ACCIDENT REPORT

MAIB MARINE ACCIDENT INVESTIGATION BRANCH

Report on the investigation of

the collision between the ro-ro passenger ferry

Red Falcon

and the moored yacht

Greylag

in Cowes Harbour, Isle of Wight

on 21 October 2018

VERY SERIOUS MARINE CASUALTY REPORT NO 6/2020 FEBRUARY 2020

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2012 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

BRM	-	Bridge Resource Management
C/O	-	Chief officer
CHC	-	Cowes Harbour Commission
COG	-	Course over the ground
COLREGS	-	The International Regulations for Preventing Collisions at Sea 1972, as amended
DPA	-	Designated person ashore
ECS	-	Electronic chart system
ISM Code	-	International Safety Management Code
kts	-	knots
LED	-	Light emitting diode
m	-	metre
MCA	-	Maritime and Coastguard Agency
nm	-	nautical miles
PEC	-	Pilotage Exemption Certificate
PMSC	-	Port Marine Safety Code
Red Funnel	-	Southampton Isle of Wight and South of England Royal Mail Steam Packet Company Limited
rpm	-	revolutions per minute
SMS	-	Safety Management System
SOG	-	Speed over the ground
STCW	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended
t	-	tonnes
UHF	-	Ultra High Frequency
UTC	-	Universal Co-ordinated Time
VHF	-	Very High Frequency
VSP	-	Voith Schneider Propeller

TIMES: all times used in this report are UTC + 1 hour unless otherwise stated.

SYNOPSIS

On Sunday 21 October 2018 at 0811, the roll-on roll-off passenger ferry *Red Falcon* collided with and sank the yacht *Greylag*, which was on its mooring in Cowes Harbour, while the visibility within the harbour was severely reduced by fog. *Red Falcon* subsequently passed through the yacht moorings and ran aground in soft mud. *Red Falcon* was re-floated later that morning having suffered no damage. There were no injuries sustained to passengers or crew, and no pollution. The yacht *Greylag* was a constructive total loss.

After entering Cowes Harbour the visibility had reduced and the helmsman experienced difficulty steering due to the lack of visual references and his lack of practice steering by digital compass alone into Cowes Harbour. This led to the master taking over control and operating the steering and propulsion himself. Critically, the role of keeping an oversight of operations was then lost. The poor visibility required the master to rely totally upon his instrumentation. His lack of practice using instruments alone to manoeuvre the ferry resulted in over-correction of steering, which led to the vessel swinging to port out of the channel, ultimately turning through 220˚.

The subsequent collision and grounding occurred because the master lost his orientation in the fog and drove the ferry in the wrong direction. He became disorientated because he was suffering from cognitive overload due to high stress, lack of visibility, bridge equipment ergonomics, and the breakdown of support from the bridge team. The master's actions and the lack of communication of his intent, resulted in the members of the bridge team becoming disengaged, and this led to an absence of any challenge to the master's decisions.

Following its own investigations, Red Funnel has taken steps to improve its management processes, equipment and training routines, and Cowes Harbour Commission has undertaken a review of its aids to navigation and risk assessments.

Recommendations aimed at reducing the likelihood of future collisions and risk to harbour users have been made to Red Funnel, Cowes Harbour Commission and Cowes Yacht Haven.

SECTION 1- FACTUAL INFORMATION

1.1 PARTICULARS OF *RED FALCON*, *GREYLAG* AND ACCIDENT

SHIP PARTICULARS		
Vessel's name	*Red Falcon*	*Greylag*
Flag	United Kingdom	
Classification society	Not applicable	
IMO number/fishing numbers	9064047	n/a
Type	Roll-on roll-off Class IV passenger ferry, operating in category D waters	Contessa 32 sailing yacht
Registered owner	Southampton Isle of Wight and South of England Royal Mail Steam Packet Company Limited	n/a
Manager(s)	As above	n/a
Construction	Steel	Glass-reinforced plastic
Year of build	1994	About 1979
Length overall	93.22m	32ft (9.75m)
Gross tonnage	4128	4.3
Minimum safe manning	8	n/a

VOYAGE PARTICULARS		
Port of departure	Southampton	n/a
Port of arrival	Cowes	n/a
Type of voyage	Commercial domestic passenger	n/a
Cargo information	Foot passengers, cars and commercial vehicles	n/a
Manning	8	n/a

MARINE CASUALTY INFORMATION		
Date and time	21 October 2018; 0811	
Type of marine casualty or incident	Very Serious Marine Casualty	
Location of incident	Cowes Harbour	
Place on board	Port side bow	Hull starboard side
Injuries/fatalities	None	
Damage/environmental impact	None	Constructive total loss
Ship operation	On passage	Moored
Voyage segment	Arrival	n/a
External & internal environment	Variable wind direction, force 3 or less; restricted visibility due to fog; daylight	
Persons on board	40 passengers; 8 crew	None

Red Falcon

1.2 BACKGROUND

Red Falcon was one of three[1] Raptor class roll-on roll-off passenger ferries owned and operated by the Southampton Isle of White and South of England Royal Mail Steam Packet Company Limited (Red Funnel). The Raptor class ferries provided a passenger and commercial vehicle service between Southampton and East Cowes on the Isle of Wight. The transit time was about an hour and the ferries completed about 11,800 sailings per year.

The Raptor class ferries were double ended with a central bridge that had control consoles at either end that were mirror images of each other. This allowed the ferries to be driven in either direction and therefore enter and leave the Southampton and Cowes ferry terminals without the need to turn around. For navigation purposes, the orientation of the vessel changed with the direction of travel; the 'Cowes end' being the bow on passage to Cowes **(Figure 1)** and the 'Southampton end' being the bow on passage to Southampton **(Figure 2)**.

1.3 NARRATIVE

1.3.1 Passage to Cowes

At 0615 on Sunday 21 October 2018, the crew boarded *Red Falcon* at its overnight berth in Southampton and prepared the vessel for its first sailing of the day. At 0638, the vessel was moved to the ferry terminal and its passengers and vehicles embarked. On completion of the loading operation the master delivered his pre-departure brief to his chief officer (C/O) and helmsman. During the brief he informed them that, because of fog, the vessel would be operated in accordance with its reduced visibility routine. He also explained that although he was not anticipating strong tides on passage or within Cowes Harbour, he was expecting fog and a cross current within the harbour itself.

[1] The other two vessels were *Red Osprey* and *Red Eagle*.

At 0702 *Red Falcon* sailed from Southampton bound for Cowes.

Once underway and safely clear of the Southampton ferry terminal, the master contacted *Red Osprey*, which had just departed Cowes, and asked what the visibility was in Cowes Harbour. *Red Osprey*'s master reported that he could see buoy to buoy within the harbour. This confirmed the visibility to be within the operational limits for Cowes Harbour.

The master had navigational control of the vessel (the con) during the passage down Southampton Water **(Figure 3)** and stood next to the helmsman in front of the radar and the electronic chart system (ECS) at the Cowes end control console. The C/O and a dedicated lookout were also on the bridge. The C/O was standing at the control console at the Southampton end of the bridge and used the radar and ECS to provide the master with navigation and collision avoidance information. The lookout was stationed on the port bridge wing.

During the passage down Southampton Water the visibility varied from about 0.2nm to over 1nm. The master gave the helmsman courses to steer and proceeded at slightly reduced speed. He also gave instructions to the C/O, who was controlling the ferry's speed. The master received several visibility reports from other vessels in the area and from Southampton Vessel Traffic Services via Very High Frequency (VHF) radio on channel 12.

At 0744, *Red Falcon* passed Calshot light float and followed the restricted visibility passage plan down the Thorn Channel and across the Solent toward Cowes Harbour.

At 0752, *Red Falcon* passed to the west of the West Brambles buoy at a speed of 10kts. The master ordered the C/O to gradually reduce the ferry's speed to 6kts as it made its approach to Cowes Harbour entrance. He also instructed an additional crew member to go to his allocated lookout station on the forward deck. The master used the variable range marker on his radar to check the visibility, which was varying between 0.2nm and 0.5nm.

1.3.2 Entry into Cowes Harbour

At 0804, *Red Falcon* passed No.2 buoy and entered the Cowes Harbour inner fairway. As it did so the ferry was being set to the west and the master ordered courses to steer to counteract the effects of the prevailing tidal stream currents close to the harbour's outer breakwater.

Once past the breakwater, the master ordered the C/O to further reduce speed to 5kts, and gave frequent course orders to the helmsman. The master also instructed the helmsman to let him know if the vessel became difficult to steer.

In anticipation of a small east to west cross-stream near to the inner fairway's No.4 buoy, the master ordered a course to steer that took the ferry to the east of the channel centre line, close to the port hand channel buoys. At 0807, as *Red Falcon* approached No.4 buoy, the deck lookout called the bridge on his hand-held Ultra High Frequency (UHF) radio and reported that the vessel was close to the buoy **(Figure 4)**, and that it needed to be brought to starboard.

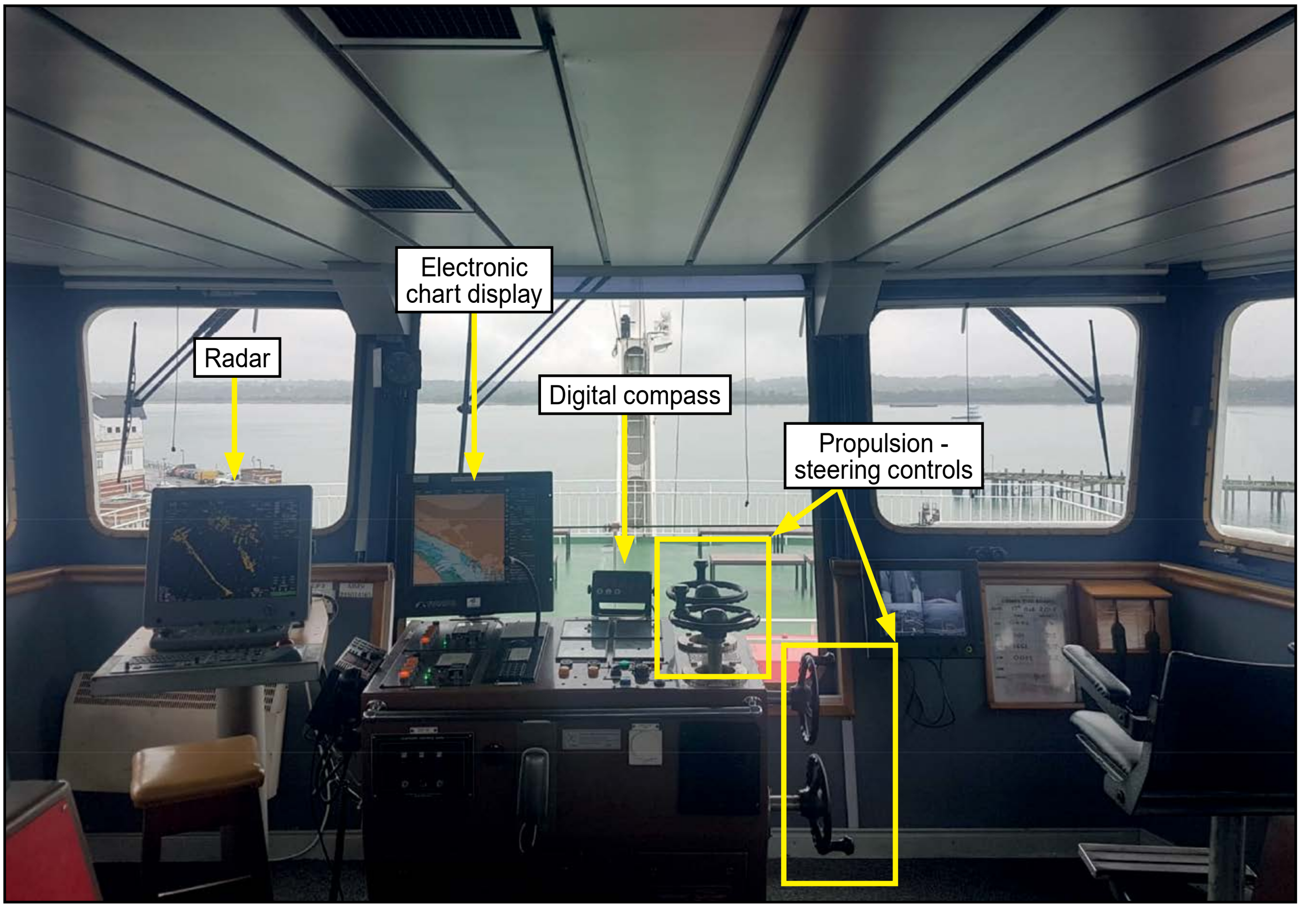

Figure 1: View toward Cowes end of ferry

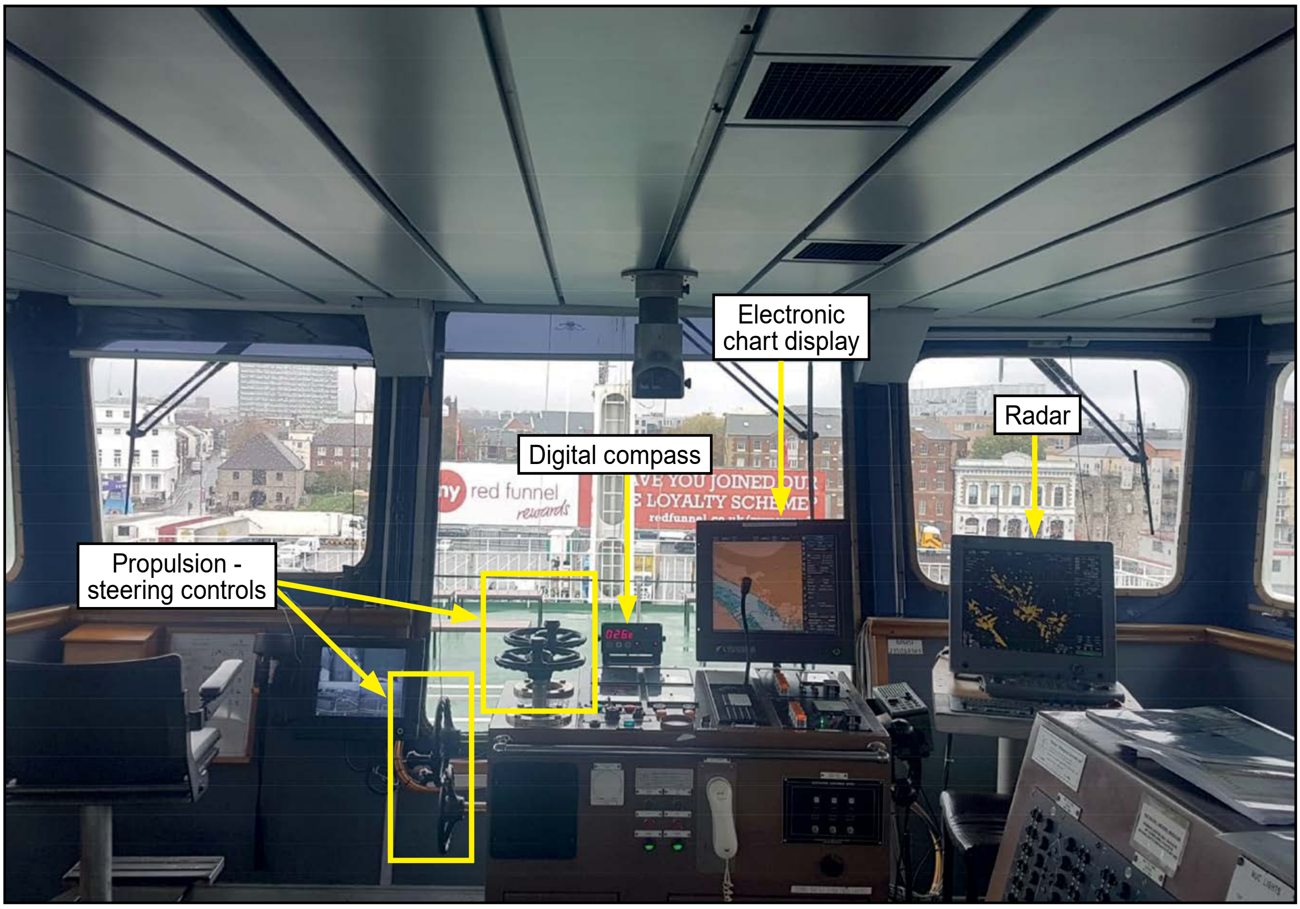

Figure 2: View toward Southampton end of the ferry

Reproduced from Admiralty Chart 2036 by permission of HMSO and the UK Hydrographic Office

Figure 3: *Red Falcon* passage track from Southampton to Cowes

Reproduced from Admiralty Chart 2793 by permission of HMSO and the UK Hydrographic Office

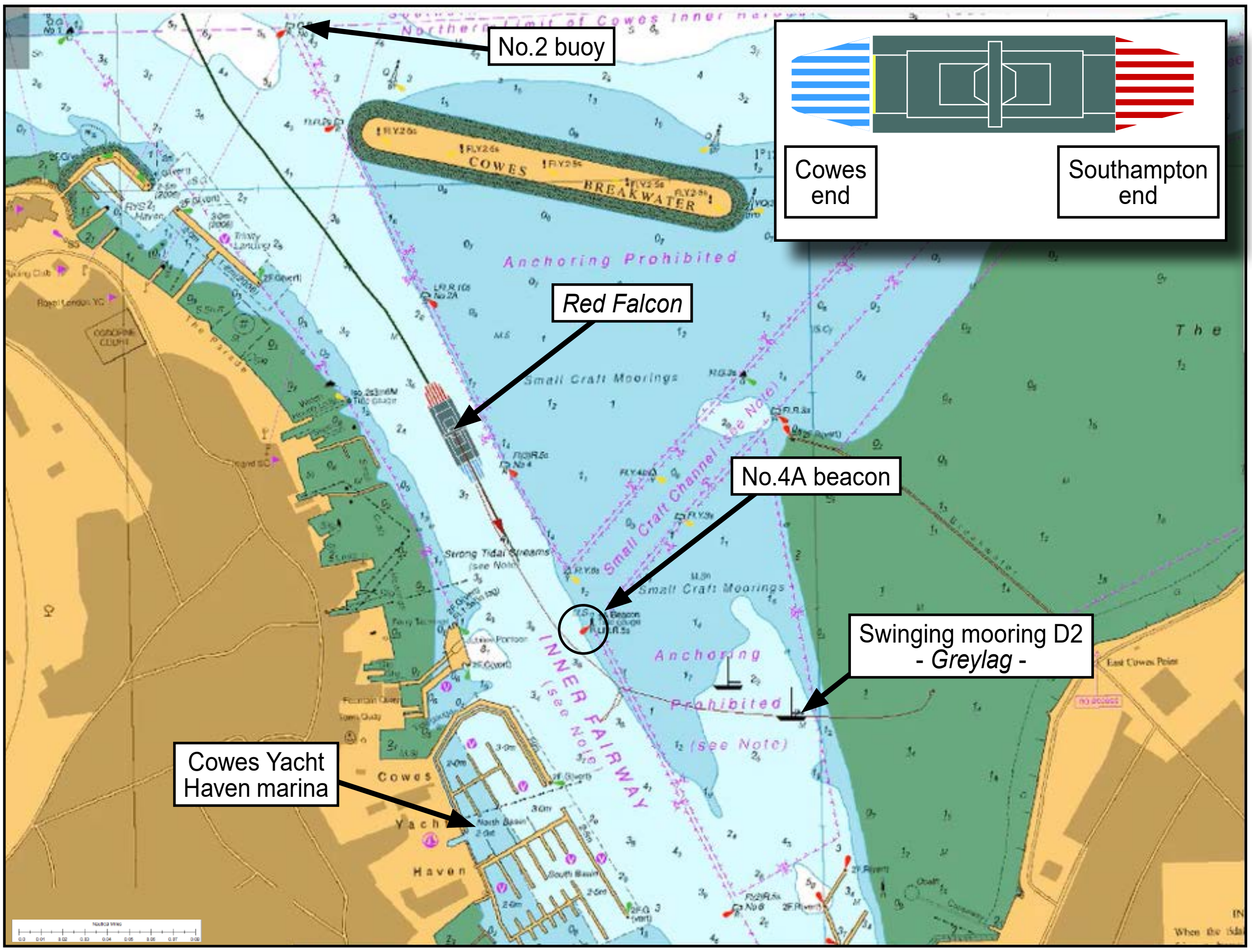

Figure 4: *Red Falcon* passage track into Cowes Harbour

The master gave a series of helm orders to bring the vessel to starboard and then to port to re-align it with the buoyed inner fairway channel. The helmsman was having difficulty maintaining the required course, and *Red Falcon* started to swing to port in the channel. He immediately raised his concerns and, at 0807:39, the master took over control of the vessel's steering and propulsion **(Figure 5a** and **5b)**. As he did this, the visibility reduced to less than 200m. The C/O remained at the Southampton end of the bridge and continued to relay positional information and messages from the deck lookout, whose radio calls were becoming more frequent and urgent.

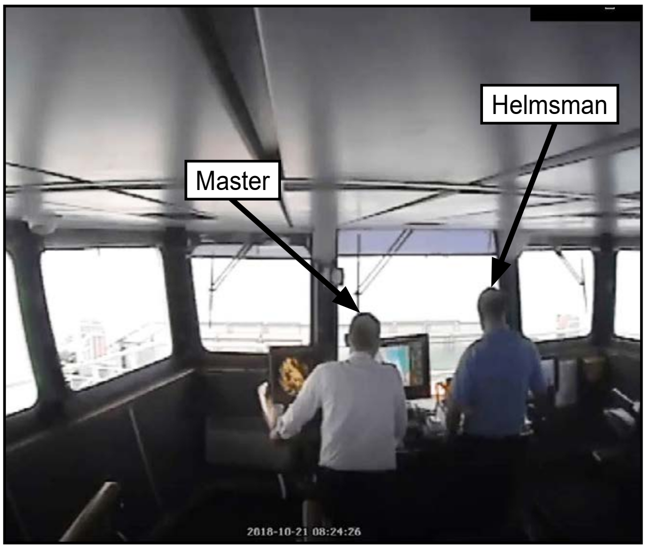

Figure 5a: Master and helmsman position entering Cowes

Figure 5b: Master and helmsman position after master took over control

The master managed to arrest the vessel's swing briefly but, at 0808:30, *Red Falcon* started to swing to port once again as it passed close to No.4a beacon **(Figure 6)**. The master attempted to stop the vessel's swing, but as the Cowes end of the ferry left the inner fairway to the east, just missing the No.4a beacon, the Southampton end spun round quickly. At this point the visibility closed in even further and the bridge team were no longer able to visually identify the shoreline or navigation marks. The C/O continued to provide the master with his own observations and updates from the deck lookout.

At 0809:30, with *Red Falcon* perpendicular to the inner fairway, the master stopped the vessel's forward momentum and continued to swing it to port **(Figure 7)**. At 0810:20 the Cowes end passed clear of the No.4a beacon by less than 10m.

At 0810:40 the master arrested the vessel's swing. It had turned through about 220° from its original heading and was stopped very briefly in the water. Its Cowes end was pointing north-west into the inner fairway channel and its Southampton end was pointing toward the yacht moorings on the east side of the harbour **(Figure 8)**.

The master decided to abort the berthing and manoeuvre the ferry back into the channel and out of Cowes Harbour. He shouted his intentions to the C/O and, at 0810:55, put the propulsion system astern and ran to the Southampton end of the bridge. When he got to the Southampton end control console, he immediately increased the propulsion power ahead and told the C/O to give him a course to steer into the inner fairway. This confused the C/O because the vessel was increasing speed toward the yacht moorings on the east side of the harbour and he was receiving radio calls from the deck lookout alerting him to the proximity of yachts ahead as they emerged from the fog.

At 0811:28, *Red Falcon* collided with the moored sailing yacht *Greylag* at a speed of about 6.5kts **(Figure 9)**. *Greylag* was forced underwater and sank immediately. The collision was witnessed by the bridge team and deck lookout, who immediately alerted the master. The master stopped the engine thrust at 0811:43, but the ferry continued toward the shoreline and grounded on soft mud about 130m from the East Cowes promenade **(Figure 10)**.

1.3.3 Emergency response

Once aground, the master ordered the Cowes end anchor to be dropped and alerted the coastguard. At about the same time the coastguard received a distress call from the skipper of a nearby yacht and reports of cries for help coming from the fog. In response, the coastguard tasked local lifeboats, coast rescue teams and the Cowes Harbour Commission motor launch to search for persons in the water.

The Cowes harbourmaster later confirmed that there was no one on board *Greylag* at the time of the collision and that a family on a nearby yacht was safe and well. As a result, the search was called off shortly after 1000.

Later that morning, *Red Falcon* was manoeuvred to the East Cowes ferry terminal with the aid of a local tug, where all the passengers and vehicles were discharged. The master and C/O were both breathalysed, with negative results.

At 1345, following an inspection by a Maritime and Coastguard Agency (MCA) surveyor, *Red Falcon* left Cowes and returned to Southampton. A dive survey carried out in Southampton found no damage to the vessel's hull or its propulsion system. *Red Falcon* returned to service the following morning.

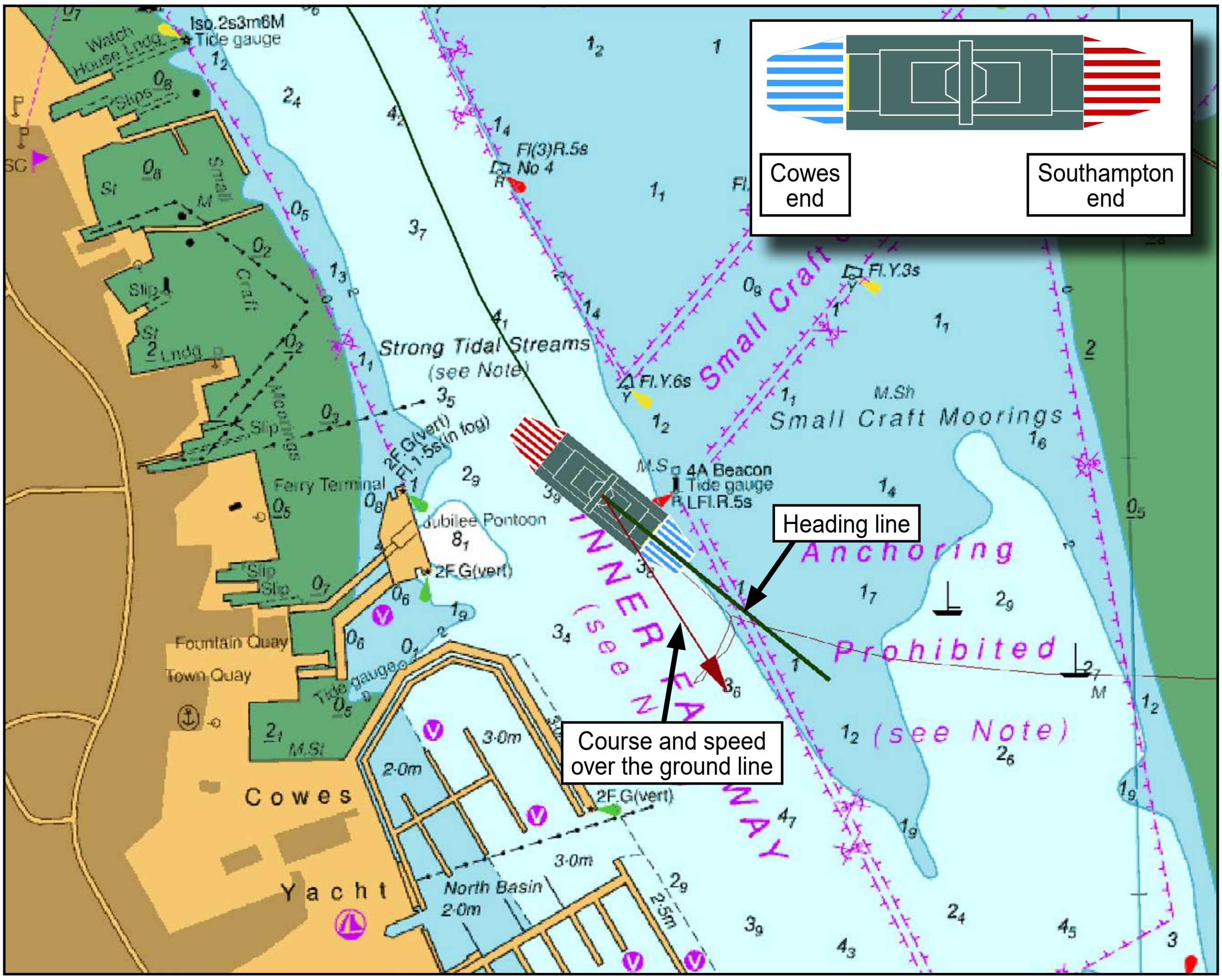

Figure 6: *Red Falcon* starting to swing out of the channel

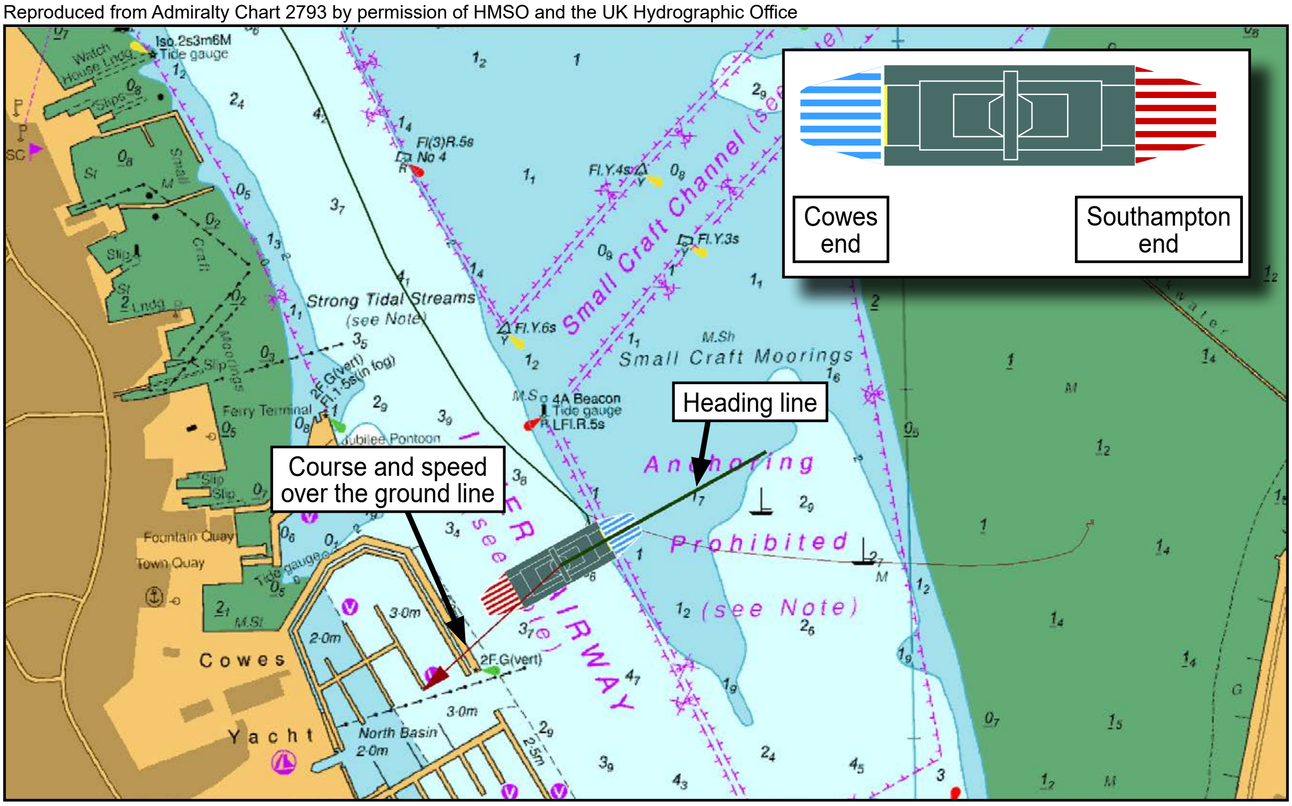

Figure 7: *Red Falcon* perpendicular to the inner fairway

Reproduced from Admiralty Chart 2793 by permission of HMSO and the UK Hydrographic Office

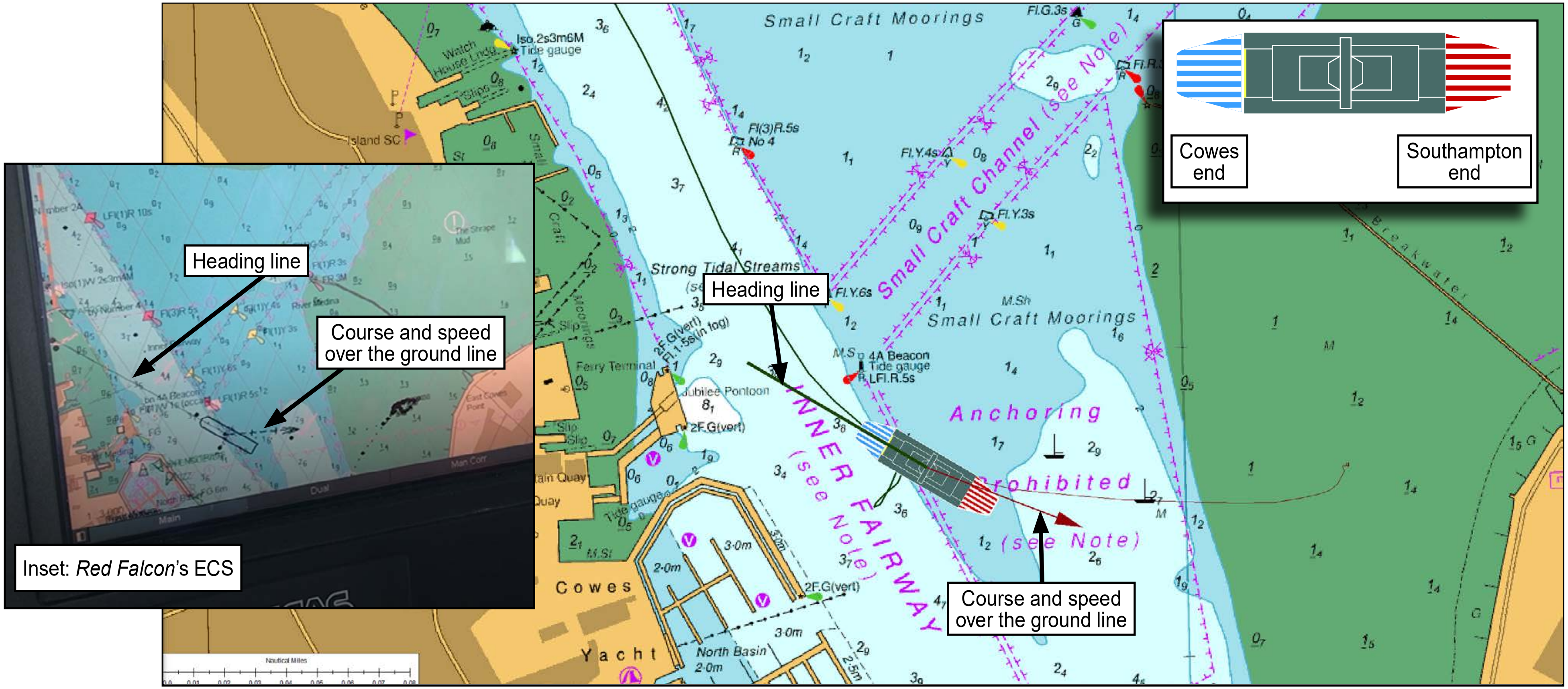

Figure 8: *Red Falcon* turned around before proceeding through moorings (taken from *Red Falcon*'s ECS (see inset))

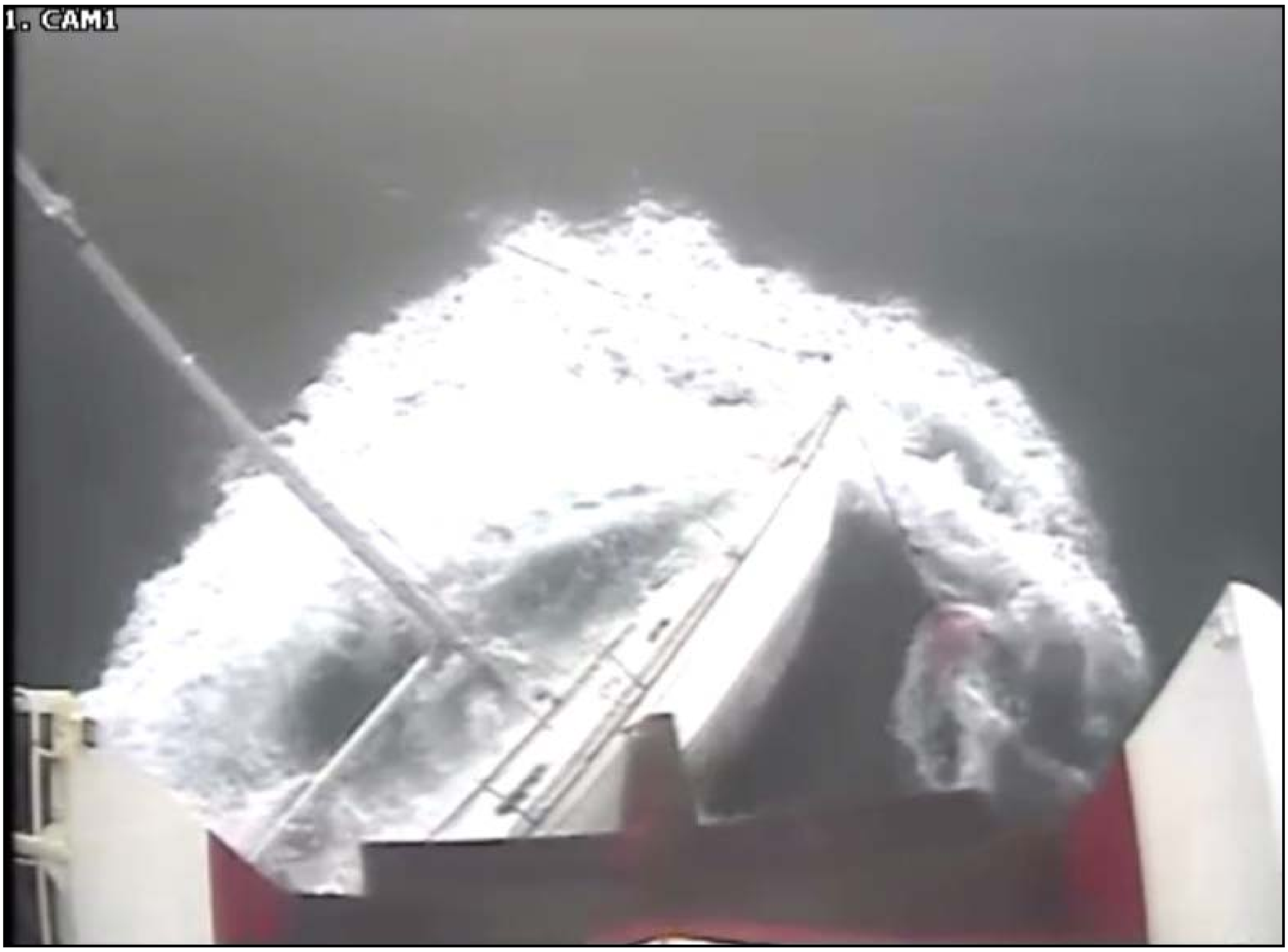

Figure 9: Still from onboard closed-circuit television showing moment of collision

Figure 10: *Red Falcon* aground in the mist

1.4 ENVIRONMENTAL CONDITIONS

The wind was variable in direction and Beaufort force 3 or less. The sea was smooth, and the visibility was restricted by thick fog. The visibility ranged from 2nm down to 0.2nm while on passage, and 0.3nm to 0.1nm in Cowes Harbour until just before the accident, when it closed in to about 50m.

At the start of the buoyed channel, into Cowes Harbour, the tidal stream flows toward the east until about 2½ hours before high water, when it changes rapidly to flow to the west. During the 2½ hour period before high water the flood tide into Cowes Harbour and the Medina river flows from east to west in way of the small boat channel, and across into the main channel, where it splits, with the main flow into the Medina **(Figure 11)**. The effects of the cross-currents are more apparent during spring tides.

Image courtesy of Cowes Harbour Commission

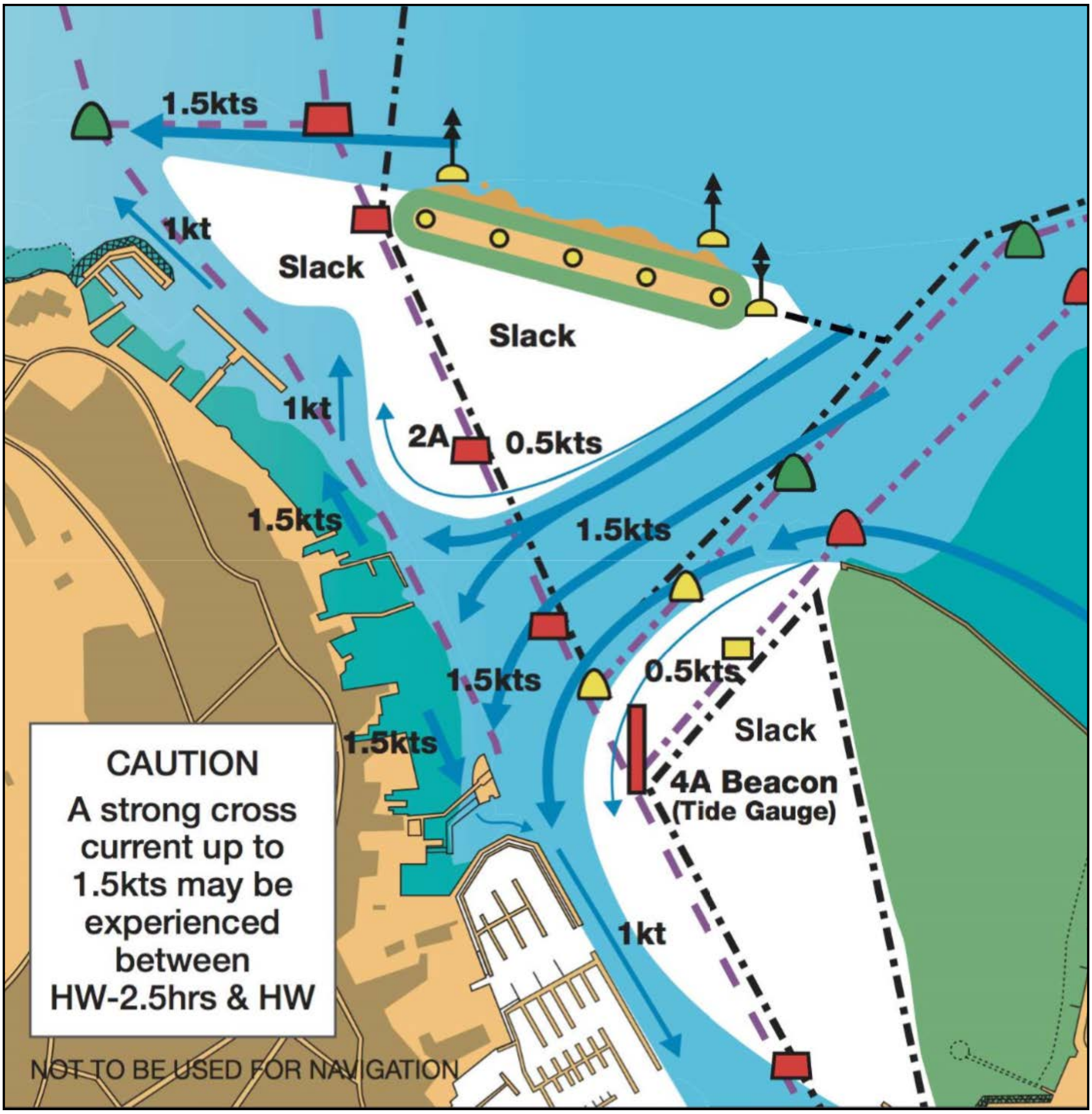

Figure 11: Current flow in Cowes Harbour

The accident occurred 4 days after the neap tide; high water was at 0925 with a height of 3.9m. Cross-currents were anticipated by the master but not expected to be very strong.

1.5 CREW

1.5.1 Work roster

Red Funnel's Raptor class ferry crews worked a 4-day on 4-day off shift pattern. *Red Falcon*'s crew were on the second day of their 4-day on period when the collision occurred. The previous day they had worked from 0320 to 1245.

1.5.2 Master

The master was 35 years old and joined Red Funnel full-time as C/O in 2012. He held a master's certificate of competency and had held a pilotage exemption certificate (PEC) for Cowes Harbour since February 2013. His substantive rank was C/O but he had completed Red Funnel's training programme for masters and would assume the role of acting master when required. He first sailed as acting master on 11 June 2017 and last undertook the annual refresher training for his Cowes PEC on 6 December 2017.

On 11 May 2018, the master resigned from Red Funnel and became a trainee pilot on the river Humber. He re-joined the company on 28 September 2018 and, following a re-familiarisation programme, had served a total of 9 days as acting master prior to the accident.

1.5.3 Chief officer

The C/O was 44 years old and joined Red Funnel as C/O in May 2018. He held a master's certificate of competency and had previously worked for 10 years as master of a passenger/freight ship on international trade. He did not hold a PEC for Cowes Harbour.

1.5.4 Helmsman

The helmsman was 53 years old and had worked as a deckhand with Red Funnel for 22 years, which included 19 years on the 'Raptor' class ferries.

The role of helmsman was shared between three deck crew during their rostered time on board. It had become custom and practice in good visibility for the helmsman on the Raptor class vessels to steer during the first half of the passage from Southampton to Cowes and then hand over to the C/O. The helmsman would then leave the wheelhouse for the rest of the passage and would very rarely steer the vessels into or out of Cowes.

1.5.5 Lookouts

The bridge lookout had worked for Red Funnel for several years after leaving the Royal Navy. The deck lookout was not a career seafarer and had worked in a variety of different trades ashore before joining Red Funnel.

1.6 *RED FALCON*

1.6.1 General

Red Falcon was classified by the MCA as a Class D passenger vessel[2], and its area of operation between Southampton and Cowes was classified as Category D waters[3].

1.6.2 Bridge layout

Red Falcon's bridge was totally enclosed and contained four manoeuvring control consoles: two main consoles, one at either end of the bridge, and two manoeuvring consoles, one on each bridge wing. The bridge also had a central administration console, which included an electrical switchboard.

The main control consoles **(Figures 1** and **2)** were mirror images of each other and each had propulsion and steering controls, propeller thrust gauges and engine speed buttons. They also had an alarm panel, an ECS display screen and a digital compass. A radar display screen was mounted adjacent to each main control console.

1.6.3 Propulsion system

Red Falcon had two Voith Schneider Propeller (VSP) units; one mounted on the centre line at each end of the vessel. The VSP units provided both propulsion and steering, and removed the need for rudders.

Each VSP unit consisted of a rotor casing mounted flush with the vessel's hull, fitted with five hydraulically operated aerofoil shaped blades **(Figure 12)**. Each blade protruded vertically down through the bottom of the casing. The angle of the blades could be altered to produce between 0% and 100% thrust in any direction. Each VSP unit was driven by its own diesel engine. The magnitude of the thrust from the blades, for a given blade angle, was governed by the speed of rotation of the rotor casing, and therefore by the speed of the engine.

The engine speed was controlled using buttons on the bridge control consoles. There were four settings available, although only two were regularly used. These being low speed (approximately 20% power) used while alongside, and intermediate speed (approximately 80% power) used during the transit of the Solent. Full speed (100% power) was available if necessary and would be used, for example if the vessel was running behind schedule during busy periods.

The controls for the VSP units were mounted on each of the four bridge control consoles and consisted of four control wheels **(Figure 13)**. The longitudinal thrust (ahead and astern) control wheels for each VSP were mounted on the side of the consoles and were usually synchronised to operate together, the upper of the two control wheels controlling both VSP units when synchronised.

The transverse thrust control wheels, to move the ferry sideways, were mounted on the top of the console in line with each other. Each wheel controlled the transverse thrust from one VSP and each was operated independently. Without a conventional rudder, steering was controlled by operating the transverse thrust wheel of the trailing (aft) VSP in a similar way to steering a conventional ship with a rudder.

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[2] The Merchant Shipping (Passenger Ships on Domestic Voyages) Regulations 2000.

[3] As defined in Merchant Shipping Notice MSN 1837 (M) *Categorisation of Waters*.

Image courtesy of Red Funnel Group

Figure 12: Voith Schneider Propeller unit

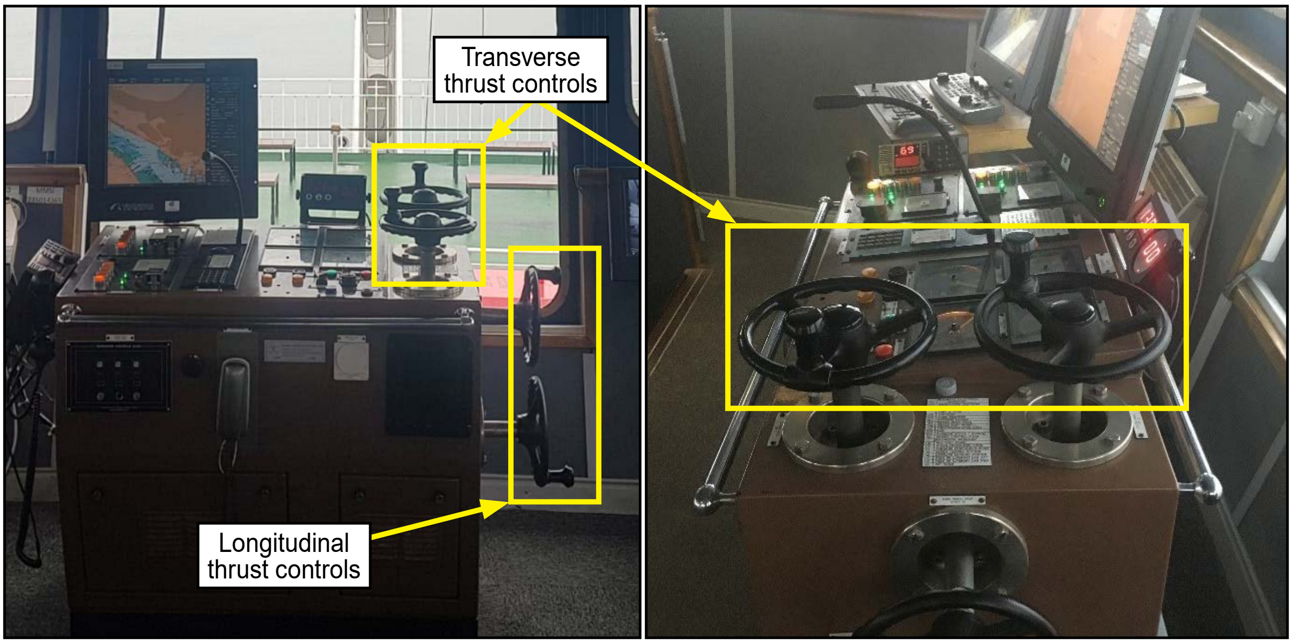

Figure 13: Voith Schneider Propeller unit control wheels

When manoeuvring, a combination of longitudinal and transverse thrust could move *Red Falcon* in any direction **(Figure 14)**. However, the application of transverse thrust would reduce the amount of longitudinal thrust (and therefore ship's speed) available. Without using longitudinal thrust, and applying only transverse thrust to each VSP unit, *Red Falcon* could be moved bodily sideways through the water or spun around its own centre axis **(Figure 14)**. The VSP units therefore provided a very high degree of manoeuvrability, particularly at low speeds.

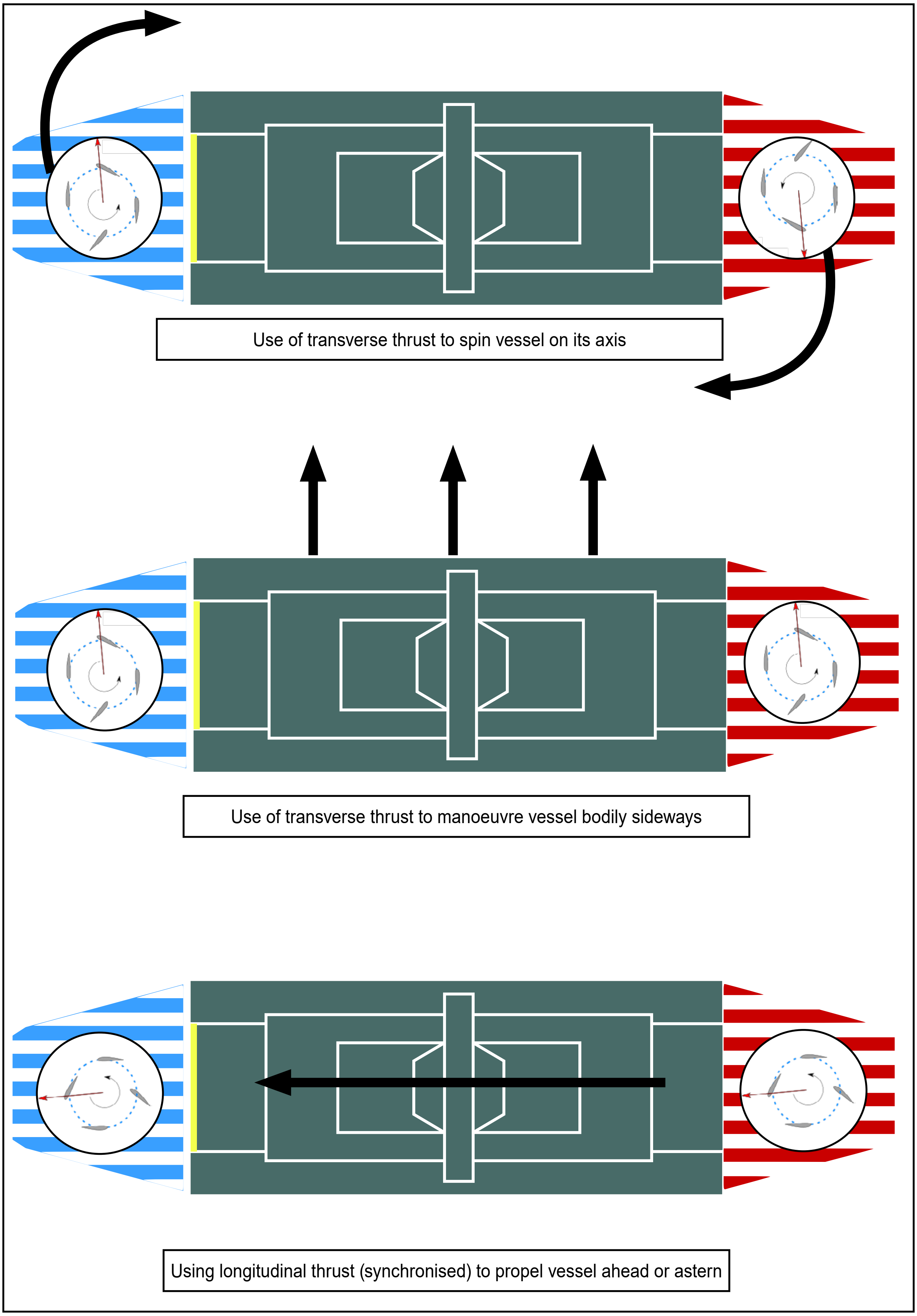

Figure 14: Voith Schneider Propeller thrust diagram

The VSP control wheels on each console were always operationally live and therefore did not require an operator to transfer control between consoles. Each of the wheels was fitted with a knob to aid its rotation by the operator. With each console being live, the position of the wheel knob did not provide an indication of thrust being applied. The gauges at each console showed the percentage of longitudinal and transverse thrust for each VSP.

When on passage, the helmsman would usually stand behind the console, looking forward. When manoeuvring, the master or C/O would typically stand to the side of the console to operate both transverse thrust wheels for each engine, and the synchronised wheels for longitudinal thrust ahead and astern. When *Red Falcon* entered Cowes Harbour, the helmsman was steering the vessel from the Cowes end of the bridge by applying transverse thrust from the Southampton end (stern) VSP. The C/O was controlling the propulsion power/speed from the Southampton end with the engines at intermediate speed and VSPs in synchronised mode.

1.6.4 Radars

The heading line displayed by each radar display pointed in the same direction as the end of the ferry that the radar display was sited. For example, when on passage to Cowes, the heading line on the display at the Cowes end of the ferry pointed ahead while the heading line on the display at the Southampton end pointed astern. In addition, once underway a dashed line centred on the ship's position would also appear on the radar display to indicate the ferry's actual course over the ground (COG). The length of this dashed line was proportional to the ship's speed over the ground (SOG), lengthening as it went faster and vice versa.

Each radar display was fitted with an automatic plotting aid and had the capability to manually create rudimentary maps showing the position of buoys. Each display also displayed the position, heading, COG and SOG numerically.

On the passage to Cowes, the aft radar display operated by the C/O was offset to the north-west. Just before *Red Falcon* entered Cowes, the C/O reduced the range scale in use from 1.5 to 0.75nm, but the radar picture remained offset to the north-west, and was not reset until after the accident **(Figure 15)**.

Figure 15: Radar picture offset
(approaching Calshot Spit, not in Cowes Harbour)

1.6.5 Electronic chart system

Red Falcon was equipped with a Transas ECS and carried a full set of corrected paper charts for the Solent area. The primary means of navigation was the paper charts, but the crew used the ECS for day-to-day position monitoring.

The ECS was equipped with vector charts and was programmed with routes and waypoints. The vector charts were regularly updated by uploading weekly chart corrections. Position, course and speed information were fed from a satellite navigation receiver and displayed on the ECS screens. The position of the ship was displayed as a small circle for range scales above 0.75nm. For the range scales of 0.75nm and below it was displayed as a 'ship' shape. This was the scale selected for navigating into Cowes Harbour.

Due to the nature of the information received from the satellite systems and the time taken to display the processed information, there was a short time lag of about 1 second between the information being received and it being displayed on the ECS screens. This resulted in the ship's shape moving across the screen with a motion that was not smooth.

Because *Red Falcon* was fitted with one ECS unit and slave displays, the heading line, and therefore orientation of the ship shape, was manually changed each time the ferry changed direction in Southampton or Cowes. The heading signal was linked electronically to the whistle toggle switch (labelled *Whistle*) located on the central administration console **(Figure 16)**. When the whistle was switched from one end of the vessel to the other, this also changed the heading line orientation on the ECS.

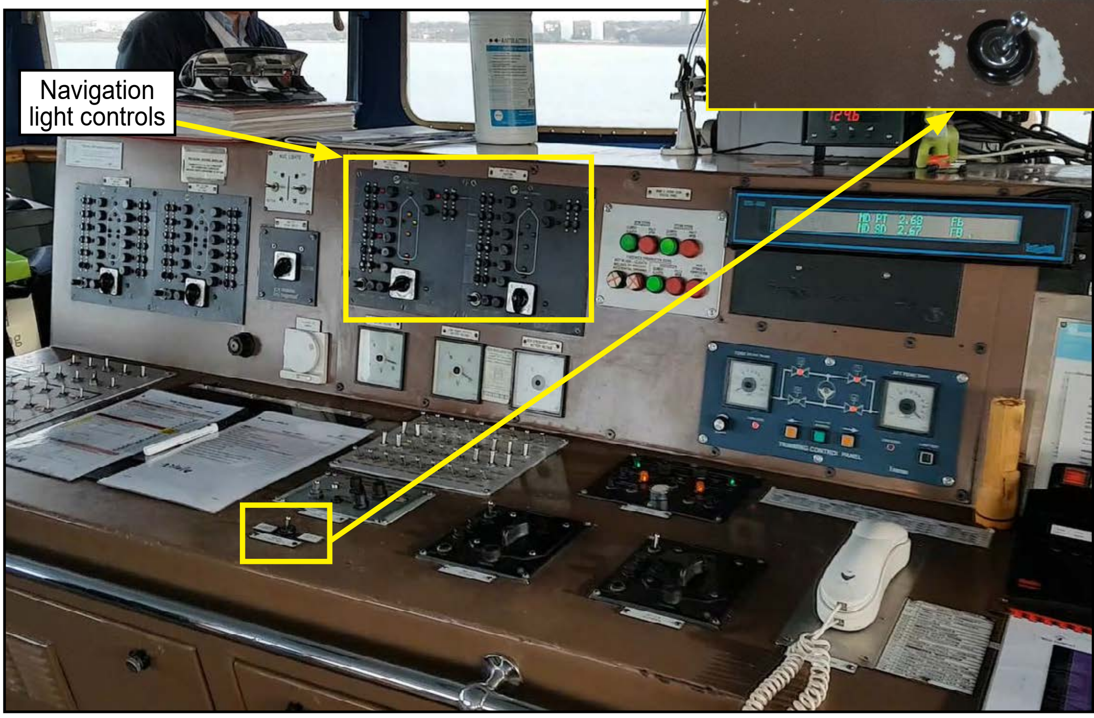

Figure 16: Whistle toggle switch and navigation lights controls

The bridge departure checklist included prompts to switch over the whistle and navigation lights to coincide with the vessel's orientation. It did not refer to the orientation of the heading line on the ECS.

Similar to the radar display, each ECS display screen presented the position, heading, COG and SOG digitally **(Figure 17)**, and the COG arrow appeared once the ferry was making way and grew in length as the SOG increased.

Figure 17: Electronic Chart System display

1.6.6 Digital compass

A digital compass mounted on each centre line control console displayed the ship's heading orientated to the direction faced by the end of the ferry at which it was located, i.e. their readings differed by 180°. The heading was displayed in clear, large, red LED digits in a three-figure notation **(Figure 18)**. To the right of the heading display on the unit was an LED display that indicated the ferry's rate and direction of turn. The direction of turn was indicated by the clockwise or anticlockwise rotation of LED lights.

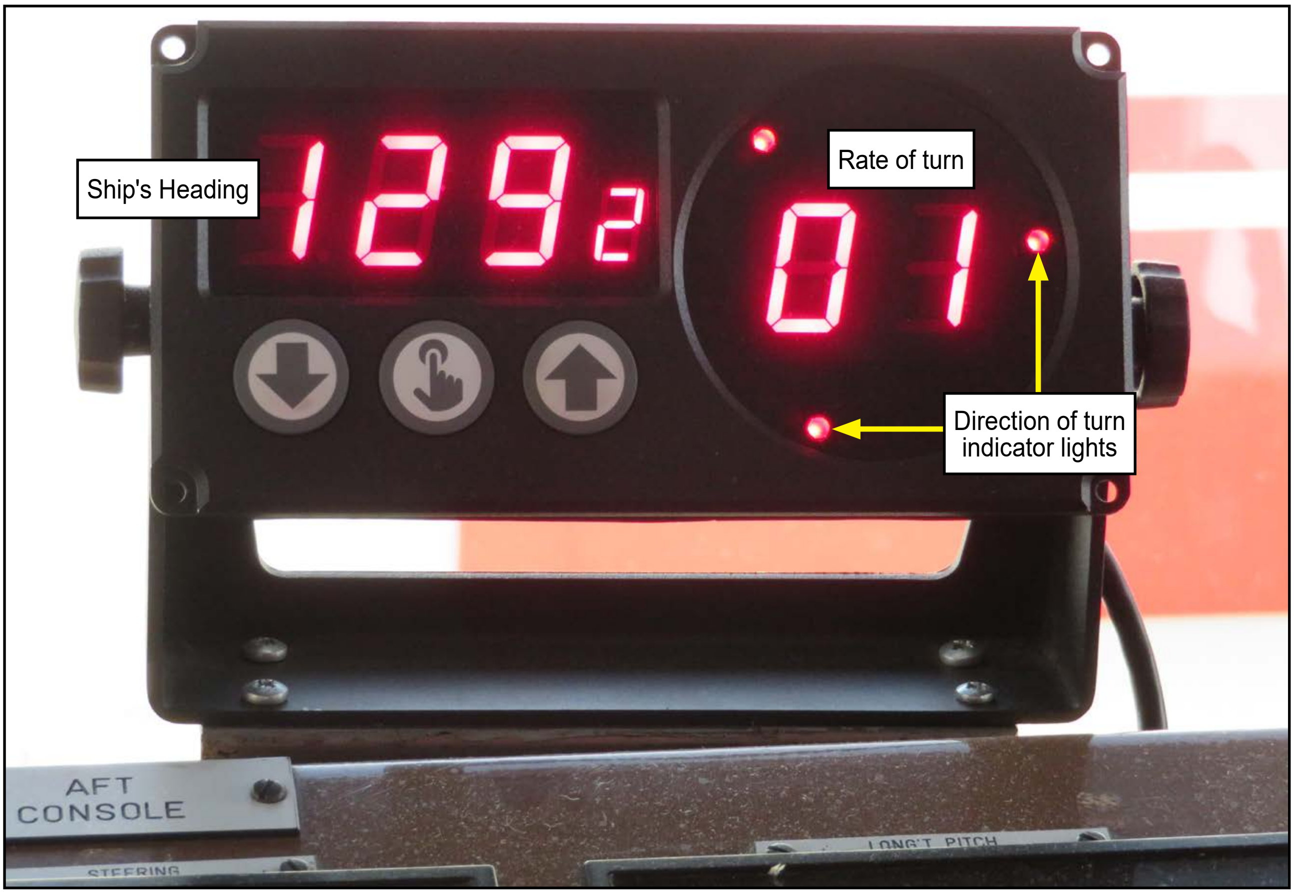

Figure 18: Digital compass display

1.7 RED FUNNEL

1.7.1 Safety management

Red Funnel voluntarily complied with the International Safety Management Code (ISM Code), which exceeded statutory requirements for domestic passenger ferries. The company safety management system (SMS) contained operations procedures for daily shipboard work routines.

The ISM Code section 1.2 states that:

> *Safety management objectives of the Company should assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards.*

Red Funnel had identified risks as required by the ISM Code and this formed part of its SMS. Its risk assessment entitled 'Navigation in Restricted Visibility – Raptors', stated that:

> *Navigation in restricted visibility is one of the most high risk operational tasks that we incur. Full appreciation of all aspects of the potential hazards need to be fully adhered to by all involved.*
>
> *Navigating a ship in restricted visibility requires a full understanding of the COLREGS*[4]*, in particular Part B (Steering and Sailing Rules) both Section III (Rule 19) - conduct of vessels in restricted visibility and Section I (Rules 4 to 10 inclusive) – Conduct of vessels in any condition of visibility.* [sic]

[4] International Regulations for Preventing Collisions at Sea 1972 (COLREGs) (as amended).

In addition, Red Funnel's risk assessment for 'Navigation In Cowes Harbour and Approaches' **(Annex A)** identified collision and grounding as a hazard when in restricted visibility. Both risk assessments recognised bridge resource management (BRM) training as a significant mitigating measure.

1.7.2 Qualifications and training

Due to the nature of its operations, the frequency of sailings, and the numbers of passengers carried, Red Funnel required, as a risk mitigation measure, all its officers to hold a higher level of professional qualifications than those required by the Flag State for similar classes of domestic passenger vessels.

Red Funnel had a structured training programme for all its staff, and a familiarisation task list for new staff joining the company. Its SMS also required staff to undergo a defined re-familiarisation programme if they had been away from a class of vessel for a period of more than 2 months.

1.7.3 Bridge resource management

Red Funnel had developed a bespoke 1-day BRM training course with a local company, which consisted of classroom theory and simulator-based practical elements. The training course was aimed at master and C/Os and covered basic theory of accident causation, leadership, team dynamics and effective communication. It did not include emergency scenarios or passages into Cowes Harbour and was not attended by other members of the bridge team such as the helmsman or lookouts.

Standard BRM courses that meet the requirements of the 2010 Manila Amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), are usually at least 3 days long. They typically include various practical emergency scenarios and allow time for all students to assume different roles in the simulated environment.

The master had undertaken a pilot resource management course between May and September 2018 while a trainee pilot, but had not undertaken Red Funnel's 1-day course. The C/O completed Red Funnel's BRM training course shortly after joining the company in May 2018 and had done an STCW approved 3-day course about 11 years earlier.

1.7.4 Ship-handling

All Raptor class C/Os were required to be proficient at ship-handling. The company's *Raptor Safety Training/Assessment Form for C/O - Manoeuvring, Steering and Propulsion System Training* **(Annex B)** contained a list of 19 tasks against which an officer's competence was assessed before he or she was deemed competent to manoeuvre the ferries unsupervised. Once deemed competent, there was no formal continual assessment process for ship-handling proficiency for either C/Os or masters.

The tasks included demonstrating an understanding of the propulsion system, how the wind and tides would affect the vessel, and knowledge of tidal streams in Southampton Water and Cowes Harbour. The main tasks focused on berthing and unberthing at the Southampton and East Cowes terminals in various weather conditions, and manoeuvring in Cowes fairway and harbour during various tidal conditions.

The C/O was an experienced ship-handler, but at the time of the accident he had not completed all the required 19 tasks.

1.7.5 Navigating in restricted visibility

Red Funnel's procedures contained detailed requirements for the safe operation of its vessels in or near an area of restricted visibility. These included calling the master, complying with the requirements of the COLREGS, and the use of equipment. Additionally, for the Raptor class vessels there was a requirement to man the bridge with a helmsman, and consideration was to be given to the posting of additional lookouts.

The operational procedures manual stated that:

> *If the Master, after careful consideration of the factors affecting their vessel (e.g. wind speed and direction, visibility, tidal effects, availability of tugs etc) considers a manoeuvre involves unacceptable risks,*
>
> ***"THEY SHALL NOT ATTEMPT TO ENTER OR LEAVE THE BERTH"***

On the afternoon before the accident, the Cowes harbourmaster composed a temporary General Direction (No.3.18.1), which stated:

> *RESTRICTED VISIBILITY (less than 0.1nm)*
>
> *Vessels 48 metres and above, LOA, should not navigate in the Inner Fairway or River Medina, if visibility is one cable (0.1nm) or less.*
>
> *If Masters / Pilots deviate from this Direction then they shall justify and record the reasons. Any deviation from this Direction should be based on the result of a dynamic risk assessment, taking into account all considerations and any special circumstances that support the Master's / Pilot's decision.*

This direction was sent to Red Funnel management, who then distributed it to all company vessels that evening. A copy of the direction was available on board *Red Falcon* and had been noted by the master when he arrived on the vessel on Sunday 21 October **(Annex C)**.

The advice contained within the direction was in anticipation of fog by the harbourmaster for the morning of 21 October, and as a result of a previous accident involving *Red Eagle* in fog a few weeks earlier (see section 1.9).

Red Falcon's master applied the direction to his vessel arriving into the port. He used his lookouts and radar to determine the extent of the visibility by detected objects, and therefore to ensure his compliance with the direction prior to entry into Cowes Harbour.

1.7.6 Blind pilotage

Red Funnel's operating procedures for navigation stated that:

> *All Masters and Officers must practice blind pilotage in clear weather as a Bridge team in order to establish confidence and familiarity with the Radar pictures of the district and the techniques required to manoeuvre the vessels without visual references. Such blind pilotage exercises must be carried out and recorded at intervals not exceeding one month.* [sic]

Any blind pilotage training carried out was recorded within the company's computer-based training record system. The records showed that the crew of *Red Falcon* had last undertaken blind pilotage training departing Cowes on 20 October 2018, the day before the accident. The training records did not show who undertook the role of helmsman, and therefore who had practised steering by compass or steering within Cowes Harbour.

Further investigation of the records revealed that the helmsman on the day of the accident had not steered a 'Raptor' class ferry into Cowes for over 10 months.

1.8 COWES HARBOUR

1.8.1 Background

Cowes is a trust port, run by a commission of nine appointees and the Chief Executive. The port's harbourmaster was the chief executive of the commission. The port employed 26 full-time and three part-time staff.

Cowes Harbour Commission (CHC) is the statutory harbour authority for Cowes. It is also the Competent Harbour Authority under the provisions of the Pilotage Act 1987 and is responsible for the pilotage service within the Cowes pilotage area. As such, the harbourmaster was empowered to issue pilotage licences and PECs.

1.8.2 Pilotage exemption certificates

In Cowes, pilotage was compulsory for all passenger vessels over 20m in length. Pilotage was therefore compulsory for all 'Raptor' class ferries. All Red Funnel masters, and most of its C/Os, held PECs for Cowes.

CHC had a process in place to monitor the performance of Red Funnel's PEC holders. Senior masters were required to conduct an annual knowledge check, and every 3 years they were assessed by an experienced and qualified Cowes pilot. Additionally, every 3 years all PEC holders were required to be interviewed by the Cowes Pilotage Standards Officer to confirm their competence.

1.8.3 Cowes inner harbour and fairway channel

Cowes Harbour limits extended to about 0.3nm north of the inner fairway channel. The inner fairway channel entrance was marked by a pair of lateral buoys, No.1 green conical buoy to starboard and No.2 red can buoy to port. The western side of the inner fairway channel was not marked by any further buoys, but was bounded by various jetties, floating pontoons and solid marina walls, most of which were fitted with green lights. The eastern side of the channel was marked with lit red can buoys to the East Cowes ferry terminal, except for No.4a, which was a large pile beacon fitted with a red flashing light. The average width of the inner fairway channel was 80m **(Figure 4)**.

1.8.4 Safety management and risk assessments

CHC operated an SMS based on the UK government Department for Transport's Port Marine Safety Code (PMSC).

To comply with the PMSC, port authorities had to:

- *Ensure all risks are formally assessed and as low as reasonably practicable in accordance with good practice.*

- *Operate an effective marine SMS which has been developed after consultation and uses formal risk assessment.*

- *Use competent people (i.e. trained, qualified and experienced) in positions of responsibility for safety of navigation.*

Once a port had implemented the requirements set out in the PMSC through its SMS, it could formally declare itself compliant.

CHC had appointed a designated person (DP) to independently audit its compliance with the Code. The DP's last audit before the accident had been conducted on 17 December 2017. Within the report the DP stated that the port's electronic risk assessment programme, purchased in 2014, was sophisticated and complex to use, which had resulted in it not being fully utilised to manage operations dynamically and routinely.

CHC's SMS contained risk assessments for its general port operations ashore and afloat.

In its risk assessment titled *Navigating in Cowes during periods of restricted visibility – Incident category – Collision* **(Annex D)**, CHC stated that:

> *Navigating in restricted visibility is a challenge in itself, but when you consider the tidal regime, limited space for manoeuvrability, narrow channels, and fixed structures in Cowes, it becomes an even greater risk.*

The risk of collision between transiting commercial craft and a raft of yachts moored on pontoons in Cowes Harbour, was identified by CHC as its highest rated risk. The effect to people identified within this risk assessment in a worst-case scenario, was multiple fatalities **(Annex E)**.

The MCA's publication *Port Marine Safety Code Health Checks 2018* included reference to marinas within a harbour authority jurisdiction. It suggested that marina operators should be invited to attend port user groups to enhance engagement with the statutory harbour authority. The publication further recommended alignment of port and marina procedures and practices, particularly with reference to risk assessments within each SMS, to enhance navigational safety.

1.8.5 Yacht moorings in Cowes harbour

There are two main yacht marinas within Cowes Inner Harbour, Shepards Wharf Marina and Cowes Yacht Haven Marina, which are both located on the west side of the harbour. In addition, there are numerous swinging moorings to the east of the inner fairway channel. *Greylag* was on swinging mooring D2 about 100m from the edge of the fairway **(Figure 4)**.

There were no restrictions imposed by CHC on people staying overnight on yachts within Cowes Harbour, either on the swinging moorings or alongside in the marinas. Wherever possible, CHC deliberately allocated the swinging moorings closest to the fairway channel to yachts without accommodation on board. As *Red Falcon* was driven through the yacht moorings, it passed 110m from a yacht on its swinging mooring that was occupied by a family of five who had slept on board overnight.

Shepards Wharf Marina was owned by CHC; Cowes Yacht Haven Marina was owned by Cowes Waterfront Trust, which was a charitable organisation. Risk assessments at Shepards Wharf were similar to those of CHC; Cowes Yacht Haven did not have any documented risk assessments. Although CHC convened their regular port user group '*Cowes Harbour's Advisory Committee*' which included safety as a standing agenda item, the CHC risk assessments and those of the marina operators did not align as recommended in the Port Marine Safety Code Health Checks 2018.

The marina managers at both Cowes Yacht Haven and Shepards Wharf prioritised the berthing of yachts inside the marina. In times of high demand, yachts were also moored to the marinas' outer pontoons and walls.

During events such as Cowes Week, yachts were frequently rafted alongside each other on the outer part of the pontoons and marina walls. These rafts often encroached into the inner fairway channel, reducing its navigable width by up to 20m (25% of the total fairway width). Due to the popularity of such events, there could often be over 100 yachts rafted out into the inner fairway, between two and six boats deep. Because of the scarcity and cost of accommodation locally, yacht crews taking part in events would often remain on board the yachts overnight, with ferries and large commercial craft passing very close by. At times, there could be over 500 people sleeping on yachts rafted on the outer part of pontoons and marinas.

1.9 POST-ACCIDENT STEERING TRIALS AND INDEPENDENT ERGONOMIC AND HUMAN FACTORS ASSESSMENT

1.9.1 Steering trials

A few days after the accident, MAIB inspectors witnessed a set of steering trials conducted on board *Red Falcon*. The trials, overseen by members of Red Funnel's senior management team, were undertaken in controlled conditions without any cross-tide. The aim was to establish if there were differences between steering by sight and steering by digital compass without visual references.

The trials showed that in good visibility the helmsmen were able to maintain a given course with ease. However, in simulated restricted visibility, steering by digital compass alone, without visual references, they were prone to over-correction and found it more difficult to maintain the given course.

1.9.3 Human factors assessment

The MAIB commissioned Greenstreet Berman Ltd to undertake an ergonomic assessment of *Red Falcon*'s bridge control consoles and a human factors assessment of its crew's actions during the incident. In support of the assessment, Greenstreet Berman's experts received a brief from the MAIB, had guided voyages on board *Red Falcon*, held discussions with and interviewed serving crew, and visited a similar type of roll-on roll-off ferry operated by a different company.

The ergonomic assessment was focused on the wheelhouse equipment, various controls and their use on board by the ship's staff.

The human factors assessment focused on the master's decision-making process and his cognitive function, and how this was most likely to have changed as the incident unfolded. In addition, the assessment looked at the human factors issues that most likely influenced the bridge team as a whole.

Greenstreet Berman Ltd's report findings have been used to support the analysis contained in this report.

1.10 PREVIOUS ACCIDENTS

1.10.1 *Red Falcon*

On 29 September 2018, *Red Falcon* and the privately-owned motor cruiser *Phoenix* collided in the Solent as both vessels headed for Cowes. *Phoenix* was pinned against the ferry's bow for 18 seconds and was seriously damaged. *Red Falcon* was undamaged and there were no injuries or pollution.

The MAIB investigation report[5] identified that the lookout on both *Red Falcon* and *Phoenix* was solely by eye. However, *Red Falcon*'s bridge team did not see the motor cruiser on the starboard bow due to their focus on a sailing vessel close on the port side, which was potentially impeding the next intended course alteration. *Phoenix* was also obscured by the sun's glare. *Phoenix*'s owner did not see the ferry approaching on the motor cruiser's port quarter because he was looking ahead.

Following the accident, an internal investigation by Red Funnel identified several areas of navigational watchkeeping practice that needed to be improved.

The helmsman and lookouts on board *Red Falcon* during the *Greylag* collision were on board *Red Falcon* at the time of this accident.

1.10.2 *Red Eagle*

On 27 September 2018, *Red Eagle* made contact with several moored boats and the No.4a beacon during a departure from East Cowes in restricted visibility. The company found that a departure from the agreed passage plan led to loss of situational awareness on the bridge, after the master undertook the steering himself rather than passing it to the helmsman as initially agreed.

5 MAIB Report No 4/2019 - Collision between the ro-ro passenger ferry *Red Falcon* and the motor cruiser *Phoenix*, Thorn Channel, Southampton, England 29 September 2018.

The C/O, helmsman and lookouts on board *Red Falcon* during the *Greylag* collision were on board *Red Eagle* at the time of this accident. The C/O was suspended from duty pending an internal investigation. This was standard company practice and he returned to work on 11 October 2018.

On 18 September 2018, *Red Eagle* had a close quarter encounter with the cruise ship *Mein Schiff 4*. *Red Eagle* was on passage to Cowes and *Mein Schiff 4* was heading toward Southampton. *Mein Schiff 4* was experiencing a lot of leeway due to strong west-south-westerly winds and *Red Eagle* did not act early enough to leave the channel and provide sufficient sea room. Red Funnel's investigation found that BRM techniques exhibited on *Red Eagle* required improvement.

1.10.3 *Red Osprey*

On 30 April 2016, *Red Osprey* suffered a propulsion failure while manoeuvring toward the East Cowes ferry terminal. A steering ram on the ferry's aft VSP unit stuck at 100% thrust to port. This caused *Red Osprey* to swing in the channel to the east, hitting No.4a beacon and a small yacht in the vicinity before control was regained.

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 OVERVIEW

Red Falcon collided with *Greylag* and ran aground because its bridge team became disorientated in thick fog and its master drove the vessel in the opposite direction to that intended. In this section of the report, the decisions to sail from Southampton and to enter Cowes Harbour in fog, and the reasons why the helmsman was unable to steer the courses ordered and the bridge team became disorientated, will be analysed. Underlying factors that contributed to this accident, and issues related to the safety of navigation and to those staying overnight on board yachts moored in Cowes Harbour, will also be discussed.

2.3 DECISIONS TO SAIL AND TO ENTER COWES HARBOUR

Red Falcon's master was aware of the environmental conditions in Southampton Water and the Solent prior to the ferry's departure from Southampton. He discussed the reduced visibility with his crew and implemented the company's restricted visibility procedure. Once on passage, the master received visibility reports from Southampton Vessel Traffic Services, *Red Osprey*'s master in Cowes and other vessels operating in the area.

As *Red Falcon* made its approach to Cowes the visibility was 0.2 to 0.5nm, which was above the minimum limit recently set by the Cowes harbourmaster. Given the information available to the master and enhanced navigational precautions put in place, the decisions to sail from Southampton and enter Cowes harbour appeared to be sound. It was only after the ferry had entered Cowes Harbour that the visibility deteriorated to a point where most visual references were lost.

2.4 HELMSMAN'S INABILITY TO MAINTAIN COURSE

In accordance with Red Funnel's restricted visibility routine, one of *Red Falcon*'s three deckhands was on the helm during the ferry's passage through Southampton water and entry into Cowes harbour. The deckhand was an experienced helmsman with almost 20 years' experience on the Raptor class vessels. Despite this, the helmsman was not able to maintain the courses ordered by the master as the ferry proceeded through the fairway channel in thick fog.

During normal visibility, the practice of the C/O taking over as helmsman before entry into Cowes Harbour meant that the deckhands were not gaining experience of steering in the tidal cross stream, or the flood tide in the tight confines of Cowes Harbour. Furthermore, they did not routinely practise steering by digital compass alone.

The Raptor class hull form was designed to allow for maximum manoeuvrability; however, this introduced a degree of directional instability[6] that made it more difficult to steer a straight course. This phenomenon was demonstrated during the restricted visibility steering trials conducted after the accident, when in benign and stress-free circumstances the helmsmen had difficulty maintaining a course when steering by the digital compass alone, and were prone to over-correct the steering **(see 1.9.1)**.

The inherent directional instability of *Red Falcon*'s hull form coupled with tidal stream effects, the master's frequent course orders, the absence of visual references and lack of experience steering into Cowes, meant that the helmsman struggled to maintain the ship's heading. However, although he was having difficulty steering the vessel using the transverse thrust control of the trailing VSP unit, *Red Falcon* was not out of control when the master took over the manoeuvring responsibility.

2.5 BRIDGE TEAM LOSS OF ORIENTATION

2.5.1 Overview of bridge team operations

When *Red Falcon* entered the Cowes inner fairway the master had the con, with a helmsman steering and the C/O controlling the speed. When the master took over from the helmsman, he also took control of the vessel's speed (longitudinal thrust) from the C/O.

Before he took over *Red Falcon*'s steering and speed controls, the master had a good overview of bridge operations and was receiving regular navigation and positional updates from the C/O and his lookouts. As soon as the master had full propulsion control, he immediately became task focused and lost his overview. Because the role of keeping an overview was not re-assigned, the members of the bridge team started to act in isolation and did not adequately support the master. The C/O remained at the Southampton end of the bridge, physically remote from the master, even though the company's blind pilotage procedure was no longer being followed, and the helmsman was unsure of his new role which resulted in him becoming disengaged from the bridge team. Consequently, the cohesive structure of the bridge team, which had been used effectively on the passage to Cowes, was lost.

2.5.2 Use of aids to navigation and human interfaces

While the helmsman steered, the master stood behind the consoles and was able to see all the navigation equipment clearly. He used the ECS for positional awareness, and the radar for navigation and collision avoidance. As the vessel approached Cowes Harbour, the master used the radar to identify the buoyage, and once the buoys were sighted visually he was able to use the radar to determine their distance and therefore the state of visibility.

The positioning of the controls and console displays, although designed for a two-person operation, could be operated by one person. However, the ergonomic layout of the VSP controls, ECS and radar were not compatible with the natural manoeuvring position at the side of the console during single person operation, i.e.

[6] A ship is said to be directionally stable if a deviation from a set course increases only while an external force or moment is acting to cause the deviation. It is said to be unstable if a course deviation begins or continues even in the absence of an external cause. A ship with low directional stability is easy to manoeuvre, but more difficult to keep on a straight course.

when the master took over from the helmsman he could no longer see the radar display **(Figure 5b)**. It was therefore much more likely that the swivel mounted ECS display closer to the VSP controls would be used for navigation.

Once the master had moved to the side of the bridge control console, his focus was on the ECS, and the information shown on its display drove his decision-making as it became his principal navigation aid **(Figure 17)**. This situation would not have been helped by the slight time delay on positional information being updated on the ECS.

2.5.3 Vessel rotation

After the master had taken over the VSP controls for both units the visibility quickly reduced. Because of the lack of visual references, the master became focused on manoeuvring the vessel in response to the information displayed on the ECS. In the absence of external visual references, the master, in common with the helmsman, over-corrected with the thrust controls, causing *Red Falcon* to start to swing out of the channel. This resulted in him experiencing a ship-handling problem for which he had not practised. He used both VSP units to stop the ship and then to turn it to port, ultimately through 220˚. In so doing he avoided hitting the marina wall, yachts and navigation marks. However, there was an element of good fortune involved, given the difficulty he was having controlling the vessel with no visual references.

2.5.4 Loss of orientation

Once the ferry started to swing to port in the confines of the fairway channel the master's interventions caused it to spin around on its axis very quickly, narrowly missing several hazards. This resulted in multiple competing simultaneous and successive tasks for the master to undertake, which were compounded by the stress of very limited visibility. In the 3 minutes between him taking over the controls and *Red Falcon* completing the turn through 220°, the master was completely reliant upon his instrumentation and inputs from the bridge team.

However, under increasing stress, the master's attention became fixated on the ECS and operating the VSP controls. This had the consequence of the master blocking out aural and visual information from the bridge team and other instrumentation, and so diverted attention away from monitoring the ferry's orientation. This can be described as an instance of cognitive tunnelling, where one has to multi-task to achieve a goal but where one keeps attention firmly fixed on one task long after a second task should have been attended to.

In this situation the master was simultaneously receiving a considerable amount of complex spatial information about the orientation and location of the ferry over a very short period. This information became confusing to the master as the ferry moved, and some was delivered in an increasingly emotional manner. His high task load, compounded by the consequences of the failure of the operation, would have made the master highly stressed. This would have reduced his cognitive ability to adequately manage tasks effectively and keep track of the ferry's orientation. In high stress situations like this, the mental functions that conduct planning, decision-making, trouble shooting and problem solving, are often overwhelmed. As in this accident, the ability of individuals to effectively conduct the 'right' tasks can be severely affected and they are often highly resistant to feedback from colleagues or from aural or visual alarms.

With the master fixated on the ECS and VSP controls due to the high task load and levels of stress, he was probably not able to attend to all the information his bridge team were trying to give him or take in all the relevant information from the visual displays in the wheelhouse. This would have impaired the master's ability to locate himself and the vessel in relation to the environment, so he became disorientated and confused as to which direction the ship was now pointing. The lack of visual references and misleading information on the ECS would have meant there was also very little immediate information to support the master in problem solving the situation and maintaining an awareness of the ship's orientation.

The result of this disorientation was the master failing to recognise that *Red Falcon* had turned around completely. He believed that he had arrested the swing, and in his confused state thought that it had only turned through about 90˚.

Had the C/O moved to join the master at the Cowes end console as soon as the master took over the VSP controls, he might have been able to provide the master with the feedback needed and an oversight of the unfolding emergency situation. Given the C/O's experience as ship master prior to joining Red Funnel, it is difficult to understand why he did not do this. However, it is possible that the previous incident on board *Red Eagle*, in which he had been involved, affected his confidence, his willingness to leave his allocated station and to challenge the master.

2.6 THE COLLISION AND GROUNDING

After the ferry had turned around, with the Cowes end pointing toward the north-west, there was a brief moment when the ship was stopped in the water in a safe position. The master decided that he needed to take the ferry to a safer location, out of the confines of Cowes Harbour. While in his disorientated state, he failed to recognise that the ferry had turned around fully. Despite the correct information being displayed on his instrumentation in front of him, the master thought that the other end of the ferry was pointing in the direction he needed to go. It was his instinct to drive *Red Falcon* toward Southampton from the Southampton end. Without consultation with his bridge team, or voicing his intentions, the master put the VSP controls astern while at the Cowes end of the bridge, and ran to the Southampton end control console, shouting that he was going to drive the ferry out of Cowes Harbour.

When the master ran from the Cowes end to the Southampton end of the bridge, he did not change the navigation lights or whistle direction switches on the central control desk, and therefore did not alter the heading information displayed on the ECS screens. As a result, the 'ship shape' and heading line on the ECS displays remained pointing to the north-west, back into the channel **(Figure 8)**. In his confused state, the master completely ignored the radar and digital compass, which gave the correct orientation, focused on the ECS, operated the VSP units ahead, and continued to drive the ferry in the wrong direction. The C/O had been monitoring the turn and provided verbal information to the master, but when the master ran to his console at the Southampton end, he became confused regarding the master's actions.

The master's operation of the VSP units ahead when he arrived at the Southampton end, surprised the C/O, who had not reset the radar display from its offset position to the north-west. When the master shouted for a course to steer back into the channel, the C/O was unable to do this quickly as the radar picture showed the Southampton end pointing toward the south-east. This picture was at odds with what he was seeing on the ECS.

When the master ran to his end of the ferry the C/O dismissed the picture displayed by the radar and in the time-pressured situation became confused and did not seek information that would have enabled him to re-orientate himself and so allow him to challenge the master's actions.

As the ferry started to gather way, the COG/SOG line began to appear on the ECS, in the opposite direction to the heading line displayed **(Figure 8)**. The master's action to put even more thrust ahead, suggests that when looking at the ECS, the COG/SOG line was misinterpreted by him as being a consequence of the flood tide pushing the ferry astern, rather than accurately showing *Red Falcon*'s direction and speed of travel. It was only 32 seconds between the master running to the Southampton end and *Red Falcon* colliding with *Greylag* at a speed of 6.5kts, a short timeframe in which the bridge team needed to assimilate the situation and correct the master's actions.

2.7 BRIDGE RESOURCE MANAGEMENT

Effective BRM requires the efficient use of all available resources, both human and electronic, but is dependent upon several factors. These include:

- Each team member fully understanding their role.
- All team members being fully aware of the passage plan and having dynamic awareness of any changes.
- Good information exchange and pro-active communication.
- All team members being empowered to seek clarification and to challenge where necessary.
- Best use of electronic navigation aids.

There is no doubt that BRM principles broke down as the crew transitioned from a standard approach into Cowes in fog, to a rapidly changing hazardous situation. The master did not communicate his intentions before undertaking actions, and the C/O steadfastly continued with his assigned role despite there being a significant change to the normal routine. Further, given the circumstances on the day, there was very little time for the master to direct the resources available to him and the lack of emergency training for such an incident, which should have provided the desired behaviours in the bridge team, resulted in an absence of support to all concerned.

A rapid deterioration in visibility in the harbour after a ferry had entered the channel was unusual, but not unforeseeable. Emergency training for such a scenario would have helped ensure that all members of the bridge team were familiar with and practised in their respective roles, and able to react quickly when the need arose.

2.8 TRAINING AND MANNING

The company blind pilotage training was intended to embed in the team the lessons learned as part of the BRM training, and to use these lessons in the simulated environment of a loss of visibility. However, the roles for each team member were not clearly defined within the company SMS, and no records were kept within the company training system of the role undertaken by each of the three deck ratings. In addition, there was no practising of emergency scenarios during the company blind pilotage training routines. The blind pilotage practice, therefore, was not as effective as intended by Red Funnel.

Because the C/O had not yet completed his in-house ship-handling familiarisation training, he was unable to step in to manoeuvre the vessel and leave the master to maintain his oversight role. Additionally, by remaining at the Southampton end strictly following the fog routine procedure, the C/O was unable to effectively provide an overview role to the master.

In addition, the master's substantive role within Red Funnel was that of C/O. Therefore, at the time of the accident, Red Funnel had rostered an inexperienced master with an inexperienced C/O. Improving the recording of individuals' training and experience would enable the company to target shortfalls and, when this cannot be achieved quickly, adjust rosters to best ensure the team has the skills necessary.

2.9 COWES HARBOUR AND RISK ASSESSMENTS

The highest ranked hazard within the CHC risk assessment register, 'Collision between commercial vessel and raft of yachts', contained limited mitigation measures that were under the direct control of CHC. Those mitigations were principally assessing the competence of an individual to pilot a vessel through the area, and seeking assurance of the vessel's seaworthiness.

The risk assessment for yachts moored at Shepards Wharf Marina did not identify the hazard to occupants of the vessel being struck by a commercial vessel while moored alongside. The only mitigation measure within the risk assessment, was the limit imposed by CHC, that rafts of yachts were not to extend more than 20m away from the pontoon. Although Cowes Yacht Haven did not have any formal risk assessments, it also observed the CHC limitation on rafts of yachts. Neither marina operator imposed restrictions on sleeping on board yachts berthed on the channel side of the pontoons. Each relied on the risk mitigation imposed by CHC, or operational practices implemented by the management systems of commercial vessels, none of which were within the marina operators' control.

In certain circumstances yachts offer very little protection to the people sleeping below deck. They are often quite cramped, have limited and constrained exits, and smaller craft often have little or no watertight subdivision. Most are fabricated from glass reinforced plastic, which offers little protection if hit by a much larger, heavy steel commercial vessel, such as *Red Falcon*.

Those yachts moored inside the pontoons within a marina will be protected to some degree by the pontoons themselves and their steel securing piles. Marina operators should ensure that wherever possible, yachts are moored inside the pontoons.

Where it is not possible, crews of yachts on outer moorings and those rafted alongside, should be made aware of the potential hazards and be discouraged from sleeping on board given the risk of collision from shipping in the main channel.

Within Cowes Harbour, yachts on swinging moorings close to the main channel have been hit by commercial craft, but because they can move around their mooring, historically, this has mainly resulted in only minor damage.

As demonstrated by this accident, it is entirely feasible for a ferry to lose control when piloting through Cowes Harbour, either through human error, restricted visibility or a mechanical failure. Given the tight confines of the harbour, the margins to recover from such situations are relatively small and, therefore, would indicate that a further review of CHC risk assessments is required to ensure adequate control measures are in place.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. The collision and grounding occurred because the master became disorientated in the fog and inadvertently drove the ferry in the wrong direction. [2.2, 2.6]

2. The helmsman was inexperienced at steering the vessel into Cowes Harbour and was insufficiently practised at steering by digital compass alone. [2.4]

3. When the master took over operating the controls, the oversight of operations was lost, the members of the bridge team started to act in isolation and did not adequately support the master. [2.5.1]

4. The ergonomic layout of the navigation equipment did not support single person operation of the ship's controls from the side of the console. [2.5.2]

5. With no visual references the master experienced significant difficulty in controlling *Red Falcon* and was fortunate not to hit the marina wall, yachts or navigation marks in the vicinity. [2.5.3]

6. The master fixated on the ECS and VSP controls due to high task load and levels of stress. This, compounded by the lack of visibility and the breakdown of bridge team support resulted in him becoming disorientated. [2.5.4]

7. The electronic chart system relied on a manual switch to provide heading information, which was not operated by the master as he rushed between the Cowes and Southampton ends. [2.6]

8. The master became focused on the ECS and used the information displayed to drive his decision-making. The erroneous head ing information being displayed supported the master's belief that he was driving *Red Falcon* back into the channel. [2.6]

9. The actions of the master and the lack of communications of his intent, resulted in the bridge team becoming disengaged, and not supporting the master adequately. [2.7]

10. A rapid deterioration in visibility in the harbour after a ferry had entered the channel was unusual, but not unforeseeable. Emergency training for such a scenario would have helped ensure that all members of the bridge team were familiar with and practised in their respective roles, and able to react quickly when the need arose. [2.7]

3.2 OTHER SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT[7]

1. The inherent limited directional stability of *Red Falcon*'s hull form, coupled with tidal stream effects, master's frequent course orders, and the lack of visual references, led to the helmsman struggling to maintain the ship's heading. [2.4]

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[7] These safety issues identify lessons to be learned. They do not merit a safety recommendation based on this investigation alone. However, they may be used for analysing trends in marine accidents or in support of a future safety recommendation.

2. The poor visibility removed the visual confirmation of the vessel's position and orientation, causing the master to rely on instrumentation and greater input from the bridge team. [2.5.4]

3. The C/O became confused, mentally rejected the picture displayed by the radar and believed the ECS display instead. In the circumstances, he did not have sufficient time to re-evaluate the ferry's position, and, therefore, did not challenge the master's actions. [2.6]

4. The lookouts, helmsman and C/O had been involved in recent incidents that might have affected their confidence. The C/O had only just returned to work following suspension, and had little experience working with the master, who was acting in a temporary role. [2.8]

3.3 SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. The blind pilotage training records did not identify the roles undertaken by any of the three deck crew during the periods of training. [2.8]

2. The roles of individual bridge team members were not sufficiently detailed within the company's reduced visibility procedures. [2.8]

3. Cowes Yacht Haven did not have a comprehensive suite of risk assessments that included the hazard of collision between commercial vessels and raft of yachts on its outer pontoons. [2.9]

4. The hazard to people sleeping on yachts in Cowes Harbour had not been sufficiently considered, documented or mitigated within risk assessments produced by Cowes Harbour Commission, Shepards Wharf Marina or Cowes Yacht Haven. [2.9]

SECTION 4 - ACTION TAKEN

4.1 ACTIONS TAKEN BY THE MAIB

The MAIB has contracted Greenstreet Berman Ltd to undertake an ergonomic assessment of the equipment and control layout of the wheelhouse on board *Red Falcon*, and a human factors study of the actions and activities undertaken by the staff involved in the accident. Parts of the Greenstreet Berman report have provided a basis for some of the analysis contained within Section 2 of this report.

4.2 ACTIONS TAKEN BY OTHER ORGANISATIONS

Red Funnel has:

- Undertaken its own internal investigation and has shared its report findings with Cowes Harbour Commission.

- Implemented a new navigation procedure, which includes assessment of helmsman competence, regular frequent practice steering through Cowes Harbour and regular practice at steering by compass alone.

- Amended its blind pilotage routine to include rotation of ratings' duties and more accurate detailed recording of drill composition within its training management system.

- Reviewed the content of its bridge resource management training programme, increased its length to 2 days, included emergency scenarios and has involved deck officers, engineers and ratings.

- Commenced regular navigation assessments of vessel operations, which includes the implementation of resource management techniques. In addition, several shore management team members have undertaken navigation assessment training.

- Included ratings and engineers in company crew resource management training.

- Joined an industry crew resource management group at the United Kingdom Chamber of Shipping for the purpose of developing and implementing best practice.

- Amended the company ship-handling training for C/Os, to include aspects of anticipated vessel operations and the practising of emergency scenarios.

- Adjusted the positioning of the radar units on all 'Raptor' class vessels so that they are more visible to the person conning the vessel from the side of the forward and aft manoeuvring consoles.

- Installed voice recording capability to the wheelhouse of all 'Raptor' class vessels.

Cowes Harbour Commission has:

- Undertaken its own investigation and shared its report findings with Red Funnel.
- Issued a temporary General Direction to mariners for movements in periods of restricted visibility.
- Reviewed its risk assessments and produced a new assessment for '*Red Funnel raptors being set out of the fairway in restricted visibility due to a potentially strong cross current in the Inner fairway*'.
- Reviewed its safety management plan and its emergency response plan for adequacy.
- Reviewed its aids to navigation, including buoyage, tidal stream indicators and visibility monitors.
- Included local marina operators in its safety committee & forum.

SECTION 5 - RECOMMENDATIONS

Red Funnel is recommended to:

2020/110 Conduct regular assessment of ship-handling capabilities of masters and C/Os, not limited solely to normal operational routines of berthing and unberthing, including pilotage by instruments alone.

2020/111 Review the method of determining the orientation of the vessel displayed on the ship's electronic chart system, to ensure that the system is not solely reliant on the operation of a toggle switch, and that there is a method of positive confirmation of the orientation displayed at each manoeuvring console.

Cowes Harbour Commission is recommended to:

2020/112 Review its risk assessment for collision between a commercial vessel and raft of yachts moored at Shepards Wharf Marina, to provide more clarity on mitigating measures that can be controlled by Cowes Harbour Commission.

Cowes Yacht Haven is recommended to:

2020/113 Produce a comprehensive risk assessment of the risk of a collision between a commercial vessel and raft of yachts moored at Cowes Yacht Haven Marina, detailing the mitigating measures that can be controlled by Cowes Yacht Haven.

Safety recommendations shall in no case create a presumption of blame or liability

Marine Accident Report

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