Report on the investigation of

Red Falcon's

contact with the linkspan at

Town Quay, Southampton

10 March 2006

Marine Accident Investigation Branch
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Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 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

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AB	-	Able Bodied Seaman
ISM	-	International Safety Management (Code)
LNTM	-	Local Notice to Mariners
OBSO	-	On Board Services Officer
Pitch	-	The blade angle setting on the Voith Schneider propellers
Ro-ro	-	Roll On, Roll Off
rpm	-	revolutions per minute
SMS	-	Safety Management System
UTC	-	Universal Co-ordinated Time
VTS	-	Vessel Traffic Services

SYNOPSIS

All times: UTC

At 1558 on 10 March 2006, the ro-ro passenger-vehicle ferry *Red Falcon* made heavy contact with the linkspan at Town Quay, Southampton. Eleven people - 8 passengers and 3 Red Funnel employees were injured as a result of the accident, and some of the vehicles on board were damaged.

Red Falcon, owned and operated by the Red Funnel Group, was permanently engaged on the route between Southampton and East Cowes, Isle of Wight. The vessel was designed and built specifically for the route in 1994 and, with two other nearly identical ferries, operated a 24 hour, year round, schedule.

The vessel was powered by two engines which each drove a five bladed Voith Schneider propulsion unit, one of which was located forward and one aft on the centreline of the vessel. The vessel was normally operated with the Voith units synchronised at circa 80% loading.

Two days before the accident, a loose securing bolt was discovered on the charge air cooler of the aft engine, and further loose bolts were subsequently found. The company's engineering superintendent made the decision that it was safe to continue to run the engine, on reduced power as necessary, until it was operationally convenient to undertake a permanent repair.

On 10 March 2006, *Red Falcon* departed from East Cowes at 1500 (5 minutes behind schedule), with 130 passengers and 65 vehicles on board for the passage to Southampton.

The master had the conduct of the vessel for departure from Cowes for which the Voith Schneider units were synchronised. However, once clear of the Cowes fairway, the master elected to desynchronise the Voith Schneider units, which meant that both units were operating but had to be controlled independently.

This decision enabled the forward engine to be run at full power while the aft engine could be run at reduced power as per the engineer's requirements. In this configuration, the master expected to be able to make the maximum speed for the passage and hopefully to make up some of the lost time.

An AB was then placed on the wheel and the master advised him that, with one of the engines operating on reduced power, more helm than normal may be needed to keep the vessel on course. The master, as was usual, remained on the bridge throughout the passage.

The chief officer came to the bridge as the vessel entered Southampton Water, and he took over the steering from the AB. He also took over the conduct of the vessel at that point. He was not informed that the Voith units were desynchronised.

As the vessel approached Town Quay, the chief officer began to reduce speed by adjusting the pitch setting on, what he believed to be, both of the Voith units. In fact he was only adjusting the pitch of the aft unit, and failed to notice that the forward unit was still operating at full power. Thus, although the vessel's speed reduced slightly, she continued to approach the linkspan at a much higher speed than usual.

With *Red Falcon* very close to the linkspan, the chief officer informed the master that the speed was not reducing as expected, whereupon the master suddenly remembered that the propulsion units were desynchronised. The master quickly put the units back into synchronisation, but not before contact with the linkspan occurred.

After the impact, the master took over the conduct of the vessel and positioned her to permit access by the emergency services.

The MAIB investigation has identified a number of key safety issues, including:

- The unnecessary risks associated with operating with the propulsion units desynchronised;
- Inadequate indication for operating in the desynchronised mode;
- Ineffective bridge handover procedures;
- The need for a safe speed of approach to Town Quay.

Actions taken by the Red Funnel Group and the Southampton Harbour Authority should prevent a recurrence of this accident.

Figure 1

Red Falcon detailing Voith Schneider propeller blades

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *RED FALCON* AND ACCIDENT

Vessel details		***Red Falcon***
Registered owner	:	Southampton Isle of Wight and South of England Royal Mail Steam Packet Company Ltd
Manager(s)	:	Southampton Isle of Wight and South of England Royal Mail Steam Packet Company Ltd
Port of registry	:	Southampton
Flag	:	British
Type	:	Ro-ro passenger vehicle
Built	:	1994, Ferguson Shipbuilders
Classification society	:	Lloyd's Register (for construction only)
Construction	:	Steel
Length overall	:	93.22
Gross tonnage	:	3953
Engine type and power	:	2 x Stork-Wartsila FHD 240G, each developing 1360Kw @ 750rpm
Service speed	:	14 knots
Other relevant info	:	2 x Voith Schneider propulsion units.

Accident details		
Time and date	:	1558 UTC, 10 March 2006
Location of incident	:	Town Quay, Southampton
Persons on board	:	130 passengers, 16 crew plus 9 supernumeraries
Injuries/fatalities	:	11 persons injured – none serious
Damage	:	Material damage to vessel and linkspan

1.2 BACKGROUND INFORMATION

Red Falcon **(Figure 1)** was built at Ferguson Shipbuilders and delivered to Red Funnel in March 1994, specifically to operate on the Southampton to Cowes route. She was one of three identical "Raptor Class" vessels ordered by Red Funnel.

The vessel was designed to be double ended, ie she could load and discharge vehicles at both ends. This avoided the need to turn the vessel during the passage, and thus ensured maximum operational efficiency.

When the vessel was first introduced onto the service, the advertised passage time was 1 hour, but this has since been reduced to 55 minutes.

In common with many other double ended ferries built around that time for operations around the coast of the UK, *Red Falcon* was fitted with 2 Voith Schneider units, one forward, one aft; each unit being shaft-driven by its own engine. The two propulsion units were designed to be synchronously operated under normal operating conditions, with the option to desynchronise them in special situations.

The vessel commenced service on the route in March 1994.

In March 2004, in a programme involving all three sister vessels, *Red Falcon* was lengthened by some 10 metres and an additional, fixed, car deck was added. This increased vehicle capacity by 60 to 200 cars equivalent.

1.3 NARRATIVE

All times: UTC

1.3.1 Events prior to the incident

Red Funnel ferries were being operated on their winter schedule due to the annual refits that were being carried out on the three Raptor class ferries. During the refit period, only two ferries were in use as each one was taken out of service for its refit.

Red Falcon returned to service from her refit in Falmouth 5 weeks before the incident. During the refit, the main engines had undergone a 24000 hour service which included removal, overhaul and refitting of the charge air coolers by contractors.

On 7 March 2006, during a routine inspection of *Red Falcon'*s aft engine, the night shift duty engineers noted that one of the tie bolts on the charge air cooler had slackened. The engineers were unable to retighten it.

The following day, the relieving, morning shift, duty chief engineer was told of the slack tie bolt. He carried out a further inspection and found four other tie bolts had slackened and could not be re-tightened. He contacted the company engineering superintendent and asked the superintendent to visit the vessel. The superintendent brought an engineering contractor to the vessel to consider repair options. The only repair option originally considered possible was later dismissed when the contractor found that the support brackets had moved and the bolt holes no longer lined up. The superintendent requested the ship board engineers to monitor the condition of the cooler. The superintendent advised Red Funnel's senior management that a full repair, including removal and refitting of the cooler, would take about 12 hours, and suggested that this could be done during a vessel layover in the next few days.

The chief engineer subsequently agreed with the master to run the aft engine at a limited speed (button 3) [section 1.8.1 refers] during the crossings, and this continued in to the following day (9 March). Regular inspections of the aft engine air cooler were carried out by the vessel's engineers, without any further problems being found.

On 10 March, during the regular inspection of the charge air cooler, the early morning shift duty chief engineer found that three bolts securing the bottom flange to the cooler housing had failed. This resulted in failure of a section of jointing between the flange and housing. A temporary repair was made using silicon sealant to replace the failed jointing, and a sash cramp was used to prevent further movement between the flange and the housing.

The relieving chief engineer on the day shift discussed the cooler problem with the master, and they agreed to further limit the engine load, and thus the charge air pressure within the cooler. They decided to continue with the button 3 setting for the aft engine, with a maximum pitch on the associated (aft) Voith unit of 90%.

Three crossings were made without any further engine problems occurring; however, as only two ferries were operating on the route, and several crossings had been relatively busy, *Red Falcon* began to fall behind schedule. When the relieving master and chief officer joined in Southampton at 1322, the vessel was running approximately 10 minutes behind schedule.

The relieving master spoke to the chief engineer and asked if the aft engine could be run at full speed on the crossing to Cowes in order to make up some of the lost time on the schedule. He explained that it would not be under excessive load as it was not the steering unit for that crossing. Additionally, there were favourable environmental conditions for the passage, ie a following wind and slack tides. The chief engineer agreed that the maximum setting could be used. However, the engine would be monitored continuously, and any deterioration in the condition of the air cooler would require a reduction in the engine load. *Red Falcon* sailed from Southampton at 1348 with both engines synchronised and, as agreed, these were operated at the button 3 setting for the passage to Cowes.

1.3.2 The incident

At 1442 on 10 March 2006, *Red Falcon* arrived at Red Funnel's East Cowes Ferry terminal, where 130 passengers and 65 vehicles boarded for the passage to Town Quay, Southampton.

The vessel sailed at 1500, having been scheduled to depart at 1455.The master was at the controls for departure, the chief officer and an AB came to the bridge once they had completed their mooring and car deck duties.

The master elected to leave the Voith Schneider propulsion units in synchronisation for departure from Cowes.

The chief officer recorded the passenger figures in the bridge logbook and reported them to Southampton VTS on VHF in the normal manner. He then left the bridge.

The master remained at the controls, with the Voith Schneider units synchronised, until the vessel was clear of the Cowes fairway. Once clear of the harbour, the master increased the vessel's speed and elected to desynchronise the Voith Schneider units

in order to achieve the best possible speed for the passage to Southampton. This decision was made because of the advice to operate one of the engines at reduced power and due to the fact that the vessel, which was already 5 minutes behind schedule on departing Cowes, would be proceeding into a strong head wind on passage to Southampton.

The master then set up the engine and propulsion controls with the forward engine at full power, and the forward propulsion unit at 100% longitudinal ahead pitch, while the aft engine was set on button 3 with the aft propulsion unit at 90% ahead pitch.

The master desynchronised the Voith Schneider units from the forward centre control panel and silenced the audible alarm, which had sounded to indicate the units were now desynchronised. The master silenced this alarm by turning a key which was permanently located on the panel. There were four identical control panels on the bridge, each fitted with an audible alarm which sounded when the propulsion units were desynchronised **(Figure 2)**. On this occasion, the alarm on the centre forward panel was the only one to sound because the alarms on the other three panels had previously been isolated with the key switch.

Figure 2

Centre control panel

With the propulsion units now desynchronised, the master instructed the AB to take over the steering of the vessel at the centre forward console. *Red Falcon* was then steered by applying transverse thrust as required to the aft propulsion unit, **(Figure 2)**. The master advised the AB that more 'wheel' than normal might be required to keep the vessel on course, as the aft engine was not operating on full power. The AB was already aware that one of the engines was being operated at reduced power because he had joined the vessel at 0500 that day, and the previous master had advised him of this when he had steered the vessel during earlier passages.

Southampton VTS had advised the master that there were no significant shipping movements expected in the area for the passage to Southampton. As the vessel could expect a reasonably clear passage, the master was content that operating her with the Voith Schneider units desynchronised, was a safe option for this particular passage.

At an early stage of the passage, a group of nine trainee passenger services staff, who were on a familiarisation visit to the vessel, visited the bridge accompanied by an OBSO training officer. They remained on the bridge for about 10 to 15 minutes, during which time the master gave them a brief description of the vessel and its operation. The group left the bridge before the vessel rounded the Calshot Spit at approximately 1520.

At 1530, *Red Falcon* reached the mid point of the passage as the vessel entered Southampton Water and, with 30 minutes of the voyage to run **(Figure 3)**, the chief officer returned to the bridge and took over the steering from the AB. The AB advised him that the vessel was taking slightly more wheel than usual and then went below, leaving the chief officer and master on the bridge.

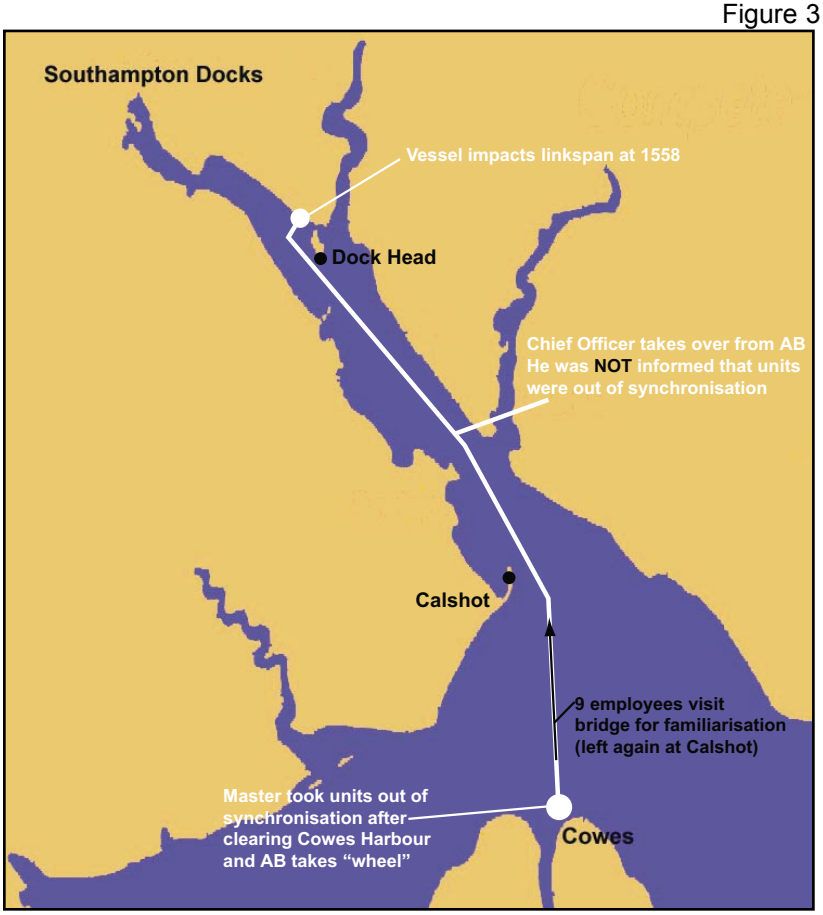
At this time, the chief officer also took over the conduct of the vessel, in accordance with the division of workload previously agreed between the master and chief officer. This was consistent with the way in which they had operated during their previous 12 months together on board. They would share the number of berthing operations undertaken during their shift. No formal handover took place on this occasion; the master remained on the bridge for the remainder of the passage in accordance with their normal practice.

Red Falcon passed Dock Head at 1552 **(Figure 4)**, at a speed of 11.6 knots; the chief officer, who was at the centre control console, started to reduce speed as the vessel approached the eastern end of Town Quay. As the chief officer had the conduct of the vessel, the master assumed a support role and took on the radio and lookout duties.

At 1556, with *Red Falcon* now level with the seaward end of Town Quay, the chief officer wound back the upper of the 2 wheels on the side of the console to select approximately 50% ahead pitch, on what he believed to be both the forward and aft Voith propulsion units. He then moved the control position to the starboard bridge wing console. The master also went to the starboard side and stood inboard of the console to pass radio messages, as required, to the crew, who were now at mooring stations and to assist the chief officer, as required.

At 1557, with the vessel at the mid-point of Town Quay and proceeding at almost 9 knots, the chief officer reduced the pitch to 30% ahead and, shortly after that, to 0%. In normal circumstances, had the units been synchronised, this action would have significantly reduced the vessel's speed.

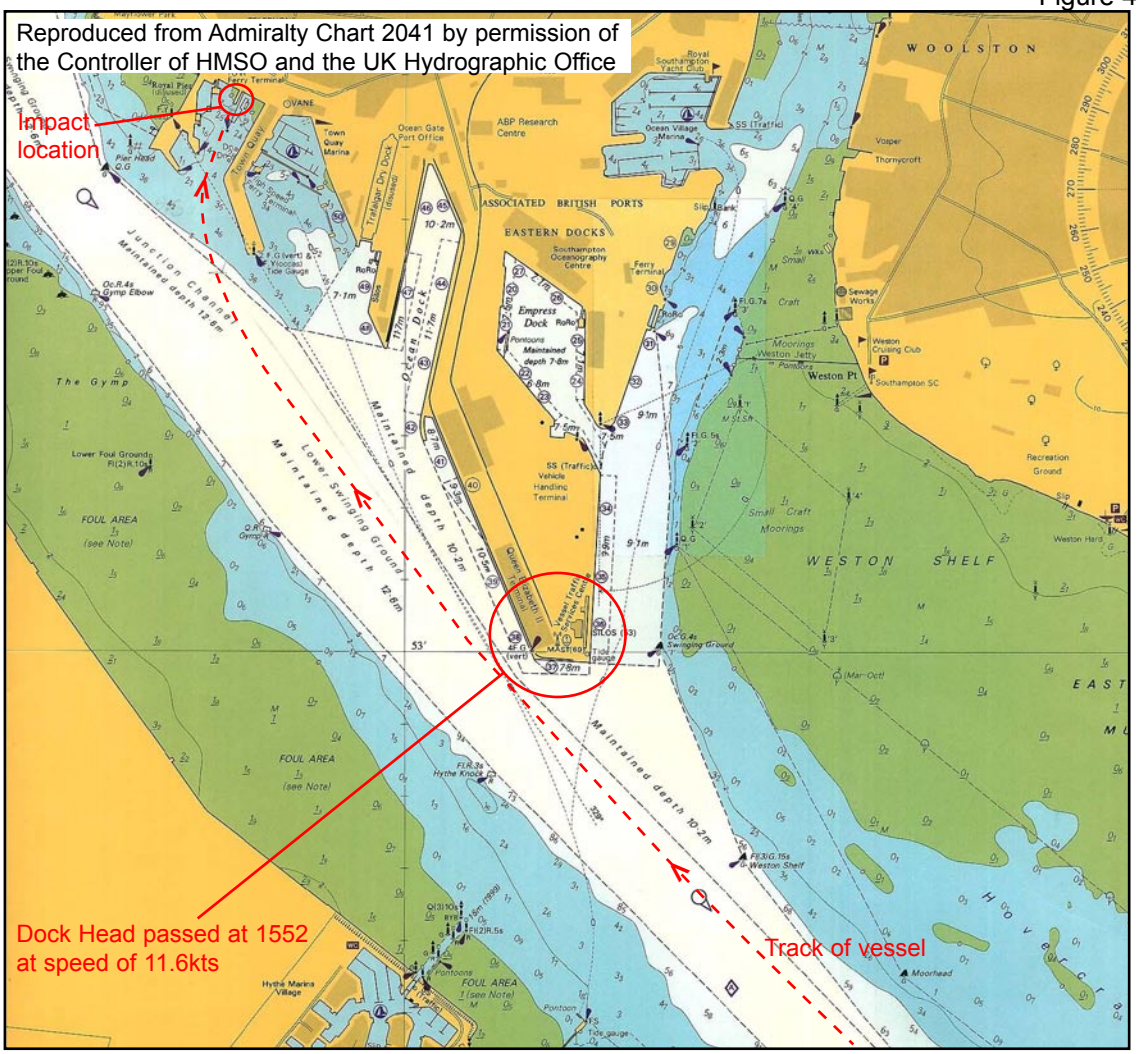
Figure 3



Departure Cowes:
Scheduled: 1455
Actual 1500
(Units in sychronisation for departure)
130 passengers, 15 crew

Chart of route - Cowes to Southampton 10th March 2006

Figure 4



However, as he wound back the upper control wheel, with the units desynchronised, the chief officer was in fact only reducing the pitch on the aft Voith Schneider unit **(Figure 5)**. He failed to notice that the forward unit remained at 100% ahead pitch at full power. As normal, he attempted to adjust the approach of the vessel to the linkspan by visual reference to the approaching berth and marks on Town Quay, and was not, at that time, actively looking at the various dials on the console.

The chief officer next selected 40% astern pitch and altered the vessel's course to starboard to approach the linkspan. He quickly attempted to increase the astern pitch to 90% as he realised that her speed was not reducing. At this time, with the vessel approximately 100 metres from the linkspan and making more than 8 knots, the chief officer informed the master that she was not slowing down as expected.

The master then realised why *Red Falcon* was not slowing down, and attempted to synchronise the units from the starboard console. However, he quickly realised that he would only be able to synchronise the units at the centre console, as this was the console from which he had desynchronised them. As he rushed across to the centre

Figure 5

Starboard console

console, he made a radio call alerting the crew to move away from the forward mooring area. The master synchronised the units and reduced the rpm of both engines just as the contact occurred.

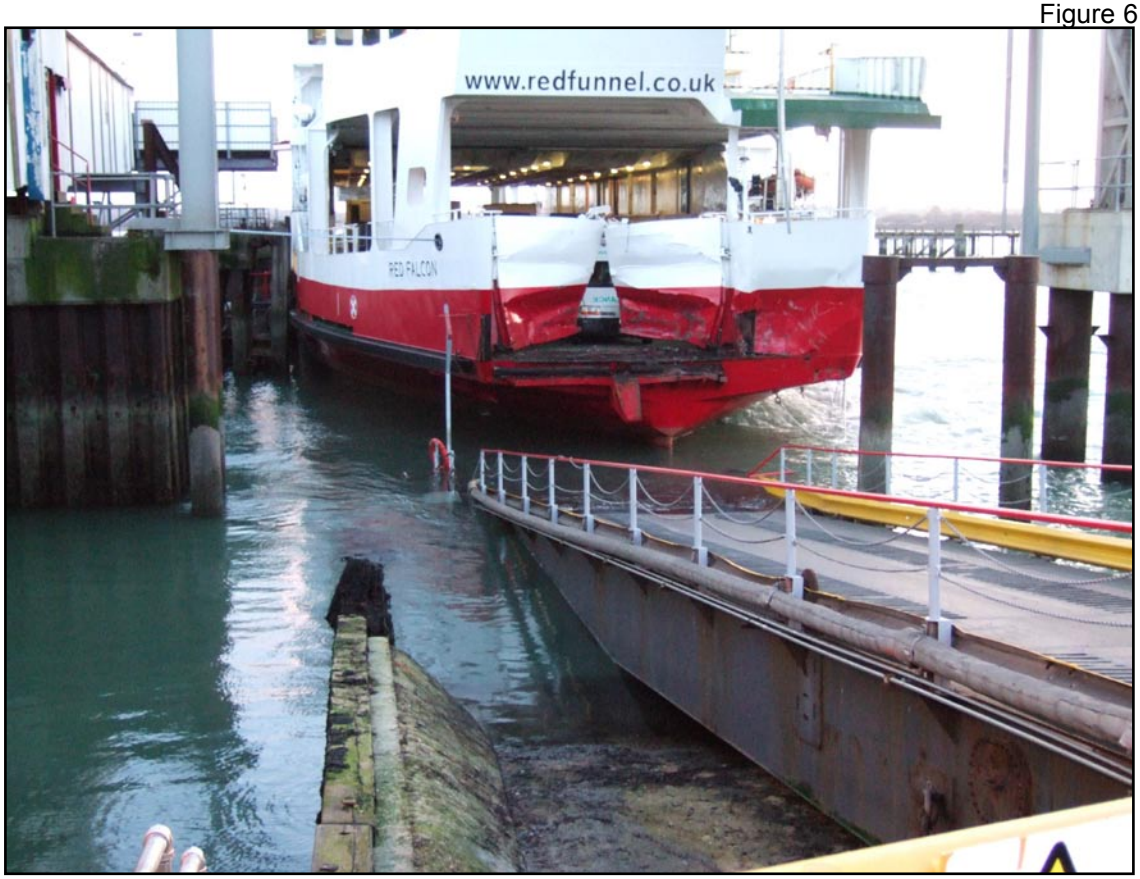
As the master was moving back to the centre console, the chief officer, now realising that impact was inevitable, aligned the vessel to ensure that she struck the linkspan end-on. He did this to reduce the likelihood of the vessel slewing on impact, and possibly causing even more damage that would increase the risk of compromising the vessel's watertight integrity.

At 1558 *Red Falcon* made heavy contact with the linkspan. The master then contacted the OBSO by radio to determine whether there had been any injuries to the passengers. He also requested information on the vessel's condition.

The chief officer continued to operate the controls, with the units synchronised, to keep *Red Falcon* in a position just off the berth. The master then took over the con and manoeuvred the vessel alongside the berth so that the shore gangway could be rigged to allow members of the emergency services and Red Funnel's shore based management team to board.

Red Falcon was later manoeuvred into a position to facilitate the unloading of the vehicles from the upper car deck. As a result of the damage caused to the linkspan, the vehicles on the lower car deck could not be discharged at Town Quay. Several hours later, the vessel was moved to another linkspan in Southampton docks so that her damaged bow gates could be removed **(Figure 6)**, which allowed the discharge of the vehicles from the vessel's lower car deck.

Figure 6



Red Falcon's damaged bow area

1.4 PASSENGER FEEDBACK

Passenger feedback differed as to how well they were kept informed of the situation during the period immediately following the impact. Passengers who had cars on the upper car deck were not as aware of the situation as the passengers in other parts of the ship.

Some passengers reported that they were allowed to wander freely into the forward area of the vessel which had suffered damage as a result of the impact. However, in general, the passengers considered they were kept reasonably well informed by ship's staff.

Once the emergency services and the Red Funnel shore staff boarded *Red Falcon*, the situation was quickly and efficiently brought under control and the passengers were generally very satisfied with the handling of this stage of the incident.

1.5 ENVIRONMENTAL CONDITIONS

Wind: WNW Force 5

Tide: Low Water 1359, 1.80m Neap Tides
High Water 2041, 3.8m

Weather : Cloudy and Fine with Good visibility

1.6 BRIDGE TEAM, *RED FALCON*

1.6.1 Master

The master held a Class 1 Certificate of Competency. He had over 40 years of experience at sea and had joined Red Funnel in 1981. He had been promoted to master in 1992 and had been master of *Red Falcon* since 1994. He held Pilotage Exemption Certificates for both Cowes and Southampton.

1.6.2 Chief officer

The chief officer held a Class 1 Certificate of Competency and had worked at sea for over 40 years. He had joined Red Funnel in 2003, having previously served as master on foreign-going vessels for 16 years. He had spent all his time with the company on the ro-ro vessels, and had been chief officer on board *Red Falcon* for 20 months. He had served with the master for the preceding 12 months.

1.6.3 General comment

The master and chief officer had sailed together on board *Red Falcon* for approximately 12 months, and each had confidence in the other's abilities. They had known each other previously because they both worked for the same company as apprentices. They had developed a working routine which resulted in the workload being equitably shared during berthing operations.

1.7 WORK PATTERNS

The master and chief officer worked the same shift pattern. The shifts were divided into 3 shifts per 24 hours, with 3 sets of officers (masters and chief officers) working 4 days on, then 2 days off, in the following rotation:

AM: 0445 to 1310 and 0610 to 1430

PM: 1300 to 2130 and 1420 to 2300

Nights: 2115 to 0625 and 2245 to 0500

The shifts were worked such that each officer undertook 4 AM shifts, alternating start times between 0445 and 0610, and then took 2 days off. On return, the officer would work 4 night shifts, alternating starts between 2115 and 2245, followed by 2 days off. On return, the officer would work 4 PM shifts, with alternating start times of 1300 and 1420, after which he would take 2 days off.

The pattern then started again, with the officer working 4 AM shifts.

On the day of the accident, the master and chief officer had begun their second PM shift, having been ready to embark the vessel at 1300, although they in fact boarded at 1322.

They had both left the vessel the previous evening at 2300, had returned to their respective homes and each had had a good night's sleep.

1.8 MAIN PROPULSION MACHINERY

1.8.1 General description

Red Falcon was fitted with two Stork-Wartsila FHD240G, turbo charged and intercooled, eight cylinder diesel engines **(Figure 7)**, which provided propulsion power only, via propeller shafts to the Voith Schneider units. Electrical power generation on board was provided by three auxiliary diesel engines.

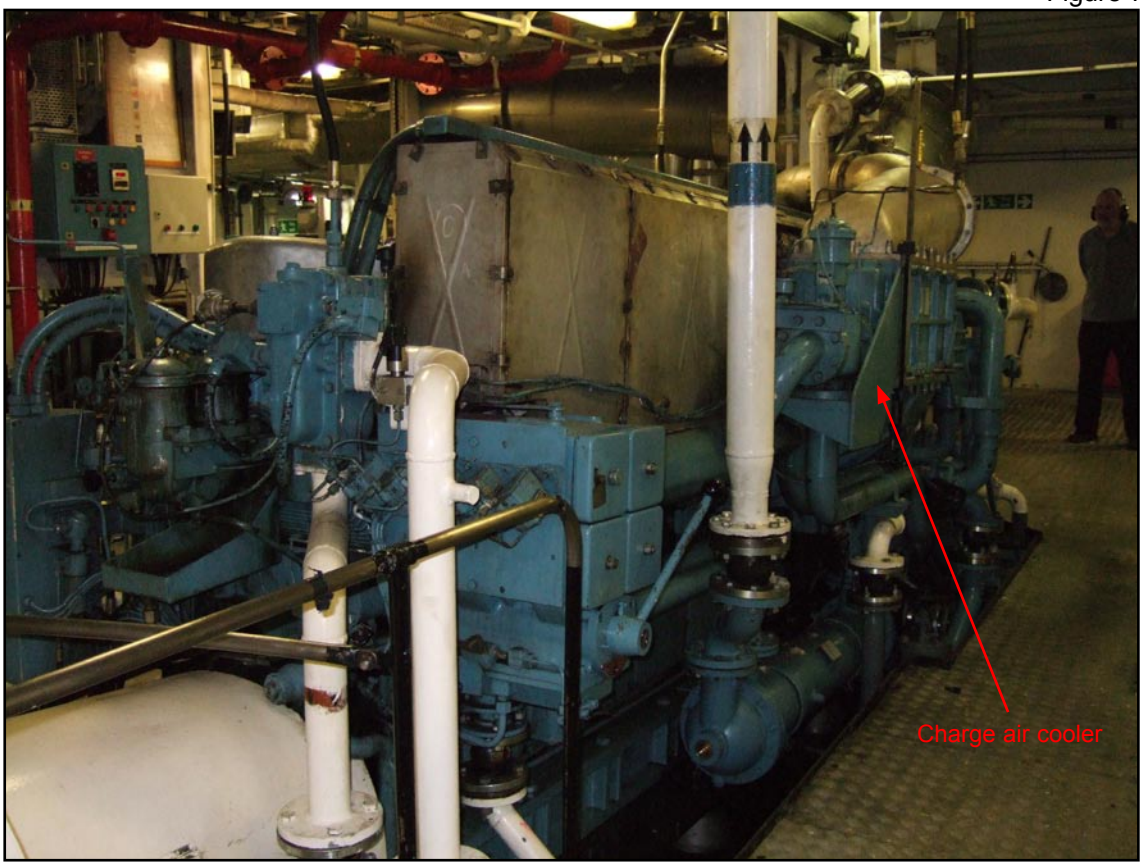
As the Voith Schneider units were normally run synchronised, the engines were therefore usually run at the same speed. Four engine speeds were available for use by the bridge officers, although only two were used regularly. These being low speed (button 1, approximately 20%) used while alongside, and intermediate speed (button 3, approximately 80% at 715 rpm) used during transit of the Solent. Full speed (button 4, 100% at 760 rpm) was available if necessary and would be used, for example, if the vessel was running behind schedule during busy periods.

Although the engines were normally run at the same speed, their respective loads would be different because the engine that was providing both propulsion and steering would have a higher load.

1.8.2 Charge air cooler

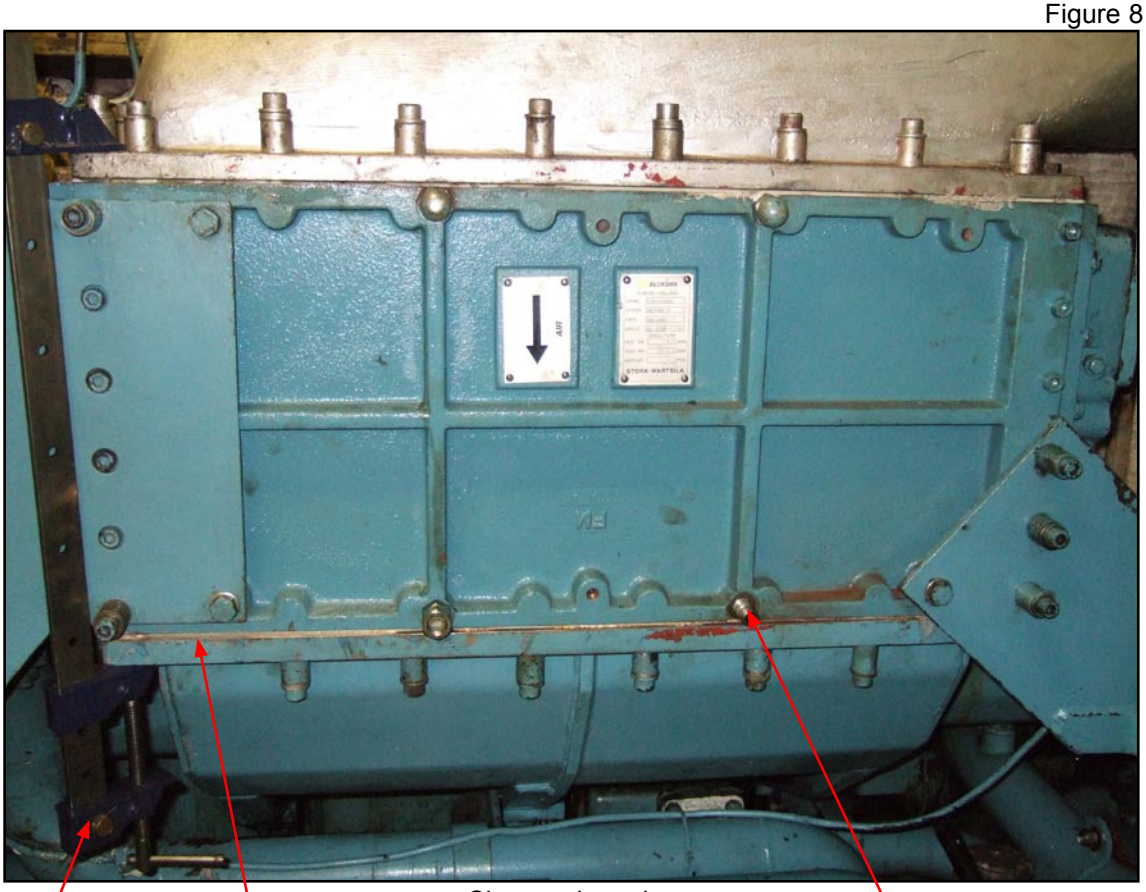
Each engine was fitted with a charge air cooler **(Figure 8)** with air flowing from the turbocharger outlet casing at the top to the air manifold below. Low temperature jacket cooling water was piped through the cooler to reduce the charge air temperature prior to it entering the cylinders. Each cooler weighed approximately 400kg. Red Funnel maintained a large inventory of spares, which included a complete spare cooler.

Figure 7



Aft main engine

Figure 8



Charge air cooler

The cooler was connected to the inlet casing (from the turbocharger) with studs on the flange ends and bolts along the outer flange. On the inner flange of the cooler were eight through bolts (tie bolts) roughly 425mm in length which were screwed in to two backing plates (support brackets). The backing plates were attached to the entablature which was situated below the air cooler outlet flange. Each of the backing plates had four threaded holes to accept the through bolts. When tightened, the through bolts had the effect of clamping the upper flange, the air cooler and the lower flange together.

1.9 VOITH SCHNEIDER PROPULSION

1.9.1 General description **(Figure 9)**

Voith Schneider propulsion combines both propulsion and steering requirements in one unit, and makes additional active and passive manoeuvring devices unnecessary as the same amount of thrust can be generated in any direction. Their application on double-ended ferries also precludes the need to turn the vessel prior to berthing.

The design comprises a rotor casing, which ends flush with the ship's bottom, and is fitted with a number of aerofoil shaped blades which protrude vertically down through the bottom of the casing. They are parallel with the axis of the rotor casing, and each blade can partially rotate around its vertical axis to generate thrust between 0% and 100%, in any direction, as the rotor rotates around its central vertical axis.

Photograph courtesy of Red Funnel

Figure 9

Voith Schneider propulsion unit

The two units on *Red Falcon* were individually shaft-driven from the two diesel main engines to deliver the rotor speed, and were hydraulically operated to control the blade pitch. Rotor speed and blade pitch were controlled from the bridge consoles. Pitch could also be controlled locally in the Voith Schneider machinery spaces in an emergency.

The four bridge consoles on *Red Falcon*, one each fore and aft, and one on each bridge wing were, essentially, identical, and control of the Voith Schneider units could be taken at any console at any time.

Each console had four hand wheels **(Figures 2 and 5)**, two on the top, which provided the steering input (transverse pitch component) for each unit, and two on the console side, which provided the longitudinal pitch component. On the top of the console were four associated analogue dials, two to indicate blade pitch and, therefore, thrust, and two to indicate the direction of thrust.

The consoles also housed the synchronisation/out of synchronisation switch, green and red indicator lights for the switch, an associated out of synchronisation buzzer and a buzzer cancellation key switch. Other controls on the console were for engine speed and overload warning, and communications equipment **(Figures 10a and 10b)**.

1.9.2 Synchronisation

On vessels equipped with multiple Voith Schneider units, the units are normally operated synchronised with respect to the thrust generated ahead and astern. Usually, on passage, only one unit is used to provide transverse thrust for steering purposes and, in the case of *Red Falcon*, the after propulsion unit was used for this purpose.

The synchronisation system, as fitted to the fleet, can be switched on or off at any of the wheelhouse consoles so that the blade pitch component for each Voith unit can be operated independently, both in terms of vessel speed or steering.

The original fitment on *Red Falcon* only included the synchronisation switch and a green indicator lamp, on each of the four consoles, to indicate whether or not the two units were synchronised. However, as a result of a similar incident in 1994, a warning buzzer and red indicator lamp were fitted on each console to warn the operator when the units were desynchronised.

In the normal, synchronised, mode, the two longitudinal component hand wheels are connected so that only one needs to be operated to control the combined thrust of the Voith Schneider units. Additionally, only one top wheel has to be operated in order to adjust the steering for the aft unit (depending on which end of the vessel is aft for that particular passage). Thus, only two of the four hand wheels are normally in use at any time.

When the Voith Schneider units are synchronised, the green lamps on the consoles will remain lit, the red lamps are unlit and the buzzer silent. When desynchronised, the illumination of the lamps changes and the buzzer sounds. The buzzer will sound on each console and has to be cancelled at each console with a key switch. However, the synchronisation switch position will only indicate that it is off at the console at which

Figure 10a

Control console showing synchronisation switch and alarms

Figure 10b

Control console showing pitch indicators

desynchronisation was selected. Thus, at the other consoles, the switch will remain in the “on” position to indicate that the units are synchronised when, in fact, they are not. The red light, indicating that the units are desynchronised, will be illuminated on all the consoles.

1.9.3 Out of synchronisation tests

The three Red Funnel ferries are each taken out of service every third Saturday night/ Sunday morning on a rotational basis, so that only two ferries operate on a reduced service. Additionally, on a daily basis, when operating a three vessel service, one of the ferries is taken out of service from 2200 until the following early morning.

When the out of service vessel is re-started the following morning, the out of synchronisation alarms and indicators are tested.

As part of Red Funnel’s Safety Management System (SMS), the propulsion system was required to be tested out of synchronisation, as part of the bridge officers’ training procedures, every 3 months. This test entailed switching off the synchronisation and controlling the Voith units independently from the bridge during the passage. Guidance is provided within the SMS documentation on the need for a warning notice to be placed in a prominent position, for the chief officer to be informed, and for caution to be exercised when approaching or leaving berths with the units out of synchronisation.

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 PASSAGE FROM COWES TO SOUTHAMPTON – SIGNIFICANT FACTORS

2.2.1 The decision to desynchronise the Voith Schneider propulsion units

The master took the decision to operate *Red Falcon* with the Voith Schneider units desynchronised to achieve the optimum speed for that passage, without overloading the aft main engine. He was aware that, with the wind against the vessel for the passage, she would be unable to make up time with the units synchronised. He wished to ensure that the vessel arrived as close as possible to the published schedule. This decision was taken independently by the master, and was not influenced by any commercial pressure from Red Funnel's management.

The master, who was very experienced, had operated with the Voith Schneider units out of synchronisation on only a handful of occasions in his 12 years on board the vessel. Thus, this was an extremely rare situation when compared to the very familiar routine established by the many thousands of passages he had made with the Voith Schneider units operating in the synchronised mode. In the event, it is unlikely that electing to desynchronise the units would have achieved much more than a 1 or 2 minute reduction in passage time.

During normal operation, there is no need to desynchronise the Voith Schneider units. In the light of this and the previous accident, Red Funnel should review the necessity for this mode of operation.

2.2.2 The master apparently forgetting the engines were desynchronised

When clear of Cowes harbour, the master placed the Voith Schneider units out of synchronisation and handed over the vessel's steering to an AB. Shortly after this, a group of newly appointed Red Funnel catering staff arrived on the bridge as part of a familiarisation visit they were making to the vessel. They remained for approximately 15 minutes, during which time the master explained aspects of the vessel's operation to them. It is possible that this distraction was a factor in the master subsequently forgetting that he had desynchronised the units. After they had left the bridge, in his mind, the master might have reverted to the very familiar synchronised routine operation.

2.2.3 Handover of the conduct of the vessel to the chief officer

When the chief officer took over the steering and conduct of *Red Falcon*, the only handover he received was from the AB, who advised him that the vessel needed slightly more steering than usual, and informed him about other vessels underway in the immediate vicinity. The content of this handover was consistent with the duties and responsibilities of the AB on the vessel, ie those of helmsman and lookout. The chief officer was not informed that the Voith Schneider units were desynchronised, and the AB could not have been expected to have been aware of this, or to have appreciated the significance of this information.

2.2.4 Speed of the vessel approaching Town Quay

As *Red Falcon* proceeded to the north of an imaginary line from Hythe Pier, through the Weston Shelf buoy to the Weston shore, she entered an area in which the Southampton harbourmaster required vessels not to exceed a speed over the ground of 6 knots without his permission (Southampton Harbour Byelaws 2003 7(1) (c) (i) refers). The vessel's speed at this time was 12 knots. The harbourmaster had not given the vessel, or the others on this route, specific permission to exceed the general speed limit, but it should be noted that these vessels have routinely operated through this area at speeds in excess of 6 knots for many years.

As *Red Falcon* approached Town Quay, her chief officer remained at the controls, it being part of their usual routine for him to conduct this berthing of the vessel.

As the vessel passed the outer end of Town Quay, the chief officer transferred the control to the starboard bridge wing console and began to reduce the forward pitch of what, he assumed to be, both the Voith Schneider units. In fact, with the units desynchronised, he was only reducing the pitch on one of the two units, while the other, forward unit, remained operating at full ahead pitch. The chief officer had routinely reduced the vessel's speed at this location in the past and was, at this stage, looking at the various visual marks on Town Quay, which he used to judge when to turn the vessel towards the linkspan.

2.2.5 Realisation by the chief officer that the engines were desynchronised

Even if the chief officer had glanced down at the console, he might not have immediately realised that the Voith Schneider units were desynchronised. The red desynchronised light would have been illuminated, but in daylight this is not clearly visible. Immediately beside it, the selector switch was suggesting that the units were synchronised. This switch is misleading, because although the units were in fact desynchronised, the selection had been made at the centre console, and therefore the switch at the starboard console remained in the usual synchronised position.

The forward Voith unit pitch dial would have shown that this unit was still at 100% ahead pitch, but as the chief officer transferred control position to the starboard bridge wing when the vessel was at the end of Town Quay, he was routinely used to making the final approach to the berth by reference to the visual marks on the quay, and to the berth itself, and did not usually refer to the instruments at this stage of the passage.

2.2.6 Absence of vessel speed information at the control position

There is no vessel speed information available to the operator when at the starboard console. If the chief officer had realised earlier that the vessel's speed was not reducing in the normal way, it is possible that the impact could have been prevented.

2.2.7 The final approach to the berth – lack of abort option

The chief officer turned *Red Falcon* to starboard when she was approximately 150 metres from the linkspan, and simultaneously applied astern pitch. At this point, he still failed to realise that he was controlling only one of the two Voith Schneider units. The fact that the vessel was routinely turned towards the berth, with considerable way on at this stage, was unsafe. It left the vessel with no option to abort the approach if anything went wrong, as it did on this occasion.

2.2.8 Post-impact passenger information broadcasts

Passenger feedback indicated that they had received inconsistent levels of information, depending on where they were located on the vessel at the time. It is possible that the positioning of loudspeakers on board might have been influential in this observation.

The master was unable to make a public address (PA) announcement in the immediate aftermath of the accident, because he did not wish to leave the controls. The PA broadcast position is in the central area of the bridge.

2.3 FATIGUE

Analysis of the hours worked by both the master and the chief officer, prior to the accident, do not indicate that fatigue played a role in this accident.

2.4 TRAINING IN DESYNCHRONISED OPERATION

The master had operated *Red Falcon* with the propulsion units desynchronised on only about 5 previous recorded occasions in his 12 years of service on board the vessel. In normal operation, there is no need to take them out of synchronisation.

The chief officer, who had been with Red Funnel for 3 years, had not previously operated or trained with the vessel's Voith Schneider units out of synchronisation. Red Funnel's training system requires that masters and chief officers practice operating in this mode every 3 months.

2.5 PREVIOUS ACCIDENT

In November 1994, *Red Falcon* struck the linkspan at Town Quay, resulting in minor injuries to two passengers. At the time of the impact, the propulsion units were out of synchronisation, but the master was under the impression that they were synchronised.

The MAIB investigated the accident and concluded that both human factors and design issues associated with the propulsion control equipment had contributed to the accident. Red Funnel subsequently fitted audible alarms to the control panels, and changed the colours of indicator lights on the panels such that the only red light on the panel was the out of synchronisation alarm. In view of the actions already taken by Red Funnel, the report made no specific recommendations.

On this occasion, the chief officer failed to notice that the red out of synchronisation light on the console was illuminated when he took over the controls. This demonstrates that, as a control measure, this is not a sufficiently robust method of alerting the operator that the Voith Schneider units are being operated out of synchronisation, especially as no warning notice had been displayed as required by the company's procedures.

Another control measure, the audible alarm, which was introduced after the previous accident, was also ineffective. In this case, the alarms on all four consoles had been silenced much earlier, when the units were placed out of synchronisation.

2.6 THE FAULT WITH THE CHARGE COOLER

After the accident with the linkspan, the MCA, as part of its investigation, required Red Funnel to remove the air cooler from the aft engine. Five of the eight tie bolts were found to have suffered thread damage where they would have attached to the supporting brackets, and which prevented them from being properly secured. This thread damage probably occurred either when the cooler was refitted during the previous refit, or sometime before. There are no records of similar incidents which could indicate a failure pattern or engine design defect. An investigation of why the bolts had suffered thread damage was not undertaken by Red Funnel to determine the cause.

Once the bolts had begun to fail, an inspection was quickly carried out by the technical superintendent and a marine engineering contractor. The original intention to use "Devcon", or some similar epoxy compound, to refit the bolts in to the support brackets, became unviable when the contractor discovered that the support brackets had moved. This information should have warned the superintendent and the shipboard engineers that a more serious problem possibly existed. No further examination was carried out to determine what had caused the bolts to fail, or why the brackets had moved.

Although Red Funnel was in possession of a complete cooler, which could have been fitted to the vessel within 12 hours, the decision was taken to maintain *Red Falcon* in operation until a suitable date when she could be removed from service. Bearing in mind that a two vessel service was in operation at this time, removing *Red Falcon* from service would have severely affected the timetable, and probably would have been considered only as a "last resort" option. Had *Red Falcon* not collided with the linkspan, it is probable she would have continued running until the third vessel of this class was brought back in to service from refit.

Although the temporary repair to the cooler, using a sash cramp and silicon sealant was considered reasonable, the underlying causes of the fault were not known. As stated earlier, five of the eight tie bolts had suffered thread failure, preventing them from effectively supporting the cooler. Had the remaining supporting arrangements (and therefore, the associated cooling system) suffered catastrophic failure, it is entirely likely that *Red Falcon* would have had to return to port on one engine, and would have been immobilised for considerably longer. It is considered that insufficient consideration was given to investigating the underlying causes of the slack tie bolts, and that any future faults on main propulsion machinery should be effectively diagnosed and, if necessary, a decision taken to withdraw the vessel from service to enable a full repair to be done.

The cooler had been removed during the annual refit only a few weeks earlier. It would appear highly likely that this had some bearing on the failure of the bolts. However, it is unclear what, if any, supervision of the contractors was carried out by Red Funnel employees while they were refitting the cooler. Sufficiently robust processes should be in place to ensure the effective supervision of maintenance work that is carried out by contractors during refit periods.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES

3.1.1 Operating the vessel with the Voith Schneider units desynchronised

The master's decision to desynchronise the units was, in isolation, understandable. He would have done all he reasonably could to bring the vessel back onto schedule.

However, the fact that he had received training in this mode only a few times in the 12 years he had been on the vessel, and had only rarely operated with the units desynchronised, was a contributory factor in the accident.

Red Funnel should review this mode of operation to determine its relative merits, taking into account that in the normal operation there is no need to desynchronise the propulsion units. [2.2.1]

3.1.2 Signage

The presence of the trainee staff as visitors to the bridge shortly after the master had desynchronised the units might have been sufficient distraction to interfere with his memory of the event. The absence of signs, as required by the company's procedures, or other sufficiently obvious indicators that the units were desynchronised, resulted in neither the master remembering, nor the chief officer realising that the units were desynchronised.

Red Funnel should, subject to the review at 3.1.1, consider improvements to the signage on the control consoles to ensure that operators can be in no doubt as to the status of the synchronisation of the units. [2.2.2]

3.1.3 Bridge handover

The handover procedure to the chief officer was ineffective. The AB conveyed all the relevant information available to him, but the lack of any dialogue between the master and chief officer at this stage, probably due to the mutual respect which existed between them, resulted in the chief officer not being advised that the propulsion units were, in fact, desynchronised.

Red Funnel should take action to ensure that a formal procedure for bridge handovers is followed on each occasion and recognise that, especially in such familiar repetitive situations, positive reporting checks are essential. [2.2.3]

3.1.4 Speed of approach to Town Quay

The Southampton harbourmaster has the authority to exempt any vessel from the general 6 knot speed limit to the north of the imaginary line from Hythe Pier through the Weston Shelf buoy to the Weston shore. However, the speed of these vessels in this area should be reviewed, and if he considers it appropriate to continue to exempt this class of vessel it would be appropriate to inform all harbour users of this through a Local Notice to Mariners (LNTM). When undertaking this review, the harbourmaster should take into consideration the need for the vessel to be at a safe operational speed as it approaches Town Quay, to facilitate a safe abort procedure should any defects be observed as the vessel reduces speed for berthing. [2.2.4; 2.2.7]

3.1.5 Control console ergonomics

The fact that the chief officer, an experienced mariner, did not immediately realise that the Voith Schneider units were desynchronised, suggests that the existing indicators are insufficiently clear. Red funnel should review this, and improve the signage and indicators to ensure that the operator can be in no doubt when the units have been desynchronised in the future.

The chief officer failed to realise sufficiently early that the speed of the vessel was not reducing, and at the starboard bridge wing, the final manoeuvring position for both Southampton and East Cowes, there is no speed readout available to assist the officer.

Although these vessels are routinely and understandably navigated on visual marks as they make their final approach to the berth, the installation of a speed read-out at the starboard bridge wing would help to ensure the officers are fully aware of the vessel's speed at all times. [2.2.5; 2.2.6]

3.1.6 Emergency response

Passenger feedback indicates that some felt they were kept fully informed and received good assistance and guidance from the crew and, subsequently, from the emergency services. However, some passengers, mainly on the upper car deck, report that they were not aware of any announcements, and consider the crew did not provide sufficient support and guidance immediately post-incident.

The fact that the master did not wish to leave the control console to make a PA announcement from the control at the central chart table, might have resulted in a lack of information flow immediately post-accident. [2.2.8]

Due to this apparent disparity in reports, Red Funnel should review the control and audibility of its PA system on the vessel, and review the incident response with a view to acting on the lessons learnt from this aspect of the accident. [2.2.8]

3.1.7 Training

Neither the master nor the chief officer had recently undertaken the company specified training in operating with the engines desynchronised. Red Funnel should review its staff training procedures, to ensure that any such lapses are identified during the regular ISM audits undertaken both by the company and by external auditors. [2.4]

3.1.8 Charge cooler

The problem with the charge air cooler probably originated during the refit. Sufficiently robust processes should be in place to ensure the effective supervision of maintenance work carried out by contractors during refit periods. [2.6]

Once the vessel was in operation, insufficient consideration was given to investigating the underlying causes of the slack tie bolts. [2.6]

SECTION 4 - ACTION TAKEN

The Red Funnel Group has been very proactive during the MAIB investigation into this accident, and have identified the following actions which they have either already taken or intend to take in the near future:

4.1 ACTIONS TAKEN BY RED FUNNEL

1. The reporting system for all on board drill and training exercises has been changed to become a positive monthly report to the company by the vessel's senior master.

2. Handover and critical operations checklists have been consolidated into easy to use and readily available sheets for use by deck officers.

3. A review has commenced into the philosophy and design intent of the synchronisation/ desynchronisation control systems which will include a review with the designer, Voith Schneider, as to the longer term fundamental requirement for such a control feature.

4. New signage and a physical bar have been supplied to all vessels, with specific instructions for their use if it becomes necessary to operate with the Voith Schneider units desynchronised in the future.

5. The PA system on all decks of the vessel has been checked for volume and found to be in good order. The bridge team management procedures for PA announcements during emergencies have been reviewed. The importance of keeping passengers fully informed in such situations has been re-enforced.

6. A monthly spot check of key navigational activities, using the on board electronic navigation system, has been introduced.

7. The requirement to review and risk assess operations in which an equipment malfunction may impact on the safe operation of the vessel has been reiterated to staff at all levels in the company. The need to monitor procedures put in place to ensure the above has also been re- emphasised.

8. Procedures for supervising and managing the work of sub-contractors, including defect reporting and QA testing, have been reviewed and reiterated.

9. Procedures governing unusual and/or critical operations have been reiterated to all staff.

10. Passage plans for the approaches to Town Quay have been reviewed by the company's senior masters. Procedures used in training routines for masters and chief officers have been utilised to define an optimum approach speed at the head of Town Quay as 6 knots.

11. An external audit of the ISM procedures on *Red Falcon,* by the MCA, was successfully conducted on 13 June 2006.

12. V-Ships have been engaged to independently audit and benchmark the Red Funnel operation against a database of in excess of 800 vessels.

13. A Fleet Director with considerable ro-ro experience has been appointed to strengthen the shore management team.

14. A new senior master has been appointed to *Red Falcon* to help provide impetus and leadership in the rebuilding of processes and procedures onboard following the accident.

15. A series of meetings have been held with ships' staff to review the details of the accident to ensure appropriate lessons are learnt throughout the fleet.

4.2 ACTION TAKEN BY THE SOUTHAMPTON HARBOURMASTER

1. The Southampton harbourmaster has introduced a requirement for the *Red Falcon* and others in her class to observe the six knot speed limit from the seaward end of Town Quay.

SECTION 5 - RECOMMENDATIONS

As a direct result of the actions taken and proposed by both the Red Funnel Group and the Southampton harbourmaster, there are no recommendations to make as a result of this investigation.

Marine Accident Investigation Branch
October 2006