ACCIDENT REPORT

Report on the investigation of

the collision between the dredger

Shoreway

and the yacht

Orca

7 miles off the coast of Felixstowe

resulting in one fatality

on 8 June 2014

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

VERY SERIOUS MARINE CASUALTY REPORT NO 10/2015 MAY 2015

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

AB	-	Able seaman
AIS	-	Automatic Identification System
ARPA	-	Automatic Radar Plotting Aid
BNWAS	-	Bridge Navigational Watch Alarm System
CEC	-	Certificate of Equivalent Competency
CoC	-	Certificate of Competency
COLREGs	-	International Regulations for the Prevention of Collisions at Sea, 1972 (as amended)
DoC	-	Document of Compliance
DPA	-	Designated Person Ashore
ECDIS	-	Electronic Chart Display Information System
GPS	-	Global Positioning System
HHA	-	Harwich Haven Authority
IMO	-	International Maritime Organization
ISM Code	-	International Safety Management Code 2010
kts	-	knots
LOA	-	length overall
m	-	metre
m^3	-	cubic metre
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
MOB	-	Man Overboard
nm	-	Nautical miles
OOW	-	Officer of the Watch
PEC	-	Pilotage Exemption Certificate
PSC	-	Port State Control
RNLI	-	Royal National Lifeboat Institution
RYA	-	Royal Yachting Association
SAR	-	Search and Rescue

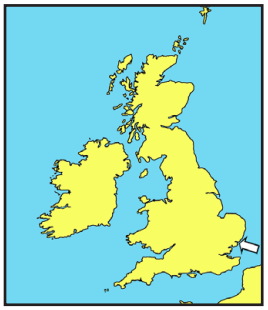
SMC	-	Safety Management Certificate
SMS	-	Safety Management System
SOLAS	-	International Convention for the Safety of Life at Sea 1974 (as amended)
STCW 95	-	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended
UTC	-	Universal Co-ordinated Time
VDR	-	Voyage Data Recorder
VHF	-	Very High Frequency
VTS	-	Vessel Traffic Services

TIMES: All times used in this report are British Summer Time (UTC +1)

Orca

Shoreway

SYNOPSIS



At 1331 on 8 June 2014 the dredger *Shoreway* and the sailing yacht *Orca* collided 7 miles off Felixstowe. Damage to *Orca* was catastrophic and it sank within minutes of the collision. The yacht's skipper was rescued from the water by *Shoreway*'s rescue boat but the skipper's wife, Mrs Bernadine Ingram, could not be found despite an extensive air and sea search. The body of Mrs Ingram was recovered from the sunken yacht by divers the next day. There was no damage to *Shoreway*.

The MAIB investigation established that:

- The vessels collided in good visibility as neither the chief officer, who was alone on the bridge of *Shoreway*, nor the skipper of *Orca*, who was below deck in the cabin, were maintaining a proper lookout during the period immediately prior to the collision.

- Following an alteration of course by the chief officer on *Shoreway*, *Orca* entered a blind sector caused by the vessel's bow-mounted rainbow discharge equipment and remained unseen by the chief officer until seconds before the collision.

- *Orca*'s skipper saw *Shoreway* approximately 1.6 miles away and, from its aspect at the time, judged there to be no risk of collision and decided to engage his autopilot and go briefly below.

- *Shoreway*'s officer of the watch should not have been alone on the bridge at the time of the accident.

- The risks of vessels, especially small craft, not being detected in the blind sector on *Shoreway*, had never been assessed by the company or the crew and were not mentioned in either the master's standing orders or the vessel's safety management system.

- The safety management system on board *Shoreway* was a computer based fleet-wide generic safety management system that was of little benefit to the ship's crew as it contained no vessel-specific information, guidance or instructions.

Harwich Haven Authority has reminded all Pilot Exemption Certificate holders that two qualified watchkeepers should be on the bridge when navigating in the pilotage area, and reminded yacht owners of the importance of keeping a good lookout. Boskalis Westminster Shipping B.V. has issued a safety message to its fleet emphasising the need to keep a good lookout, and has conducted an internal investigation.

Recommendations have been made to Boskalis Westminster Shipping B.V. aimed at improving its vessels' safety management systems and addressing a technical issue regarding the *Shoreway*'s voyage data recorder.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *SHOREWAY*, *ORCA* AND THE ACCIDENT

SHIP PARTICULARS		
Vessel's name	*Shoreway*	*Orca*
Flag	Cyprus	UK
Classification society	Bureau Veritas	N/A
IMO number	9420344	N/A
Type	Suction hopper dredger	Sailing yacht
Registered owner	Boskalis Westminster Shipping B.V.	Privately owned
Manager(s)	Boskalis	N/A
Construction	Steel	GRP
Year of build	2009	1997
Length overall	97.5m	9.68m
Gross tonnage	5005	N/A
Minimum safe manning	8	N/A
Authorised cargo	Dredge spoil	N/A
VOYAGE PARTICULARS		
Port of departure	Felixstowe	Suffolk Yacht Harbour
Port of arrival	Felixstowe	
Type of voyage	Dredging project	Day sail
Cargo information	Dredged silt & sand	N/A
Manning	14	2
MARINE CASUALTY INFORMATION		
Date and time	8 June 2014, 1331	
Type of marine casualty or incident	Very Serious Marine Casualty	
Location of incident	51°55.86N 001°29.01E	
Injuries/fatalities	Nil	1 fatality
Damage/environmental impact	Nil	Vessel sunk/none
Ship operation	On passage	Sailing
Voyage segment	Mid-water	Mid-water
External & internal environment	Wind: south-easterly force 2 to 3. Sea state: calm. Visibility: good	
Persons on board	14	2

1.2 NARRATIVE

1.2.1 Background

The dredger *Shoreway* was involved in a maintenance project within the port of Felixstowe. This involved dredging silt from areas within Felixstowe harbour and then proceeding to an agreed spoil ground at sea, where the silt was dumped. The vessel was then used to dredge for clean sand, which was brought back to the port and dumped in a reclamation area, before once again dredging silt and continuing the cycle. At the time of the accident *Shoreway* was proceeding out of the harbour to dump silt at the spoil ground.

The yacht *Orca* had been on a day-sail and was returning towards its mooring at Suffolk Yacht Harbour when the collision occurred. On board were the skipper, Mr Ingram (hereafter called the skipper), Mrs Ingram and their two dogs.

1.2.2 Events prior to the collision

At 0730 on Sunday 8 June 2014 *Shoreway*, loaded with silt, was approaching the spoil ground when the chief officer and second officer took over the 12-hour day watch on the bridge; the watch's able bodied seaman (AB) was on deck. By 1000, they had dumped the silt, moved to the sand dredging grounds, loaded the vessel with sand and were on passage back to Felixstowe.

At 0950 *Orca* left Suffolk Yacht Harbour. It was the skipper's intention to spend the day sailing the yacht in waters off Felixstowe and then return to the moorings in the late afternoon. It was a warm sunny day, with a light breeze.

The skipper motored *Orca* out of the marina before hoisting the mainsail and motor-sailing through Harwich Haven, keeping to the recommended yacht route[1] to the west. The skipper and Mrs Ingram were both in the cockpit and both were wearing 150 newton automatic inflation lifejackets. This was Mrs Ingram's first trip on *Orca* during the 2014 season and she was a passenger, with no crewing duties.

At 1110, *Orca* passed south of the Landguard North cardinal buoy and left the confines of the Haven. The skipper unfurled the genoa sail and stopped the yacht's engine. A light south-easterly breeze was blowing and he set an easterly course, within the recommended yacht track, towards the Cork Sand Beacon and Cork Sand Yacht Beacon cardinal marks. These buoys are a well-known waypoint, referred to locally as the 'Goalposts' **(Figure 1)**.

At 1115, *Shoreway* brought a load of sand into the Felixstowe reclamation area to dump. As was normal practice on board, the chief officer and second officer were alternating the dredging and manoeuvring roles. Having completed dumping sand at 1135, *Shoreway* was moved a short distance and silt dredging in the harbour commenced. At this point the master came to the bridge to stand-in for the second officer to enable him to eat his lunch.

Orca passed between the 'Goalposts' around noon and the skipper steered a north-easterly course, heading for the vicinity of the Cross buoy. *Orca* was making good a speed of around 4 knots (kts) and he and Mrs Ingram ate lunch in the cockpit.

[1] Harwich Haven Authority produces a 'Yachting Guide to Harwich Harbour and its Rivers' annually. This guide contains useful information for leisure users and indicates, on a chart, the recommended tracks for yachts.

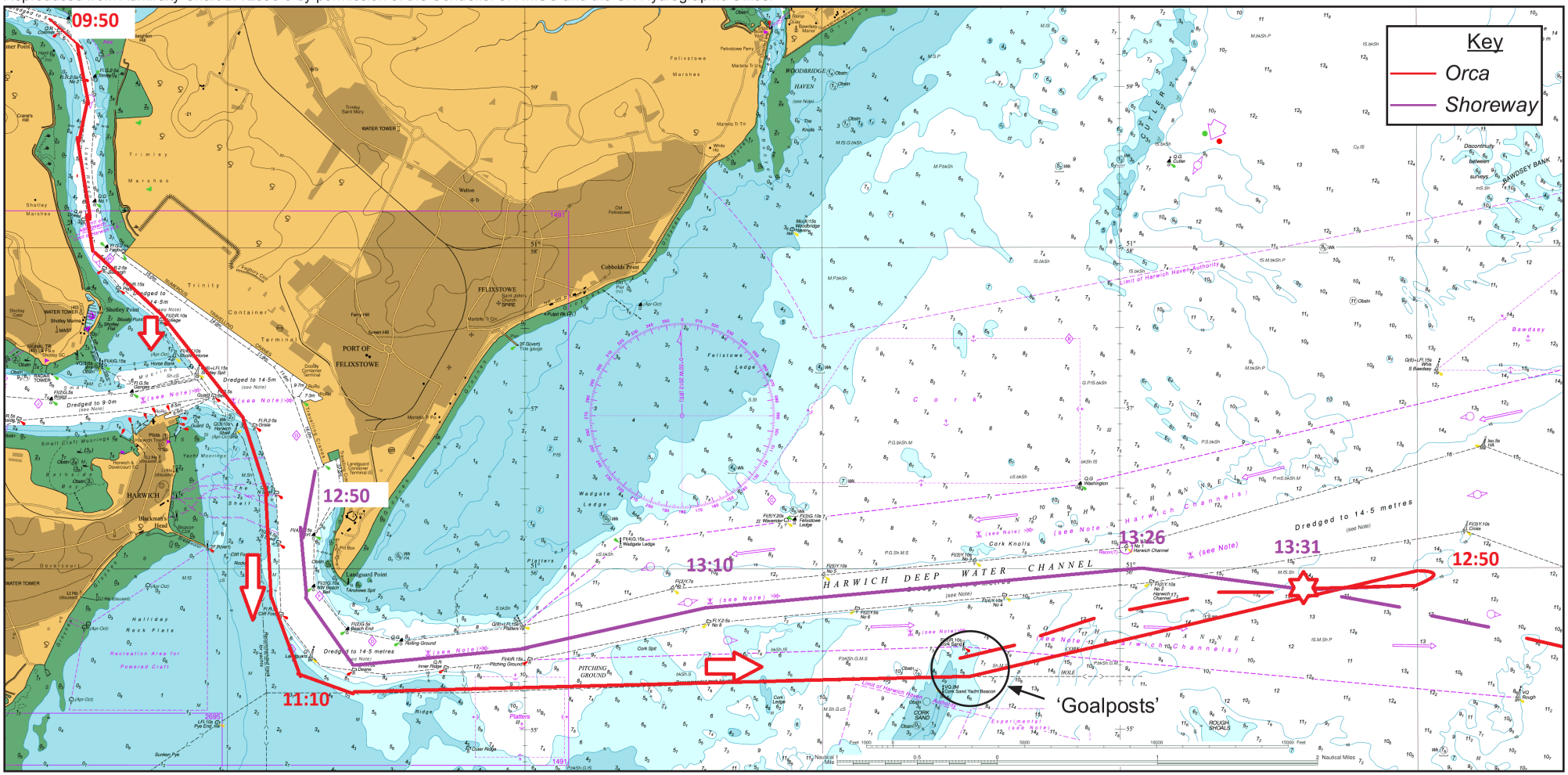


Figure 1: Chart showing route of both vessels

Although it was a warm and sunny day, leisure traffic in the vicinity was relatively light. There was one other sailing yacht, *Ellen*, visible from *Orca* throughout most of the day.

At 1230, the second officer returned to *Shoreway*'s bridge and the chief officer went to the mess room for lunch. The master and second officer continued dredging silt. When the chief officer returned to the bridge at 1250, the silt dredging was complete and the master left the bridge with the chief officer taking the con. The second officer completed the logbooks and necessary paperwork. *Shoreway*'s speed was increased to 12.5kts and the chief officer navigated the vessel out of Harwich Haven, bound for the spoil ground.

The chief officer planned to follow his normal route to the spoil ground; remaining in the deep water channel until number 2 buoy, then altering course to starboard and entering the south channel before setting a course for the spoil ground, which lay to the north of the Sunk[2] light vessel.

At around 1300, when *Orca* was south-west of the Cross buoy, the skipper decided to take advantage of the rising tide and headed back towards the Haven for Suffolk Yacht Harbour. He steered a course of 260° towards the 'Goalposts' after which he intended to follow the recommended yacht route into port. The wind was south-easterly at a speed of about 7kts and *Orca* was on a beam reach[3] making good about 4.5kts. The skipper observed *Relume*[4] following the deep water route outbound to the north.

At 1312 when passing between channel buoys 7 and 8 the chief officer on *Shoreway* reported to Harwich Vessel Traffic Services (VTS) as required on VHF radio channel 71[5] stating that *Shoreway* would exit the deep water channel at buoys 1 and 2 to enter the south channel. The chief officer was sitting in *Shoreway*'s horseshoe[6] workstation **(Figure 2)** keeping the vessel to the starboard side of the deep water channel, with the autopilot set to 090°. The radar was centred and on a 3-mile range scale; it displayed all targets, none had been manually acquired but two had been automatically acquired as AIS targets.

1.2.3 The collision

The skipper of *Orca* saw *Shoreway* transiting outbound from Felixstowe in the deep water channel as it approached number 2 buoy, and he assumed that the dredger would follow the same course as *Relume*, and remain in the deep water channel. The dredger's aspect indicated no risk of collision and *Orca*'s skipper engaged the autopilot on a setting of 260° before checking that all was clear and going down below to use the toilet. Mrs Ingram was relaxing on the starboard side cockpit bench facing aft, with her back leaning against the cabin bulkhead.

At 1326, *Shoreway* passed to the north of number 2 buoy at 12.9kts and the chief officer made an alteration of course to a heading of 095° **(Figure 3)**.

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[2] The Sunk light vessel was moored off Harwich in position 51°00.1N 001°46.02E

[3] On a beam reach the wind is coming directly across the beam of the boat

[4] *Relume* was a dive support vessel with a length overall (LOA) of 83 meters

[5] Harwich Haven General Directions stipulate that all regulated vessels be equipped with and maintain a listening watch on VHF Channel 71

[6] The horseshoe was the main conning workstation on the bridge of *Shoreway*

Figure 2: *Shoreway* horseshoe console

Reproduced from Admiralty Chart BA 2693-0 by permission of the Controller of HMSO and the UK Hydrographic Office.

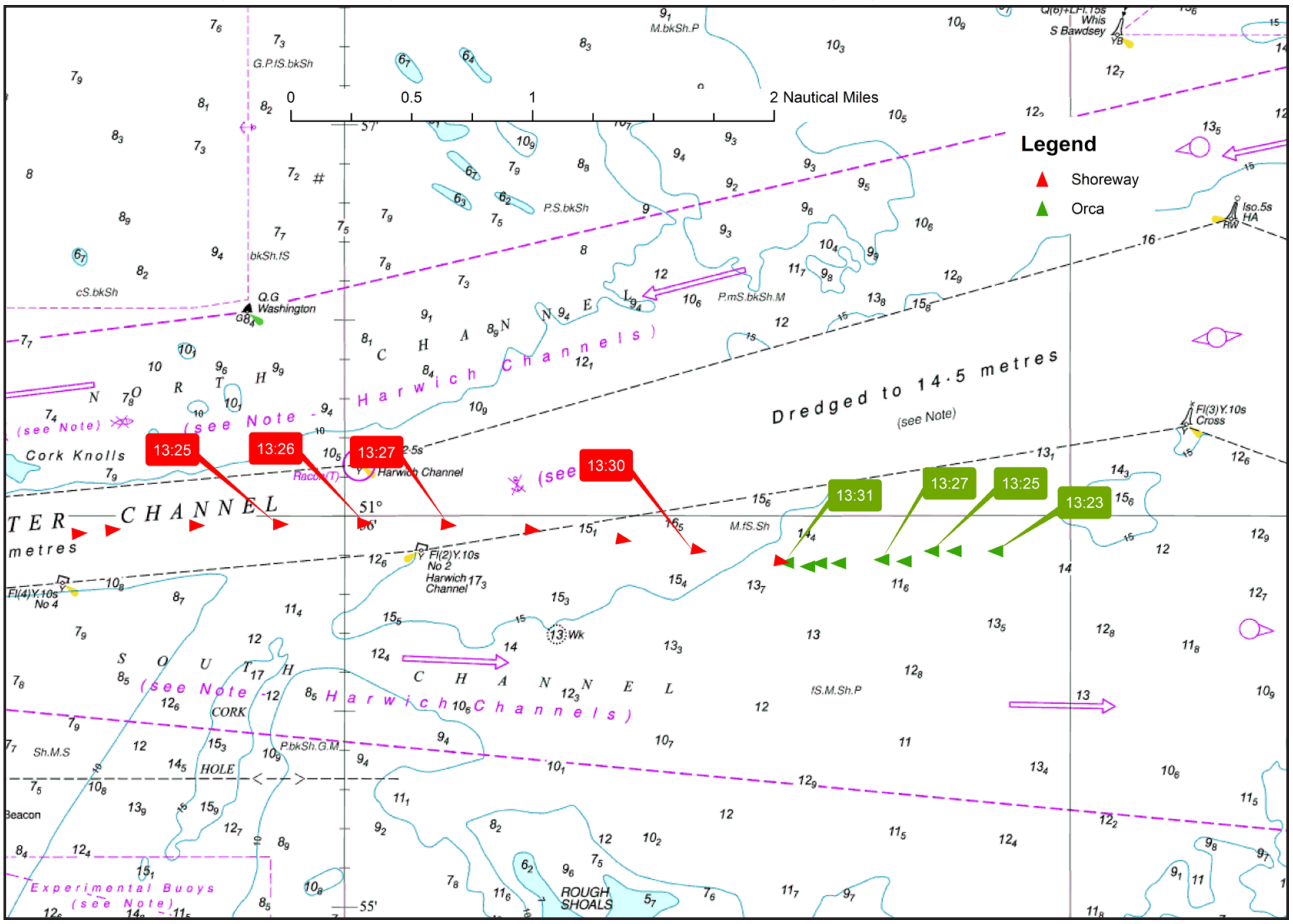

Figure 3: Tracks of both vessels leading to collision

At 1328, he made a further 5° alteration of course to starboard, putting *Shoreway* on a heading of 100°. At this point *Orca* was 0.91nm ahead.

At 1330, the second officer finished his paperwork and, having received permission from the chief officer to do so, left the bridge to complete some routine safety checks on deck. *Orca* was then 0.36nm directly ahead of *Shoreway* and had not been seen by either of the officers on the bridge of the dredger.

At 1331 the chief officer saw the top of *Orca*'s mast very close and directly in front of *Shoreway*'s bow seconds before the collision occurred.

As the skipper of *Orca* made his way up the companionway steps on his return to the cockpit, he saw *Shoreway*'s bow through *Orca*'s spray hood and shouted a warning to his wife seconds before the impact.

Shoreway's starboard bow struck *Orca*'s starboard side amidships. The skipper was thrown back down the companionway steps into the cabin by the force of the impact.

The sound of the impact was heard by several of *Shoreway*'s crew and the chief officer put both engines full astern. The master, who had been in his cabin, immediately went to the bridge.

During the impact, *Orca* was dismasted, the cockpit flooded as a result of the yacht being pushed astern by *Shoreway*'s bow and the starboard side was punctured by *Shoreway*'s starboard anchor **(Figure 4)**. The impact rotated the yacht through 180º and it then passed down *Shoreway*'s starboard side sustaining damage to its port side before moving astern of the dredger.

Shoreway's chief officer sounded the general alarm and made an announcement on the vessel's public address system stating, in Dutch, '*we have run over a sailing boat*'. The second officer, who was in the deck changing room, went to the starboard side open deck and saw the badly damaged yacht pass astern.

1.2.4 Post-collision

Shoreway moved astern and swung to starboard with the sinking yacht visible ahead. The chief officer stopped the engines.

At 1332, *Shoreway*'s chief officer advised Harwich VTS that the vessel had been in collision with a sailing yacht and that the yacht was sinking. Harwich VTS initiated its emergency response, alerted Thames Coastguard and tasked vessels to the area to attend the scene.

At 1333 the man overboard (MOB) alarm was sounded on *Shoreway* and a further public address system announcement was made to launch the rescue boat[7]. *Shoreway* was stopped in the water and *Orca* could be seen still floating approximately 100m ahead.

Orca was sinking and the skipper's automatic inflation lifejacket, despite being submerged by the inrush of water into the cabin, had failed to operate. He made his way to the emergency escape hatch at the forward end of the cabin and, reaching above his head, unlatched the two handles and opened the hatch. He then pushed

[7] A small inflatable rescue boat was carried on the starboard side of *Shoreway*. The role of this outboard propelled craft was primarily for manoverboard recovery. The boat was manned by two crew and was launched with a davit crane.

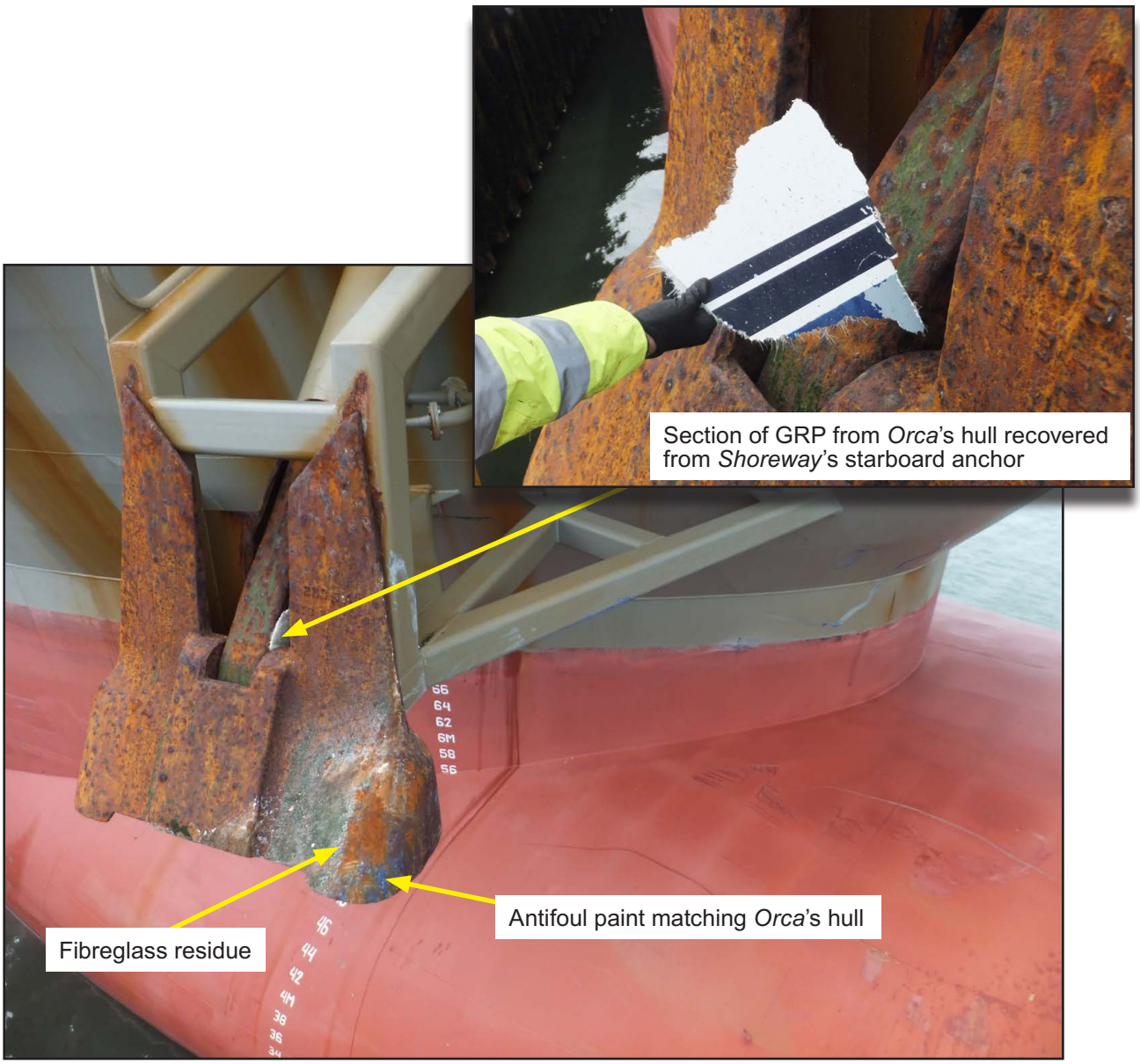

Figure 4: *Shoreway* starboard anchor, collision evidence

himself through the hatch and swam several meters to the surface, where he used flotsam from the yacht to assist him in remaining afloat. The skipper expected to find his wife on the surface.

At 1334, *Shoreway*'s master and chief officer saw *Orca* sink, and the skipper was seen in the water soon after the yacht had disappeared.

Shoreway's rescue boat, manned by the ship's two second officers left the vessel and headed towards Mr Ingram at 1335.

The yacht *Ellen* was approximately half a mile from *Orca* at the time of collision. Its skipper witnessed the accident and immediately dropped sails and motored towards the position.

Orca's skipper was recovered from the water onto *Shoreway*'s rescue boat at 1339 and he advised the boat's crew that his wife was still missing. This message was relayed by VHF radio back to *Shoreway* and onwards to Harwich VTS. A dog was sighted swimming in the water and was recovered by the crew on the deck of *Shoreway*.

Mr Ingram remained on the rescue boat for about an hour as the search for Mrs Ingram continued, before being transferred onto *Shoreway* where he received basic first-aid for cuts and bruises. He was later transferred ashore via a pilot launch to receive medical attention.

The yacht *Ellen*, commercial vessels, RNLI lifeboats, harbour launches, pilot boats, tugs and a Navy SAR helicopter all assisted with the search and rescue operation, which had started within minutes of the collision. Although flotsam from *Orca* was recovered, there was no sign of Mrs Ingram.

Shoreway was released from the search at 1750 and, having dumped its load of silt at the spoil ground, returned to Harwich where it berthed at 2150. Police boarded *Shoreway* on arrival and breathalysed the master, chief officer and second officer. All showed no evidence of alcohol consumption.

At around 1815, a survey vessel involved in the search located an unidentified object on the seabed at a depth of 13m, close to the position of the collision, and marked what was believed to be the wreck with a buoy.

The search continued into the following day until a dive team from the Norfolk Fire and Rescue Service attended the wreck site at 1515 on Monday 9 June. Divers entered the water at 1539 and soon after identified the wreck as being that of *Orca*. The dive team located and recovered the body of Mrs Bernadine Ingram from inside the yacht's cabin. Her lifejacket was found fully inflated.

1.2.5 Port state control inspection

On 9 June 2014, the day after the accident, a port state control inspection was carried out on *Shoreway* by a surveyor from the Maritime and Coastguard Agency (MCA).

Shoreway was subsequently detained following the inspection, with one of the deficiencies cited as being Navigation Bridge Visibility – '*visibility from the conning position does not allow un-obstructed view ahead*'. Drawings were produced several days later to indicate that *Shoreway* did meet the international requirements as stipulated by SOLAS Chapter V, Regulation 22 **(Annex A)** and the detention notice was lifted. There were several other deficiencies recorded, not contributory to this accident, including:

- Radio log not as required
- Records of work and rest not completed correctly
- Inflatable liferaft, painter not connected to HRU
- Lifebuoy grab line rotten and light not properly attached
- Safety guard missing from workshop pillar drill
- International shore connection, both missing packing
- Fire door on deck 4 and 3 not closing correctly.

The surveyor also requested that an International Safety Management (ISM) audit take place prior to the ship's departure.

The ISM audit was carried out, and all defects were confirmed as rectified prior to the MCA releasing the vessel from detention.

1.3 VESSEL DETAILS - *ORCA*

1.3.1 Particulars

Orca **(Figure 5)** was a Moody S31 tiller steered six berth cruiser that the skipper had purchased from new in September 1997. The yacht was constructed of glass reinforced plastic by Marine Projects (Plymouth) Limited. Marine Projects introduced the S31 in June 1994 and continued building the model until February 1998.

Orca was 9.68m long with a displacement of 4634kg. In addition to sails, *Orca* was equipped with an inboard Volvo Penta marine diesel engine and sail drive. The yacht was well equipped for cruising and carried the following equipment:

- At the navigation station in the cabin, two GPS units, a depth sounder and a VHF radio.
- In the cockpit a speed log, compass, wind speed indicator and depth indicator provided the information required for sailing.
- The tiller was fitted with an automatic pilot.
- A Firdell Blipper 210-7 radar reflector was fitted on the mast.
- A Plastimo offshore 6-man liferaft was attached to the pushpit rail and a manoverboard recovery system with dan buoy were also fitted to the stern **(Figure 5)**.
- The skipper carried a hand-held VHF radio in a pouch on his lifejacket.

Orca was kept on the water between the first week of March and the first week of December each year. Between December and March the yacht was put on a cradle ashore at a local boatyard where maintenance took place.

1.3.2 Crew

1.3.2.1 The skipper

The skipper had been a keen sailor throughout his life and he held a Royal Yachting Association (RYA) coastal skipper qualification[8]. He had sailed extensively around the UK coast and to the continent on several occasions and was very familiar with the local area having sailed there for many years.

Orca was moored at Suffolk Yacht Harbour, Levington, and the skipper sailed regularly throughout the season, mainly at weekends, with at least one longer sailing holiday of several weeks taken each year.

[8] The RYA coastal skipper qualification (superseded by Yachtmaster (coastal)) provided the knowledge to skipper a yacht on coastal passages by day and by night. The course content included passage planning, pilotage by day and by night, boat-handling, safety and emergency situations.

Figure 5: *Orca* seen from astern

Due to his extensive sailing experience in the area, the skipper was confident when sailing in the proximity of the large commercial vessels that frequented the ports of Harwich and Felixstowe.

1.3.2.2 Mrs Ingram

Mrs Bernadine Ingram, known as Bernie, was the skipper's wife. She was not a keen sailor and held no sailing qualifications. She was on board *Orca* as a passenger, and carried out no crew duties while on board. Mrs Ingram's mobility was impaired following recent medical treatment and moving around on the boat was not easy for her.

When the skipper took *Orca* on longer holiday passages, Mrs Ingram would often take a commercial passenger ferry to the port of destination to avoid long periods at sea on board the yacht.

The postmortem report indicated that Mrs Ingram died by drowning. The autopsy also identified injuries to her body including wounds to her head and damage to her shoulder

1.3.2.3 Family pets

Two border collie dogs were also on board *Orca* at the time of the accident. Both dogs wore buoyancy aids and would often spend time on the yacht, having done so since they were puppies.

1.3.3 Inspection of the wreck

On 12 June 2014 *Orca* was recovered from the seabed and taken ashore to Harwich by marine contractors employed by its insurers **(Figure 6)**.

The body of the missing dog was recovered from within the yacht.

The MAIB inspection of the wreck following its recovery identified the following damage thought to have been sustained during the collision with *Shoreway*:

- Catastrophic structural damage to its starboard side mid-ships **(Figure 7)**.
- Extensive damage to the internal mouldings, supporting steel work, frames and deck.
- Scuffs and paint witness marks on the port side of the hull **(Figure 8)**.
- The mast was broken but remained held to the hull by its standing rigging.
- The pushpit rail mountings were damaged and the stanchions bent.
- The rudder was deformed, and bent to port of the centreline.

A summary of the insurance surveyor's inspection notes is included at **Annex B**.

Figure 6: Recovery of *Orca*

Figure 7: Damage to *Orca*'s starboard side

Figure 8: Marks and damage to *Orca*'s port side

1.3.4 Lifejackets

Both *Orca*'s skipper and Mrs Ingram wore Musto 150 newton automatic inflation lifejackets. The lifejackets had an integrated deck safety harness and crotch strap **(Figure 9)**.

Both lifejackets were purchased by the skipper in 1997 and had a label indicating a maximum lifespan of 10 years. A label also recommended that the lifejackets be serviced once a year. The lifejackets had never been serviced but had been inspected by *Orca*'s skipper annually at the start of each season.

The lifejackets met CE95 and EN396 requirements. EN396 was the British Standard pertaining to adult automatic inflation lifejackets of at least 150 newton buoyancy[9]. EN396 was superseded in 2006 with BS EN ISO 12402-3[10].

During the accident, the lifejacket worn by *Orca*'s skipper failed to inflate. The lifejacket worn by Mrs Ingram inflated as designed.

[9] This level was intended for general application or for use with foul weather clothing. When inflated it will turn an unconscious person in the water into a safe position and requires no subsequent action by the user to maintain this position.

[10] International standard ISO 12402-3: Personal Flotation Devices, Lifejackets, Performance Level 150 - Safety Requirements

Figure 9: Lifejacket (**inset:** lifejacket label indicating 10 year lifespan)

1.3.5 Evaluation of lifejacket

MAIB commissioned Fleetwood Testing Laboratory to determine why the lifejacket worn by the skipper did not inflate. The laboratory's report (included at **Annex C**) concluded that the lifejacket had failed to activate because the carbon dioxide cylinder was not correctly fitted to the inflation mechanism.

Corrosion on the cylinder's threads indicated that the cylinder had been loose for some time. Additionally, residue within the automatic inflator components indicated that the system had been automatically activated well before the immersion on 8 June 2014, although this activation must have happened after the carbon dioxide cylinder became loose as the cylinder's cap had not been pierced.

1.4 VESSEL DETAILS - *SHOREWAY*

1.4.1 Owner

Boskalis Westminster Shipping B.V. (Boskalis) was a global maritime services company. Its core activities included the construction and maintenance of ports and waterways, land reclamation, coastal defence and riverbank protection. The company's fleet included 71 dredgers of which 25 were trailing suction dredgers.

1.4.2 Particulars

Shoreway was a twin screw, trailing suction hopper dredger with a hopper capacity of 5600m^3 **(Figure 10)**. The vessel was built by I.H.C Dredgers B.V. in the Netherlands and launched in 2009. *Shoreway* was registered in Limassol, Cyprus and was classed by Bureau Veritas. *Shoreway* operated worldwide and had one sister ship, *Crestway*, within the Boskalis fleet and several others in operation for other companies.

Shoreway was fitted with a rainbow discharge installation at the bow. This was made up of a coupling that enabled dredged materials to be pumped ashore via a floating pipeline and a rainbow nozzle which enabled direct discharge of dredge materials overboard at the bow **(Figure 11)**.

Shoreway was working in Harwich Haven on the quay number 9 extension project at the Port of Felixstowe. The ship was operating a continuous dredging operation that involved dredging silt within the harbour area, taking the silt to the spoil ground at sea and discharging it. Thereafter, sand would be dredged from the seabed and brought back into the harbour for use as part of the reclamation for the quay extension. *Shoreway* had operated in Felixstowe and Harwich Haven on numerous occasions before starting work on this project in May 2014.

1.4.3 Watchkeeping routine

The bridge watch was split into two 12 hour watches in each 24-hour period: the day watch from 0730 to 1930 and the night watch from 1930 to 0730.

Each watch comprised one chief officer, one second officer and an AB. The chief officer was in charge of the watch and alternated roles such as conning the vessel or operating the dredge equipment with the second officer. Both were required to be on the bridge during dredging and dumping operations. The AB's role was primarily on deck, operating and monitoring dredge equipment.

The 3-man watches alternated on a weekly basis between days and nights. The change-over of watches took place during the weekly stores and maintenance period, usually on Mondays, when the vessel would remain alongside for 12 hours.

The master supplemented the bridge team as necessary. He was on the bridge during particularly difficult dredging or dumping operations, when docking or undocking, during restricted visibility and at any other time when required by the bridge team. The master also covered meal break reliefs as necessary and often visited the bridge as part of his normal daily routine.

Figure 10: *Shoreway*

Figure 11: Rainbow discharge installation, *Crestway*

1.4.4 Crew

The minimum safe manning certificate for *Shoreway* required the dredger to have a minimum crew of eight, but at the time of the accident it was operating with a crew of 14, comprising Dutch, Lithuanian, Estonian and Latvian nationals.

The ship's officers and crew worked 1 month on board, followed by 1 month off. The majority of the crew were permanent Boskalis employees, although agency staff were used occasionally.

The master and both chief officers held pilotage exemption certificates (PEC)[11] for Harwich Haven.

1.4.4.1 Master

The master was a 45 year old Dutch National who held an STCW II/2 Certificate of Competency (CoC) as master (unlimited) and a Certificate of Equivalent Competency (CEC) issued by the vessel's Flag State, Cyprus.

The master had worked for Boskalis for 10 years and had extensive experience in command of dredgers. He had been in command of *Shoreway* for 9 months.

1.4.4.2 Chief officer

The chief officer on watch at the time of the accident was a 37 year old Dutch national. He held an STCW II/2 CoC as master (unlimited) and a CEC issued by the vessel's Flag State, Cyprus. He had been chief officer on *Shoreway* for 3 years.

The chief officer had worked almost exclusively for Boskalis since 1999 and had spent the majority of his career on dredgers. He had held a PEC for Harwich Haven since 2008 and had worked on various Boskalis dredgers in Harwich Haven. The chief officer had been on board for 2 weeks, the first of which he worked nights. At the time of the accident he was on his sixth day of day watches.

1.4.4.3 Second officer

The second officer on watch at the time of the accident was a 39 year old Dutch national. He held an STCW II/2 CoC as master (unlimited) and a CEC issued by the vessel's Flag State, Cyprus. He had joined *Shoreway* as second officer on 26 May. He was employed through a manning agency but had worked primarily on Boskalis dredgers for the past 4 years.

1.4.5 Bridge layout

Shoreway had a modern bridge layout, designed for ease of use while navigating and dredging. The focal point of the bridge was a horseshoe shaped workstation on the centre line of the bridge **(Figure 12)**. From this station all dredging and navigation tasks could be undertaken by the officer of the watch (OOW), with all relevant instrumentation and controls easily visible, audible and accessible from the workstation. All dredging equipment and computer screens, navigation equipment

[11] A PEC is a licence issued by the Authority (in accordance with Section 8 of the Pilotage Act, 1987) to the bona fide master or chief officer of a vessel subject to compulsory pilotage, permitting that person to pilot the named vessel through the Compulsory Area.

and engine controls and the helm were easily accessible **(Figure 13)**. The bridge met the requirements of IMO MSC/Circ.982 Guidelines on ergonomic criteria for bridge equipment and layout, Section 5 **(Annex D)**.

Shoreway operated a Transas ECDIS system, with one display at the conning position, one at the dredging position and an additional display available at the chart table on a separate console desk to starboard.

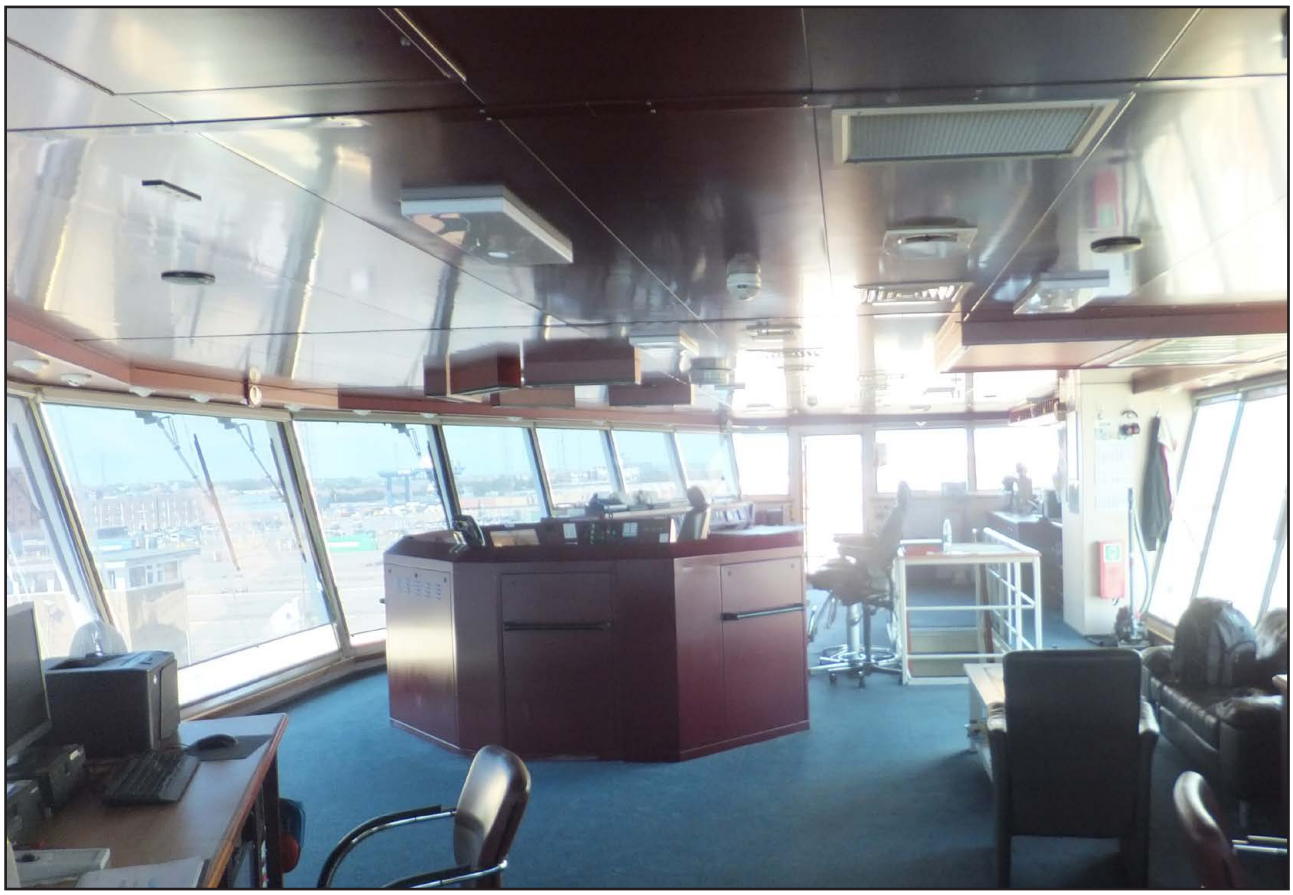

Figure 12: *Shoreway* bridge

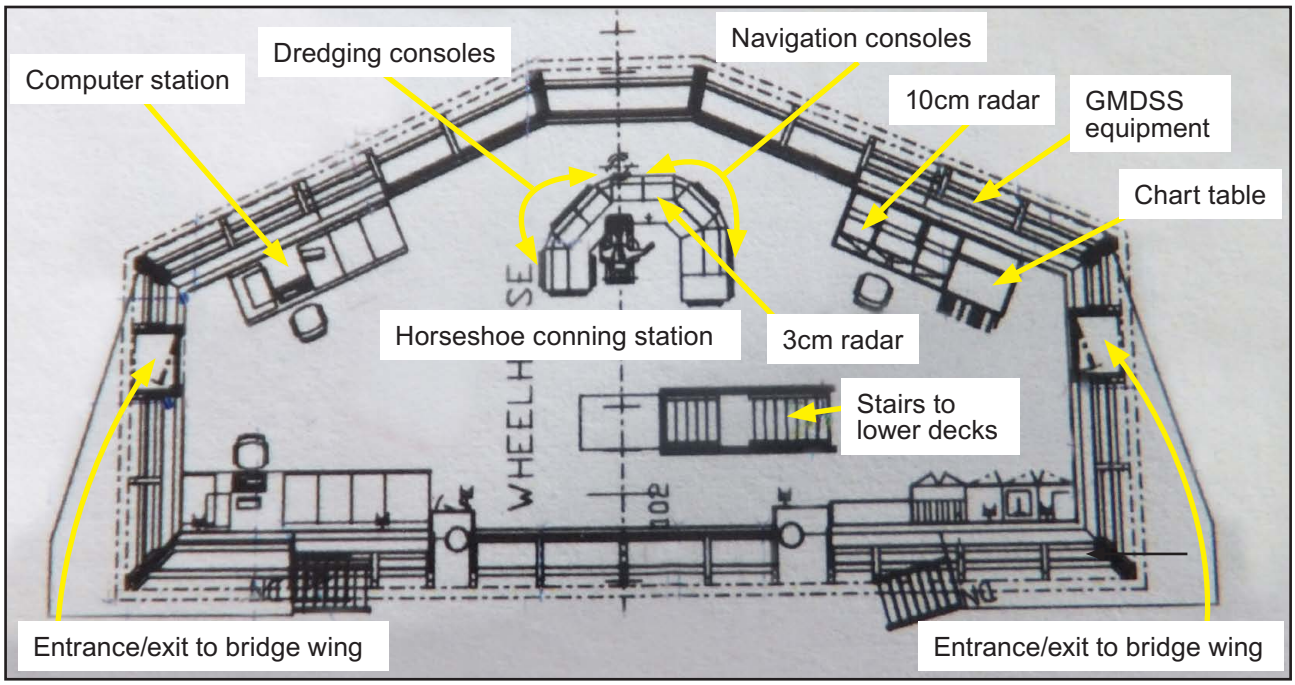

Figure 13: Plan of *Shoreway* bridge layout

A JRC X-Band 3cm radar display with ARPA and AIS capability was located on the main conning console. The ship's S-band 10cm radar display with ARPA and AIS capability was on the starboard console, and not visible while seated from the conning position. Both radars were operational at the time of the collision.

The vessel was fitted with a bridge navigational watch alarm system (BNWAS) that was not in use.

Shoreway's bridge layout and equipment had been approved by Bureau Veritas as being '*so arranged that the navigation and manoeuvring of the ship can be operated under normal conditions by one person, for periodical one man watch*' This SYS-NEQ-1 notation included specific requirements for prevention of accidents caused by the single watchkeeper becoming incapacitated.

The rainbow discharge equipment on *Shoreway*'s bow obstructed the view directly ahead of the operator's seat at the horseshoe workstation by 4º of arc in the loaded condition and 5º of arc in the ballast condition. The field of vision, although obstructed, was within the requirements specified in SOLAS Chapter 5, Regulation 22 **(Annex A)** for navigation bridge visibility. *Shoreway* also met the requirements of IMO Resolution A.708(17) Navigation Bridge Visibility and Functions **(Annex E)**. The blind sector caused by the obstruction **(Figure 14)** was not mentioned in any of the procedures, checklists or standing orders held on board.

1.4.6 Safety management

The ISM Code, Section 1.4 Functional requirements for a safety management system, states that:

> *Every Company should develop, implement and maintain a safety management system which includes the following functional requirements:*
>
> *.1. a safety and environmental-protection policy;*
>
> *.2 instructions and procedures to ensure safe operation of ships and protection of the environment in compliance with relevant international and flag State legislation;*

Section 7, Shipboard Operations states:

> *The Company should establish procedures, plans and instructions, including checklists as appropriate, for key shipboard operations concerning the safety of the personnel, ship and protection of the environment. The various tasks should be defined and assigned to qualified personnel.*

Boskalis Fleet Management was responsible for safety management and compliance with the ISM Code within the company and on board its managed vessels. The fleet manager held the role of Designated Person Ashore (DPA) for ISM purposes.

The managed fleet's technical, quality, health, environmental and safety management was carried out by the fleet management department using Q-Aid, an online fleet management resource. This was not a system regularly accessed by ship's staff in support of onboard operations.

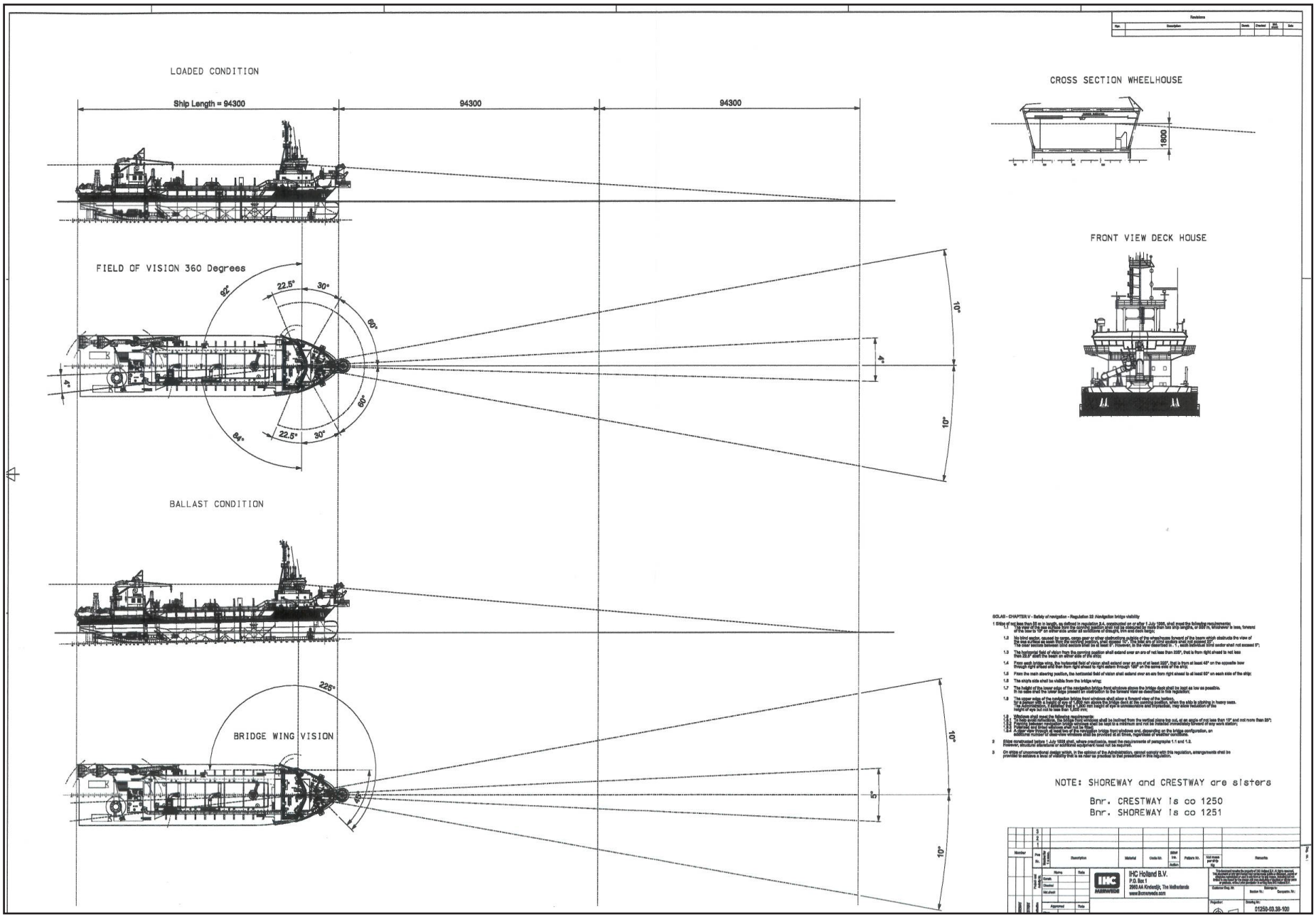

Figure 14: Bridge visibility, SOLAS drawing

When the Q-Aid system was introduced the fleet management department provided all Boskalis's managed fleet, including *Shoreway*, with 'uncontrolled'[12] booklets containing the main policies, procedures, forms and checklists applicable to onboard operations. The online Q-Aid resource and this booklet were referred to on board as the Safety Management System (SMS). The SMS on board *Shoreway* contained no vessel-specific procedures and contained no reference to:

- Bridge manning
- Watchkeeping requirements
- Lone watchkeeping
- The use of navigational equipment
- The blind sector caused by the rainbow discharge equipment
- The contents of the master's standing orders
- Actions to be taken in poor weather or visibility
- Radio communications
- Security and fire patrols
- Stability and watertight integrity
- Pilotage
- Port information and communications
- Harbour stations
- Checking and recording of draughts
- Harbour watches and patrols.

Responsibility for the implementation of company policies on board was not stipulated in the SMS, but company practice was for this to be delegated to masters and chief engineers through the use of their standing orders. The master's standing orders on *Shoreway* **(Annex F)** contained no reference to bridge manning, the use of navigational equipment or the risks associated with the blind sector caused by the rainbow discharge equipment.

The SMS stated that accident/incident analysis would be carried out to increase awareness of safety, health and environmental issues at all levels in the organisation so as to continually improve standards. On 10 June 2014, as a result of the accident, Boskalis issued a Safety Flash **(Annex G)** to its managed fleet reminding crews

[12] Uncontrolled, in this context means that the document was not always amended in line with amendments to the on-line Q-Aid resource.

of the importance of maintaining a good lookout as per the requirements of the International Regulations for Preventing Collisions at Sea 1972 (as amended) (COLREGs) and in particular Rule 5.

1.4.7 Safety management system audits

The implementation of the SMS on board *Shoreway* had been approved as ISM Code compliant by Bureau Veritas and a Safety Management Certificate had been issued to the vessel on 7 April 2011. An intermediate verification audit had taken place on 26 June 2013 during which no non-conformities[13] were raised.

An internal audit took place in November 2013, the purpose of which was to verify that all personnel on board the vessel were familiar with the company's requirements under ISM. There were two non-conformities and one observation noted during this audit, none of which were relevant to the circumstances of the accident.

On 13 June 2014, as a result of the PSC Inspector's request, Bureau Veritas carried out another ISM audit on board *Shoreway*. The auditor raised one non-conformity relating to the number of deficiencies that had been raised during the PSC Inspection being indicative of ineffective maintenance systems and routine inspections. The auditor also recorded two observations, one of which stated:

> *Bridge watch keeper procedures. The company could consider review of the master's standing orders to take into account requirements and guidelines for single bridge watch keeper.*

Following this observation an amendment to *Shoreway*'s master's standing orders was proposed. This is included at **Annex F**.

1.5 HARWICH HAVEN AUTHORITY

The Harwich Haven Authority (HHA) was a Trust Port and pilotage authority with legislative powers. The authority was responsible for the navigational safety and traffic regulation of all vessels bound to and from the Haven.

Within the Haven, regulated vessels[14] were required to report to Harwich VTS when passing the reporting points marked on navigational charts. There were no reporting requirements for non-regulated vessels such as *Orca*, although it was recommended that such vessels maintain a listening watch on VHF 71[15].

Harwich VTS provided a traffic organisation service, a navigational assistance service and a traffic information service.

1.5.1 Harwich Haven Authority's general directions

The HHA issued general directions for navigation applicable to all regulated vessels operating within the Haven. These were reviewed and re-issued as required every 3 years. The current edition at the time of the accident had been issued in 2011 and a copy was carried on board *Shoreway*. It was the responsibility of all masters, watchkeepers and PEC holders to be aware of the requirements of these directions.

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[13] Non conformity means an observed situation where objective evidence indicates the non-fulfilment of a specified requirement.

[14] HHA regulated vessels included vessels greater than 50t, ferry-boats and water taxis.

[15] Non-regulated vessels are recommended to be equipped with a VHF radio and monitor the Harwich VTS channel (VHF Channel 71) when underway in the authority's area.

Section 3.1 of these directions covered the bridge manning requirements within the Haven and stated:

The master of every vessel underway shall ensure that there are at least two persons on the bridge or at the control position

(1) The Master, authorised Pilot or PEC holder

(2) A crew member capable of
- *Taking charge of the vessel, and,*
- *When a pilot was on board, taking and acting upon the Pilot's instructions.*

1.6 ENVIRONMENTAL CONDITIONS

At the time of the collision, the wind was south-east force 2 to 3, the sea state was calm and the visibility was very good. The tidal stream was setting to the north-west at a rate of 0.5kts. Low water at Harwich occurred at 1311 UTC.

1.7 COLLISION REGULATIONS

At the time of the accident *Shoreway* was on passage, not engaged in dredging operations and was not displaying restricted in ability to manoeuvre day shapes or lights. AIS data transmitting from *Shoreway* did indicate that the vessel was restricted in its ability to manoeuvre, but *Orca* was not equipped with AIS receiving equipment.

The COLREGs set out, among other things, the navigation rules to be followed by ships and other vessels at sea to prevent collisions between two or more vessels. Under these regulations, at the time of the accident *Shoreway* was considered to be a power-driven vessel and *Orca* was considered to be a sailing vessel.

The most pertinent regulations applicable to this accident are at **Annex H** and include:

Rule 2 Responsibility, the COLREGs applied to both vessels involved.

Rule 5 look-out, requires that *Every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.*

Rule 17 Action by stand-on vessel, requires a stand-on vessel to maintain its course and speed when a risk of collision with another vessel exists. However, section (a) (ii) of this rule permits the stand-on vessel to take action where it becomes apparent the vessel required to keep out of its way is not taking appropriate action, and section (b) of the rule requires that the stand-on vessel takes avoiding action where it finds itself so close that a collision cannot be avoided by the actions of the give way vessel alone.

Rule 18 Responsibilities between vessels, places the responsibility on a power-driven vessel to keep clear of a sailing vessel.

1.8 KEEPING A NAVIGATIONAL WATCH

Watchkeeping requirements are set out in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended (STCW 95) **(Annex I)**:

Part 4-1 Principles to be observed in keeping a navigational watch

13 The officer in charge of the navigational watch is the master's representative and is primarily responsible at all times for the safe navigation of the ship and for complying with the international Regulations of Preventing Collisions at Sea, 1972, as amended.

14 A proper lookout shall be maintained at all times in compliance with rule 5 of the international Regulations for Preventing Collisions at Sea, 1972, as amended.

16 The duties of the lookout and helmsperson are separate and the helmsperson shall not be considered to be the lookout while steering, except in small ships where an unobstructed all-round view is provided at the steering position and there is no impairment of night vision or other impediment to the keeping of a proper lookout. The officer in charge of the navigational watch may be the sole lookout in daylight provided that, on each such occasion:

1. The situation has been carefully assessed and it has been established without doubt that it is safe to do so;

2. Full account has been taken of all relevant factors, including, but not limited to:

– State of the weather;

– Visibility;

– Traffic density;

– Proximity of dangers to navigation; and

– The attention necessary when navigating in or near traffic separation schemes; and

3. Assistance is immediately available to be summoned to the bridge when any change in the situation so requires.

17 In determining that the composition of the navigational watch is adequate to ensure that a proper lookout can continuously be maintained, the master shall take into account all relevant factors, including those described in this section of the Code, as well as the following factors:

.1 visibility, state of the weather and sea;

.2 traffic density, and other activities occurring in the area in which the vessel is navigating;

.11 the size of the ship and the field of vision available from the conning position

.12 the configuration of the bridge, to the extent such configuration might inhibit a member of the watch from detecting by sight or hearing any external development

In addition to these requirements, *Shoreway*'s SYS-NEQ-1 notation included specific requirements for the prevention of accidents caused by the single watchkeeper being unfit. These included a requirement that the following were to be clearly defined in an operations manual acceptable to the administration with which the ship was registered:

- The circumstances under which lone watchkeeping can commence
- How lone watchkeeping should be supported
- The circumstances under which lone watchkeeping must be suspended.

Neither the company's SMS nor the master's standing orders made any reference to bridge manning or lone watchkeeping.

1.9 PREVIOUS / SIMILAR ACCIDENTS

1.9.1 *Spring Bok* and *Gas Arctic* – MAIB report 24/2012

On 24 March 2012, the cargo vessel *Spring Bok* collided with the liquefied petroleum gas tanker *Gas Arctic*. *Spring Bok* had visibility restrictions from the bridge due to the location of deck cranes and, although *Gas Arctic* could be seen by *Spring Bok*'s master on his radar, he could not see the ship when he looked through the window as it was in the blind sector caused by cranes. There were also distraction and fatigue issues, and the vessels were being navigated in fog. There were no injuries or pollution, but both vessels suffered structural damage.

1.9.2 *Pride of Bilbao* and yacht *Ouzo* – MAIB report 7/2007

During the night of 20/21 August 2006, the yacht *Ouzo* sank off the coast of the Isle of Wight with the loss of three lives. After careful analysis of the facts, the MAIB concluded that *Pride of Bilbao* collided with *Ouzo*, or passed so close that the yacht was swamped or capsized by the vessel's wash. The lookout on the ferry had not seen the yacht until it was very close ahead, and the yacht had not shown up on the ferry's radars. The OOW tried a last minute manoeuvre to avoid the yacht and, believing he had been successful, continued on passage.

1.9.3 *Wahkuna* and *P&O Nedlloyd Vespucci* – MAIB report 28/2003

On 28 May 2003, the yacht *Wahkuna* was in collision with the large container ship *P&O Nedlloyd Vespucci* in thick fog in the English Channel. The yacht's skipper had incorrectly estimated from his radar that *P&O Nedlloyd Vespucci* would pass 1.5 miles ahead of *Wahkuna*, and had reduced speed. Minutes later the vessels collided. The yacht suffered catastrophic damage and the crew evacuated to a liferaft, where they remained for 5½ hours before being rescued. The master of the container ship was not aware that the collision had occurred, and *P&O Nedlloyd Vespucci* continued on passage.

1.10 VOYAGE DATA RECORDER

Shoreway's master had successfully secured the Voyage Data Recorder (VDR) data following the accident, although the manufacturer's procedures had not been followed, and this was analysed during the investigation.

Background music at a relatively low volume had been played on the bridge of *Shoreway* throughout the day, and the proximity of the speaker to one of the VDR's microphones seriously compromised the quality of the audio data recorded.

Boskalis's SMS did not specifically prevent the playing of recorded music on the bridge. *Shoreway*'s master permitted officers to listen to music on the bridge as long as the volume was maintained at a level where VHF and operational conversations between bridge team members were not affected **(Figure 15)**.

Neither the master's standing orders nor the vessel's SMS contained any reference to the VDR or guidance on when and how its data should be secured.

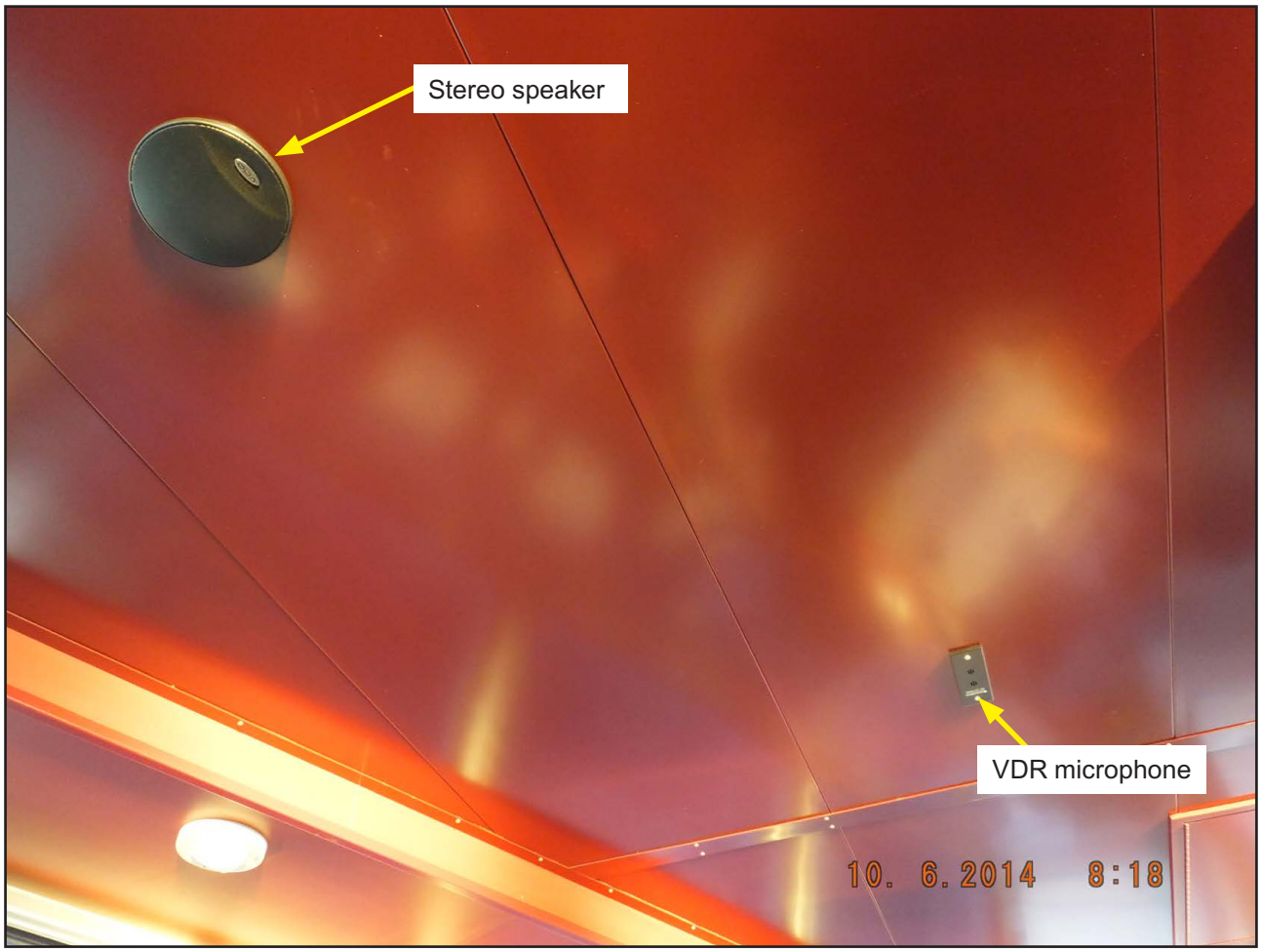

Figure 15: Bridge, proximity of stereo speaker to VDR microphone

SECTION 2 - ANALYSIS

2.1 AIM

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

2.2 FATIGUE

There is no evidence that either the chief officer on watch on *Shoreway* or the skipper of *Orca* were suffering from fatigue. Therefore it is not considered a contributing factor to this accident.

2.3 THE ACCIDENT

2.3.1 Overview

Shoreway and *Orca* collided in very good visibility as neither the chief officer, who was alone on the bridge of *Shoreway*, nor the skipper of *Orca* were maintaining a proper lookout in the period immediately prior to the collision.

When the skipper initially saw *Shoreway* in the deep water channel, no risk of collision existed and he incorrectly assumed the dredger would maintain its course and pass clear of his vessel. He then went down below to use the toilet, leaving nobody on watch. When *Shoreway*'s chief officer altered the dredger's course to the south-east to leave the deep water channel, *Orca* was approximately 1.6nm away and had not been seen. The chief officer used the autopilot to make two 5° alterations of course to starboard, putting *Shoreway* and *Orca* on near reciprocal headings and on a collision course, with a closing speed in excess of 17kts.

2.3.2 Collision Regulations

Both *Orca*'s skipper and the OOW on the bridge of *Shoreway* had responsibilities for avoiding the collision. *Orca* was under sail at the time of the accident and was the stand-on vessel. *Shoreway* was the give-way vessel and in accordance with Rule 18 of the COLREGs should have altered course to avoid a risk of collision. However, had it become apparent to *Orca*'s skipper that *Shoreway* was not taking appropriate action to avoid a collision, Rule 17(b) required him to take avoiding action.

Rules 17 and 18 apply to '*vessels in sight of one another*'. In this instance neither watchkeeper had complied with the requirements of Rule 5, which required both vessels, *in any condition of visibility, to maintain a proper look out by sight and hearing and by all available means, appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision*.

A number of other rules in the COLREGs also apply with respect to the actions to be taken when avoiding a collision. However, they are contingent upon the risk of collision being identified and in this case, neither vessel identified that the risk of collision existed in sufficient time for these actions to be taken.

2.3.3 Failure to maintain an adequate lookout on *Shoreway*

Shoreway's chief officer was alone on the bridge at the time of the accident and was responsible for the safe navigation of the vessel and complying with the COLREGs. However, the second officer had been on the bridge when the alteration of course was made. Visibility was very good and had either officer positively checked to ensure that the intended course was clear of other traffic, either visually or by radar, prior to making the alteration of course to the south-east, *Orca* would have been clearly visible approximately 1.6nm away.

2.3.3.1 Lone watchkeeping

Shoreway's SYS-NEQ-1 notation issued by Bureau Veritas, required the conditions under which a vessel could operate with a lone watchkeeper to be clearly defined in the company's SMS. The company's SMS in conjunction with the master's standing orders should have provided instructions and guidance on:

- The circumstances under which lone watchkeeping can commence
- How lone watchkeeping should be supported
- The circumstances under which lone watchkeeping must be suspended.

Furthermore, the STCW Code requires masters to satisfy themselves on each occasion prior to permitting sole watchkeeping that:

- The OOW has had sufficient rest prior to commencing the watch.
- In the judgment of the OOW, the anticipated workload is well within their capacity to maintain a proper lookout and remain in full control in the prevailing circumstances.
- Back-up assistance to the OOW is clearly designated.
- The OOW knows who will provide back-up assistance, and in what circumstances back-up must be called, and how to call it quickly.
- Designated back-up personnel are aware of response times, any limitations on their movements, and are able to hear alarm or communication calls from the bridge.
- All essential equipment and alarms on the bridge are fully functional.

Neither the master's standing orders nor Boskalis's SMS contained any reference to bridge manning. In the absence of any relevant company instructions the master permitted the chief officers to decide on the appropriate manning of the bridge during their watches. At the time of the accident, this manning was neither sufficient, nor permitted, as *Shoreway* was operating within the limits of the HHA whose general directions required a second person to be on the bridge.

Shoreway had sufficient manning available: the duty watch consisted of a chief officer, second officer and an AB. Within HHA limits, the bridge manning should have been the '*master, pilot or PEC holder and a crew member capable of taking*

charge of the vessel'. The chief officer was a PEC holder and so, when the second officer was on the bridge, the HHA's bridge manning requirements were met. However, prior to being released to work on deck immediately before the collision, the second officer had not been part of the bridge watch since he had been engaged in paperwork and was not assisting the chief officer in navigating the vessel.

2.3.3.2 Blind sector

The design and position of the bridge horseshoe workstation, on the centreline immediately aft of the rainbow discharge equipment, caused the primary conning position to be in the location with the largest blind sector on the bridge. Having completed the course alteration, *Orca* remained directly ahead of *Shoreway*, hidden from the chief officer's position within the horseshoe until seconds before the collision **(Figure 16)**.

On vessels with blind sectors, it is essential that the OOW or lookout moves around the bridge frequently and makes appropriate use of the radar, to ensure that a proper lookout is maintained at all times. The chief officer had been on *Shoreway* for the previous 3 years, and was so accustomed to the bridge layout and design that he no longer recognised the risks posed by the blind sector. Had the second officer been an active part of the bridge watch and remained on the bridge, he could have positioned himself closer to one of the bridge wings to mitigate the effects of the blind sector caused by the discharge equipment.

The obstruction to visibility had been accepted by those operating *Shoreway* since it met the legal requirements. However, the risks of vessels, especially small craft, not being detected in the blind sector, had never been assessed by the company or the crew, and were not mentioned in either the master's standing orders or the vessel's SMS **(Figure 17)**.

To ensure that the requirements for maintaining an effective lookout are maintained at all times, operators of vessels with blind sectors must ensure that the risks associated with these are properly assessed and that adequate procedures are put in place to minimise those risks.

2.3.3.3 Radar

Rule 5 of the COLREGs requires that every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means, which includes radar when fitted.

Shoreway's 3cm radar was set on a 3-mile range. It was not affected by the visual blind sector caused by the rainbow discharge equipment and was the main conning radar. Its display was positioned on the starboard side of the horseshoe workstation facing the chief officer **(Figure 18)**. *Orca* had generated a clear radar target that had been visible on the display for 11 minutes prior to the collision **(Figure 19)**. Two AIS targets had been automatically acquired earlier in the watch, and had passed clear with target data still displayed on the radar display. However, the weather conditions were good and the chief officer had not recognised the need to look at the radar or make use of its ARPA function. Therefore *Orca*'s target had not been seen, acquired or plotted.

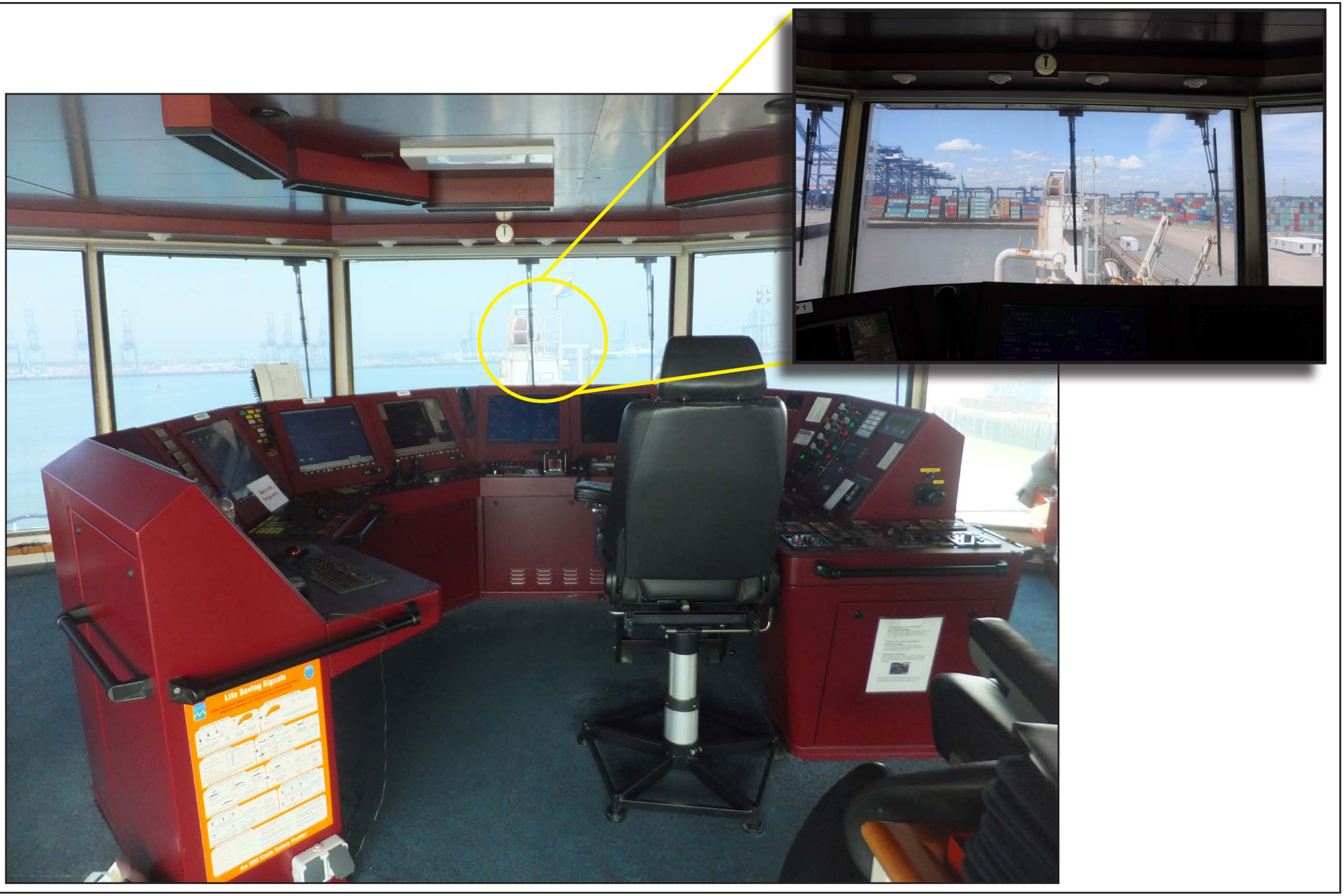

Figure 16: Bridge horseshoe workstation (**inset:** obstruction)

In addition to the usual benefits in maintaining a proper lookout, the radar on *Shoreway* should have been identified as providing some mitigation to the risks posed by the visual blind sector caused by the rainbow discharge equipment. As such, appropriate instructions regarding the use of the radar should have been included in the vessel's SMS and the master's standing orders.

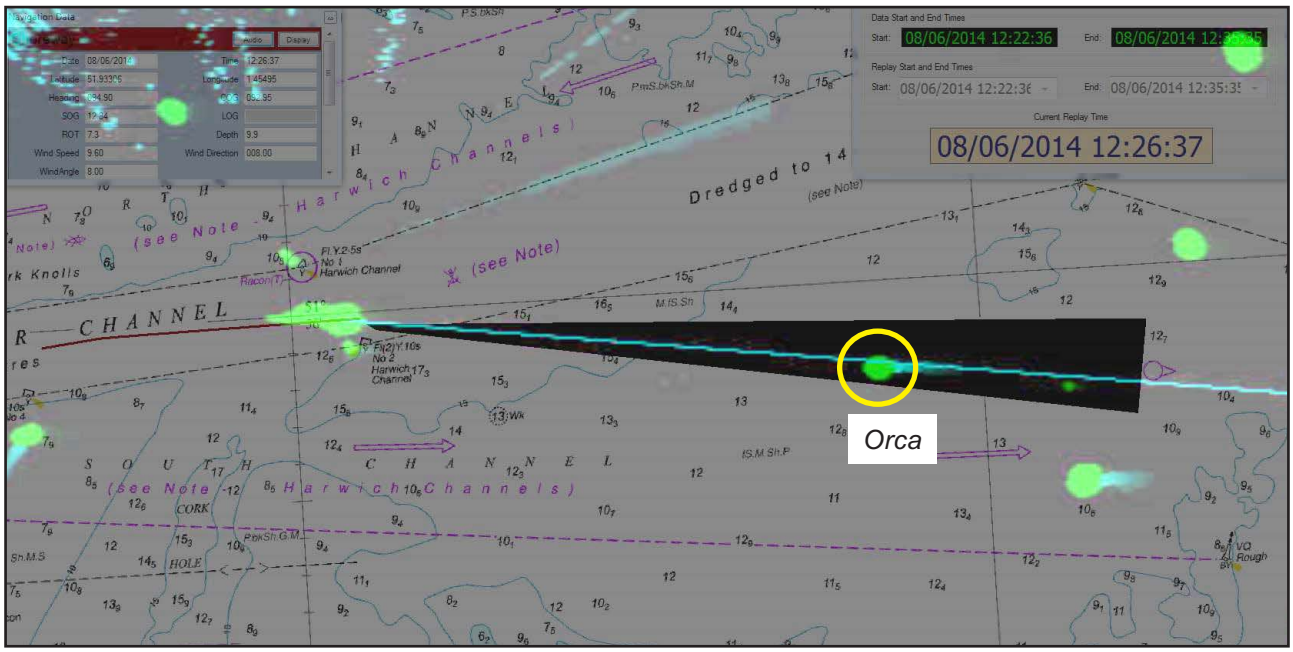

Figure 17: Projected blind sector

Figure 18: 3cm radar location, bridge *Shoreway*

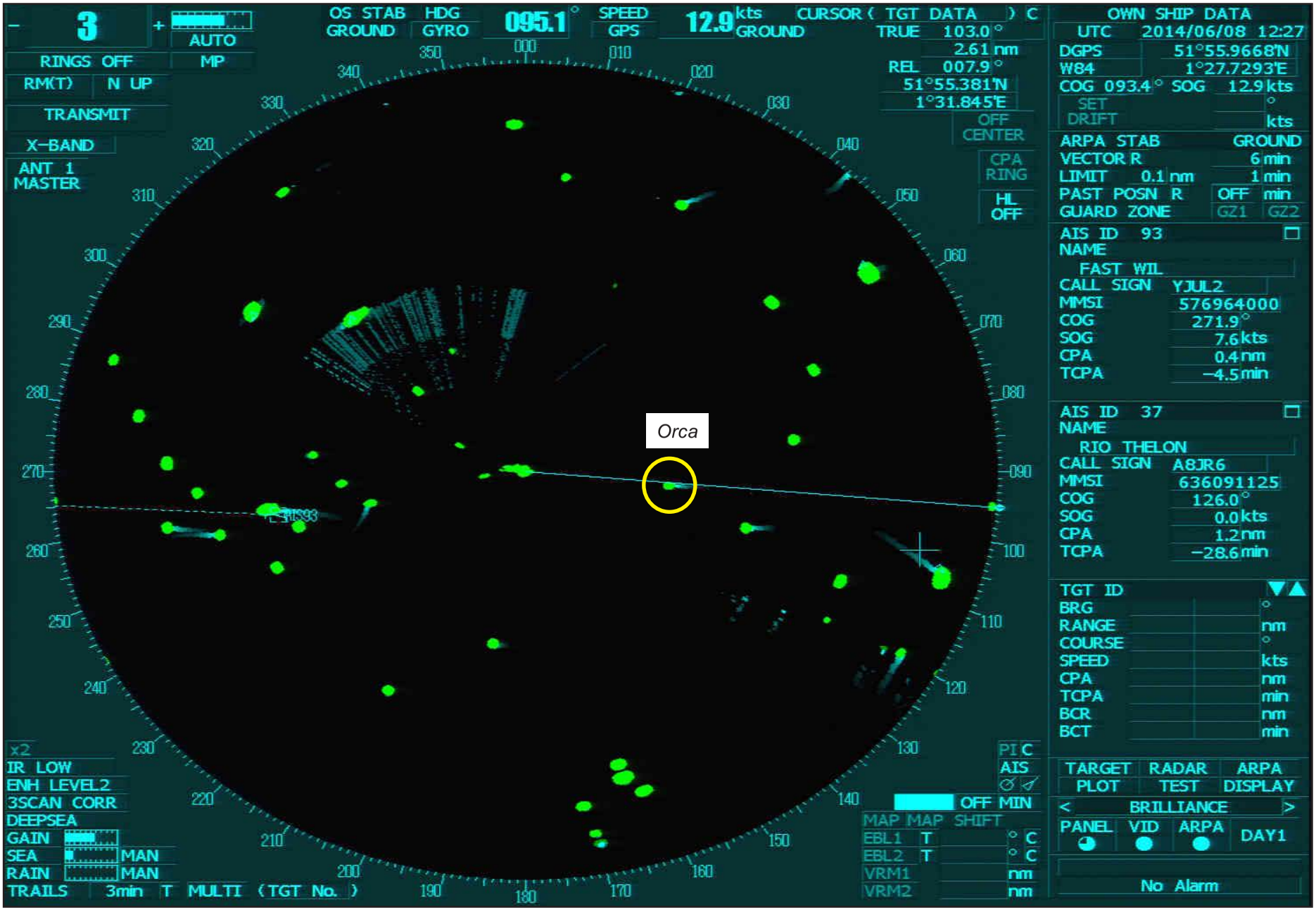

Figure 19: Radar picture from VDR (aspect ratio as captured by VDR)

2.3.4 Failure to maintain an adequate lookout on *Orca*

Shortly before 1326, *Orca*'s skipper saw *Shoreway* at a distance of approximately 1.6nm. Based on *Shoreway*'s aspect at the time, he judged there to be no risk of collision. He subsequently decided to engage the autopilot and go below to use the toilet. Very soon afterwards, when 1.52nm from *Orca* and travelling at 12.9kts, *Shoreway*'s chief officer started the alteration of course that placed the two vessels onto a collision course. The collision occurred at 1331, just over 5 minutes after Mr Ingram had assessed the situation to be safe.

HHA placed no limits or reporting requirements on outbound ships, with appropriate draughts, leaving the deep water channel, though it was customary for vessels under pilotage to their intended route when reporting passing channel buoys 7 and 8. *Shoreway*'s normal routine had been to leave the deep water channel after passing number 2 buoy.

Mrs Ingram was never involved in the navigation of the yacht and was on board purely as a passenger. When the skipper went below, his wife remained on deck, leaning against the cabin bulkhead facing aft. There was no expectation that she would act as lookout.

The skipper's assumption that *Shoreway* would remain in the deep water channel was influenced by his observation of *Relume*, which he had seen remain in the deep water channel. *Relume* was very similar in dimensions and showed the same aspect as *Shoreway*, leading the skipper to assume that *Shoreway* would follow *Relume* in the deep water channel.

As this accident demonstrates, a risk of collision can develop quickly when vessels are operating in the vicinity of other craft and maintaining a good lookout is essential if close quarters situations are to be avoided.

2.3.5 Closing speed

When the skipper of *Orca* assessed the situation to be safe, *Shoreway* was 1.6 miles away and was not on a collision course. The collision occurred some 5 minutes later. With *Shoreway* making good 12.9kts and *Orca* around 4.5kts, the closing speed between the vessels was around 17.5kts or 20 miles per hour.

A sequence of photos, taken from a stationary vessel gives an indication of how rapidly a vessel (in this case a dredger) can approach **(Figure 20)**.

Leisure sailors should be particularly aware of closing speeds between their own vessels and merchant ships. Ferries, cruise ships and container vessels in particular can all attain speeds in excess of 25kts, and distances that initially appear sufficient can reduce surprisingly quickly.

2.4 MECHANICS OF THE COLLISION

Although Mrs Ingram was lying facing aft on the bench seat in the cockpit prior to the collision, her body was recovered from the cabin of the sunken yacht.

At the moment of collision *Orca*'s skipper was on his way up the cockpit companionway and the force of the impact caused him to fall backwards into the cabin. It is possible that this fall rendered him unconscious or dazed him for a

Figure 20: Dredger closing sequence

short period of time. *Orca* sank 3 minutes after the impact and the skipper's first recollection following his fall was of being underwater. He could see light from outside, coming through the hole in the hull and through the foredeck hatch. He made his way forward towards the hatch, opened it and swam up through several metres of water to the surface.

As *Shoreway* pushed *Orca* astern at over 12kts, the yacht flooded rapidly from the stern, before being spun around and passing down *Shoreway*'s side. This caused a huge inrush of water, which swept both Mrs Ingram and one of the family's pet dogs down the companionway and into the main cabin with considerable force **(Figure 21)**. Mrs Ingram sustained several injuries consistent with this accelerated fall and it is possible that these would have rendered her unconscious prior to her lifejacket inflating.

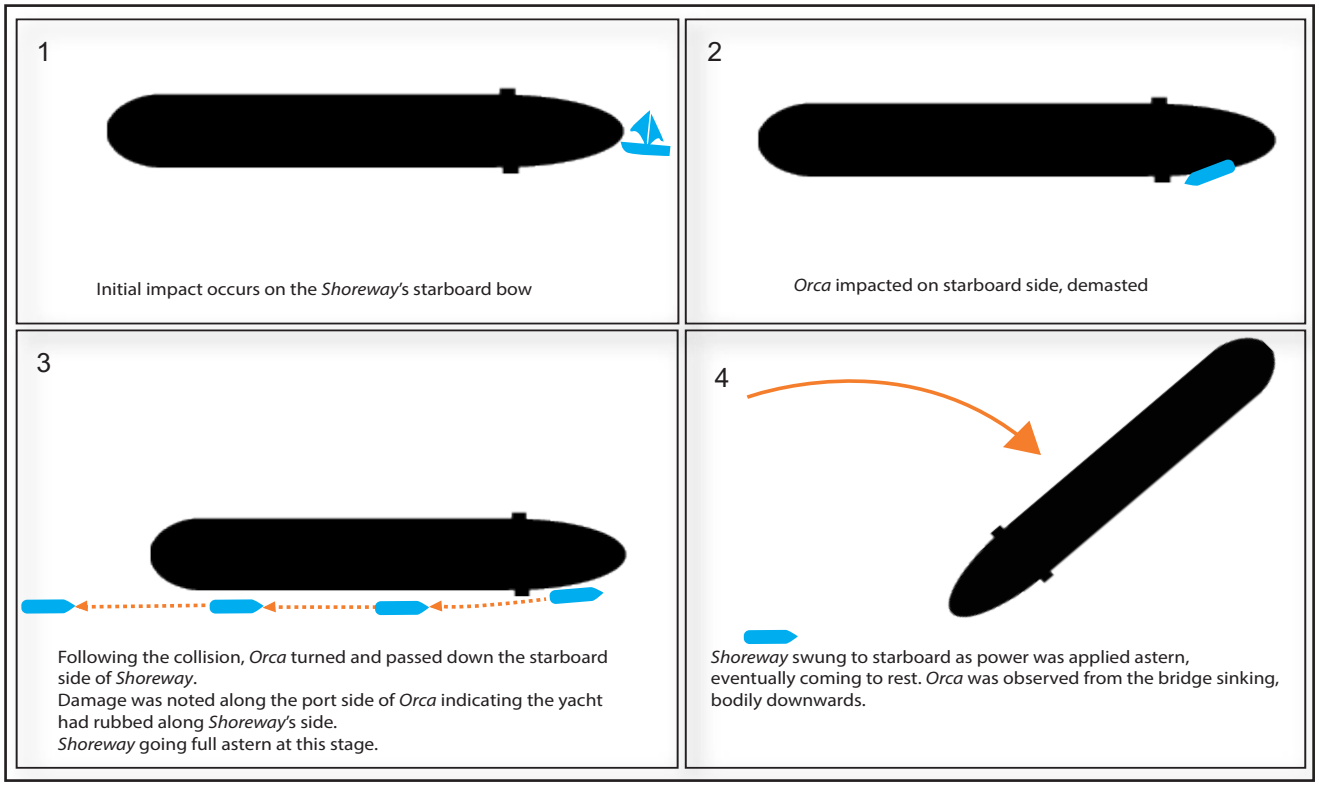

Figure 21: Damage sequence

2.5 HUMAN FACTORS

The general perception on board the majority of merchant vessels is that the period of the voyage entering or leaving a port is the most hazardous; the bridge team is therefore normally supplemented with extra manpower for this period. However, the intense nature of dredging operations meant that the opposite was the case on *Shoreway* and it was not unusual for the bridge manning to be reduced for entering and leaving port, providing a perceived opportunity for the officers to work at a lower level of concentration and to catch up on other tasks.

This resulted in the chief officer becoming over confident in his ability to manage all the tasks required in navigating the vessel single-handed within the approaches to the port. Having worked on *Shoreway* for 3 years, he had also become de-sensitised to the risks associated with the blind sector caused by the rainbow discharge equipment, so he did not consider the period between the dredging and dumping operations required more than one person on watch.

There were no procedures on board *Shoreway* to ensure that the watchkeeping officers were kept aware of the risks caused by the blind sector and the importance of maintaining appropriate bridge procedures and manning at all times.

Voyage planning as defined by STCW 95 and Boskalis's SMS was from berth to berth. *Shoreway*, in common with many other dredgers working in similar environments around the world, was not going from berth to berth. Nevertheless, the vessel was navigating in close proximity to other vessels in busy harbour waters and 10 miles out to sea, and there was no formal plan for these voyages. In the absence of a plan, the conduct of the voyage was left entirely to the judgment of the chief officer on watch.

Boskalis also allowed its masters to make decisions regarding the composition of bridge watches. In the absence of any instructions or guidance, *Shoreway*'s master delegated that authority to the chief officer. By permitting the second officer to work on paperwork, and to subsequently leave the bridge, the chief officer acted as if *Shoreway* was already out at sea whereas, in reality, it was still within the port limits of the HHA.

2.6 *SHOREWAY*'S SAFETY MANAGEMENT SYSTEM

Section 1.4.2 of the ISM Code states that a safety management system must include, inter alia, *instructions and procedures to ensure safe operation of ships and protection of the environment in compliance with relevant international and flag State legislation*. In order to fulfil this requirement, companies must first identify the risks associated with their vessel's operations, including those posed by the human element. Only then can they ensure the safety of those operations through the application of appropriate instructions and procedures.

The SMS on board *Shoreway* was a computer based fleet-wide generic safety management system that was of little benefit to the ship's crew as it contained no vessel-specific information, guidance or instructions.

Notwithstanding the fact that *Shoreway* held a valid Safety Management Certificate, the specialist nature of the vessel was such that no generic safety management system could provide instructions and procedures to ensure the vessel's safe operation.

The risks associated with the blind sector caused by the rainbow discharge equipment, especially when combined with lone watchkeeping and the confining nature of the horseshoe workstation, were identifiable, foreseeable and should have been minimised through the application of specific instructions and procedures in the safety management system. Had this been the case, it is possible that the second officer would have been required to remain on the bridge as an active member of the watch which would have increased the likelihood that *Orca* would have been seen in sufficient time to avoid a collision.

Section 7 of the ISM Code requires a company to establish procedures, plans and instructions including checklists as appropriate, for key shipboard operations concerning the safety of the personnel, ship and protection of the environment. However, on *Shoreway*, the SMS did not even identify watchkeeping, stability, pilotage or security and fire patrols as key shipboard operations.

Such elemental omissions suggests that the SMS on board *Shoreway* is severely flawed and may not be fit for purpose.

It is creditable that Boskalis issued a Safety Flash to its managed fleet **(Annex G)**, soon after the accident, to remind crews of the importance of maintaining a good lookout.

2.6.1 Auditing

In the absence of any procedures against which to audit, it is not surprising that audits have not identified any non-conformities in *Shoreway*'s watchkeeping practices.

Even when appropriate instructions and guidance are in place, many ship managers experience difficulty attempting to audit bridge watchkeeping practices. The onus of setting standards on Boskalis's vessels rested chiefly with its masters. Some owners have adopted the use of auditing on passage, or the periodic scrutiny of VDR data, both of which can be effective. Irrespective of the methods used, it is evident that Boskalis should adopt a more proactive approach to developing a more positive safety culture in respect of bridge watchkeeping practices on board its vessels.

2.7 LIFEJACKET

Despite its age and lack of servicing, Mrs Ingram's lifejacket activated and inflated as designed. It is extremely unfortunate that the inrush of water as the yacht sank carried her from the cockpit into the cabin as her lifejacket inflated, otherwise her lifejacket would likely have saved her life. The lifejacket worn by *Orca*'s skipper did not inflate, and had it done so it is very likely that he would not have been able to escape from the cabin through the hatch and swim to the surface.

The MAIB commissioned a technical analysis of the skipper's lifejacket **(Annex C)**. This concluded that it had failed to activate because the carbon dioxide cylinder was not correctly fitted to the inflation mechanism.

In this case, it is possible that the failure of the skipper's lifejacket saved his life. When entering spaces below decks, consideration should be given to removing an auto inflation lifejacket since, in the event of a catastrophic accident, it could make escape more difficult. However, in the vast majority of situations a functioning lifejacket is a lifesaver. It is therefore crucial that they are maintained, serviced and replaced according to the manufacturer's instructions.

SECTION 3 - CONCLUSIONS

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

1. *Shoreway* and *Orca* collided in good visibility as neither the chief officer, who was alone on the bridge of *Shoreway*, nor the skipper of *Orca*, who was below deck in the cabin, were maintaining a proper lookout in the period immediately prior to the collision. [2.3.1]

2. Had either officer on *Shoreway*'s bridge positively checked to ensure that the intended course was clear of other traffic, either visually or by radar, prior to making the alteration of course, *Orca* would have been clearly visible approximately 1.6nm away. [2.3.3]

3. At the time of the accident, the bridge manning on *Shoreway* was neither sufficient, nor in compliance with Harwich Haven Authority's requirements. [2.3.3.1]

4. Prior to being released to work on deck, the second officer had not been part of the bridge watch since he had been engaged in paperwork and not assisting the chief officer in navigating the vessel. [2.3.3.1]

5. *Shoreway* having steadied on the new course, *Orca* remained directly ahead of the dredger, hidden in the blind sector that affected the chief officer's position within the horseshoe, until seconds before the collision. [2.3.3.2]

6. The risks of vessels, especially small craft, not being detected in the blind sector on *Shoreway* had never been assessed by the company or the crew and were not mentioned in either the master's standing orders or the vessel's SMS. [2.3.3.2]

7. *Orca* had generated a clear target that had been visible on *Shoreway*'s radar display for 11 minutes prior to the collision. *Shoreway*'s chief officer had not recognised the need to look at the radar or make use of its ARPA function, so *Orca*'s target had not been seen, acquired or plotted. [2.3.3.3]

8. *Orca*'s skipper saw *Shoreway* approximately 1.6nm from *Orca* and, from its aspect at the time, judged there to be no risk of collision. He then decided to engage his autopilot and briefly go below. [2.3.4]

9. In the absence of any formal voyage plan, the conduct of *Shoreway*'s voyage to the spoil ground was left entirely to the judgment of the chief officer on watch. [2.5]

10. The SMS on board *Shoreway* was a computer based fleet-wide generic safety management system that was of little benefit to the ship's crew as it contained no vessel-specific information, guidance or instructions. [2.6]

11. Notwithstanding the fact that *Shoreway* held a valid SMC, the specialist nature of the vessel was such that no generic safety management system could provide instructions and procedures to ensure safe operation. [2.6]

12. It is evident that Boskalis should adopt a more proactive approach to developing a more positive safety culture in respect of bridge watchkeeping practices on board its vessels. [2.6.1]

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

1. Background music at a relatively low volume was played on the bridge of *Shoreway* throughout the day, and the proximity of the speaker to one of the VDR's microphones seriously compromised the quality of the recorded audio. [1.10]

2. Neither the master's standing orders nor the vessel's SMS contained any reference to the VDR or guidance on when and how its data should be secured. [1.10]

3. When *Orca*'s skipper assessed the situation to be safe, *Shoreway* was approximately 1.6 miles away and was not on a collision course. The collision occurred some 5 minutes later. [2.3.5]

3.3 OTHER SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. *Orca*'s skipper's lifejacket failed to activate because the carbon dioxide cylinder was not correctly fitted to the inflation mechanism. [2.7]

2. Had the skipper's lifejacket inflated, it is very likely that he would not have been able to escape from the cabin through the hatch and swim to the surface. Consideration should be given to removing auto-inflate lifejackets before proceeding below decks. [2.7]

SECTION 4 - ACTION TAKEN

4.1 MAIB ACTIONS

The **Marine Accident Investigation Branch** has:

Published a safety flyer aimed at leisure boat users, on closing speed and the importance of maintaining a lookout **(Annex J)**.

4.2 ACTIONS TAKEN BY OTHER ORGANISATIONS

Boskalis Westminster Shipping B.V. has:

- Issued a Safety Flash to its fleet reminding crews of the importance of maintaining a good lookout in accordance with the requirements of the International Regulations for the Prevention of Collisions at Sea, 1972 (as amended) and in particular Rule 5.

- Conducted an internal investigation into the accident, resulting in the following actions:

    - Amendments to the deck officer familiarisation programme for *Shoreway*, drawing attention to the blind sector caused by the rainbow discharging equipment.

    - Amendments to the dredging sailing plan checklist to ensure all local notices to mariners are incorporated into the plan.

    - The provision of marine resource management training for crews.

Harwich Haven Authority has:

- Issued a letter to all Pilotage Exemption Certificate holders reminding them of the requirements to have two appropriately qualified personnel on the bridge while navigating within the Authority's area of jurisdiction **(Annex K)**.

- Reminded local yacht clubs in the area and representatives from local sailing clubs, of the importance of maintaining a safe watch (including a listening watch on VHF channel 71) while navigating in the authorities' area of jurisdiction.

SECTION 5 - RECOMMENDATIONS

Boskalis Westminster Shipping B.V. is recommended to:

2015/125 Conduct a full review of its fleet's safety management systems and take action to ensure that any issues identified are fully addressed. This review should include inter alia:

- Bridge watchkeeping procedures
- Any obstructions affecting bridge visibility
- Procedures for lone watchkeeping (which should also take into account the requirements of SYS-NEQ-1 where appropriate)
- Scope of Master's standing orders
- The effectiveness of its Voyage Data Recorders.

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

Marine Accident Report

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