ACCIDENT REPORT

Report on the investigation of

windlass damage, grounding and accident to person

on the ro-ro ferry

Norcape

Firth of Clyde and Troon, Scotland

on 26-27 November 2011

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SERIOUS MARINE CASUALTY REPORT NO 28/2012 December 2012

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

ABP	-	Associated British Ports
bp	-	Bollard pull (of tug)
CCTV	-	Closed circuit television
CHA	-	Competent Harbour Authority
DPA	-	Designated Person Ashore
EN	-	Equipment Numeral
IACS	-	International Association of Classification Societies
kt	-	knot(s) a unit of speed; one knot is equal to one nautical mile per hour
kW	-	kilowatt
m	-	metre
MCA	-	Maritime and Coastguard Agency
NI	-	Nautical Institute
OOW	-	Officer of the watch
PEC	-	Pilotage Exemption Certificate
PMSC	-	Port Marine Safety Code
SMS	-	Safety Management System
STCW	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended in 1995 and 1997 (STCW Convention)
t	-	tonne
The Guide	-	Guide to Good Practice on Port Marine Operations
TTC	-	Troon Tug Company
UTC	-	Universal Time, Co-ordinated
VHF	-	Very high frequency (radio)

Times: All times in this report are UTC unless otherwise stated

SYNOPSIS

On 26-27 November 2011 the ro-ro freight ferry *Norcape* suffered a number of accidents, including windlass damage, grounding and an accident to person while operating in and around Troon harbour, Scotland.

Norcape operated a scheduled ferry service between Larne, Northern Ireland and Troon, Scotland. An attempt to berth at Troon in the early hours of 26 November was thwarted by the strength of the wind and one of her two bow thrusters failing. The vessel then proceeded to anchorage, across the Firth of Clyde, off the Isle of Arran, but the weather conditions were too severe for her to remain there. While recovering her anchor, the windlass suffered a catastrophic failure and the anchor and cable had to be slipped to enable the vessel to get underway.

The vessel made a further attempt to berth at Troon on the evening of 27 November. On this occasion the strength of the wind was again too great for the vessel to get alongside, and the decision was taken to abort and return to sea. However, as the master attempted this, *Norcape* was set into shallow water and grounded.

A small tug, which had been assisting the vessel during her arrival, was then secured to tow her into deeper water. During this manoeuvre the towline slipped off the tug's towing hook, and *Norcape*'s crew were in the process of recovering the line when it became fouled in one of her propellers. This caused the line to be pulled violently over the side, striking and injuring one of *Norcape*'s crew.

The injured crewman was landed ashore for medical attention before a successful attempt was made to refloat the vessel with the aid of tugs. When the vessel had refloated she was towed out to sea without engine power, as it was not initially known which of her propellers had been fouled.

Once clear of the harbour, *Norcape* anchored to her remaining anchor, but in strong to gale force onshore winds this dragged. The starboard engine was then started and the vessel weighed anchor and returned to Larne. There, the fouled port propeller was cleared by divers and the damage to the windlass was assessed.

Norcape had been operating on the Larne/Troon freight service since July 2011 and no guidelines had been developed to assist the crew in determining operational weather limits for berthing in Troon. The harbour authority in Troon had not been involved with the vessel's owner in considering her operation in adverse weather conditions, and had not developed any guidelines for the use of tugs to assist *Norcape* berthing in adverse weather.

The MAIB has issued a safety flyer to remind mariners of the limitations of anchoring equipment. Recommendations have been made to P&O Ferries regarding passage planning and its emergency response procedures. Recommendations have also been made to the harbour authority and the Maritime and Coastguard Agency (MCA) to review pilotage and Port Marine Safety Code compliance in Troon.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *NORCAPE* AND ACCIDENT

SHIP PARTICULARS

Flag	Bahamas
Classification society	Lloyd's Register
IMO number	7716086
Type	Ro-ro cargo
Registered owner	P&O Ferries Holdings Limited
Manager(s)	P&O Ferries Holdings Limited
Construction	Steel, built 1979, Mitsui Japan
Length overall	150.55m
Registered length	142.56m
Gross tonnage	14087
Engines	2 x Mitsui, Total power:13240kW
Rudders	2 x semi spade
Bow thrusters	2 x 596kW
Propellers	2 x controllable pitch
Minimum safe manning	15

VOYAGE PARTICULARS

Port of departure	Larne, Northern Ireland
Port of arrival	Troon, Scotland
Type of voyage	Scheduled ferry service
Cargo information	Road freight trailers
Manning	26

MARINE CASUALTY INFORMATION

Date	26-27 November 2011
Type of marine casualty or incident	Serious Marine Casualty
Location of incident	Troon, Scotland
Place on board	Grounding: Entire vessel Injury: Aft mooring deck
Injuries	A seaman suffered heavy bruising to his left leg
Damage/environmental impact	Material damage to port windlass No environmental impact
Ship operation	Manoeuvring
Voyage segment	Arrival in port
Environment	Beaufort scale 6-8
Persons on board	26 crew

Norcape

1.2 BACKGROUND

Norcape provided a ro-ro freight service between Larne, Northern Ireland and Troon, Scotland, operating a daily return schedule from Sunday to Friday each week. The vessel was certified to carry 12 passengers; no passengers were on board at the time of the accidents.

The owner had allocated the vessel to the route on a temporary basis, pending a commercial review of the Larne/Troon freight service. On 15 July she arrived in Larne following a period of lay-up, when she replaced *European Mariner* on the route, the majority of whose crew were transferred to *Norcape.*

Before *Norcape* entered commercial service on 18 July the owner arranged for a master, with experience of the vessel and route, to provide training to her newly appointed masters. The two masters were transferred from *European Mariner* and had experience of manoeuvring that vessel in Troon and Larne. The training included manoeuvring advice and trials as well as several entries into Larne harbour. Following this training the Larne competent harbour authority (CHA), Larne Harbour Limited, assessed the skill, local knowledge and experience of the new masters and issued them with pilotage exemption certificates (PEC) for *Norcape*.

The masters also undertook familiarisation training for the P&O berth in Troon **(Figure 1)**. However, no harbour authority assessment of the masters' capabilities took place, as pilotage was not compulsory in the port.

1.3 NARRATIVE

1.3.1 Events prior to arrival at Troon on 25 November 2011

On 24 November 2011, while *Norcape* was alongside in Larne, her master obtained a weather forecast for Barassie, near Troon, from a website, *windfinder.com*. He also consulted the Met Office forecast prepared for P&O Ferries' Cairnryan/Larne route. The master had commanded *European Mariner* on the route for several years and had found the forecast from the *windfinder.com* website **(Annex A)** to be the most reliable for operating in Troon.

The forecast obtained from the website indicated that the strong south-westerly winds would reduce before the vessel's scheduled 2330 arrival in Troon; the Met Office forecast predicted no moderation.

The master contacted the Troon Tug Company (TTC) to order an 8 tonne (t) bollard pull[1] (bp) tug to assist the vessel to berth. The owner of the tug company had also obtained a weather forecast, based on information obtained from eight weather websites, including XC weather, Met Office, Windfinder and netweather, which predicted stronger winds at the time of the vessel's arrival than the master was anticipating. He suggested to the master that it would be prudent to use a larger, 15t bp tug. The master declined this suggestion and indicated that he would either use the smaller tug or would not take a tug. The vessel subsequently berthed, without incident, in Troon, assisted by the 8t bp tug.

[1] Bollard pull is the term used to express the pulling capability of a tug. For the purposes of this report this may be considered to be the maximum pulling force that a tug can apply to a towline.

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Figure 1: P&O berth, Troon

On the afternoon of 25 November, while *Norcape* was alongside in Larne, the master again obtained a weather forecast from *windfinder.com.* This predicted that the strong south-westerly wind would moderate in time for the vessel's arrival in Troon that evening.

The master contacted TTC to order its 8t bp tug. The owner of the tug company had again obtained several weather forecasts, from different sources, which predicted that the strong to gale force south-westerly winds would persist throughout the evening. In view of the master's previously expressed preference for the 8t bp tug, the master's order was confirmed without further comment.

1.3.2 Arrival Troon, 25-26 November 2011

At 2240 *Norcape* was approaching Troon when the master took over the con from the officer of the watch (OOW). The OOW informed the master that the wind speed readings from anemometers located at the harbour office and the P&O berth were 45kts and 22 to 35kts respectively. The master noted that the wind appeared to be stronger than anticipated, and commented that "perhaps the bigger tug should have been ordered".

The bridge team for the vessel's entry into Troon consisted of the master, chief officer, helmsman and lookout. At 2254 the bridge team informed the tug *Red Empress*, on very high frequency (VHF) radio, that the arrival plan was to swing to port "the same as last night". The tug was requested to standby off the vessel's starboard quarter until called in to push her onto the berth.

Norcape passed the West Pier at 2304 when the master took control of the helm, engines and bow thrusters at the port control console **(Figure 2)**. *Norcape* was on a course of 140º and making good 125º when the swing to port was commenced in order to approach the berth stern first.

At 2312 *Norcape* had swung onto a heading of 020° with her stern about 20m from the face of the berth, when the bridge team requested the tug to push on the vessel's starboard quarter. Information on the position of the vessel's stern, relative to various points on the berth, was relayed at frequent intervals by the aft mooring party to the bridge team.

At 2326 an aft backspring mooring line was sent ashore from the vessel's port quarter to No 2 dolphin and was made fast **(Figure 1)**. Both bow thrusters, which were each rated at approximately 9t bp, were then set at full power in an attempt to bring the vessel alongside by moving her bow to port, into the wind. At this time, *Norcape'*s anemometer recorded the wind as south-westerly 35-40kts.

At midnight a second backspring was sent from the port quarter, as an earlier attempt to pass a stern line ashore, which was the vessel's normal securing routine, had proven unsuccessful. With two lines ashore, both bow thrusters operating at full power and the tug pushing on her starboard quarter, *Norcape*'s bow began to move slowly to port towards the berth.

At 0008 the vessel's heading had reached 315º, almost parallel to the berth, and the first of the headlines was being passed to the shore when one of the bow thrusters cut out. *Norcape*'s bow immediately began to move downwind, to starboard, and it was not possible for the headline to be secured ashore.

Figure 2: Port side control console

At 0011 the bridge team requested the tug to reposition, to push on the starboard bow, while the remaining bow thruster continued to be used at full power.

The vessel's engineers advised the bridge team that if an attempt was to be made to restart the failed unit, the operational bow thruster would first have to be stopped. At 0016 the master decided to abort the berthing attempt and leave harbour to allow the engineers the opportunity to restart the failed bow thruster.

Three blasts were sounded on the vessel's whistle, which was a pre-arranged signal to the line handlers ashore that all mooring ropes should be let go. The tug crew were not aware of the signal and assumed it indicated the vessel was operating astern propulsion, in accordance with Rule 34(a) of the Colregs[2].

At 0018, *Red Empress*'s skipper was told to stop pushing and keep well clear as *Norcape* was leaving harbour and would return once the second bow thruster was reinstated.

Norcape was manoeuvred clear of the harbour to await the availability of the second bow thruster. Subsequently, the vessel's engineers reported that the unit needed to be repaired before it could be reinstated.

[2] Colregs = The International Regulations for Preventing Collisions at Sea 1972, Rule 34 describes the manoeuvring and warning signals used by vessels in sight of one another.

At 0230 the wind had strengthened; the harbour office anemometer recorded gusts in excess of 60kts and *Norcape*'s master decided to delay berthing until the weather improved. The engineers reported that the fault on the bow thruster, a defective electrical breaker, had been repaired and that the unit was available for use if required.

The bridge team then considered the options of slow speed steaming in the Firth of Clyde, or anchoring. The master perceived that remaining underway for a potentially long period would incur excessive fuel costs, and so decided to anchor in Brodick Bay, Isle of Arran, and await an improvement in the weather conditions before returning to Troon.

1.3.3 Windlass damage, 26 November 2011

At 0350 *Norcape* approached her anchorage position in Brodick Bay. Due to the presence of another vessel in the bay it was necessary to re-plan the anchoring position. The revised position was 1.4 miles from Brodick pier **(Figure 3)**, which was 0.75 miles further to seaward than the originally planned position.

Figure 3: Brodick Bay, Isle of Arran

The port anchor was let go at 0354 and cable was veered to 8 shackles[3] in a depth of 35 metres. The starboard anchor was then lowered onto the seabed to reduce the anticipated yaw of the vessel, and the crew were ordered to "*screw the brakes up and put the bars across*" on both windlasses.

At 0410 the crew reported that both windlass brakes had been applied and were secure. The master wrote his night orders, which instructed the OOW to call him if the anchor dragged, and left the bridge. At the time the master left the bridge the wind was south-westerly 40knots and the vessel was yawing between 190º and 260º.

The extent and speed of the yaw increased as the wind strengthened until, at 0540, the port anchor cable rendered through the windlass following a particularly violent yaw to starboard. The OOW informed the engine room that the engines should be started immediately, and called the master. The lookout was sent to check the windlass brake, and he reported that the windlass brake was tight, but the anchor cable continued to render.

At 0552, as the port cable continued to render and *Norcape* yawed between 135º and 290º, the master instructed the OOW to weigh the anchors.

The master used a combination of engine and bow thruster movements to ease the weight on the cables during recovery of the anchors. At 0610 the starboard anchor was aweigh and the anchor party began to weigh the port anchor.

At 0615 the OOW reported that the port anchor cable had rendered while being recovered, and that the windlass had been damaged as a result. It was later confirmed that the windlass's dog clutch had been destroyed and the drive shaft had bent **(Figure 4)**. The vessel was then lying to the bitter end[4] of the port anchor cable.

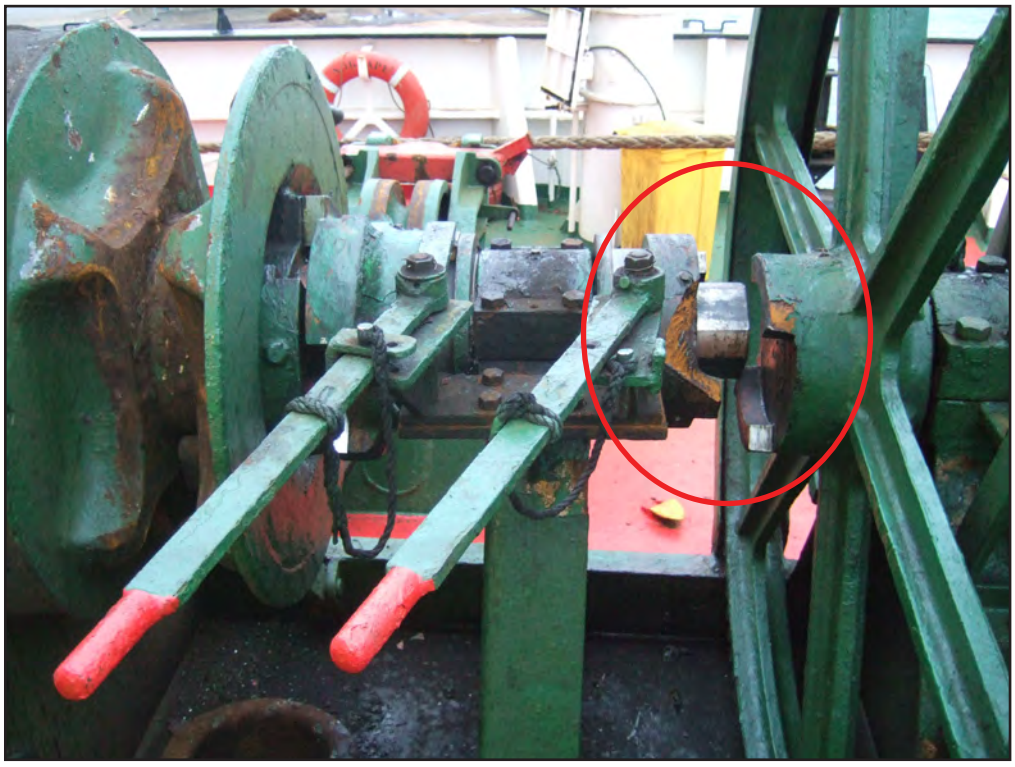

Figure 4: *Norcape*'s windlass showing damage to dog clutch mechanism and bent shaft

[3] A shackle is a measurement of length of anchor cable: 1 shackle equals 90 feet or 27.5m.

[4] Bitter end: The inboard end of the anchor cable, which is secured to a removable pin in the chain locker

The master notified the owner's designated person ashore (DPA), the coastguard, and Clydeport harbour authority - in whose waters the vessel was anchored - of the situation.

1.3.4 Slipping the anchor cable

At 0652 the wind was observed to be south-westerly 50kts and the bridge team initially used engine and helm movements to minimise the yaw and reduce the weight on the cable.

The bridge team consulted the available company guidance and considered the options for slipping the anchor cable. A marker buoy and line were attached to the cable before an unsuccessful attempt was made to slip the cable by knocking out the pin which secured the bitter end to the chain locker **(Figure 5)**.

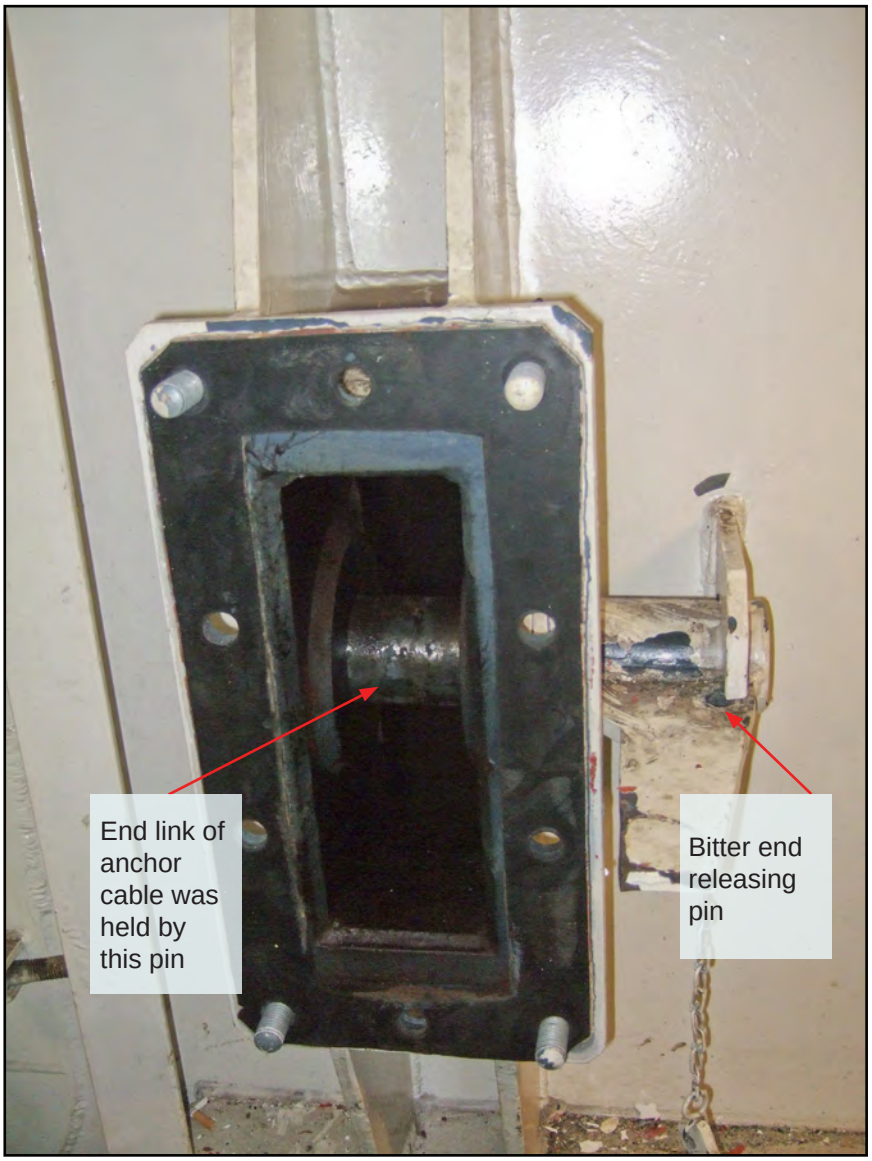

Figure 5: Releasing pin for bitter end of port anchor cable.
(Located on external bulkhead of chain locker).

The master contacted the DPA, and the decision was taken to await an improvement in weather conditions before making a further attempt to slip the cable. The starboard anchor was again walked out to the seabed to reduce the yaw.

Norcape remained at anchor for a further 24 hours, during this period the wind speed increased; at one stage a maximum gust of 80 knots was observed on the vessel's anemometer. A visual watch was maintained on the bitter end releasing pin and regular contact was maintained with the coastguard and the DPA.

A risk assessment/safe system of work for slipping the bitter end of the anchor cable **(Annex B)** was undertaken, involving all the personnel employed in the task.

The wind moderated during the morning of 27 November, and at 1316 the starboard anchor was weighed. Engine and bow thruster movements were used to reduce the weight on the port cable, and at 1338 the anchor cable was successfully slipped. The bridge team reported the position of the anchor cable to the authorities and also informed another vessel, approaching the anchorage area, of the position of the anchor and cable.

Norcape remained underway during the afternoon, slow steaming to the east of the Isle of Arran. Based on a forecast reduction in wind strength, the master planned to enter Troon at 2100, and ordered TTC's 15t bp tug, *Red Finess,* to assist with the vessel's berthing.

1.3.5 Grounding, 27 November 2011

At 2040, as *Norcape* approached Troon, the master and chief officer were on the bridge with a helmsman and lookout. The bridge team discussed the arrival plan, which was to swing the vessel to port inside the breakwater to approach the berth stern first. The tug *Red Finess* was to push on the starboard quarter once the vessel had completed her swing.

At 2050 the bow thrusters were tested and confirmed operational, and the crew confirmed the starboard anchor was clear and ready for letting go. The bridge team advised the engineers and *Red Finess* of the planned manoeuvre.

Norcape passed the West Pier at 2105 **(Figure 6a)** and began to swing to port. At 2113 **(Figure 6b)** the vessel had completed the swing and her stern was 30m from the face of the berth, heading 010º but being set to the north-east by the wind, which was west-south-westerly, 30kts. The tug was called in to push on the starboard quarter; no lines were ashore at this time.

At 2114 the master decided to abort the berthing as the vessel could not be manoeuvred as planned. Her heading remained at 010º, but she continued to set north-east towards shallow water.

The tug was instructed to reposition and push on the starboard bow in an attempt to move *Norcape*'s head to port, which a combination of bow thruster, engine, and helm movements had been unable to achieve.

At 2116 **(Figure 6c)** the vessel grounded and the propeller controls were placed to zero pitch. The tug skipper then advised that it was not possible for *Red Finess* to continue to operate on *Norcape*'s starboard side as the water was too shallow.

At 2120 the wind was west-south-west 35knots and the tide was rising. The bridge team requested the tug to take a line from *Norcape*'s port quarter and attempt to refloat the vessel. Troon harbour office was then advised of the grounding.

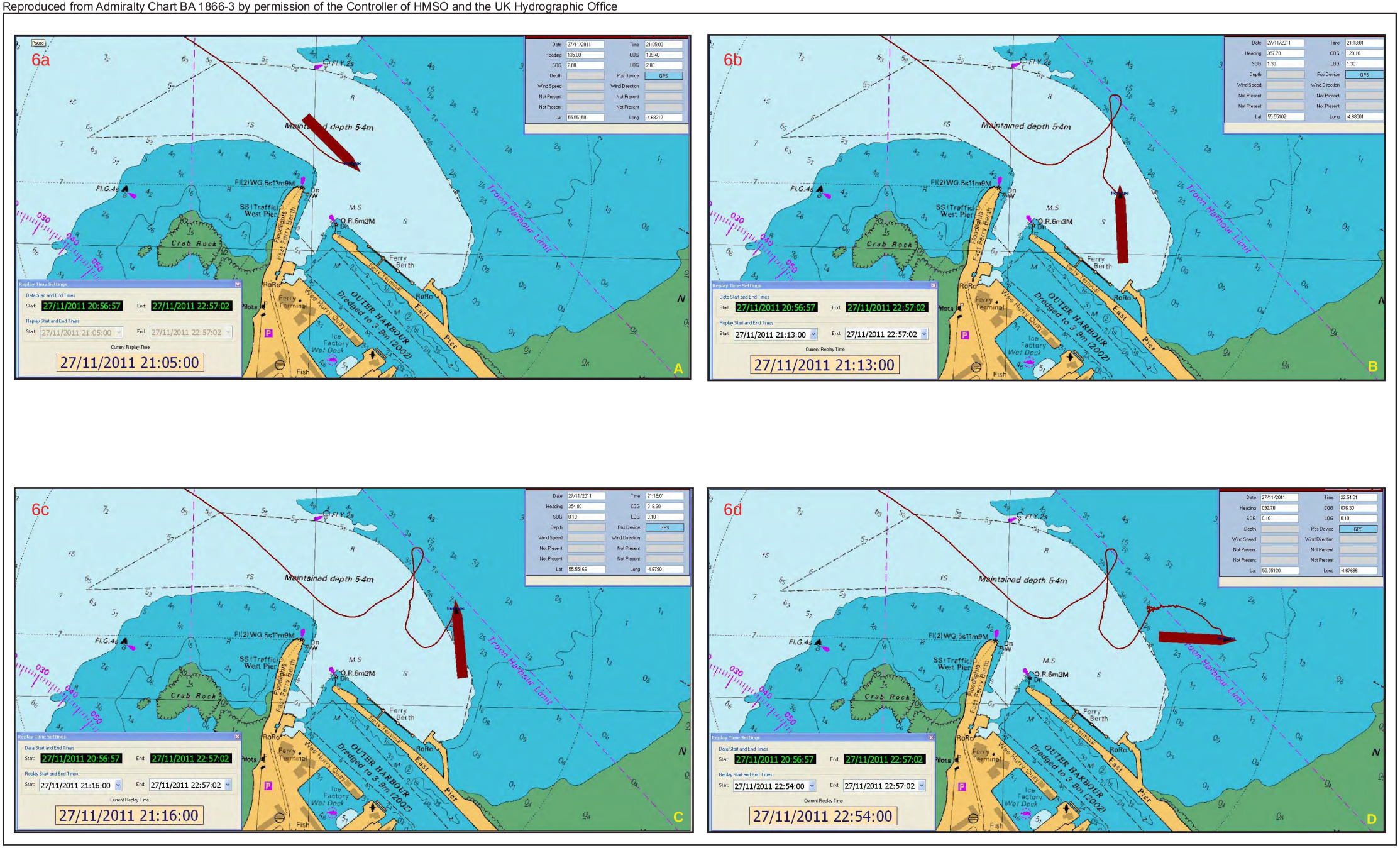

Figure 6: *Norcape*'s GPS track of entry to Troon and grounding, 27 November 2011

A mooring line was passed to the tug from *Norcape*'s port aft quarter at 2126 and the eye of the line was placed over the tug's towing hook **(Figure 7)**. The tug pulled the line out from the vessel and then stopped to check the length of line, at which point it was made fast by *Norcape*'s crew onto a set of bitts close to the port rail **(Figure 8)**.

Figure 7: *Red Finess* - towing hook

Figure 8: *Norcape* aft (portside) mooring station

No instructions were passed from either the tug or the vessel to indicate the preferred length for the towline. The bridge team then instructed the tug to pull while full power was applied to the bow thrusters in an attempt to refloat *Norcape*.

Norcape's stern was lying close to No 1 buoy **(Figure 9)**, which marked the edge of the dredged turning circle when the attempt to refloat began.

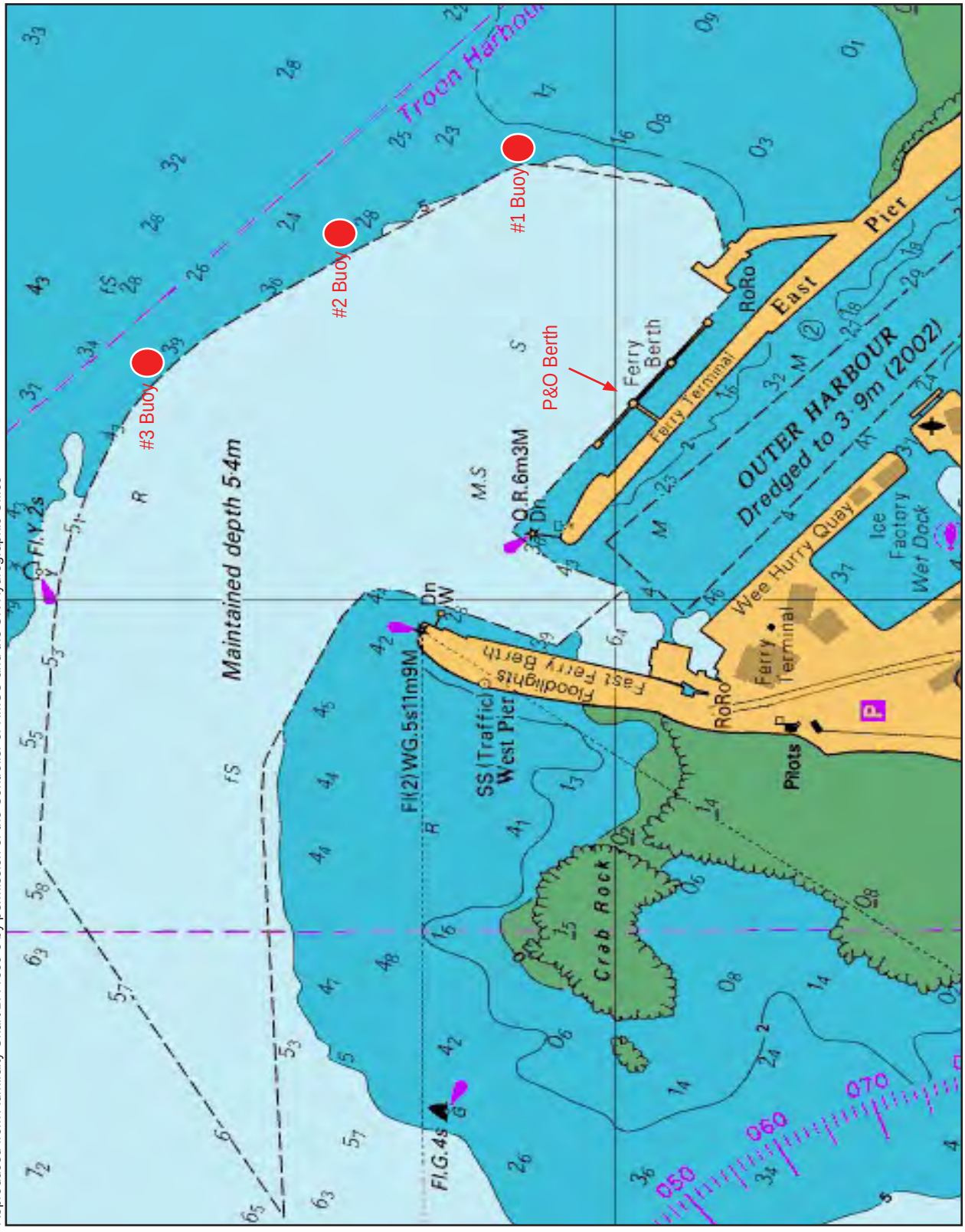

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Figure 9: P&O Berth, showing approximate locations of buoys marking edge of dredged area

At 2136 *Norcape*'s master reduced the amount of bow thrust and observed that the vessel's stern was moving to the west. The tug skipper contacted the bridge team to suggest that a second tug, with an 8t bp, could be mobilised to assist the vessel to refloat. This suggestion was declined because, in order to facilitate this plan, *Red Finess* would have had to be released.

At 2145 *Norcape'*s master saw the towline detach from *Red Finess'*s towing hook and recoil back towards his vessel's side **(Figure 10)**.

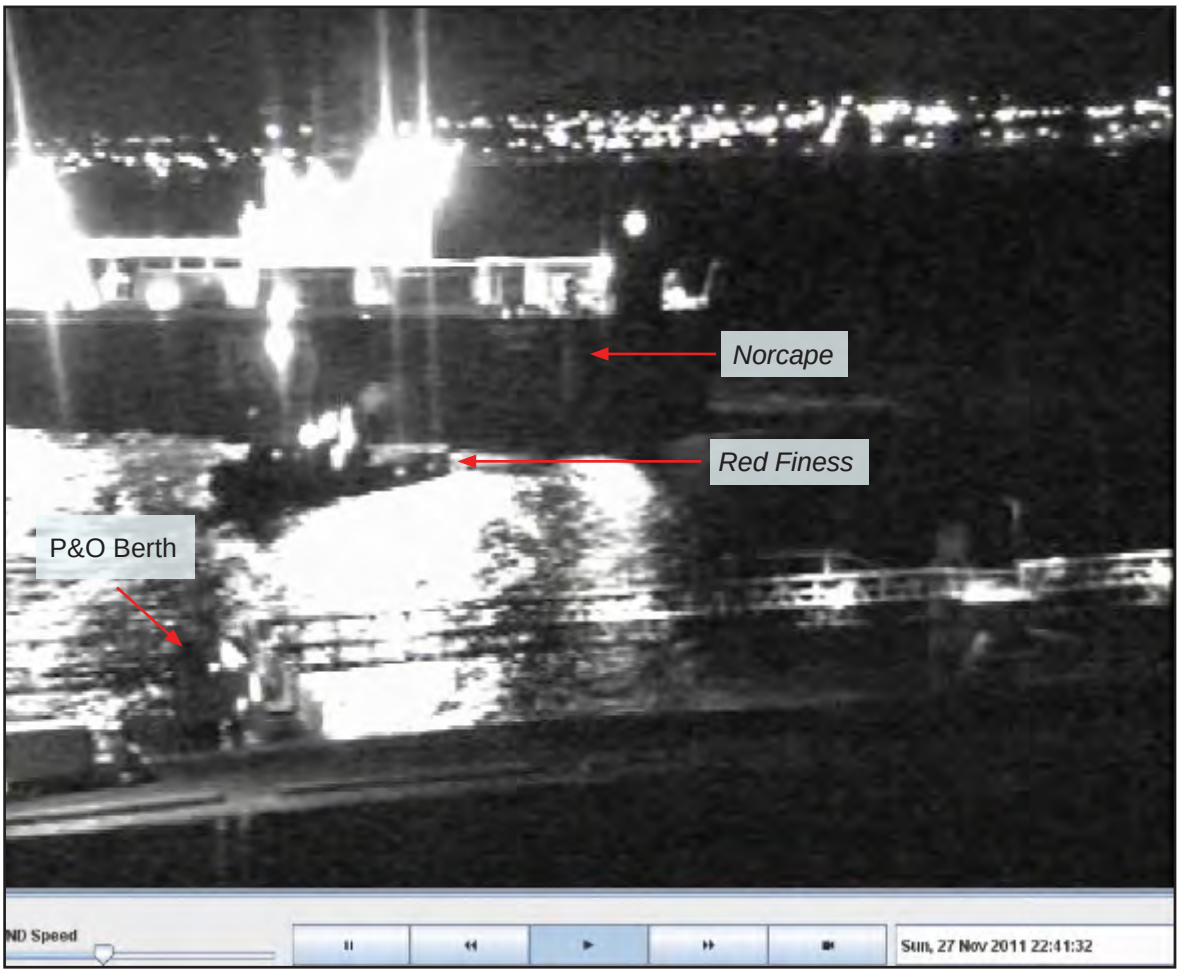

Figure 10: 'Still' from CCTV image taken as the towline slipped from the towing hook of *Red Finess* (P&O berth visible in the foreground)

1.3.6 Accident to person and fouled propeller, 27 November 2011

The crewmen on duty at the aft mooring deck also observed the towline going slack, and they reacted quickly to try to recover it. They had just placed the inboard end of the towline onto the drum end of the winch when the line became fouled in the propeller, came taut, and began to rapidly pay out. As the towline payed out, it snaked violently across the deck, between the winch and the fairlead, and struck one of the crewmen, knocking him off his feet and injuring his leg. Another crewman, standing close to the winch, was also struck a glancing blow by the line, but fortunately was uninjured.

At 2146 the second officer, who had been reporting the position of number 1 buoy on *Norcape'*s starboard side reported "*man down*" on the radio to the bridge team.

The first aid party was summoned to the injured crewman and, at 2147, the second officer reported that the line had gone into the propellers. The master acknowledged the report and stopped both the main engines.

At 2148 the bridge team briefed the engineers on the situation and the master contacted *Red Finess'*s skipper to discuss the possibility of the tug pushing on *Norcape'*s starboard side.

At 2152 *Norcape*'s master telephoned the vessel's operations manager to inform him of events. The bridge team discussed the evacuation of the injured crewman and it was agreed that the local lifeboat would provide the safest method of transfer ashore. The second officer reported that the crewman was in shock.

The master contacted Clyde coastguard at 2155 and reported that *Norcape* was aground and that the injured crewman required medical evacuation via the Troon lifeboat. The coastguard organised the launch of the lifeboat and advised the master to contact the ambulance service to arrange the injured man's transfer to hospital from the lifeboat station.

The bridge team discussed options for refloating the vessel and requested the second tug to attend. The owner's Emergency Situation Check Card for grounding **(Annex C)** was consulted, and it was decided that water ballast tanks should be filled to prevent the vessel being pushed further aground on the rising tide.

The engineers were instructed to fill the aft and fore peak tanks, and instructions were given to the crew to inspect *Norcape* for water ingress and damage, to check tank soundings, and to take soundings around the vessel as soon as was practicable.

At 2226 the Troon lifeboat was alongside. The injured crewman was transferred to the lifeboat and taken ashore to hospital, where it was confirmed that his leg was extensively bruised but that no bones had been broken.

While the lifeboat was alongside, *Red Finess* returned to her berth to facilitate mobilisation of the second tug, *Red Empress,* and both tugs were in attendance from 2230. The tugs informed *Norcape'*s bridge team that a floating rope was visible in the water close to the vessel's propellers.

*Norcape'*s master contacted the DPA to advise him of the situation and confirmed that the injured crewman had been evacuated by lifeboat. The owner's incident management team closed up in Dover.

1.3.7 Refloating and departure from Troon

At 2245 the bridge team observed that *Norcape*'s stern appeared to be afloat. They concluded that the change of trim, due to ballasting the aft peak tank, had caused the vessel to slide down the dredged slope, into deeper water. The bow was observed to be swinging to starboard, and by 2254 *Norcape* was heading 090º **(Figure 6d)**.

On instruction from the bridge team, *Red Finess* was made fast starboard aft at 2311, this time with a longer line. Meanwhile, *Red Empress* pushed on *Norcape'*s port side. Following consultation with the chief engineer, the bridge team decided that the vessel's engines should not be started as it was possible that both propellers might have been fouled by the rope.

At 2314 *Norcape* refloated as *Red Finess* pulled her astern. The skipper of *Red Finess* contacted *Norcape*'s bridge team to suggest that the vessel be towed towards the inner harbour entrance, to enable her to secure to the dolphin at the west end of the East Pier, the tugs would then push the vessel alongside. The bridge team discussed this and other options and concluded that the vessel would not be able to get alongside with the two available tugs, due to the strength of the wind, which was then south-westerly 30 to 35 knots.

At 2330 *Norcape* was being towed slowly to the west when the bridge team confirmed to both tugs' skippers their intention to continue out of harbour and anchor off the port. The tow continued, with *Norcape* having no engines running or bow thrusters available. *Red Finess* had battened down all her external doors and vents for the tow, throughout which large seas regularly broke over her bow as she pitched into the heavy westerly swell. The tug *Red Empress* also accompanied *Norcape* clear of the port and although not made fast, had also battened down in anticipation of the weather conditions outside of the harbour.

During this passage the bridge team and the chief engineer contacted the owner's incident management team to discuss the possibility of starting an engine. It was agreed that, if required, the starboard engine should be started as this engine was less likely to be fouled by the rope.

At 0047 on 28 November, when 2 miles from the west pier, the towline was released from *Red Finess,* and *Norcape'*s starboard anchor was let go and the cable payed out to 8 shackles. The crew were instructed to secure the starboard windlass such that the guillotine bar was fully down and the locking pin inserted.

Following further discussion with the owner's incident management team, the bridge team asked *Red Finess* to stay in attendance while *Norcape* remained at anchor. The tug skipper advised that weather conditions were too severe for the tug to remain outside the harbour, and it was mutually agreed that the tug would stand by inside the harbour, at immediate notice. The smaller tug, *Red Empress*, was stood down.

The master wrote up his night orders, instructing that he should be called if the anchor started to drag, and he left the bridge.

1.3.8 Dragging anchor

At 0240 *Norcape'*s starboard anchor began to drag; the master came to the bridge and instructed that the cable be payed out to 9 shackles. *Red Finess* was contacted and requested to attend *Norcape.*

The master contacted the owner's incident management team, who confirmed that, in the circumstances, it would be justifiable to start the starboard engine. The bridge team discussed the possibility of making the tug fast forward, but the tug skipper advised that, due to rough seas, it would not be possible to do so.

At 0308 the starboard engine was started, initially at idle while the engineers monitored shaft bearing temperatures and checked for vibration that would indicate problems with the propeller. The crew then began to weigh the starboard anchor.

The wind was west-south-west 35-40 knots and the engine was used to reduce the weight on the cable to allow the windlass to recover the anchor until at 0350 the anchor was aweigh.

Red Finess was then dismissed, and *Norcape* proceeded across the Firth of Clyde to slow steam to the east of the Isle of Arran.

1.3.9 Return to Larne

During the course of the day, the master discussed *Norcape*'s situation with the owner's incident management team, and the decision was taken for the vessel to return to Larne.

At 1821, *Norcape* berthed safely at Larne with the assistance of two tugs, each with a bollard pull of 45t, and a local pilot.

Divers subsequently inspected the hull and confirmed that no damage had been caused by the grounding. They also cleared the mooring line that had fouled the port propeller.

1.4 BRIDGE TEAM

The key members of the bridge team comprised:

1.4.1 Master

The 56 year old master held an STCW[5] II/2 certificate of competency as master and had been a master with P&O Ferries for 12 years. He first joined *Norcape* in early July 2011, and received some manoeuvring and familiarisation training from a previous master before leaving the vessel on 16 July, a day after its initial arrival in Larne. He rejoined the vessel on 2 August for 5 days to receive further training, after which he went on leave.

He held a Larne Pilotage Exemption Certificate (PEC) for *European Mariner,* which had been issued in 2006. On 7 August 2011 the Larne Harbour Authority added *Norcape* to his PEC following the successful completion of 13 supervised training trips.

In common with the entire crew, the master worked a 2 weeks on, 2 weeks off tour of duty.

1.4.2 Chief officer

The 56 year old chief officer held an STCW II/2 certificate of competency as master. He had sailed as master on deep sea vessels for 8 years before serving as chief officer/relief master on a variety of ferries, mainly on Irish Sea routes, since 1999.

[5] International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended in 1995 and 1997 (STCW Convention)

He had been employed by P&O Ferries for 4 years and was on his second tour of duty on *Norcape*. He held a PEC for Larne for other vessels but had not received any manoeuvring familiarisation training on *Norcape* at the time of the accident.

1.5 ENVIRONMENTAL CONDITIONS

Troon (from harbour office records):

25 November 2011:	Wind: WSW 35-45 knots, with gusts to 70 knots
26 November 2011:	Wind: W 40-50 knots with gusts to 80 knots
27 November 2011:	Wind: W 38-45 knots
	Tides: HW 1315, 5.9m; LW 1850, 2.9m
28 November 2011:	Wind: SW 30 knots
	Tides: HW 0140, 5.7m.

1.6 INTRODUCTION OF *NORCAPE* ONTO THE LARNE-TROON ROUTE

Norcape had operated on P&O Ferries' Liverpool to Dublin route before being replaced by a ro-pax vessel in February 2011, when she was taken out of service and laid up in Liverpool.

Norcape was brought out of lay up in July 2011 to replace *European Mariner*, which had been taken out of service and sent for scrap, on the Larne to Troon route. At the time of her introduction, the owner regarded *Norcape* as a stop-gap solution to maintain the service pending a strategic review of the route.

1.6.1 Comparisons between Norcape and European Mariner

Norcape had a reputation within the P&O Ferries fleet as being a vessel which was quite difficult to manoeuvre. The vessel's rudder/propeller configuration, with offset rudders **(Figure 11)**, was different to the more conventional, in-line configuration fitted on *European* Mariner **(Figure 12)**.

Norcape's tonnage, 14087gt, was considerably larger than *European Mariner*, 5897gt. The vessels' profiles were also significantly different **(Figure 13)**; *Norcape* had a larger cross-sectional area, which gave her a larger windage area than *European Mariner*. The total power developed by the engines and bow thrusters of both vessels was:

Norcape:	Engines: 13,240kW, bow thrusters: 1192kW
European Mariner:	Engines: 4,414kW, bow thruster: 448kW

1.6.2 Crew familiarisation training

When *Norcape* was allocated to the Larne to Troon route, masters with previous experience of the vessel were utilised to provide familiarisation training to her new masters, who had been transferred from *European Mariner*.

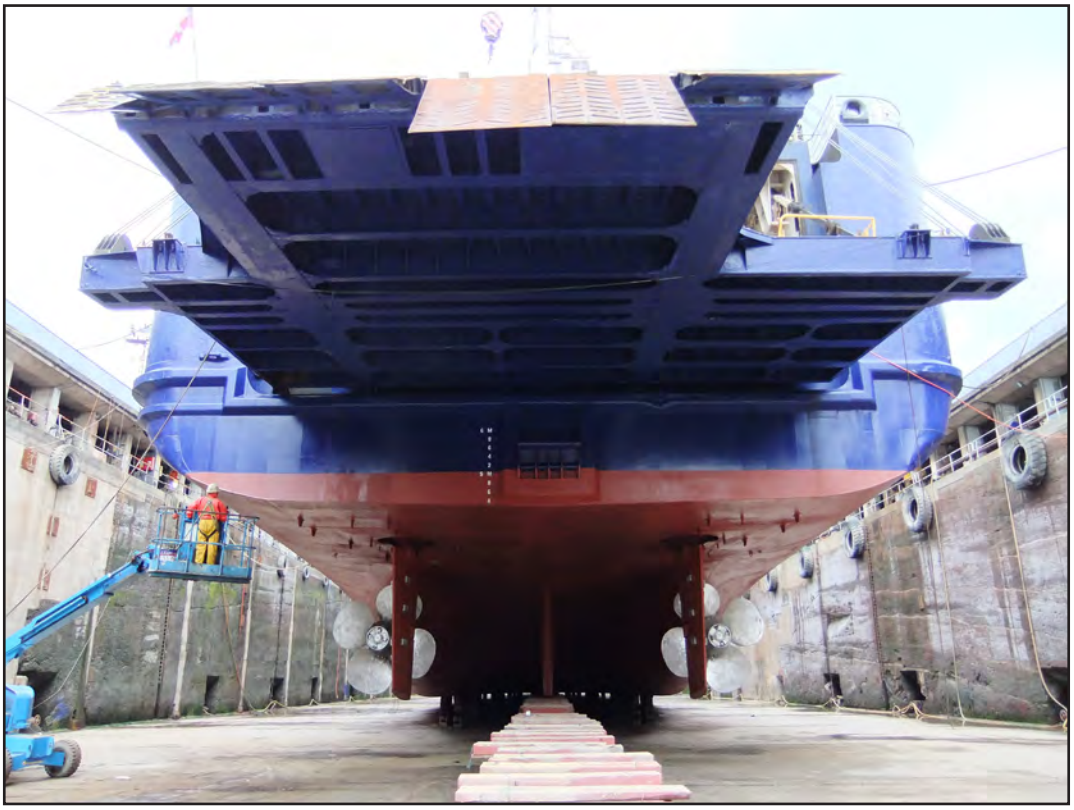

Figure 11: *Norcape* showing offset rudders

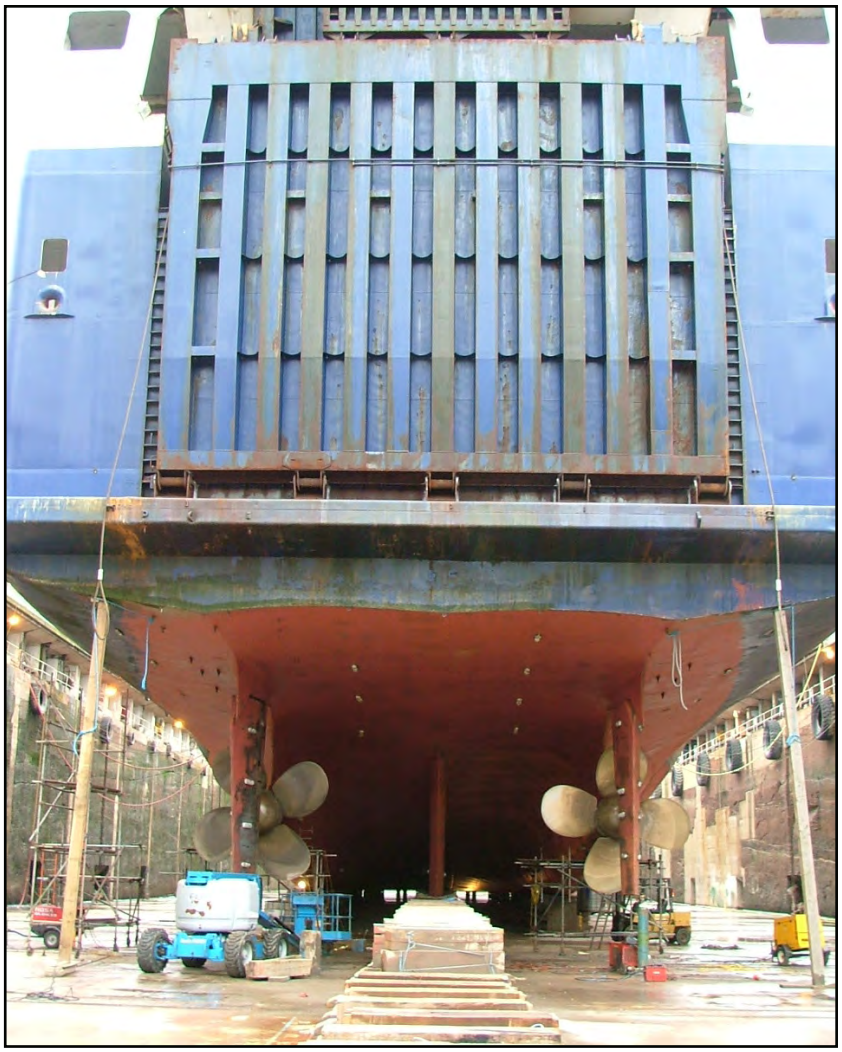

Figure 12: Ferry with in-line rudders

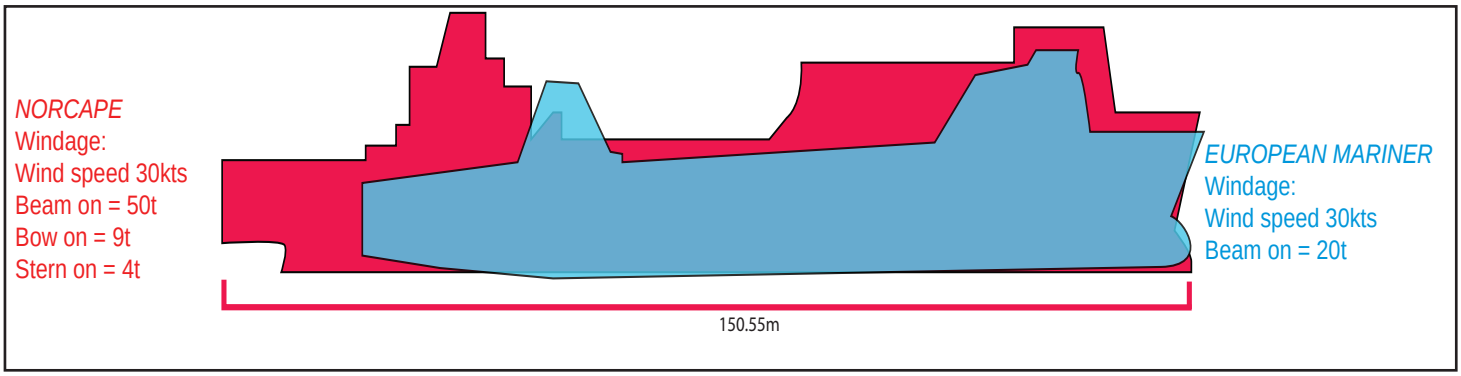

Figure 13: Silhouette comparisons of *Norcape* and *European Mariner*

The owner had programmed the in-house Rembrandt ship-handling simulator with details of *Norcape*'s manoeuvring characteristics and the port of Troon. However, the newly appointed masters did not have the opportunity to take advantage of this training aid before joining the vessel.

The training role of the masters with previous experience of the vessel was to ensure the newly appointed masters were confident in manoeuvring the vessel. The training did not include the exchange of detailed operational knowledge, such as the bow thrusters' continuous full power rating of 30 minutes.

There was a generally held recognition that the effects of the wind would be greater on *Norcape* than *European Mariner*, due to *Norcape*'s greater size. The owner required that the lead/senior master of a route produce ship-specific handling guidance relevant to the route. However, no such guidance had been prepared for *Norcape* at the time of the accidents as the masters were still evaluating the vessel's handling capabilities.

1.7 PORT OF LARNE - PILOTAGE REGIME

Larne Harbour Limited, as the CHA for the port of Larne, set requirements which regular users of the port had to satisfy to ensure their skill experience and local knowledge were sufficient[6] before they could be considered for the issue of a PEC **(Annex D)**.

For the first issue of a PEC, the requirement was for a candidate to have completed a minimum of 12 trips in and 12 trips out of the port. In addition the candidate must have been assessed by an authorised pilot or an existing PEC holder for the vessel for which the PEC was sought.

The masters appointed to *Norcape* already held PECs for *European Mariner* and satisfied some of the CHA's requirements (local knowledge, etc). As *Norcape*'s gross tonnage was more than 20% greater than that of *European Mariner*, the CHA required PEC applicants to undertake a period of onboard familiarisation and ship-handling training before they could be issued with a PEC for the vessel.

The requisite training was provided by one of the vessel's previous masters, who held a Larne PEC for vessels of a similar size to *Norcape*. On completion of this training, the new masters were interviewed by the Larne harbourmaster, who was satisfied that their knowledge and familiarity with the vessel enabled them to conduct *Norcape* in and out of Larne without a pilot. The vessel was then added to their PECs.

[6] Pilotage Act 1987, Chapter 21, s8,1(a) *Pilotage Exemption Certificates* refers

1.8 TROON HARBOUR - PILOTAGE REGIME

The Troon CHA, Associated British Ports (ABP), issued a pilotage direction, applicable from 1 October 1988, that pilotage was not compulsory in the port. Consequently, the harbourmaster did not become involved in the assessment of the skill, experience and local knowledge of the masters appointed to operate *Norcape* in Troon.

1.9 PORT MARINE SAFETY CODE

The Port Marine Safety Code[7] (the Code), issued by the UK's Department for Transport, was developed to improve marine safety in UK ports and enable harbour authorities to manage their marine operations to nationally agreed standards.

The Code was supplemented by the Guide to Good Practice on Port Marine Operations[8] (the Guide). Both publications were intended to provide information and guidance to assist a harbour authority to develop a safety management system specific to its own marine operations.

1.9.1 Consultation with stakeholders

The Guide, Section 3.1.5, states that *"a safety management system is only effective if the authority responsible takes active measures to involve and secure the commitment of those involved. This applies both to the risk assessment, operation and maintenance of the safety management system"*.

The Guide, Section 4.2.6, also refers to the need for a reactive approach to a risk assessment *prompted by a change in trade or the scope of marine operations in the port or following an accident or near miss, where the hazard may or may not have been previously identified in the risk assessment*.

Norcape commenced service from Troon with no harbour authority involvement or consultation with P&O Ferries regarding the marine operation of the vessel. No marine risk assessment was carried out by the harbour authority in relation to the vessel's operation in the port.

1.9.2 Ship towage operations

The Guide, Section 9.1.1, states that "*ship towage is a vital service that needs to be properly reviewed, approved and regularly assessed by harbour authorities*".

The harbour authority was not involved in the assessment of the appropriate tug to be used to assist *Norcape* in entering and leaving Troon in varying weather conditions. No towage risk assessment had been carried out and no guidelines had been prepared by the harbour authority for towage within the port.

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[7] Port Marine Safety Code is published by the Department for Transport and is available in pdf format at: http://assets.dft.gov.uk/publications/topics/ports-4/pmsc.pdf

[8] The Guide to Good Practice is available in pdf format at: http://assets.dft.gov.uk/publications/topics/ports-4/goodpracticemarineoperations.pdf

1.10 TROON STATUTORY HARBOUR AUTHORITY

ABP was the statutory harbour authority for Troon and the duty holder[9] is the harbour authority board. The designated person, the Marine Advisor, was appointed to report to the duty holder on marine safety related matters in Troon, as well as the other ports and harbours owned by ABP.

In addition to P&O Ferries, Troon harbour users included a mix of leisure, fishing and small commercial vessels, and the port also hosted a small ship repair facility.

The marine management for Troon was linked with the nearby port of Ayr, and the harbourmaster was appointed to both ports. In practice, day to day harbour management for Troon was undertaken by the deputy harbourmaster (Ayr and Troon), who had held the post for several years.

A number of harbourmaster's assistants maintained a 24-hour watch at the Troon harbour office, working 12-hour shifts. Their duties included issuing VHF radio warnings to vessels using the harbour, regarding the movements of ferries and larger vessels. They also undertook general quayside duties to keep the harbour and quays in a safe and tidy condition.

1.10.1 Harbour Office anemometer

An anemometer was located above the harbour office in Troon, adjacent to the west pier. The anemometer was regularly calibrated, although port users reported that it read consistently high in strong westerly winds.

1.11 TROON TUG COMPANY, TUGS AND CREWS

Red Finess and *Red Empress,* were the tugs used to assist *Norcape* in Troon harbour, and were owned and operated by TTC **(Figure 14)**.

Figure 14: Troon Tug Company's *Red Finess* and *Red Empress*

[9] Port Marine Safety Code, s2.3: Each harbour authority must have a 'duty holder' who is accountable for its compliance with the code and its performance in ensuring safe marine operations in the harbour and its approaches

Red Finess was a 1967 built twin screw, twin rudder tug with a bollard pull of 15t. She had entered service at Troon in September 2011 and had been previously used to assist *Norcape*.

The skipper, who was also the owner of TTC, had 17 years' experience of operating tugs in Troon, and held a commercially-endorsed Royal Yachting Association Yachtmaster Offshore certificate. He also held a Boatmaster's certificate with towage endorsement, issued by the MCA.

Red Empress was a 1968 built, single screw, single rudder tug with a bollard pull of 8t and had frequently been used to assist *Norcape*. The skipper held a a Boatmaster's Tier 1 Level 2 certificate and had several years of experience in handling tugs in Troon.

The tugs were hired directly on an ad hoc basis by the masters of P&O ferries operating in Troon. There was no contractual agreement in place for their use, and costs varied with the power of the tug used; the costs for hiring the larger, *Red Finess,* were greater than for *Red Empress.*

Before the accident on 27 November the tugs had never made fast to *Norcape* or any other P&O ferries which they had assisted in Troon.

1.12 PASSAGE PLANNING

*Norcape'*s bridge team's passage planning process for the Larne to Troon route followed well established routes across the North Channel. The plan for berthing in Troon was determined by the wind speed and direction, as well as by the tidal height.

The master on duty at the time of the accidents normally elected to enter Troon and swing the vessel to port before berthing port side alongside.

1.13 *NORCAPE* - ANCHORS AND WINDLASS

Norcape was fitted with two Admiralty AC14 high holding power anchors, each weighing 3777kgs. Ten shackles of 54mm, grade 3, stud link chain were connected to each anchor.

The windlass was a Fukishima type K5054, driven by a hydraulic motor.

The securing arrangements for the anchor cable when the vessel was at anchor comprised a hinged guillotine bar, with retaining pin, located above each hawse pipe lead and a band brake on the windlass gypsy **(Figure 15)**.

1.13.1 Guillotine bar

The guillotine bar and pin arrangements were designed to ensure that, with the pin engaged, the anchor cable could not pay out and the structure would take the weight of the anchor cable.

Measurements were taken to verify that the cable could not have passed under the bar with the pin engaged.

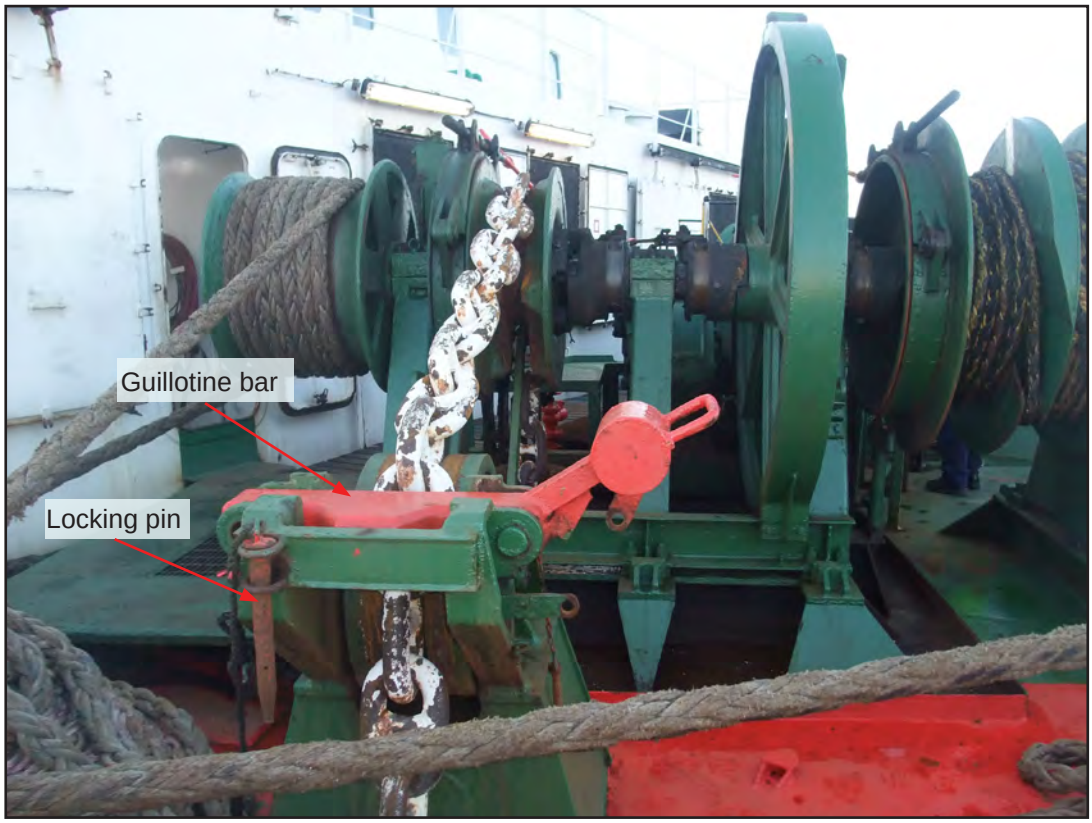


Figure 15: *Norcape* - starboard windlass showing guillotine bar across cable with locking pin in its stowage position

1.14 ANCHORING: REGULATIONS AND GUIDANCE

1.14.1 P&O Ferries, Fleet Regulations

Fleet regulations, which govern all aspects of P&O Ferries operations, include a section on anchoring that includes instructions on bringing up to an anchor:

> *"When the desired length of cable has been veered the guillotine bar should be dropped and the cable length finely adjusted by heaving or walking back so that the guillotine compressor bar lies flat across both landing surfaces of the guillotine. The full weight of the cable should be taken on the guillotine compressor bar as the primary purpose of the guillotine is to take the weight and prevent excessive strain on the windlass".*

1.14.2 IACS requirements

An extract from the International Association of Classification Societies (IACS) *Requirements concerning mooring, anchoring and towing* states:

> *The anchoring equipment required herewith is intended for temporary mooring of a vessel within a harbour or sheltered area when the vessel is awaiting berth, tide, etc.*
>
> *The equipment is therefore not designed to hold a ship off fully exposed coasts in rough weather or to stop a ship which is moving or drifting. In this condition the loads on the anchoring equipment increase to such a degree that its components may be damaged or lost owing to the high energy forces generated, particularly in large ships.*

The anchoring equipment presently required herewith is designed to hold a ship in good holding ground in conditions such as to avoid dragging of the anchor. In poor holding ground the holding power of the anchor will be reduced.

The Equipment Numeral (EN) formula for anchoring equipment required here is based on an assumed current speed of 2.5 m/s, wind speed of 25 m/s and a scope of cable between 6 and 10, the scope being the ratio between length of chain payed out and water depth.

The IACS requirements in relation to the strength of the windlass brake and stopper (guillotine) states:

A chain stopper should withstand a pull of 80% of the breaking load of the chain. The windlass with brakes engaged and cable lifters disengaged is to be able to withstand a pull of 45% of the breaking load of the chain.

1.14.3 Nautical Institute (NI) publication: Mooring and Anchoring Ships[10]

The NI publication includes a reference to the possible effects of weight on the anchor cable placing excessive loads onto a windlass drive assembly:

The excessive load on the drive can create a sideways force on the clutch if the dog clutches are slightly worn. The force is born by the fork guides that follow the circular groove which then fracture and so release the clutch, which allows the cable to run freely out of control.

1.14.4 Scope of anchor cable

The P&O Fleet regulations recommend that the number of shackles to use should be 1.5 x square root of the water depth (measured in metres). The regulations also advise that the scope of the cable used (ratio of the length of cable used to the depth of water) should be 5:1 in normal conditions, with up to 10:1 in heavy weather.

The NI publication and IACS requirements state that the scope of cable used should be between 6 and 10.

1.15 BOW THRUSTERS

Norcape was fitted with two bow thrusters, each rated for full power use of 650kW for 30 minutes, with an alarm setting of 600kW and a design cut-out of 1000kW. There was a history of the bow thruster alarm, located at the centre console on the bridge, routinely sounding during the operation of the thrusters.

Before one of the units cut out at 0008 on 26 November, the chief officer had needed to cancel the audible alarm on a number of occasions. Each time he did so he had to leave his position, beside the master at the port control console, to move to the centre of the bridge to reset the alarm.

The bridge team were unaware of the bow thruster ratings and were not informed by the engineer officers that the units were operating above their maximum rating and close to the cut-out level.

[10] Nautical Institute, Mooring and Anchoring Ships, Volume 1, 2009. ISBN: 978 1 870077 93 4.

1.16 CONTROL CONSOLE DISPLAY EQUIPMENT

The master was controlling the engines from the port bridge console when the vessel grounded. There was no radar display or electronic chart system at this location, although this information was available at the centre console.

1.17 P&O FERRIES - TRAINING COURSES

Norcape's bridge team had previously attended, on different occasions and as individuals, a 3-day training course in Maritime Resource Management, provided by the owner in its Dover offices. The aim of the training course was to foster teamwork, excellent leadership and good communication to reduce the occurrence of accidents and injuries.

The owner also operated a computer-based vessel manoeuvring simulator which the master of *Norcape* had previously used to simulate the handling of other vessels in the owner's fleet. He had not undertaken any simulator training on the *Norcape* model prior to the accident.

1.18 PREVIOUS SIMILAR ACCIDENTS

1.18.1 *Clipper Point* contact with quay and berthed ships, Port of Heysham, 24 May 2011 (MAIB report 16/2012)

The ro-ro cargo ferry *Clipper Point*, which operated a ferry service between the Port of Heysham and Warrenpoint, Northern Ireland, made heavy contact with the quay, two ro-ro ferries, and another vessel while manoeuvring onto its berth in Heysham.

During her arrival, the wind strengthened to 34 knots, which prevented the master from turning the vessel in the intended manner. The MAIB investigation found that, among other things:

- The port authority had not defined operational limits for vessels using the port.
- The bridge ergonomics were poor and increased the workload on the vessel's bridge team at a critical time during the manoeuvre.
- The port authority had not issued guidelines on the use of tugs in the port.
- There were no formal channels of co-ordination and co-operation between the port authority and the vessel's operators as required by the Port Marine Safety Code.

The MAIB made recommendations to the port authority to review among other things its implementation of the Port Marine Safety Code in relation to:

- Marine risk assessment
- Communications with port stakeholders
- Provision of towage services.

The vessel's managers were recommended to implement a programme to ensure their bridge teams are properly trained and supported to undertake their duties.

1.18.2 *European Mariner*, contact with beacon, Troon 1 August 2006

This accident occurred as *European Mariner* approached Troon in strong north-westerly winds with only one of her two bow thrusters operational. No tug was ordered to assist the vessel.

The master had completed 11 previous arrivals in Troon but none in the weather conditions experienced during the manoeuvre. The arrival plan was to swing to port, off the West Pier, and to the assess conditions before entering harbour stern-first.

However, during the swing to port, the vessel was set down towards a navigational beacon. The port anchor was dropped, but this could not prevent the vessel making heavy contact with the beacon.

As a result of the contact, the beacon was destroyed and the vessel's starboard propeller was severely damaged, resulting in her having to be taken out of service.

The owner investigated the accident and concluded that the strong weather conditions exceeded the vessel's capability to safely conduct the planned manoeuvre. The investigation report made recommendations to prevent recurrence, including:

- Senior management should conduct a business risk assessment of operation in Troon in adverse weather conditions.
- Guidance should be issued to masters on ship handling and the factors to be taken into account prior to committing to a manoeuvre in adverse weather conditions or with limited equipment.
- It should be ensured that the period of familiarisation for the master is effective.
- Masters to use the company's Rembrandt ship-handling simulator to further assess manoeuvres, abort contingencies and adverse weather berthing parameters for various wind directions in Troon.

1.18.3 *European Highlander* grounding 8 January 2005

MAIB conducted a preliminary examination when *European Highlander* grounded while attempting to berth in Cairnryan in very high winds. The vessel was successfully refloated the following day and no injuries or pollution resulted from the accident.

The owner conducted an internal investigation, which recommended, among other things, to senior managers:

- The development of a guidance manual for masters and officers on the operation of its vessels in extreme weathers.
- That masters should utilise the Rembrandt ship-handling simulator to further

assess manoeuvres, abort contingencies and extreme weather berthing parameters for various wind directions in Cairnryan.

- Bridge emergency procedures for grounding to include a decision support prompt to “ballast down ship” following assessment of seabed and tidal conditions.

These recommendations were accepted and implemented throughout the owner’s fleet by 2006.

The Chief Inspector of Marine Accidents wrote to the owner supporting the actions taken as a result of its internal investigation and commented that in future:

- Passage planning should include details of abort positions, and the radar recorded on the vessel’s VDR should be properly adjusted and set at an appropriate range.

1.18.4 *Stellar Voyager* catastrophic failure of windlass motor, 23 March 2009 (MAIB Report 25/2009)

The tanker *Stellar Voyager* was weighing anchor in adverse sea and weather conditions off Tees Bay, UK. During the operation, her windlass hydraulic motor exploded and fragments from the motor caused serious injury to one of her crew.

The MAIB, with the support of the Australian Transport Safety Board and the German Federal Bureau of Maritime Casualty Investigation, issued a Safety Bulletin (1/2009) to raise awareness of the potentially life threatening danger of this and other similar accidents.

The investigation identified that the catastrophic failure of the motor was due, in part, to excessive forces acting on the windlass, generated by weight on the anchor cable, which exceeded the machinery’s safe operating limits.

The bulletin also identified other similar accidents which appear to have occurred when heaving in the anchor in adverse weather conditions when the anchor chain was tensioned beyond the safe loading of its windlass.

One of the recommendations made in the report was to the Oil Companies International Marine Forum to include lessons learnt from this accident in its publication ‘*Anchoring Systems and Procedures for Large Tankers’*. The need to minimise the tension on the anchor chain, when ‘heaving in’ on the windlass in adverse weather conditions, was also emphasised.

1.18.5 *Young Lady*, dragging anchor and snagging of underwater pipeline 25 June 2007 (MAIB Report 3/2008)

This accident occurred when the tanker *Young Lady* was anchored in Tees Bay, in strengthening winds, and started to drag her anchor. The master eventually decided to weigh anchor, but during the operation the windlass hydraulic motor exploded.

The reason for the catastrophic failure of the windlass motor was found to be that the forces generated by the excessive weight on the cable, had exceeded the design parameters of the equipment by a factor of four.

The vessel then continued to drag her anchor and subsequently fouled a major gas pipeline carrying North Sea gas to the UK; although the pipeline was not breached it was out of use for more than 2 months as a result of the accident.

SECTION 2 - ANALYSIS

2.1 AIM

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

2.2 FATIGUE

Although some of the crew, particularly the bridge team, had worked long hours on the days of the accidents, there is no evidence to suggest that they were suffering from fatigue. Therefore, it is not considered to be a contributing factor.

2.3 SUMMARY

The sequence of accidents described in this report began when one of *Norcape*'s bow thrusters cut out while the vessel was attempting to berth in strong winds in Troon. Over the course of the following few days the vessel suffered a series of accidents, which tested the crew's training and emergency preparedness to the limit.

Analysis of the various accident scenarios shows the importance of owners and crews being well prepared for all eventualities by planning and undertaking emergency scenario drills. The crew reacted well to the various scenarios encountered, but with more effective contingency/abort planning procedures in place some, if not all, of the accidents could have been avoided.

An effective port risk assessment for the vessel's entry to Troon, in adverse weather conditions, might also have prevented the sequence of accident events. This demonstrates the importance of ports developing safety management systems, in accordance with the Port Marine Safety Code and the associated Guide to Good Practice on Port Marine Operations.

2.4 INTRODUCTION OF *NORCAPE* ONTO LARNE TO TROON ROUTE

2.4.1 Owner's actions

Norcape had been laid up prior to replacing *European Mariner* on the route. The owner recognised that *European Mariner*'s masters would need specific familiarisation and ship's handling training when they transferred to the larger vessel, and masters who had previously commanded *Norcape* were given the task.

The training provided to the new masters did not follow a structured format but aimed to satisfy the PEC requirements in Larne as well as ensuring that the masters themselves felt confident on the vessel. The opportunity for the masters to gain a full understanding of the vessel's manoeuvring limits, based on the company's extensive experience of operating the vessel in different ports over several years, was not taken. Troon harbour and *Norcape* had been modelled within the company's Rembrandt manoeuvring simulator. However, their masters were not provided with the opportunity to use the simulator before Norcape entered into service on the Larne – Troon route.

The owner should review the training and support provided to its crews when a new vessel is introduced onto an existing route to ensure they are conversant with the vessel's manoeuvring characteristics and foreseeable navigational challenges when in service.

2.4.2 Consultation

The Guide for the Port Marine Safety Code provides guidance to harbour authorities regarding the development of safety management systems.

The Guide states that a harbour authority should consult with its users when developing its risk assessments, and should review the risk assessments following a change in trade or in the scope of marine operations. The port of Larne CHA had identified that *Norcape*'s gross tonnage was more than 20% greater than *European Mariner*, and had therefore required her masters to undergo further assessment before their PECs were endorsed. Troon CHA had consulted with P&O and was made aware that the masters from *European Mariner* had transferred to *Norcape.* The CHA was satisfied that the masters had sufficient local knowledge of the port. However, the differences between manoeuvring *Norcape* and *European Mariner* in Troon were not discussed in detail.

If detailed consultation in relation to manoeuvring *Norcape,* had taken place it would have provided the opportunity for the port's marine experts to engage with *Norcape*'s masters. This would have enabled discussion on the vessel's operating parameters in relation to wind limits, port passage plans and the use of tugs.

Troon harbour authority should review its safety management system for marine operations and establish a documented consultation process with the port's users to inform its marine risk assessments. The owner should ensure that it consults with harbour authorities when planning changes to its marine operations which could affect a port's marine risk assessments.

2.4.3 Pilotage

Norcape arrived in Larne on 15 July and entered service on the route on 18 July. A master, with previous command experience on the vessel and a PEC holder for Larne, provided *Norcape*'s newly appointed masters, who had transferred from *European Mariner,* with manoeuvring training in Larne and Troon before she entered service. The majority of the training took place in the port of Larne.

This training was provided, in part, to meet the Port of Larne's pilotage requirements for the issue of a PEC in accordance with the requirements of the Pilotage Act, 1987. The new masters were required to prove their skill, experience and local knowledge to the competent harbour authority before *Norcape* could be added to their PEC for Larne as the vessel was more than 20% larger than *European Mariner*. In Troon, the competent harbour authority had previously decided that pilotage was not compulsory, therefore there was no requirement for the masters to prove their skill, experience and local knowledge on the new vessel.

Had a pilotage regime been in place in Troon, it is probable that the bridge team would have benefited from the depth of local knowledge and experience of the harbour authority's marine staff. The Competent Harbour Authority should re-assess whether compulsory pilotage should be required in Troon.

2.5 PASSAGE PLANNING

2.5.1 Weather forecasts

Although he had access to the Met Office weather forecast for the Larne to Cairnryan route and the Met Office's Navtex weather report, the master did not consider this to be sufficiently detailed, in relation to Troon, for passage planning purposes. He therefore consulted a number of weather forecasts for Troon when planning *Norcape*'s passage from Larne to Troon on 25 November. The website which he preferred to use forecast a reduction in wind strength around the time of the vessel's arrival in Troon. However, other weather forecasts, obtained by the TTC, were not predicting a reduction in wind strength for the evening of 25 November. The wind which the vessel encountered was stronger than the master expected, and it proved too strong for the vessel to berth safely.

Access to a reliable, accurate weather forecast is essential for planning and executing a safe passage. The owner should identify the most suitable source of weather forecast data for the Larne to Troon route, and ensure it is accessible to its bridge teams when passage planning.

2.5.2 Abort/cancellation planning

For *Norcape*'s arrival in Troon on 24 November, the master rejected the tug company's recommendation that the 15t bp tug should be used due to the strong winds forecast and instead ordered an 8t bp tug to assist with berthing. In similar conditions on 25 November he again ordered an 8t bp tug, though on that occasion, in light of the reaction they had received the previous day, the tug company refrained from advising that the 15t bp tug would be more appropriate.

The actual wind strength encountered during *Norcape*'s approach to Troon on 25 November was stronger than the master had expected. The master acknowledged that the larger tug should have been ordered, but continued the approach to the port.

Although an abort position was included in the vessel's passage plan, it was not included in the master's arrival briefing to the bridge team. Therefore, it did not, on this occasion, provide the formal trigger point for deciding whether or not it was safe to enter port.

The owner should ensure that its bridge teams are reminded of the importance of using the abort position as a formal trigger for deciding whether or not to enter port when undertaking pre-arrival briefings.

2.5.3 Weather information, Troon

The wind speed and direction information, provided by the harbour authority on VHF radio, was taken from an anemometer located above the harbour office, adjacent to the west pier. An anemometer was also located on *Norcape*'s berth in Troon, and the bridge team was able to access this information, by telephone, from the staff at the P&O terminal in the port.

Some port users considered the data from the harbour authority's anemometer read consistently high in strong westerly winds. This was the view of *Norcape*'s bridge team, who also suspected that the anemometer at the P&O berth read slightly low when the wind was from certain directions. The harbour authority was confident that its anemometer was registering an accurate wind speed for the harbour entrance, which differed from the wind speed inside the harbour.

As a basis for its marine risk assessments, the harbour authority should take steps to ensure that its stakeholders have confidence in the wind speed and direction information available in the harbour. The data source should then be used as the basis for introducing manoeuvring limits in the port.

2.6 TOWAGE GUIDELINES

The 8t bp tug ordered to assist *Norcape* on 25 November proved to be inadequate for the task in the strong to gale force winds. *Norcape*'s first headline was almost ashore when the bow thruster failed, and the vessel fell rapidly off the wind. It is possible that, had the 15t bp tug been used, the vessel would have berthed successfully.

The importance of tug operations in ports is emphasised in the Guide, Section 9.1 and the absence of towage guidelines in Troon demonstrates that the safety management system requires review.

The harbour authority should, in conjunction with port users, undertake a risk assessment of towage operations in Troon and produce appropriate towage guidelines.

2.7 VESSEL'S APPROACH TO THE BERTH, TROON

When entering Troon harbour, *Norcape*'s master normally swung the vessel to port off the berth in order to approach the linkspan stern first. Stern lines would then be passed, and the bow thrusters used to bring the bow alongside. If the wind strength was significant, then one of TTC's tugs would be engaged to push *Norcape* onto the berth as necessary. The master had used this approach successfully on 24 November in strong winds, and so attempted to repeat the manoeuvre on 25 and 27 November.

Analysis of approaches made by other bridge teams, operating the vessel in similar wind conditions, shows that a swing to starboard could also be utilised. This approach enabled the vessel's head to be brought through the wind and for a headline to be the first rope ashore. With the bow secure, then lateral thrust from the propellers supplemented by a tug pushing as required were used to move the stern into the berth.

Had *Norcape*'s master been aware that the vessel had recently berthed safely in similar conditions to those forecast, using a swing to starboard, his berthing plan might have been revised. The owner should encourage the exchange of manoeuvring information between bridge teams. This is particularly important when crews have limited experience of the vessel they are operating, and may not have had an opportunity to assess a vessel's manoeuvring capability in all weather conditions.

2.8 BOW THRUSTER OPERATION

Norcape's master was unaware that the vessel's bow thrusters were rated to operate at full power for a maximum of 30 minutes, and so he was unprepared on the night of 25 November for the failure of one bow thruster after 42 minutes of full power operation. With only an 8t bp tug in attendance, the master had little chance of retrieving the situation in the prevailing wind, and had to abort the berthing. A number of alarms had sounded at the central console while the bow thrusters were operating, but as this was a regular occurrence, they had been cancelled by the chief officer without further investigation.

Norcape's bow thrusters each produced thrust approximately equivalent to 9t bp. Had the master had access to a windage diagram for the vessel, he would have been better placed to understand the effect that the strong wind on the beam would have on his intended berthing manoeuvre. MAIB has calculated that 50t bp would be required to hold *Norcape* stationary in a 30kt beam wind. *Norcape*'s profile **(Figure 13)** shows the vessel has more windage forward, and with the bow thrusters only generating a combined total of 18t bp, it is evident that significantly more thrust was needed towards the bow to push *Norcape* alongside. Armed with this information, the master would have been able to plan an appropriate approach, order sufficient tugs of appropriate power to assist, and would have understood the need to complete the berthing expeditiously before the bow thrusters reached their maximum rating.

Norcape had been operated by P&O Ferries for many years, during which time its masters would have built up an in-depth knowledge of the vessel's systems and manoeuvring characteristics. Further, the company had conducted two internal investigations into relevant accidents involving P&O vessels **(see Section 1.18)**. Both investigations had concluded that there was need to provide masters with guidance on operating in extreme weather, and one had concluded that there was a need to ensure the period for familiarisation of the master was effective. However, *Norcape*'s bridge team were unaware of the bow thruster limitations, they had no windage diagram or manoeuvring guidance for use in strong winds, and they were insufficiently familiar with the machinery alarms that sounded on the bridge. Despite their experience of the port from operating *European Mariner*, they had not been properly trained and prepared to operate *Norcape* in that environment.

2.9 CONTROL CONSOLE DISPLAY EQUIPMENT

There was no electronic positional information available to the bridge team at the port console. Consequently, when *Norcape* was manoeuvring close to the berth in Troon, the mooring parties had to report a constant stream of positional information to the bridge team to enable them to retain spatial awareness. This information, relayed via radios, caused the bridge team to become overloaded at times during the manoeuvres. Had the electronic information, available at the centre console, been replicated at the port console, the bridge team would have been better able to monitor the vessel's position relative to the berth and navigational hazards. This would have enabled them to put the position reports from the mooring stations into clearer context.

The owner should review the provision of information at the manoeuvring consoles to ensure that officers manoeuvring the vessel are able to retain full situational awareness at all times.

2.10 USE OF LOCAL SOUND SIGNALS

When *Norcape*'s master decided to abort the berthing, following the failure of a bow thruster, the bridge team sounded three blasts on the vessel's whistle, which was a pre-arranged signal for the linesmen to let go the mooring ropes.

Three short blasts is the sound signal required by the Colregs Rule 34(a) to indicate that a vessel is using astern propulsion, and the skipper of *Red Empress*, the tug assisting *Norcape*, assumed that this is what was happening. The use of three short blasts on the whistle was inappropriate in this context as it had the potential to confuse the tug's crew and other harbour users.

The owner should ensure that its vessels make no sound signals which may be confused with those specified by the Colregs. The harbour authority should ensure that it approves any special sound signals used in its area and that port users are made aware of the meaning of any such signals.

2.11 ANCHORAGE IN BRODICK BAY

2.11.1 Anchoring decisions

Following the aborted berthing at Troon early on 26 November, *Norcape*'s master was informed that the defective bow thruster would not be available as soon as anticipated. The master perceived that remaining underway while awaiting an improvement in the weather would incur excessive fuel costs, and took the decision to proceed to an anchorage. His decision coincided with a further strengthening of the wind.

Having decided to anchor in Brodick Bay, the position in which the master intended to anchor *Norcape* had to be amended when it became evident that another vessel had anchored close to that location. To provide sufficient swinging room the revised anchorage was further to seaward, and this meant that *Norcape* was more exposed to the south-westerly severe gale force winds.

Once he realised that the planned, sheltered anchorage position was not available, the master had the opportunity to reconsider the merits of anchoring in the more exposed location, against remaining underway and steaming slowly. This opportunity was not taken.

A vessel's anchoring equipment is intended for temporary mooring of a vessel; the equipment is not designed to hold the vessel off exposed coasts in rough weather. The change of anchorage position left *Norcape* more exposed to the elements, and the forces acting on the anchoring equipment were increased accordingly.

The owner should ensure, through its SMS and Maritime Resource Management training programme, that bridge teams are made aware of the limitations of anchoring equipment in rough weather, and that decisions regarding the safe conduct of the vessel are not compromised by perceptions of financial consequences.

2.11.2 Scope of anchor cable

On 26 November, *Norcape* anchored off Brodick Bay with 8 shackles of cable on the port anchor in a depth of 36m, the scope of cable being just over 6:1. After the vessel had anchored, the wind strength increased from 40kts to 50kts, with gusts of 80kts. Although the starboard anchor was lowered to the seabed to reduce yaw, the vessel, with her large windage, yawed violently through more than 90º.

The owner's Fleet Regulations state that in heavy weather the scope should be up to 10:1 and that the number of shackles to use at anchor should equal 1.5 x the square root of the depth, which in 36m of water would be 9 shackles.

It was notable that, once the anchor cable had veered through the damaged windlass to the bitter end to its full 10 shackles, the yaw reduced and *Norcape* was able to remain at anchor without dragging, initially in similar weather conditions, until the following day.

The owner should ensure that its officers are made aware of the importance of using a sufficient length/scope of anchor cable, in accordance with its fleet regulations.

2.11.3 Windlass damage

During the early hours of 26 November, *Norcape*'s port anchor cable rendered through the guillotine bar, indicating that the guillotine pin had not been engaged in order to hold the bar in place. In the adverse weather conditions, when the crew attempted to recover the anchor the excessive load on the cable created a force on the clutch which was greater than its design capability. This led to the catastrophic failure of the clutch dog and distortion of the drive shaft.

The owner should note the lessons learnt from previous accidents involving catastrophic windlass failures to ensure its crews are made aware of the limitations of anchoring equipment in severe weather. The owner should also ensure that guillotine pins, where fitted, are always engaged to ensure the full weight of the cable is taken by the bar and its associated housing, and not by the windlass.

2.11.4 Slipping the cable

Prior to slipping the anchor cable and getting underway, a risk assessment was undertaken and the master involved the crew associated with the task in collectively developing a safe system of work. The successful execution of the task demonstrates the benefits of adopting an inclusive approach when undertaking such tasks.

2.12 GROUNDING IN TROON

On 27 November, as *Norcape* approached her berth in Troon, the wind speed exceeded 30kts. The master swung the vessel to port before backing up, but was unable to hold the vessel close to the berth against the wind, and the vessel was set downwind, away from the berth, before mooring lines could be sent to the shore. Although he decided to abort the berthing, *Norcape* grounded before this could be achieved. The bridge team appear to have lost situational awareness at a critical part of the manoeuvre, in common with the berthing attempt 2 days earlier.

The owner should ensure that the lessons learnt from both berthing attempts are promulgated to its fleet to avoid a recurrence.

2.12.1 Connecting the towline

Following *Norcape*'s grounding, the bridge team instructed *Red Finess* to take a line from the port quarter. This was the first time that a tow line had been taken from *Norcape* in Troon, and neither vessel's crew was accustomed to working with a towline connected in this manner.

The towline, one of *Norcape*'s spare mooring lines, had been payed out until the tug stopped and was then made fast on board. No signals were exchanged between the vessels during this process, and both crews assumed the other was satisfied with the length of towline employed. In the event, the towline was too short and, with no gob rope[11] in place, it eventually slipped off the top of the towing hook and recoiled into the water, leading to the fouled propeller and the subsequent injury to the crewman.

The owner should ensure that its crews are familiar with the process and signals associated with connecting a towline and, where tugs are not regularly used, undertake training exercises with local tugs made fast to demonstrate competence. When developing its towage guidelines, the harbour authority should ensure that harbour tugs are familiar with the use of towlines, including the benefits of using a gob rope.

2.12.2 Fouled propeller and injury to crewman

The owner's checklist for grounding **(Annex C)** item 1: *Stop Engines or De-Clutch* was not followed. Later, the master saw the towline detach from the tug, but he took no immediate action to stop the engines or de-clutch the shafts.

The crew at the aft mooring station reacted quickly when they saw the towline detach from the tug, and immediately began to recover it. However, the line found its way into the turning propeller, and as the rope rapidly tightened a crewman was injured.

Notwithstanding the requirements of the company's emergency checklist, the hazard of a line in the water, close to a turning propeller, should have been obvious and resulted in the immediate and automatic braking of the adjacent shaft.

The crewmen at the aft mooring station reacted quickly when they saw the towline go slack. However, while they recognised the danger of a rope in the water and used their initiative in attempting to recover it without delay, they did not alert the bridge team to the hazard. Such a warning might have prompted the bridge team into taking urgent action to stop the shafts.

The MAIB has investigated many accidents involving injuries and fatalities to crew members who have been struck by ropes which have fouled propellers. The owner should take action to ensure that its masters are aware both of the importance of

[11] A gob rope, also known as a gog rope or bridle, is a rope which is passed over the towline in order to move the tow point closer to a tug's stern, which reduces the likelihood of capsize during a towing operation. It can also ensure that the towline runs horizontally onto the tow hook to prevent the towline slipping off the hook.

following the guidance provided in its emergency checklists and, most importantly, the need to control the risks associated with recovering a rope from the vicinity of a turning propeller.

2.13 REFLOATING AND SUBSEQUENT RE-ANCHORING

Once the injured crewman had been landed ashore, the attempt to refloat *Norcape* resumed. A towline was connected and the operation to ballast the vessel down had, serendipitously, caused her to trim by the stern and begin to slide down the slope of the dredged area into deeper water. With the tug pulling and the tide rising *Norcape* was soon afloat.

Once *Norcape* was afloat *Red Finess*'s skipper suggested that he tow her stern towards the west end of the P&O berth in order that the vessel could attempt to secure to the berth. By turning *Norcape* head or stern to wind, her windage would have been reduced to less than 10t, and this would therefore have been a feasible course of action. This option was not formally assessed and the master took the decision to leave harbour and instructed the tug's master to tow *Norcape t*o sea. His decision was made quickly, but was endorsed by the incident management team that was closed-up in the company's offices in Dover.

Norcape had refloated much sooner than anticipated, and before detailed planning had taken place about what to do when she was afloat. However, there was an onshore gale blowing, the propulsion was not running and at least one propeller was fouled. Without the shaft generators running the bow thrusters were not available, and external assistance was limited to two small harbour tugs. That *Red Finess* was able to tow *Norcape* stern first 2 miles to seaward is remarkable and demonstrates that the tug would have been capable of controlling the vessel in the harbour. *Red Empress* was in attendance, but unable to assist due to the weather, and had the towline parted early during this passage it is possible that *Norcape* would have been driven ashore before a main engine could be started.

Given the circumstances, the safer option was to keep *Norcape* within the calmer waters of the harbour and, with both tugs attached, either hold position in deep water or manoeuvre to get lines ashore.

When *Norcape* anchored 2 miles from Troon, the vessel was still without propulsion or bow thrusters. The wind remained onshore, gale force, and the sea state was too rough for the tugs to remain in attendance. Within 2 hours of anchoring, the vessel began to drag her anchor and the bridge team in conjunction with the company's incident management team took the decision to start the starboard engine, weigh anchor and get underway.

Norcape anchored off a lee shore, in gale force winds, before any attempt had been made to check whether the starboard shaft was available. Fortunately, once the remaining anchor started to drag, the starboard shaft was found to be unaffected, and *Norcape* was able to get underway. However, if the fouling of the propellers had been more inhibiting, the outcome could have been more serious.

With the benefit of hindsight, it is difficult to conclude anything other than the decision to tow *Norcape* to sea, into an onshore gale, was inappropriate. The owner should carefully review its emergency response arrangements to ensure all feasible options are proactively evaluated to provide its bridge and incident management teams with the data needed to take informed decisions when faced with similar dynamic scenarios in the future.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENDATIONS

1. The provision of reliable weather forecasts is an important factor in the information needed to plan and execute a safe passage. The owner should ensure that its bridge teams have access to a reliable weather forecast for passage planning. [2.5.1]

2. Had the abort position been used as a formal trigger for deciding whether to continue the approach, the option to abort the arrival and arrange for the larger tug to be used could have been considered. The owner should ensure its bridge teams are reminded of the value of using passage plan abort positions as formal triggers for validating the decision to enter port. [2.5.2]

3. The bridge team's situational awareness was compromised and would have been improved if the electronic information available at the centre console had been available at the port console. The owner should review, and enhance as necessary, the provision of information at the manoeuvring consoles to ensure that officers manoeuvring the vessel are able to retain full situational awareness at all times. [2.9]

3.2 OTHER SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION ALSO LEADING TO RECOMMENDATIONS

1. There was no detailed consultation between the owner and the harbour authority relating to manoeuvring *Norcape* in Troon before she entered service. [2.4.2]

2. Had a pilotage regime been in place in Troon, it is probable that the bridge team would have benefited from the depth of local knowledge and experience of the harbour authority's marine staff. [2.4.3]

3. As a basis for its marine risk assessments, the harbour authority should ensure that its stakeholders have confidence in the wind speed and direction information available in the harbour. This information should then be used as the basis of introducing manoeuvring limits in the port. [2.5.3]

4. The importance of tug operations in ports is emphasised in the Guide to Good Practice on Port Marine Operations, Section 9.1. The absence of towage guidelines in Troon demonstrates that the safety management system requires review. [2.6]

5. Three short blasts is the sound signal required by the Colregs to indicate that a vessel is using astern propulsion, and the tug assisting the vessel assumed that this is what was happening. In different circumstances the sounding of this signal might have caused confusion to the tug's crew and other harbour users. [2.10]

6. *Norcape* anchored off a lee shore, in gale force winds, before any attempt had been made to check whether the starboard shaft was available. Fortunately, once the remaining anchor started to drag, the starboard shaft was found to be unaffected, and *Norcape* was able to get underway. However, if the fouling of the propellers had been more inhibiting, the outcome could have been more serious. [2.13]

7. The owner should carefully review its emergency response arrangements to ensure all feasible options are expeditiously evaluated to provide to bridge and incident management teams with the data needed to take informed decisions when faced with similar dynamic scenarios in the future. [2.13]

3.3 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE BEEN ADDRESSED OR HAVE NOT RESULTED IN RECOMMENDATIONS

1. The opportunity for the masters to gain a full understanding of the vessel's manoeuvring limits, based on the company's extensive experience of operating the vessel in different ports and from lessons learnt from previous accidents, was not taken. The owner had a manoeuvring simulator, with Troon harbour and the vessel modelled, but the masters did not have the opportunity to use this facility prior to the vessel entering service. [2.4.1 2.8]

2. Had the bridge team been aware that the vessel had recently berthed safely in similar conditions to those forecast on this occasion, using a swing to starboard, the passage plan might have been revised. The owner should ensure that an exchange of manoeuvring information occurs between successive bridge teams. This is particularly important when crews are appointed to new vessels and may not have had an opportunity to assess a vessel's manoeuvring capability in all weather conditions. [2.7]

3. Officers should be familiar with the operating limits of all manoeuvring equipment on their vessels. The importance of officers understanding alarm condition information on in-use equipment should also be emphasised. [2.8]

4. When considering the options for anchoring, the master perceived that remaining underway while awaiting an improvement in the weather would incur excessive fuel costs. The owner should ensure that its vessels' management teams are reminded of the limitations of anchoring equipment in rough weather and that decisions regarding the safe conduct of the vessel should not be compromised by perceptions of financial consequences. [2.11]

5. A vessel's anchoring equipment is intended for temporary mooring of a vessel; the equipment is not designed to hold the vessel off exposed coasts in rough weather. The change of anchorage position left the vessel more exposed to the elements, and the forces acting on the anchoring equipment were increased accordingly. [2.11.1]

6. It was notable that, once the anchor cable had veered through the damaged windlass to the bitter end to its full 10 shackles, the yaw reduced and the vessel was able to remain at anchor, initially in similar weather conditions, until the following day. The owner should ensure that its officers are made aware of the importance of using a sufficient length/scope of anchor cable, and clarify the guidance given in its fleet regulations. [2.11.1] [2.11.2]

7. The fact that the anchor cable rendered through the guillotine bar indicates that the guillotine pin was not engaged to hold the bar in place. [2.11.3]

8. The successful execution of the task to slip the cable demonstrates the benefits of an inclusive approach when undertaking risk assessments and developing safe systems of work. [2.11.4]

9. The bridge team lost situational awareness at a critical part of the manoeuvre. The owner should ensure that the lessons learnt from both berthing attempts are promulgated to its fleet to avoid a recurrence. [2.12]

10. No signals were exchanged between the vessel and the tug, and both assumed the other was satisfied with the length of towline employed. In the event, the towline was too short and, with no gob rope in place, it eventually slipped off the towing hook and into the water, leading to the fouled propeller and the subsequent injury to the crewman. [2.12.1]

11. The owners should take action to ensure its masters are aware of the importance of following guidance contained in emergency checklists. [2.12.2]

12. The MAIB has investigated many accidents involving injuries and fatalities to crew members struck by ropes which have fouled propellers. Recovering a rope from the vicinity of a turning propeller is a hazardous task; the owner should ensure that its crews are aware of the risks involved in such an operation. [2.12.2]

SECTION 4 - ACTION TAKEN

4.1 MAIB

The MAIB has:

- Issued a safety flyer **(Annex E)** to remind mariners that anchoring equipment is designed for the temporary mooring of a vessel within a harbour or sheltered area.

4.2 P&O FERRIES

P&O Ferries has:

- Revised its fleet regulations to:
    - Recommend the scope of anchor cable to be used on its vessels in varying weather conditions.
    - Highlight the need to use a suitable length of towline to avoid the line slipping from the towing hook.
    - Introduce a training exercise regime for crews to occasionally use tugs to improve familiarity with the operation.
    - Stress the benefits of briefing all involved personnel when risk assessing tasks such as slipping an anchor.
- Issued a fleet circulars to:
    - Ensure crews are familiar with relevant information found in manufacturers' manuals for manoeuvring equipment when taking over a new ship.
    - Alert crews to the limitations of the design of anchoring equipment when anchoring in gale or near gale force conditions.
    - Clarify the importance of the guillotine bar taking the load of the cable and that securing arrangements, when fitted, are used.
    - Introduce a management of change document which will, among other things, provide guidance on the introduction of new vessels to existing routes and the need to develop windage assessments and manoeuvring limits.
    - Emphasise the importance of regular interface between masters and harbour authorities.
    - Ensure bridge teams pass on experience gained from manoeuvres to the relieving crew.
    - Ensure crews are aware of the dangers associated with recovering a rope near a turning propeller.

- Reviewed the lessons learnt from the accidents, including the decision to return to sea and anchor on a lee shore, without engines, at its Maritime Resource Management courses.

4.3 ASSOCIATED BRITISH PORTS

ABP has:

- Met with the Troon Tug Company to discuss lessons learnt from the accidents.
- Commenced a review of the Troon safety management system.
- Agreed with P&O Ferries the need to liaise in relation to other proposed vessels for the Larne to Troon service.
- Planned to review risk assessments to determine whether pilotage should become compulsory within Troon harbour.

SECTION 5 - RECOMMENDATIONS

Associated British Ports is recommended to:

2012/151 Undertake a formal review of the need for compulsory pilotage in Troon.

2012/152 Review the formal safety assessment for marine operations in Troon harbour to ensure that:

- Towage guidelines are developed in conjunction with port users.
- Its anemometer is placed in an optimum location to provide accurate, reliable wind information which is accepted by port users as a basis for its control measures.
- Port users are aware of any locally agreed sound signals, which should be such that they cannot be confused with those required to be used by the Colregs.

The **Maritime and Coastguard Agency** is recommended to:

2012/153 Liaise with Associated British Ports and arrange a Port Marine Safety Code "health check" visit to Troon on completion of the harbour authority's formal safety assessment for the port (see 2012/152).

P&O Ferries is recommended to:

2012/154 In relation to passage planning, monitoring and manoeuvring:

- Review the weather advice available for its ports of call, and provide guidance to its masters on the most appropriate sources to use.
- Remind its bridge teams of the value of using passage plan abort positions as formal triggers for validating the decision to enter port.
- Review the provision of information to manoeuvring consoles to ensure that officers manoeuvring their vessels are able to retain full situational awareness.

2012/155 Carefully review its emergency response arrangements to ensure all feasible recovery options are proactively evaluated so as to provide its ships' staff and incident management response teams with the data needed to take informed decisions.

Marine Accident Investigation Branch
December 2012

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

Annex A

Weather forecasts for Barassie (Troon) obtained from windfinder.com and Met Office forecast for Larne/Cairnryan route

Barassie (BARASSIE)

Time zone: UTC 0.0 | Sunrise: 08:12 Sunset: 15:59
Last update: 16:26 local time - initial time: 06:00 UTC

WINDFINDER.com

Friday, Nov 25

Local time	00h	01h	02h	03h	04h	05h	06h	07h	08h	09h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h
Wind direction	←	←	←	←	↖	↖	↑	↑	↑	↑	↖	←	←	←	←	←	←	←	←	←	←	↖	↑	↑
Wind speed (Knots)	23	24	25	24	25	23	25	28	32	38	32	30	28	24	23	22	22	24	24	23	21	21	22	22
Wind gusts (Knots)	31	31	33	32	33	29	33	39	44	50	42	39	37	32	31	29	31	32	33	30	28	27	29	27
Cloud cover																								
Relative humidity (%)	74	70	68	65	62	65	63	66	67	80	81	66	68	66	64	66	67	69	66	66	68	75	69	75
Precipitation type																								
Precipitation (mm/h)	0.3	1.0	0.5	0.5	0.4	0.3	0.2	0.3	0.1	1.2	0.7	1.4	1.1	0.7	0.2	0.2	0.4	0.6	0.5	0.3	0.1	0.4	0.2	0.0
Air pressure (hPa)	1005	1006	1008	1009	1009	1008	1008	1008	1006	1007	1007	1008	1009	1011	1012	1013	1014	1015	1016	1017	1017	1017	1016	1016
Air temperature (°C)	10	9	9	9	9	9	9	9	9	9	8	9	8	8	8	8	8	8	8	8	8	8	9	9
Feels like (°C)	5	5	4	4	4	4	4	4	4	3	2	3	3	3	3	3	3	3	3	3	4	4	4	4

Saturday, Nov 26

Local time	00h	01h	02h	03h	04h	05h	06h	07h	08h	09h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h
Wind direction	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖	←	←	↖	←	←	↖	↖	↖	↖	↖	↖	↖	↖	↖
Wind speed (Knots)	22	25	26	26	25	26	27	26	25	27	27	25	25	25	26	28	27	26	26	27	28	28	30	32
Wind gusts (Knots)	28	34	34	37	37	39	40	41	38	40	40	39	37	37	39	41	39	37	36	37	38	40	43	45
Cloud cover																								
Relative humidity (%)	81	84	86	89	89	86	84	85	86	83	84	86	89	90	89	84	76	80	80	80	80	80	80	83
Precipitation type																								
Precipitation (mm/h)	0.0	0.3	0.3	0.5	0.7	0.7	0.7	0.1	0.1	0.1	0.1	0.1	0.4	0.5	1.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Air pressure (hPa)	1015	1014	1012	1011	1010	1009	1008	1008	1008	1008	1008	1007	1006	1006	1005	1005	1005	1005	1005	1004	1003	1003	1001	999
Air temperature (°C)	9	9	10	10	10	11	11	11	12	13	13	14	14	14	14	14	14	13	13	13	13	13	13	13
Feels like (°C)	4	4	5	5	10	11	11	11	12	13	13	14	14	14	14	14	14	13	13	13	13	13	13	13

Sunday, Nov 27

Local time	00h	01h	02h	03h	04h	05h	06h	07h	08h	09h	10h	11h	12h	13h	14h	15h	16h	17h	18h	19h	20h	21h	22h	23h
Wind direction	↖	↖	↖	↖	↖	↖	←	←	↘	↘	↘	↘	↘	↘	↘	↘	←	←	←	←	←	←	←	←
Wind speed (Knots)	34	33	32	34	35	40	39	36	35	32	30	28	25	22	20	20	20	18	16	18	16	16	15	12
Wind gusts (Knots)	48	48	46	51	53	55	55	50	47	44	41	38	34	30	27	26	25	24	21	23	20	21	20	16
Cloud cover																								
Relative humidity (%)	86	90	90	82	76	72	78	75	74	71	68	64	65	66	69	70	69	66	69	72	69	84	73	76
Precipitation type																								
Precipitation (mm/h)	0.7	2.3	2.2	3.2	0.2	0.0	0.3	0.2	0.0	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.6	0.2	0.0
Air pressure (hPa)	997	996	995	995	996	996	997	1000	1002	1005	1007	1009	1011	1012	1013	1014	1015	1015	1016	1016	1017	1017	1017	1017
Air temperature (°C)	13	13	13	13	12	11	11	10	10	9	9	9	9	9	9	9	9	9	8	9	9	9	9	9
Feels like (°C)	13	13	13	13	12	11	11	5	4	4	4	4	5	5	5	5	5	4	5	5	5	5	5	5

Five Day Forecast

Tel: 0870 900 0100 www.metoffice.gov.uk

For access to a forecaster: +44(0)1224 407562
Communications Manager: +44(0)1224 407560 Email: nimbusamo@metoffice.gov.uk

P&O EUROPEAN FERRIES (IRISH SEA) LTD

Forecast Issued on Monday, 21 November 2011 at 13:00 UTC

Cairnryan/Larne

HEADLINE

GALE WARNING IN FORCE	NO	**LIGHTNING RISK:** 3 (moderate)
SEA TEMP (Celsius)	PS 11	

GENERAL SITUATION: A large anticyclone has across central Europe continues to stall the normal eastwards progression of fronts across the British Isles through today. The anticyclone will drift southwards on Wednesday as a deepening depression near Iceland on Tuesday tracks northeast past Scotland reaching the Norwegian Sea by Friday bringing strong southwesterly flow.

CONFIDENCE: High becoming low during Thursday due to the uncertainty in the track and depth of the depression.

AT A GLANCE - VALID UNTIL 1800 Tue 22-Nov-2011

Phase	Wind (Mean)	Time (UTC)	Sea (Sig)	Time (UTC)
Max	22	22/0100	1.4	22/0200
Min	03	21/2100	0.6	21/1200

Times in 'UTC' - Cloud Height (FT) above sea level = 5/8 coverage or more below 5000ft

	Mon 21-Nov-2011				Tue 22-Nov-2011				
	12	15	18	21	00	03	06	09	12
Weather	DRY	DRY	DRY	DRY	RAIN	RAIN	DRY	DRY	DRY
Visibility	8KM	9KM	10KM+	10KM+	9KM	8KM	10KM+	10KM+	10KM+
Temp	12	12	12	11	10	10	10	11	11
Cloud	NIL SIG	4600	4000	1100	1700	3400	4900	NIL SIG	NIL SIG

Times in 'UTC' - Wind Speed in 'Knots' - Wave and Swell Heights in 'Metres' - Wave and Swell Periods in 'Seconds'

		Mon 21-Nov-2011				Tue 22-Nov-2011								Wed
		12	15	18	21	00	03	06	09	12	15	18	21	00
Wind Dirn		SSW	SSW	SSW	W	WNW	NNW	NNW	NW	WNW	SW	SSW	SSW	SSW
10m Wnd Spd		10	7	7	3	14	18	11	10	12	11	16	18	21
10m Gust		14	10	10	5	19	25	15	14	17	15	23	26	30
50m Wnd Spd		11	8	7	3	15	23	12	11	14	12	18	21	25
50m Gust		15	11	10	5	22	32	17	15	19	17	26	29	35
100m Wnd Spd		12	8	8	4	17	24	13	12	15	13	20	23	27
100m Gust		16	12	11	5	23	34	18	16	21	18	28	32	38
Sig Wav Hgt		0.6	0.6	0.7	0.7	0.9	1.2	1.0	1.0	0.9	0.9	0.7	0.9	1.0
Max Wav Hgt		1.0	1.0	1.1	1.2	1.4	1.9	1.6	1.6	1.4	1.4	1.2	1.4	1.6
Sig Wav Prd		5	8	11	11	11	8	10	11	10	10	11	7	6
Swell Dirn		S	S	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW	WNW
Swell Hgt		0.4	0.4	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.5
Swell Prd		5	5	12	15	15	15	15	15	14	14	14	13	13

	Wed 23-Nov-2011				Thu 24-Nov-2011				Fri 25-Nov-2011				Sat 26-Nov-	
	03	06	12	18	00	06	12	18	00	06	12	18	00	06
Wind Dirn	SSW	SSW	WSW	WNW	SSW	SSW	SSW	SSW	SSW	W	W	WSW	SSW	SSW
10m Wnd Spd	23	22	12	2	18	20	22	29	26	18	17	17	17	22
10m Gust	32	31	17	3	26	27	30	40	36	26	24	23	23	30
50m Wnd Spd	27	26	15	3	23	24	26	36	32	22	20	20	20	26
50m Gust	37	36	21	4	32	33	37	50	45	31	29	28	28	36
100m Wnd Spd	29	28	16	3	25	26	29	39	35	24	22	22	21	28
100m Gust	40	39	23	4	34	36	40	54	49	34	31	30	30	39
Sig Wav Hgt	1.3	1.6	1.5	1.3	1.4	1.5	1.6	2.4	2.1	1.6	1.3	1.2	1.2	1.6
Max Wav Hgt	2.1	2.6	2.4	2.0	2.2	2.3	2.6	3.8	3.4	2.5	2.1	1.9	2.0	2.6
Sig Wav Prd	5	6	7	8	7	6	6	6	6	7	6	8	8	6
Swell Dirn	WNW	WNW	SW	WNW	NW	NW	NW	WNW	WNW	S	S	NW	NW	NW
Swell Hgt	0.5	0.6	0.8	0.9	0.9	0.8	0.6	0.4	0.3	1.3	0.8	0.9	1.0	0.9
Swell Prd	13	13	9	12	12	12	11	11	12	7	7	13	12	11

Annex B

Risk assessment and safe system of work for slipping the anchor and cable from *Norcape*

P&O Ferries — Risk Assessment - NORCAPE

Title	Anchor Cable, release of bitter end under tension.		
Operation	Deck Department Operations - Mooring Decks - Mooring operations		
Location	Mooring deck fwd	**Department**	D
Duration	1 Hour	**Frequency**	Unique
Operators at Risk	Crew	**Assessment ID**	RAV0000070
Other persons at Risk			

DESCRIPTION OF ACTIVITY

Full anchor cable paid out due windlass failure, and windlass unusable. Tension now on bitter end of cable. Bitter end to be released to let go cable overboard through spurling pipe and hawse pipe.

HAZARDS, RISKS AND ASSESSMENT OF RISK

Overall Risk Factor: MODERATE(4)

No	Hazard	Existing Controls	Control References	Likelihood x Severity = Risk Factor
01	Slips/Trips	Adequate Loghting, highlight hazards where practical, good housekeeping, be aware of surface underfoot.	Code of SWP for Merchant Seamen	Highly Unlikely 1 Slightly Harmful 1 TRIVIAL (1)
02	Manual handling including knocking out bitter end pin.	Correct manual handling procedutes. Adequate and standby personnel available.	Code of SWP for Merchant Seamen	Highly Unlikely 1 Slightly Harmful 1 TRIVIAL (1)
03	Injury from flying object, rust/scale etc	Stand as far as possible from windlass, appropriate PPE.	Code of SWP for Merchant Seaman	Highly Unlikely 1 Slightly Harmful 1 TRIVIAL (1)
04	Communications - incorrect intership messages	Prefix walkie talkie messages with Norcape. All instruction to come from Bridge.		Highly Unlikely 1 Slightly Harmful 1 TRIVIAL (1)
05	Being hit by bitter end as it passes overboard.	Writtend tool box talk/discussion. Bitter end not released until personnel confirmed clear. Direct instructions from bridge only.	Code of SWP for Merchant Seamen	Highly Unlikely 1 Extremely Harmful 3 MODERATE (3)
06	Tension on anchor chain	Tension to be minimised to up and down by ship handling.		Likely 3 Slightly Harmful 1 MODERATE (3)
07	Other injury, personnel on catwalk fall off.	Personnel on catwalk to wear safety harness.	Code of SWP for Merchant Seamen	Unlikely 2 Harmful 2 MODERATE(4)

ADDITIONAL CONTROL

No	Additional Controls	Action Date	Completed
01		/ /	/ /
02		/ /	/ /
03		/ /	/ /
04		/ /	/ /
05		/ /	/ /
06		/ /	/ /
07		/ /	/ /

ADDITIONAL INFORMATION

Vessel Additional Information

Office Additional Information

SIGNATORIES

Assessed by	Rank	Date	Review by
Hutchinson R.	C/O	27/11/2011	
Confirmed by	**Rank**	**Date**	26/11/2012
Mark R. Atkinson	MASTER	27/11/2011	

Norcape

Safe System of Work for Releasing the Bitter End

Plan A

1. Have two engines and two thrusters running and in use.
2. Retrieve and house the starboard anchor.
3. Windlass gypsy to be out of rear, separated from the drum end.
4. Attach the marker buoy to the anchor cable outboard of the guillotine and pass the buoy out through the hawse pipe so it is in the water along with all the spare "tail".
5. Two man team standing by adjacent to the bitter end.
6. Lubricate the bitter end pin as much as possible using oil/penetrating oil/WD 40.
7. Two men maximum on the focsle head. One to standing by at the guillotine, the other to be ready at the windlass brake.
8. One man on the cat walk watching the anchor cable
9. Manoeuvre the vessel so that the weight comes off the anchor cable and the cable is up and down.
10. On confirmation that the cable is up and down the guillotine is lashed up and out of the way. Guillotine man then moves to the starboard corner of the focsle head
11. Cat walk watcher confirms that the cable is still up and down, and informs the bridge. The bridge instructs the windlass brake to be released.
12. Brake man then moves quickly to the starboard corner of the focsle head and confirms to the bridge that both focsle men are in a safe position.
13. Bridge instructs the bitter end team to hammer the pin out.

Annex C

P&O Ferries, Emergency Situation Check Card for grounding

23 ESCC 23. GROUNDING

1.	Stop engines or De-Clutch (see note)	time
2.	Sound General Emergency alarm & Inform Master	
3.	Close watertight doors without any delay & check all closed	
4.	Start Event Log	
5.	Double ring STANDBY for ECR & Inform ER	
6.	Determine position, tidal detail and nature of bottom	
7.	Ballast down to prevent movement until ready to refloat	
8.	Keep passengers, ECR and OBS informed	
9.	Deck lights on	
10.	Show appropriate signals	
11	Broadcast relevant radio signals (safety/urgency/distress) & inform the Coastal Authorities	
12	Warn shipping in the area.	
13	Inform the Company.	
14	Fax departure stability condition to Fleet Department	
15	**Before** taking **further action**, consider all relevant information such as: State, height and range of tide Nature of bottom Weather and sea state Depth of water all round vessel Damage to ship, flooding, possible pollution Stability condition of the ship	
16	Consider possible actions, such as: use of high sea suction(s) lightening of the ship: ballast tanks, lifeboats, passengers, cargo, fuel need to ballast down to prevent damaging movement	
17	Refer to SOPEP (Pollution or possible pollution)	
18	Call for assistance as necessary, if unable to float safely by the ship's own efforts	
19	Let go the anchors (unless good reason not to do so) to prevent the ship moving further aground on a rising tide, or under influence of wind and sea	
20	Use the accident boat to take soundings, if required	
21	Keep all parties informed (Coastal Authorities, Company, Passengers and Crew)	
22	Consider other emergencies, fire, pollution, missing persons, personal injury	
	Notes: Reversing engines before carrying out the investigations in 15 may have serious consequences Grounding refers to both stranding and beaching. Engines may be de-clutched then stopped.	

Annex D

Larne Harbour Limited - PEC requirements

PILOTAGE EXEMPTION CERTIFICATE REQUIREMENTS

1 Applications and Qualifications

Pilotage exemption certificates (PEC's) for the Port of Larne Pilotage District will be granted by Larne Harbour limited (the Competent Harbour Authority) to persons who are bona fide Masters or First Mates of ships, subject to their fitness and qualifications both by experience and examination.

The bona fide Master or First Mate of a ship applying for PEC will satisfy the CHA as to their experience in the pilotage area by completing the following acts of pilotage.

(a) A minimum of **12 trips in and 12 trips out** to and from any berth within the Pilotage District. At least 50% must be undertaken during the hours of darkness. Such tripping to be completed throughout the 12 months immediately prior to application. 2 acts of pilotage (1 inward, 1 outward) will be onboard assessment acts. Assessment acts will be undertaken with an authorised PEC holder (the assessor) for the vessel for which the PEC is sought or an authorised Larne Harbour Pilot.

The PEC candidate will be responsible for ensuring that the form is completed by the assessor and is forwarded to the Harbour Office prior to the examination.

(b) Candidates must have visited LPC within the preceding month prior to the examination and be familiar with VTS procedures within the pilotage area. They must ensure that the application form is signed by the Duty Marine Officer.

(c) Familiarisation trip. Each candidate will complete a familiarisation trip of the harbour and attend a berthing of a ship on board a tug. They must ensure that the application form is signed by the tug master.

(d) Supply copy of evidence of suitability from employer or Masters.

2 Vessels

Pilotage Exemption Certificates may be limited at the discretion of the Authority to particular berths and zones and will be limited to vessels of substantially similar or lesser size and with similar handling characteristics to those on which the candidate has acquired his/her pilotage experience.

At the discretion of the Authority, a PEC holder will normally be entitled to pilot vessels with similar handling characteristics up to 20 percent larger (gross tonnage) than those on which he/she has pilotage experience, after one year, provided at least one hundred pilotage acts are completed within that year.

3 Zones

Harbour - All waters north of a line running eastward from Curran Point – i.e. for practical purposes – form seaward as far as Ballylumford "A" Jetty.

Larne Lough- The waters south of a line running eastward from Curran Point – i.e. for practical purposes – Larne Lough south of Ballylumford "A" Jetty

4 **Monthly Returns**

Every non-ferry PEC holder will, within 14 days, after the expiry of each calender month, make a return in writing to the Harbourmaster of the occasions during the calendar month immediately proceeding on which he will have navigated vessels within the limits of the Port. To facilitate the making of these returns pre-printed forms are available.

Ro-Ro ferry PEC holders will have their pilotage acts recorded by LPC and it will be the PEC holder's duty and responsibility to ensure it is so recorded.

5 **Renewals**

Pilotage Exemption Certificates will be issued for a period not exceeding 12 months. They will be renewed upon written application by the PEC holder (supported by the operator of the ship or ships to which the PEC relates) provided that the Authority is satisfied that the PEC holder has piloted the ship (or ships) to which the PEC relates for at least the same number of acts as that required for the initial exemption qualification during the previous year, and there has been no significant incident involving the PEC holder during that period.

Where candidates fail to meet the above then a renewal will only be granted subject to a further examination. When a PEC is continuously renewed the holder will be re-assessed every 5 years. Certificates will not be renewed after holders reach the age of 65 years, except in exceptional circumstances relative to craft plying within the limits of the pilotage area.

6 **Conditions relating to Examination**

Examinations will be conducted by the Harbourmaster and a senior Master (Pilotage Exemption Certificate holder), experienced in the operation of that class of vessel in the Port of Larne. The PEC syllabus is Appendix III.

Candidates will be required to satisfy the examiners on the following:

- their competence to navigate safely in the Pilotage District, or that part of it to which the certificate is to relate and to manoeuvre safely onto and from the relevant berths located in the area to which the certificate is to relate;

- their knowledge of local bylaws and regulations, tidal and geographical

conditions and buoys and other navigation marks;

- their practical familiarity with the use of local tugs for assisting the ship or ships to which the certificate is to relate when berthing and unberthing;

- their knowledge of communication procedures in operation in the Pilotage District;

- their working knowledge of spoken English;

If successful the CHA will issue a letter of condition between the CHA and PEC holder and his employer defining the criteria to be met by the holder for his PEC to remain valid.

7 CHA Investigations / Inquiry following an incident

Pilotage Exemption Certificate holders shall attend the Harbour Office at the order or summons of the CHA to answer any complaint or charge which may be made against them for the alleged misconduct, or in respect of any marine casualty which may have occurred whilst they were in charge of their vessel in that part of the pilotage area for which they are certificated.

8 Suspension or revocation of a PEC

If, following an appropriate enquiry by the CHA, the PEC holder is found guilty of negligence, incompetence or misconduct, the CHA may suspend or revoke the certificate. Before doing so, prior written warning of the suspension or revocation will be given as will the right to make representations.

9 Fees

Fees related to the issue, examination and renewal of PEC's can be found in Appendix IV.

APPENDIX III

PILOTAGE SYLLABUS

Candidates for authorisation as a PILOT or EXEMPTION CERTIFICATE HOLDER are required to be fully conversant with the following subjects: -

1 **General Navigation**

(a) The International Regulations For The Prevention Of Collisions At Sea

(b) IALA Maritime Buoyage – System A

(c) Relevant Notices to Mariners, Marine Guidance and Information Notices

(d) Passage Planning and anticipated underkeel clearance

(e) Ship-handling characteristics of vessels – squat, bank effect and interaction with other vessels

(f) General radio communication procedures

2 **Rules and Regulations**

(a) Bye-laws, Regulations and Directions for Navigating in the District

(b) Pilotage Directions, including the areas and ships to which they apply

(c) Pilot Boat Regulations*

(d) Restricted Areas and Zones (none currently implemented)

(e) Limitations and restriction of other vessels requiring special consideration

(f) Dangerous Substances in Harbour Areas Regulations 1987

3 **Local Knowledge and Experience**

The candidate's experience will be determined by his/her ability to demonstrate detailed local knowledge pertinent to the area for which he/she is being examined with particular reference to: -

(a) Pilotage and Harbour limits

(b) Traffic movement and patterns

(c) The names and characteristics of lights, their ranges and arcs of visibility

(d) The names and characteristics of buoys, beacons and other seamarks

(e) General direction of tidal streams for the approaches, channels and berths.

(f) Weather patterns and impacts upon sea and harbour conditions

(g) The set, rate, rise and duration of the tides and use of tide tables

(h) General coastal features, channel reaches, headlands, points and shoals in the district.

(i) The approximate width of the various channels

(j) The bearing and distance from one buoy to another on each side of the channel.

(k) The depths of water throughout the area, particularly at the buoys.

(l) Clearing marks for shoals and points visually by day or night and by radar.

(m) Significant radar patterns of aids to navigation and the use of parallel indexing.

(n) Passage planning and critical areas of navigation.

(o) The names of anchorages, their positions, uses and limitations.

(p) Knowledge of Jetties and Berths including general description, type of vessels using the facility, maximum and minimum sizes of vessels, limits for berthing and unberthing, depths, manoeuvring area, etc

(q) Limitations and restrictions of other vessels requiring special consideration.

(r) Boarding and landing hazards and procedures*

(s) Knowledge of Larne Harbour Emergency Procedures

4 **Communications**

(a) Larne Port Control Centre

(b) Ballylumford Power Station Jetties

(c) Larne Quays

(d) Tug and line boat operations

Assessments and Courses

(a) Simulation training*

(b) Bridge Team Management

(c) Basic sea survival*

(d) Ship-handling

(e) Radar Course

Any other relevant information at the discretion of the examiners

Note: Items marked with an asterisk are not applicable to applicants for exemption certificates.

Annex E

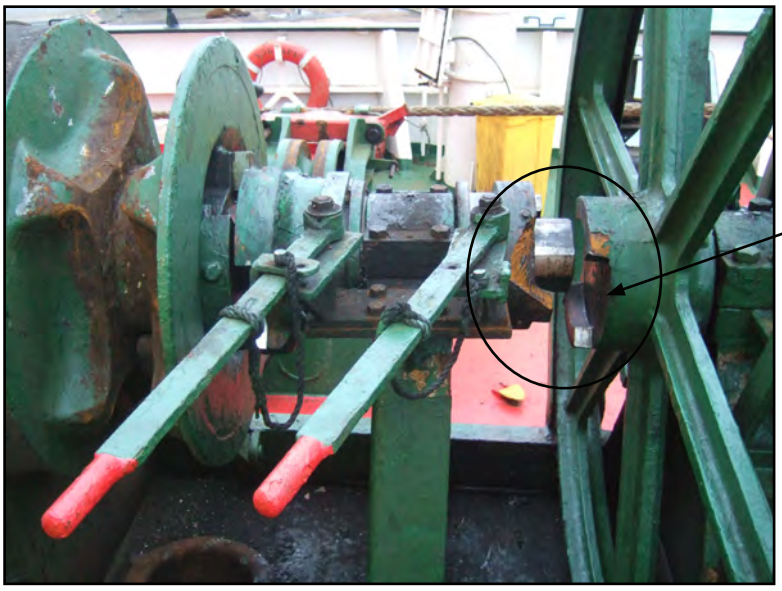
MAIB Safety Flyer to the Shipping Industry

MAIB

MARINE ACCIDENT INVESTIGATION BRANCH

FLYER TO THE SHIPPING INDUSTRY

Windlass damage when weighing anchor in gale force winds



Narrative

On 26 November 2011, the port windlass of the UK registered ro-ro vessel *Norcape* suffered catastrophic damage during an attempt to weigh anchor in near gale force winds.

At 0354 the wind was south westerly 30 knots when the vessel anchored in Brodick Bay, Isle of Arran, with 8 shackles on the port anchor and the starboard anchor on the seabed to reduce anticipated yaw. A short time after anchoring, *Norcape* began to yaw, the intensity of which increased steadily until, at 0536, the vessel yawed through 150º and the port cable began to slip through the windlass.

The decision was taken to get underway, and the starboard anchor was weighed. The crew then began to weigh the port anchor, using engines to reduce the load on the cable.

The wind strength was increasing steadily and the windlass struggled to recover the cable when, suddenly and without warning, the dog clutch shattered and the cable payed out to the bitter end. The cable was subsequently slipped and *Norcape* was taken out of service due to the damage to the windlass and the loss of her anchor.

Safety Lessons

The decision to anchor was taken with strong winds blowing and with gale force winds expected. Although the selected anchorage was on the lee side of the Isle of Arran, it did not provide sufficient shelter to prevent the vessel's anchoring equipment being subjected to excessive loads.

An extract from the International Association of Classification Societies (IACS) *Requirements concerning mooring, anchoring and towing* states:

> *The anchoring equipment required herewith is intended for temporary mooring of a vessel within a harbour or sheltered area when the vessel is awaiting berth, tide, etc.*

The fact that the anchor cable rendered indicated that the cable had slipped through the guillotine bar arrangement. Investigation revealed that the locking pin, which should have held the bar in place, was not engaged when the cable rendered. It transpired that the vessel's SMS for anchoring operations contained no reference to the use of the locking pin when anchoring.

The IACS requirements in relation to the strength of the windlass brake and stopper (guillotine) states:

> *A chain stopper should withstand a pull of 80% of the breaking load of the chain. The windlass with brakes engaged and cable lifters disengaged is to be able to withstand a pull of 45% of the breaking load of the chain.*

The guillotine/chain stopper housing is the strongest part of the anchoring equipment and is designed to take the load of the cable when a vessel lies at anchor. In this case, the load of the cable transferred to the windlass as the cable slipped, and this initiated the failure mechanism which culminated in the catastrophic failure of the dog clutch.

The severe yaw that developed was due to the windage of the vessel's superstructure, which generated forces in excess of the design load of the anchoring equipment.

To try and prevent such accidents occurring in the future, owners and operators are strongly advised to review their SMS procedures for anchoring to ensure they address the above safety issues and, specifically:

1. That masters have clear guidance on the capability of their vessel's anchoring system, including:
    - Any limitations of the anchor system components, including that of the windlass.
    - Effects of windage in various load conditions
    - Risks associated with excessive yaw.
2. That the SMS guidance on anchoring is vessel-specific and highlights that, when at anchor, the weight of the cable should be taken on the guillotine fittings, which should be correctly engaged (Nautical Institute, Mooring and Anchoring Ships, Volume 1, 2009. ISBN: 978 1 870077 93 4 refers).

This flyer and the MAIB's investigation report are posted on our website:

www.maib.gov.uk

For all enquiries:

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December 2012

Marine Accident Report