as 'host'. The crew member did not hold any marine qualification and had not undergone sea survival training which probably accounted for an incorrect method of wearing a life jacket being demonstrated. Further, passengers were provided with no clear information about the specific locations where life jackets were stored.
- 2.47 Passengers were informed life jackets were stored in the forward part on the main deck though the storage containers did not display signage identifying them as jacket storage. Some of the jackets in the three bins inspected were wet and mouldy, some had frayed tying tapes and the reflective tape on most had deteriorated to such a state as to be ineffective. Printed instructions for donning on several jackets were illegible.
- 2.48 Below deck in the saloon area jackets were stored next to an escape ladder. Although the jackets were in serviceable condition some were still wrapped in plastic and therefore not ready for immediate use. A cabin in the same area below deck posted a 'Life Jackets' sign but there were no jackets stored inside, a situation that would cause consternation and confusion should they be required in an emergency.
- 2.49 The only sign with instructions advising passengers on the procedure for donning life jackets was on a bulkhead below decks well away from where the jackets were stored. This sign did not relate to the type of jackets that were onboard and was not in a position visible to passengers.
- 2.50 The Carley floats stowed on the roof of the main saloon did not have signage indicating the capacity for each float. Investigators were informed

that the capacity had been written in felt pen but had worn off due to weather and not yet been reinscribed.

LPG

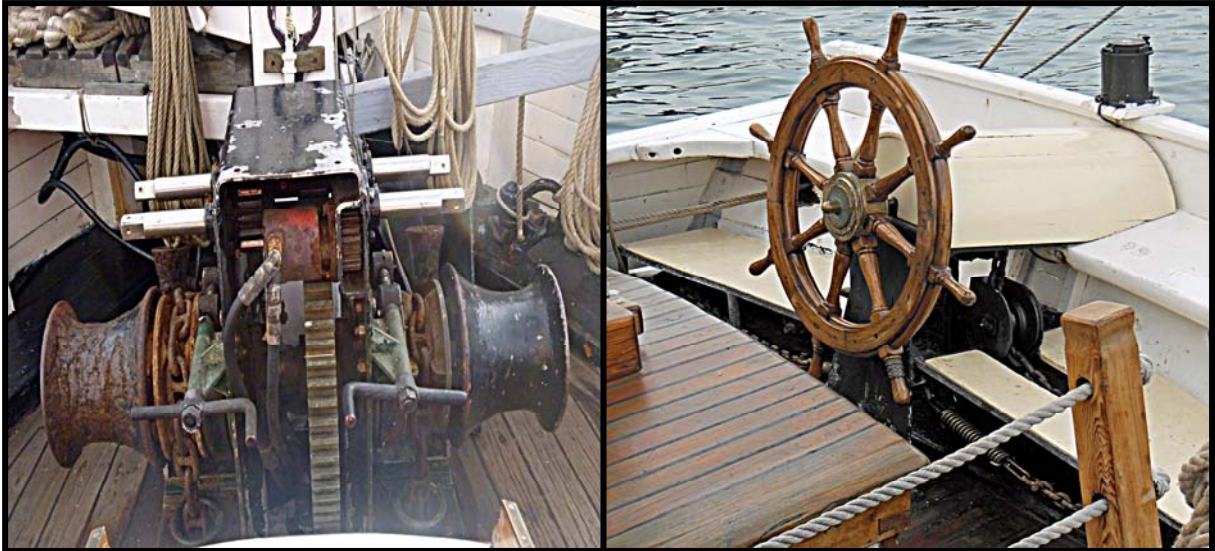
- 2.51 LPG bottles were housed unsecured in a storage bin with one bottle lying on its side. On the aft deck there was another single unsecured LPG bottle next to a barbeque made from a 44 gallon drum which did not have a compliance plate attached (see *Photograph 4*).



Photograph 4: Barbeque and LPG bottles

Anchor winch and steering machinery

- 2.52 The anchor winch on the foredeck was not barricaded off from the public thereby allowing unauthorised access with the possible consequence of the anchor being accidentally released (see *Photograph 5*). Similarly, in the area on either side of the steering wheel at the stern, the chain was exposed and represented a hazard in which a passenger could become entangled. This area should also be isolated from public access. There was no sign on the entrance hatch to the engine room advising that access was restricted and this hatch remained open while underway on a charter.



Photograph 5: Unprotected anchor winch and steering chain

Safety harnesses

- 2.53 During observation of the *Southern Swan* when the crew were aloft both setting and furling sails, they were wearing a webbing belt with a short rope line spliced onto it as a safety harness. Observations showed that while moving about aloft on the yards the crew was not at all times secured as required as outlined in Safe Work Australia's *Managing the Risk of Falls at Workplaces Code of Practice*. This harness does not comply with the Standard for *Industrial fall-arrest systems and devices - Harnesses and ancillary equipment* (AS/NZS 1891.1:2007).
- 2.54 After reviewing the draft report of this investigation, the Master of *Southern Swan* advised that WorkCover has inspected the harness system and related training and documentation and 'acknowledged that the special nature of our operation, combined with the thoroughness of our checks, the ship's perfect safety record over more than forty years of operation (since known records exist) and our thorough training for working aloft make the current system more than acceptable'. Notwithstanding the reported WorkCover position, OTSI is aware that other notable square rigged sailing vessels in survey and operating on Sydney Harbour, such as *James Craig* and *Young Endeavour*, have compliant harnesses worn by all crew when aloft.

Manoeuvring and warning sound signals

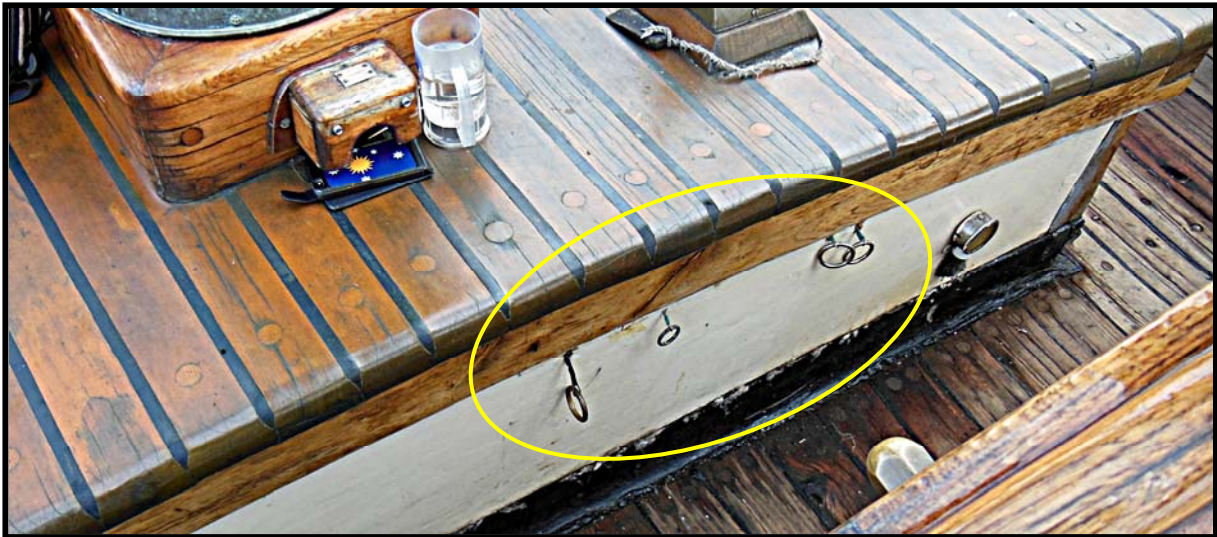
2.55 In accordance with Rules 32 and 33 of the COLREGS, all vessels are required to have appropriate devices for signalling intentions or give warnings to other vessels within hearing. The horn signal on *Southern Swan* was located in a position on the port side under a rail on the bulwark and was not in a position readily available to the Master, nor was the horn's position labelled. This position precluded the Master from a quick response to either initiate or reply to signals necessary during navigation and could be a reason the Master of *Southern Swan* did not respond to sound signals from *Narrabeen*.

Communications

2.56 *Narrabeen* had excellent communications available with VTS and HCF Ferry Control. All crew used portable radios to communicate with one another. The communications onboard *Southern Swan* were inadequate. Portable radio communication between the Master and lookout or other crew members was not being used. Although a portable VHF radio was available, *Southern Swan* did not communicate with VTS at any time during the voyage as was required.

Fuel shut-off

2.57 The fuel shut-off valve positions were not labelled (see *Photograph 6*). In an emergency situation requiring the fuel supply to be shut-off and where the Master was either incapacitated or absent, it is highly likely that an inexperienced crew member required to perform the task would experience difficulty in identifying these shut-off cables.



Photograph 6: Fuel shut-off cables

Safety management systems

2.58 The operators of both *Southern Swan* and *Narrabeen* are required to comply with the requirements of sections 12(2)(b), 16(2) and 48(5)(e) of the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* in relation to safety management systems (SMS).

Narrabeen SMS

2.59 HCF has in place a robust SMS which has been developed over many years of operation and is constantly reviewed and upgraded as operations require. The HCF fleet is regularly audited by the RMS SMS Auditor/Surveyor Section.

Southern Swan SMS

2.60 *Southern Swan's* SMS is contained in two separate manuals, a SMS manual and a training manual, but the two documents are not stand alone. This makes them difficult to navigate because of the amount of cross-referencing necessary, especially in relation to operational procedures.

2.61 A number of areas are not adequately addressed. The SMS does not contain a drug and alcohol policy or procedures for testing other than mentioning that crew should not go aloft if they are affected by alcohol or drugs. The section on the reporting of incidents does not fully cover the

requirements of the *Passenger Transport Act 1990* in relation to the manner of reporting and to whom incidents should be reported.

- 2.62 Coverage of workplace health and safety requirements is limited with nothing in the SMS or the training manual dealing with crew working aloft. There is also no mention of access to or the dangers of entering machinery areas. These areas are not isolated or cordoned off thus exposing passengers to hazards.
- 2.63 An audit conducted by RMS on 14 April 2010 identified deficiencies in the operation of the vessel, including training and induction of crew not being documented, and absence of maintenance schedules. These deficiencies were found not to have been addressed when the vessel was inspected subsequently by investigators.

Training and drills

- 2.64 HCF conducts regular training of all crews onboard all vessels with regular drills being conducted covering all emergency procedures. Drills are scenario-based with crew members physically responding to different emergency situations and utilising the necessary equipment. Debriefing is conducted on completion and a register is kept containing the details of all drills performed and the crews involved.
- 2.65 At the time of the reported incident all crew onboard *Narrabeen* had recently been involved in drills. The Master had conducted 39 drills in the twelve months prior to the incident, four of which involved Critical Control Failures (CCF) and Crew Resource Management (CRM). The Engineer had undertaken 18 drills including three CCF/CRM drills. The GPH who was on the bridge at the time had received training and participated in five drills since being endorsed for duty on the Freshwater Class on 18 April 2013. The remaining three GPHs had all received training and participated in drills including CCF/CRM.
- 2.66 No drill record book or register was kept for emergency training on *Southern Swan*. The only record of emergency drills was an entry made in the vessel's log by the Master. These log entries made only brief

mention of the type of training or drill undertaken. They contained no details of who attended the drill, how it was conducted, what part of the vessel was involved or what equipment was used. Due to the lack of information available it could not be determined if any of the 10 crew onboard at the time of the incident had participated in any drills.

- 2.67 Two crew members had joined the *Southern Swan* in the previous two months, one had rejoined six days before the incident and two had been onboard six months. There was no information provided as to when the other four members joined.
- 2.68 Log extracts supplied for *Southern Swan* showed seven training entries in the previous six months; two were for fire drills, two were for person overboard drills conducted while alongside and one was for training aloft. The remaining two entailed discussion on bow watch duties, how to start the portable fire pump, and induction of White Bay facilities for fuelling.
- 2.69 Without a register of drills and training available, the Master is unable to accurately determine the knowledge and hence the competency of the crew on any given day.
- 2.70 Crew names were recorded in the log at the commencement of each day using Christian names only and without any indication of their position held onboard. Not all logs recorded the name of the Master or Engineer, the rationale being that the person completing the log can identify their own writing. SHTS' management indicated that, during the course of a day, crew can change with some joining and others leaving; such crew changes are not recorded.
- 2.71 The lookout is rostered on a rotational basis amongst the crew irrespective of their training or marine knowledge. The investigation revealed that the lookout at the time of the incident had no training in this 'essential' role, was not able to provide reliable information to the Master and was not in possession of a portable radio. Although survey and the SMS require 2-way communications, a portable radio is not always utilised between the lookout and the helmsperson. Hand signals appeared to be the preferred option for communication. At the time OTSI

investigators were onboard during a regular charter, the lookouts were not provided with a radio, nor was one on hand at the helm.

Remedial action

Harbour City Ferries

2.72 As a result of the incident HCF had the Master of *Narrabeen* undertake refresher simulator training on 5 June 2013 at TAFE Sydney Institute covering the following elements:

1. Requirements of the Sydney Cove Code of Conduct.
2. Collision Regulations with emphasis on:
 - Rule 5 - Use of radar
 - Rule 6 - Ability to assess safe speed
 - Rule 7 - Look out for timing associated with the assessment of the risk of collision and related appraisal
 - Rule 8 - Action to avoid a collision
 - Rule 13 - Overtaking and obligations
- 3 Ability to analyse various sources of available information
- 4 Challenge and response culture.

Sydney Harbour Tall Ships

2.73 OTSI investigators inspected *Southern Swan* on 3 December 2013 to verify the action taken in relation to the 'other safety matters' as reported by SHTS. The following remedial action was confirmed:

- Life jackets have been relocated, new signs have been made and correct labelling is in place.
- The Carley floats have been reinscribed.
- The barbeque has been removed from the ship.
- The fuel shut-off valves have been labelled with new signs.
- The SMS was updated in September with the addition of most of the relevant chapters from the Crew Manual including the rules for working aloft. Most of the safety issues have now been transferred across. SHTS's stated intention is to transfer the remaining

material, such as the drugs and alcohol policy and access and dangers of entering machinery space, when the next edition of the SMS is produced.

- Comprehensive crew documentation has been introduced. Crew particulars are documented in the front of the Log Book and in a Crew Joining Form duplicate copies of which are kept aboard and in the office. Crew training is documented in an Induction Form. Drills undertaken are recorded in the Log Book and a Drills Log Book has been introduced in which to record details of drills and training conducted.

2.74 The following matters have either not been rectified or the action taken may not be fully effective:

- The steering compass has been reinstalled in the binnacle but the bowl has a large air bubble and there is no deviation card.
- Although the gas locker box has been repaired, there is no LPG gas compliance plate.
- The horn button and signage have not been moved.
- The engine room main deck hatch is not signed with the warning “No Entry Crew Only”.
- The anchor winch and steering machinery remain accessible to passengers.
- The harnesses have not been replaced with models that meet the Australian Standard.

PART 3 FINDINGS

- 3.1 There is sufficient evidence to establish that a close quarter situation developed on Sydney Harbour on the evening of 17 May 2013 which resulted from the manoeuvring of the vessels *Narrabeen* and *Southern Swan*.

Contributing factors

- 3.2 On turning east after rounding Bennelong Point on his regular passage to Manly, *Narrabeen's* Master judged there was sufficient room to pass between Fort Denison and the port side of *Southern Swan*.
- 3.3 As *Narrabeen* was astern of *Southern Swan* with both on an easterly heading, *Narrabeen*, the overtaking vessel, was required to give way to *Southern Swan*.
- 3.4 *Narrabeen's* Master perceived a possible risk of a collision when *Southern Swan* unexpectedly increased speed and altered course towards the north and across his intended path.
- 3.5 When *Southern Swan's* Master did not accede to a request to alter course to starboard, instead steering further around to the north, *Narrabeen's* Master took the evasive action of engaging emergency astern and came to a stop 0.5 metres from the Fort Denison lateral mark.
- 3.6 *Southern Swan's* Master did not have adequate situational awareness as the events unfolded because of his restricted field of vision from the helm position, distractions due to passenger activities, together with proximity and reliance on inaccurate position estimates from inexperienced crew members.

Other safety matters

- 3.7 The nature of tall ship operations on the Harbour is such that it makes identification and prediction of their speed and course difficult for masters of other vessels. This can present as a hazard in narrow channels and densely trafficked, regular routes.

- 3.8 Although they are in accordance with the vessel's current survey, *Southern Swan*'s crewing arrangements provide for a very limited pool of expertise and experience.
- 3.9 The masthead light used to illuminate sails on *Southern Swan* would be interpreted as denoting a power-driven vessel underway.
- 3.10 A number of additional and important safety issues concerning the *Southern Swan* was identified coincidentally with the undertaking of this investigation and are listed as follows:
- Lifejacket storage and its signage were not in accordance with safe practice and information provided to passengers was unsatisfactory.
 - LPG bottles were not secured.
 - The anchor winch, steering machinery and engine room were readily accessible to passengers.
 - Only non-compliant harnesses were available and in use.
 - The horn signal was not in an optimum location or labelled.
 - Fuel shut-offs were not labelled.
 - Crew training was not being adequately recorded.
 - There were a number of deficiencies in, and non-compliances with, the vessel's safety management system.

OTSI investigators inspected *Southern Swan* on 3 December 2013 to verify the action taken by Sydney Harbour Tall Ships Pty Ltd to rectify these matters and note any matters not yet addressed (refer to 'Remedial actions' in the Report).

PART 4 RECOMMENDATIONS

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

Australian Maritime Safety Authority

- 4.1 Review the crew numbers and qualifications required to operate *Southern Swan* taking into account the requirement for competent crew to set and trim sails and perform the lookout function.

Roads and Maritime Services

- 4.2 In consultation with the Harbour Master, determine areas of operation where *Southern Swan* and other commercial sailing vessels can safely operate charter activities while under sail within Sydney Harbour having regard to traffic densities and regular ferry routes.

Sydney Harbour Tall Ships

- 4.3 In accordance with the requirements of the revised *National Standard for Commercial Vessels Part E Operations* which came into effect on 1 July 2013, undertake, as a matter of priority, a risk assessment to determine the optimum number of qualified crew members required to safely operate *Southern Swan* when under sail.
- 4.4 Only allow a crew member holding a marine qualification to be a lookout and enforce the survey requirement for 2-way communication between the lookout and helmsman at all times.
- 4.5 Replace all current equipment used as harnesses with equipment that complies with current Australian Standards AS/NZS 1891.1.2007.
- 4.6 Expedite remedial action in relation to the safety issues identified during the course of the investigation and noted as not rectified as at 3 December 2013. (Refer to Paragraph 2.74).

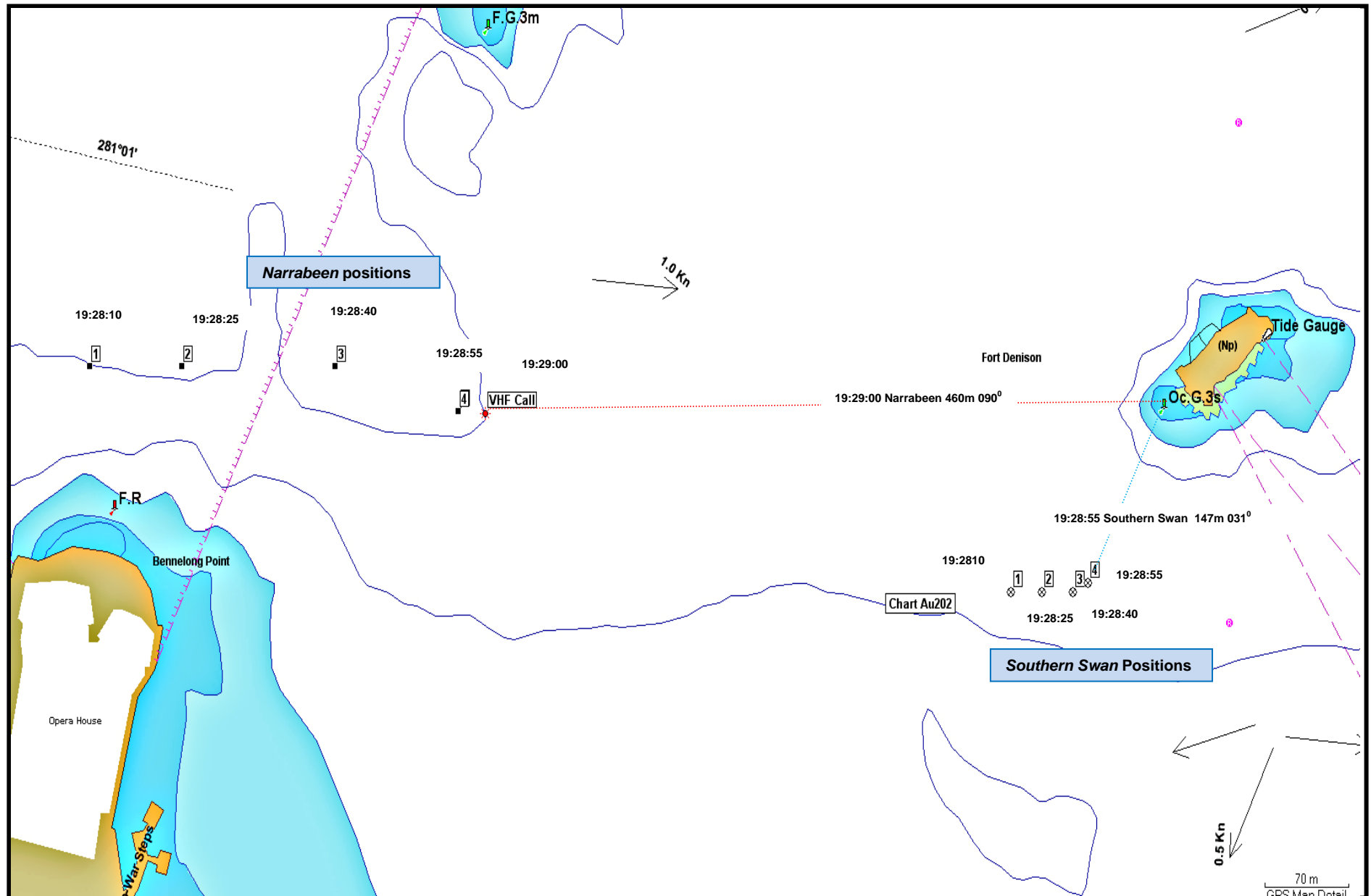
PART 5 APPENDICES

Appendix 1: Vessel Information – *Southern Swan*

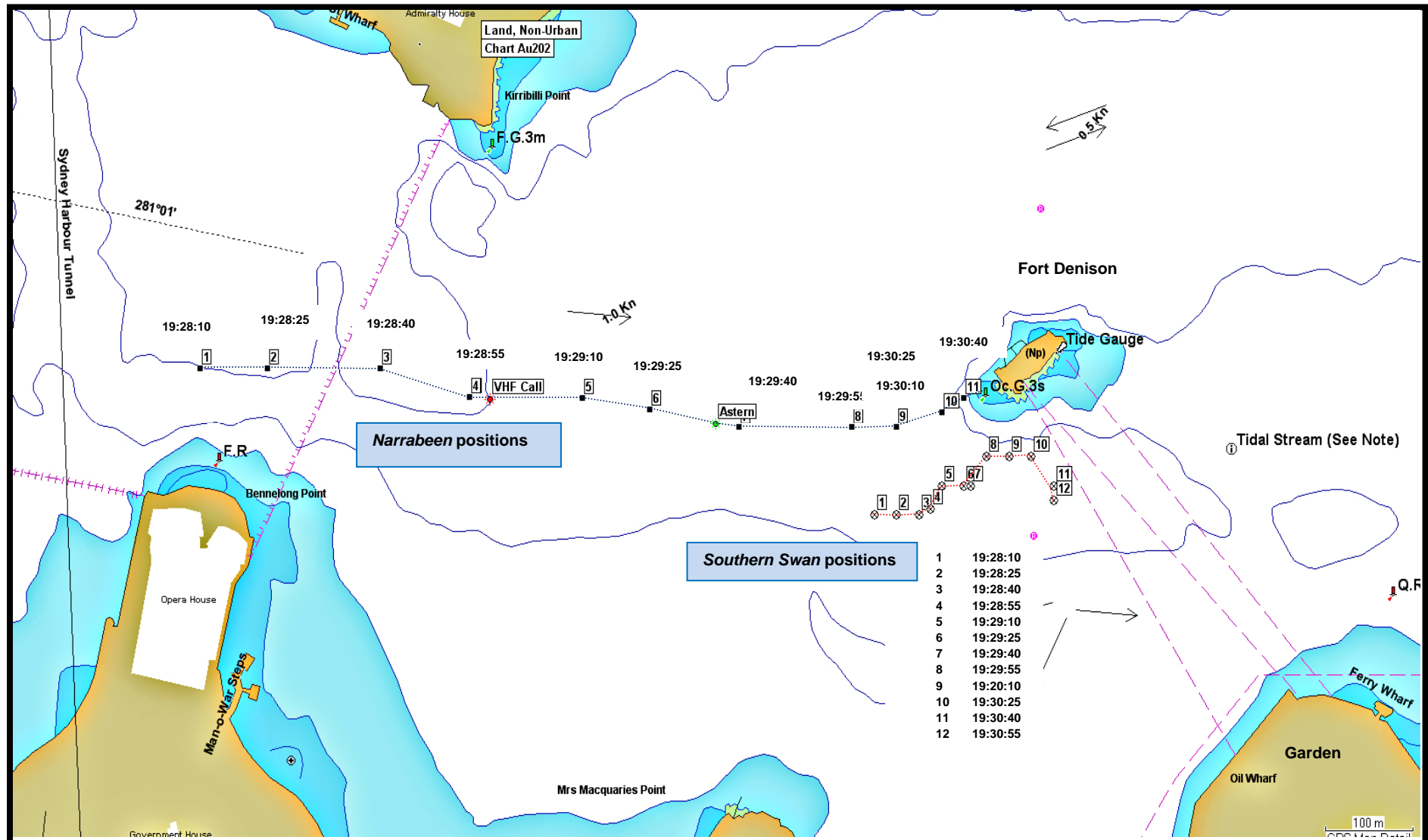
Name	<i>Southern Swan</i> 2008 Previously <i>Mathilde</i> (1922), <i>Pacific</i> (1926), <i>Hans Christian Anderson</i> (1930), <i>Svanen</i> (1938), <i>Our Svanen</i> (1975)
Vessel Type	Barquentine (originally built as three masted Schooner)
Registered owner	Sydney Harbour Tall Ships Pty Ltd
Construction	Timber
Launched	1921-22, Frederikssund, Denmark
Length overall	41 metres
Length	27.2 metres
Beam	6.6 metres
Extreme Beam	8.2 metres
Moulded Depth	2.52 metres
Draft aft	3 metres
Engine	Caterpillar 3406
Power	186.5 kW
Propeller	Conventional
Crew	3 (Master/MED III, 2xGPH)
Equipment	Radar, VHF and HF Radio
Survey Class	1E
Identifying Number	17852
Passengers	100 (max)

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), Newcastle, NSW
Launched	1984
Length	70.4 metres
Breadth	12.5 metres
Draught	5.5 metres
Displacement	1140 tonnes
Engine	Two Daihatsu marine diesel engines
Power	2238kW
Service speed	14 knots
Propeller	Variable pitch propellers
Crew	6 (Master, Engineer, 4xGPH)
Equipment	AIS type A, FLIR, VHF Radio, Radar
Survey Class	1D
Identifying Number	15528
Passengers	1100 (max)



Appendix 3: Chart Extract 3



Appendix 5: Sources, Submissions and Acknowledgements

Sources of Information

- Australian Maritime Safety Authority
- Harbour City Ferries
- Roads and Maritime Services
- Sydney Harbour Tall Ships Pty Ltd
- Sydney Ports Corporation

References

- AS/NZS 1891.1:2007 - *Industrial Safety Belts and Harnesses*
- Charts Aus 200 and Aus 202
- Marine Safety Act 1998
- Marine Safety (Domestic Commercial Vessel) National Law Act 2012
- Marine Safety (General) Regulation 2009
- National Standard for Commercial Vessels Part E Operations
- 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
- Work Safe Australia Managing the Risks of Falls at Workplaces Code of Practice

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:

- Australian Maritime Safety Authority
- Harbour City Ferries
- Roads and Maritime Services NSW
- Sydney Harbour Tall Ships Pty Ltd
- Sydney Ports Corporation
- Transport for NSW

Written responses were received from all DIPs except Transport for NSW. 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

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