ACCIDENT REPORT

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

Report on the investigation of the collision between the fishing vessel ***Kirkella* (H7)** and harbour tug ***Shovette*** resulting in pollution at King George Dock, Hull, England on 24 June 2022

SERIOUS MARINE CASUALTY REPORT NO 4/2024 JUNE 2024

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

1/E	-	first engineer
1/O	-	first officer
ABP	-	Associated British Ports
DNV	-	Det Norske Veritas
ECR	-	engine control room
HRA	-	human reliability assessment
HSE	-	Health and Safety Executive
IACS	-	International Association of Classification Societies
ISO	-	International Organization for Standardization
kW	-	kilowatt
MBL	-	Minimum Breaking Load
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
MSN	-	Merchant Shipping Notice
SMS	-	safety management system
SOLAS	-	International Convention for the Safety of Life at Sea 1974, as amended
t	-	tonnes
UR	-	Unified Requirement
UTC	-	universal time coordinated

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

Image courtesy of Martin Klingsick (shipspotting.com)

Kirkella

Image courtesy of PWR (shipspotting.com)

Shovette

SYNOPSIS

On 24 June 2022, while alongside at King George Dock, Hull, England, the crew of the UK registered fishing vessel *Kirkella* lost control of its propulsion system and the vessel collided with the unmanned tug *Shovette*, which was moored ahead of *Kirkella*. During the collision *Shovette*'s hull and starboard fuel tank were breached by *Kirkella*'s bulbous bow. The tug partially sank, which resulted in pollution of about 7,000 litres of marine diesel oil being released into the dock. *Kirkella* was not significantly damaged and there were no injuries.

The investigation found that the pitch levers for *Kirkella*'s propulsion control system were mismatched between the bridge and engine control room when control was transferred. The classification society's interpretation of the requirement that the control system should prevent the propulsion from altering significantly when transferring control between stations allowed the pitch levers to be mismatched when changing control from the bridge to the engine control room.

Kirkella's operating company, UK Fisheries Ltd, has introduced measures to help stop a reoccurrence until the system can be retrofitted with prevention interlocks. The vessel's classification society, Det Norske Veritas, has been recommended to propose to the International Association of Classification Societies that it reviews its Unified Requirement for remote control of propulsion systems. The system support company, Kongsberg Maritime, has been recommended to issue a service letter and advise its customers of available options to prevent propulsion from altering significantly when transferring control.

SECTION 1 – FACTUAL INFORMATION

1.1 PARTICULARS OF *KIRKELLA*, *SHOVETTE* AND ACCIDENT

SHIP PARTICULARS		
Vessel's name	*Kirkella*	*Shovette*
Flag	UK	UK
Classification society	Det Norkse Veritas	Not applicable
IMO number/fishing numbers	9808405 (H7)	7341518
Type	Fishing vessel	Pusher tug
Registered owner	Kirkella Ltd.	Deans Marine Services Ltd.
Manager	Marr Management Ltd.	Deans Marine Services Ltd.
Construction	Steel	Steel
Year of build	2018	1974
Length overall	81.2m	24.0m
Registered length	75.5m	Not applicable
Gross tonnage	3976	157
Minimum safe manning	30	3
Main propulsion	One 6-cylinder 3600kW Rolls-Royce diesel engine, controllable pitch propeller.	Not applicable

VOYAGE PARTICULARS		
Port of departure	Hull	Not applicable
Port of arrival	Hull	Not applicable
Type of voyage	Fishing	Not applicable
Cargo information	Frozen boxed fish	Not applicable
Manning	31	0

MARINE CASUALTY INFORMATION		
Date and time	24 June 2022 at 0613	
Type of marine casualty or incident	Serious Marine Casualty	
Location of incident	King George Dock, Hull, England	
Place on board	Bow	Port side hull
Injuries/fatalities	None	None
Damage/environmental impact	None	Vessel holed; about 7,000 litres of marine diesel oil pollution.
Ship operation	Manoeuvring	Alongside
Voyage segment	Berthing	Berthed
External & internal environment	Wind south-south-westerly force 2, 6 knots.	
Persons on board	31	0

1.2 NARRATIVE

1.2.1 Events leading to the collision

On 23 June 2022, *Kirkella* was on passage between its fishing grounds in the North Sea and Hull, England. During the passage the ship's engineers carried out engine maintenance that required propulsion control to be transferred from the bridge to the engine control room and the vessel to be at full speed. During the trial the pitch control lever in the engine control room (ECR) was set to full ahead. When control was passed back to the bridge on completion of the engine maintenance the ECR pitch control lever was left in the full ahead position.

On 24 June, *Kirkella* returned from its fishing grounds off northern Norway and was piloted up the Humber river to the lock at King George Dock, Hull[1]. The master, first officer (1/O), and a pilot were on the bridge. The wind was south-south-westerly force 2 with good visibility.

At 0531, *Kirkella*'s master manoeuvred the vessel from the lock towards the berth using the starboard helm station. The master then berthed the vessel starboard side alongside 12 Quay and adjacent to shed 11 **(Figure 1)**.

Image courtesy of Associated British Ports

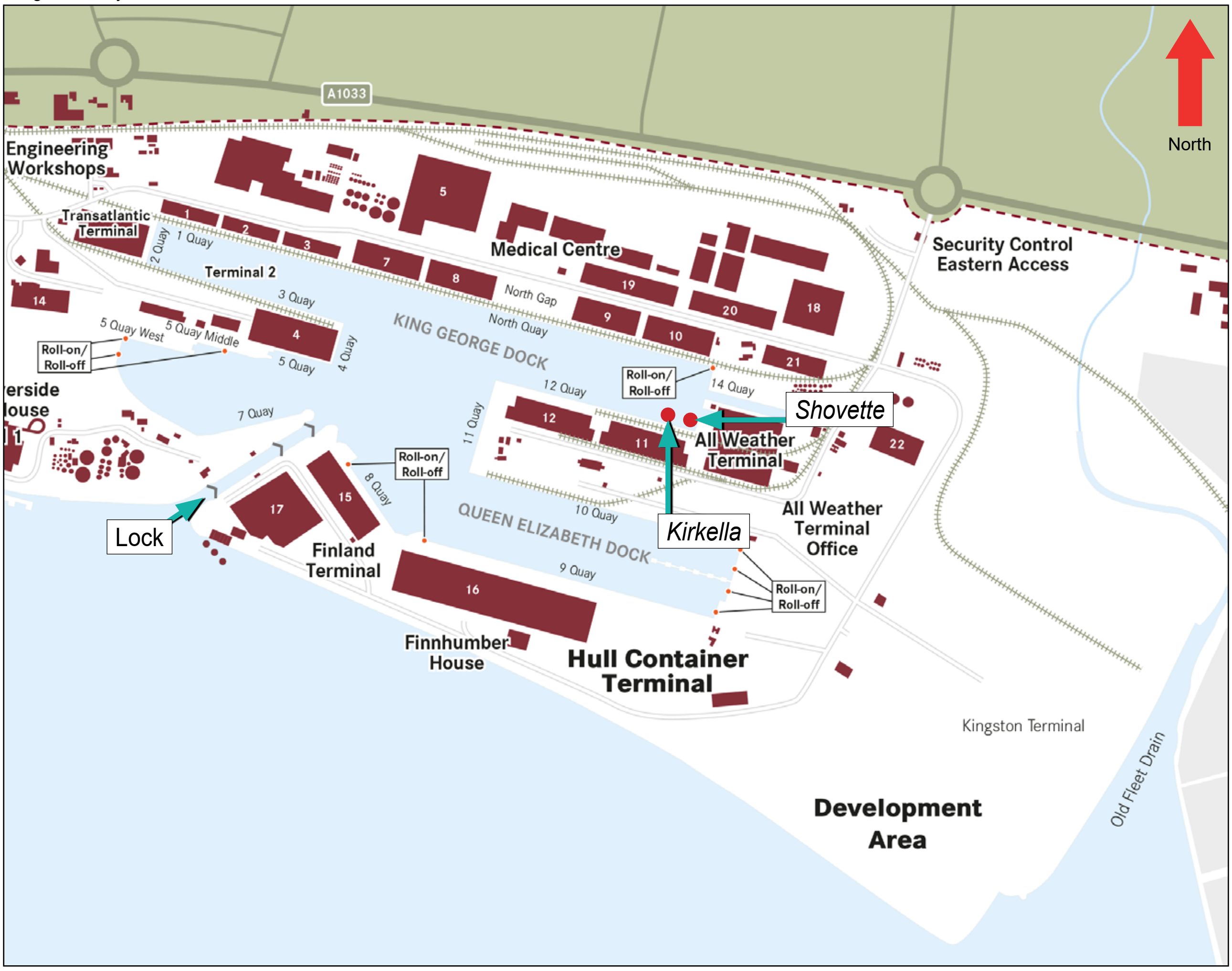

Figure 1: King George Dock

[1] Operated by Associated British Ports (ABP).

At 0557, *Kirkella*'s crew sent mooring lines ashore to the port's line handlers, who secured them to the bollards. The master positioned the vessel to make sure its cargo of frozen fish could be discharged through the vessel's cargo door onto the quayside. By 0606, the vessel was secure with two head lines and two spring lines forward and two stern lines and two spring lines aft. The line handlers departed shortly afterwards.

At 0611, *Kirkella*'s master passed control of the vessel's propulsion system from the starboard wing control station to the centre console position **(Figure 2)**. At the same time, the crew deployed the vessel's gangway to the quayside. Once the master was content that the vessel was secured in position control of the propulsion system was passed to the ECR **(Figure 3)** so that the main engine could be shut down.

The first engineer (1/E) was sitting in the ECR working at a computer. The 1/E heard the propulsion command change alarm and reached across from their chair and pressed the 'ECR' then 'Accept' buttons on the touchscreen to accept control **(Figure 4)**. Eighteen seconds later, *Kirkella* started to move ahead.

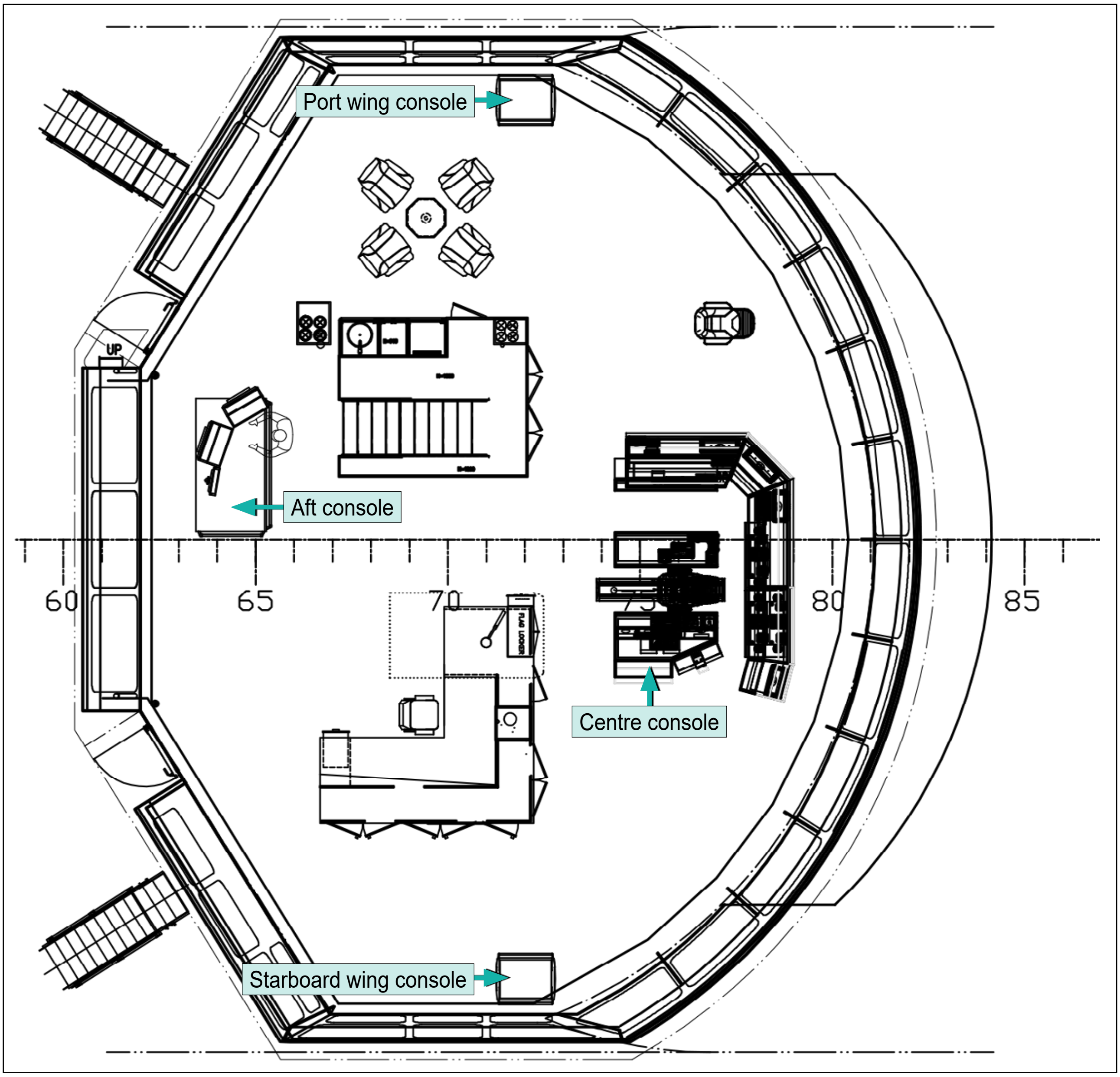

Figure 2: Bridge manoeuvring control consoles

Image courtesy of [Fishing News]

Figure 3: The engine control room

Figure 4: Engineer reaching across to the propulsion control touchscreen

On the bridge, the 1/O was shutting down the bridge equipment when they noticed the vessel moving ahead and raised the alarm. The master reacted to the 1/O's exclamation and saw that the vessel was moving ahead. Shortly afterwards, the two stern lines parted and the forward spring lines surged on the mooring bitts.

The master went to the centre console and telephoned the ECR, instructing the 1/E to stop the engine. At about the same time, the master pushed the emergency stop button on the centre console, which declutched the engine. Moments before the master's telephone call, having sensed a change in the main engine load, the 1/E had checked the engine control console and observed that the pitch was 85%.

As *Kirkella* continued to move forward, two further mooring lines parted and the gangway was dragged until it fell from the quayside. Ten seconds after the master had declutched the engine, *Kirkella* collided with the moored and unmanned harbour tug *Shovette* **(Figures 5a** to **5c)**, which was berthed adjacent to the all-weather terminal at the end of the King George Dock **(Figure 1)**. *Kirkella* bounced off the tug and came to rest with three forward mooring lines and one aft mooring line still intact.

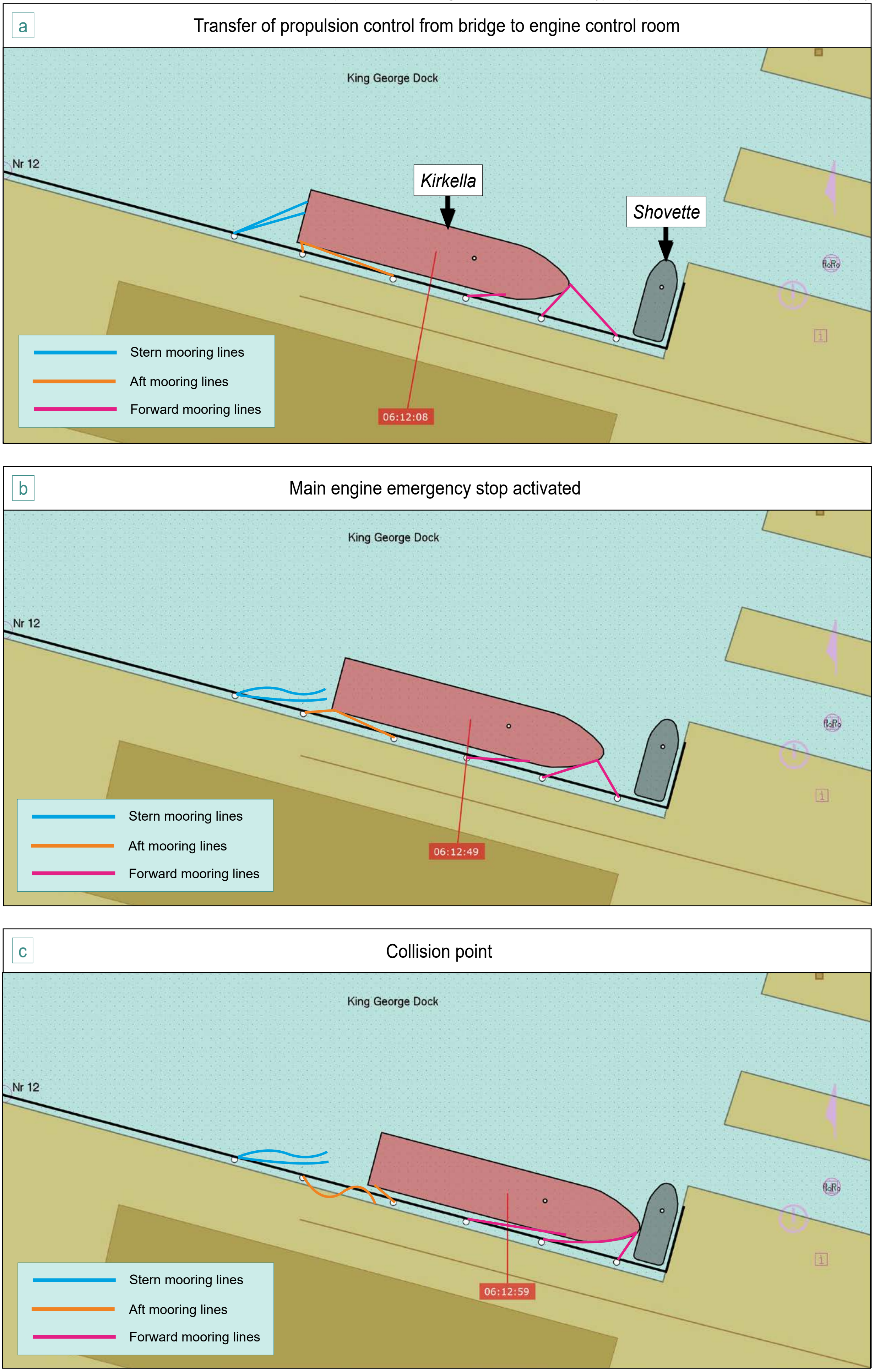

Figure 5: Sequence of *Kirkella*'s loss of control

1.2.2 Post-collision events

Kirkella's crew sent other mooring lines ashore, which were secured by the ship's manager who had been waiting for the vessel's arrival alongside. By 0620, *Kirkella* was once again moored in its original position. The 1/O inspected the bow and minor damage was noted to the bulbous bow and stem.

Shovette's port side hull had been holed below the waterline; the fuel tank had been breached and the engine room flooded. The tug settled low in the water and marine diesel oil spilled from the ruptured fuel tank into the dock **(Figure 6)**.

Figure 6: *Shovette* low in polluted dock water after the collision

Kirkella's pilot reported the collision to the duty assistant dockmaster and Vessel Traffic Services Humber and requested a tug to assist *Shovette*. At approximately 0630, the tug *Serviceman* arrived and pushed against *Shovette*'s port side to prevent the tug capsizing.

The dockmaster telephoned the port's oil spill response contractor whose team, once on site, deployed containment booms and absorbent materials to limit the extent of the pollution **(Figure 7)**. The contractor used a variety of methods, including an oil recovery boat **(Figure 8)**, to remove most of the oil within 3 weeks; the clean-up operation was completed after a further 8 weeks. The pollution response operation cost around £250,000, with unknown additional costs incurred for loss of business continuity and port personnel involvement.

Shovette was repaired locally and returned to service on 2 September 2022.

Figure 7: Pollution booms deployed

Figure 8: Oil recovery boat in operation

1.3 *KIRKELLA*

1.3.1 Vessel

Kirkella was a sophisticated factory trawler, built in Poland under continuous Det Norske Veritas survey and designated ICE – 1B[2] for its strengthened bow and hull. The vessel was fitted out in Norway in 2018 and was one of four sister ships.

[2] Ice class designation for a vessel designed for service in moderate ice conditions with an icebreaker escort.

Part of the UK distant water fleet, *Kirkella*'s voyages included fishing in the Barents Sea and Greenland Sea. The vessel would fish for as long as necessary to fill the hold with frozen fish before returning to its home port of Hull.

Kirkella had a single 3,600 kilowatt (kW) main engine, driving a controllable pitch propeller via a clutched reduction gearbox, and a single 950kW bow thruster.

1.3.2 Propulsion and bow thruster controls

Kirkella's propulsion and bow thruster were controlled by a Rolls-Royce Helicon-X3 system **(Figure 9)**. There were four control stations on the bridge **(**see **Figure 2)** and one in the ECR. The bridge control positions were frequently used during fishing and navigation and the crew had adopted a process whereby controls at the console in use were set to stop/zero before changing to a different console.

The change of control between the bridge and ECR occurred when the ship was either secured alongside a berth, preparing to depart, or undergoing engine maintenance. The bridge and ECR pitch levers would be set to 'zero' when changing the control station while the vessel was in port and to 'full ahead' when *Kirkella* was on passage. There was no documented procedure for the changeover between control stations.

Figure 9: Engine control room propulsion control system

1.3.3 Ownership and management

Kirkella was owned by *Kirkella* Ltd, a subsidiary company of UK Fisheries Ltd, and managed by another subsidiary company, Marr Management Ltd. Technical assistance was provided by Deutsche Fischfang-Union GmbH, which owned two of *Kirkella*'s sister vessels.

1.3.4 Crew

Kirkella's 31 crew comprised Icelandic, Danish and British nationals. The vessel's common working language was English. All of the crew were appropriately qualified for their roles. When engaged in fishing operations, the bridge team followed a 6 hours on/6 hours off watch pattern. The engine room team followed a 12-hour watch pattern, with the 1/E on watch from 1800 to 0600 and the chief engineer on watch from 0600 to 1800.

1.3.5 Mooring system

Kirkella was moored using four polypropylene lines at both the bow and stern. Except for one stern line, all of the lines were 76mm in diameter with a manufactured minimum breaking load (MBL) of 90 tonnes (t). The differing stern line was 45mm in diameter with an MBL of 36t.

1.3.6 Safety management system

Kirkella had a safety management system (SMS) that was developed by Marr Fishing Vessel Management Limited. The SMS referenced the company structure and organisation and contained policies and procedures for the vessel's operation and crew functions. Issued in 2003, the SMS was generic for the company's vessels and had not undergone subsequent review. There was no formal internal or external audit process.

Risk assessments were completed on board using an uncontrolled format and with no requirement for them to be reviewed.

1.4 *SHOVETTE*

Shovette was a local tug used to assist barges and small ships in the upper reaches of the Humber river. The vessel was unmanned at the time of the accident and was moored securely in a port approved location. *Shovette* was properly certificated for its operations.

1.5 ROLLS-ROYCE HELICON-X3 PROPULSION AND THRUSTER CONTROL SYSTEM

1.5.1 History

The Rolls-Royce Helicon range of propeller and thruster control systems was launched in 1984 and the Helicon system's hardware and software had since undergone numerous improvements. The Helicon-X3 system was introduced in 2004, and over 4,000 units had been fitted to vessels.

Rolls-Royce Commercial Marine was acquired by Kongsberg Gruppen in 2019. The Helicon-X3 system was later discontinued for supply and customer support was supplied by Kongsberg Maritime.

1.5.2 Operation

The Rolls-Royce Helicon-X3 was a propulsion and thruster control arrangement principally designed for vessels using dynamic positioning capability. The microprocessor-based unit allowed multiple controls to work through a common graphical user interface and was frequently used as part of complex computer-controlled dynamic positioning systems.

The operator manual described two transfer scenarios. Firstly, the 'command transfer' procedure, for when control was passed between bridge stations without acceptance at either station. Secondly, the 'control transfer' procedure, for when control was transferred between the main station, the ECR **(Figure 9)**, and the remote stations on the bridge, which had to be accepted by the operators. The purpose of the control transfer procedure was to make sure that control could not be transferred to an unmanned remote station. The ECR control station had priority, enabling it to take control from the bridge stations without acceptance if necessary.

There were four steps in the 'control transfer' procedure from the bridge to the ECR:

1. *Set the control levers at the new station* [ECR] *in accordance to the position of the levers at the present station* [Bridge] *in command.*

2. *Press the ECR button.*

3. *To confirm press the accept button within 10 seconds when it starts to flash.*

4. *The station in command is indicated with blue colour in the ECR/ Bridge buttons.*

In the ECR, the control transfer alarm would sound and the operator was required to press the accept button within 10 seconds to complete the transfer of control from the bridge to the ECR. The operator manual noted that, *There is normally no command transfer interlock because of discrepancy between the lever position at the present station in command and the lever position at the new station to be in command.*

1.5.3 Class approval

Many countries and regions required type approval for certain products to be sold or used within their jurisdictions. By obtaining type approval from a recognised classification society, manufacturers could demonstrate compliance with multiple regulatory frameworks, facilitating access to various global markets.

The Rolls-Royce Helicon-X3 system was approved for *Kirkella* in 2016 by the Det Norske Veritas Germanischer Lloyd[3] (DNV) classification society's head office and the certificate for the control and monitoring system for *Kirkella* was issued at its local office, in Ålesund, Norway **(Figure 10)**. The local office had also approved the Rolls-Royce Helicon-X3 factory acceptance test, which was used for post-build trials **(Figure 11)**.

[3] The organisation changed its name to Det Norske Veritas on 1 March 2021.

There were three steps in the approvals process:

1. Equipment design review – to check compliance with relevant standards and regulations. This review included a detailed analysis of the equipment's performance, materials and software, and documentation;

2. Testing and analysis – to verify performance and safety; and

3. Approval certificate – issued when the equipment was found to be compliant with class rules.

DNV·GL

CERTIFICATE
FOR CONTROL AND MONITORING SYSTEM

Certificate No:
N141EUW4

This is to certify

that the product:	Remote Control System
Type designation:	Helicon X3
Application/context:	Thruster control for Bow1 and Main Propulsion
Serial/tag no:	N.A.

Has been found to comply with relevant requirements in:
DNVGL-RU-SHIP :DNV GL Rules for classification – Ships, (2016-01)
DNV Rules for Classification of Ships (2015-07)

The product is intended for

Yard:	Myklebust Verft AS
Yard No:	396
Name of vessel:	KIRKELLA
DNV GL Id No:	36905

The product / material has been marked: N141EUW4 on: Brass plates in UN1 cabinets.

Particulars of Vendor and Purchaser

Vendor:	Rolls-Royce Marine AS Automation & Control
Vendor reference:	16S000043
Purchaser:	Rolls-Royce Marine AS - Propulsion Ulsteinvik
Purchaser reference:	

Issued at Ålesund on 2017-07-18

for DNV GL

This document has been digitally signed and will therefore not have handwritten signatures

[redacted]

Surveyor

Form code: CMC 201 Revision: 2016-08 www.dnvgl.com Page 1 of 3
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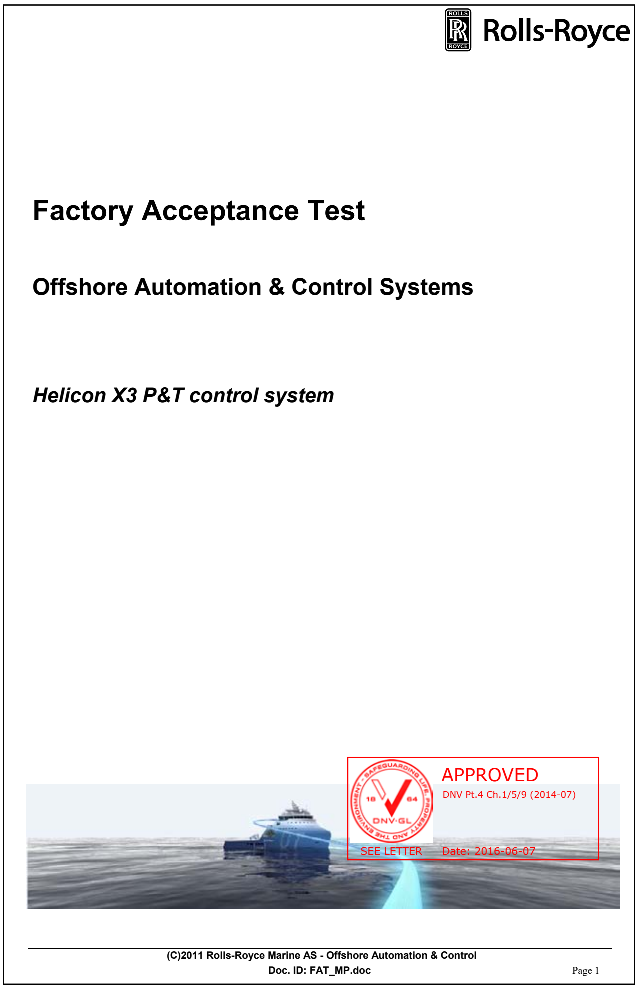
Figure 10: DNV local office certificate showing compliance with the relevant requirements



Rolls-Royce

Factory Acceptance Test

Offshore Automation & Control Systems

Helicon X3 P&T control system

APPROVED
DNV Pt.4 Ch.1/5/9 (2014-07)
SEE LETTER Date: 2016-06-07

(C)2011 Rolls-Royce Marine AS - Offshore Automation & Control
Doc. ID: FAT_MP.doc
Page 1

Figure 11: DNV approval of Helicon-X3 factory acceptance test (cover page)

1.6 DET NORSKE VERITAS

DNV was the world's largest maritime classification society, certifying newbuild and in-service vessels to verify their compliance with statutory regulations and international safety standards. DNV also certified manufacturers' products to confirm they complied with international standards. DNV used a set of rules and standards to evaluate the design, construction, and safety features of a newbuild vessel. The classification process included plan approval, construction surveys and testing and certification of systems and equipment.

1.7 CLASSIFICATION SOCIETIES

Classification societies are independent, non-government organisations that provide services associated with the design, construction and operation of ships and other marine structures. Classification societies are responsible for verifying compliance with international and national standards and regulations related to shipbuilding and operation, including:

- Ship classification – verifying compliance with international and national standards for safety, environmental protection and other aspects of ship design, construction and operation;
- Technical inspection: – verifying compliance with safety and environmental regulations;
- Certification – verifying a vessel and its equipment complied with safety, environmental and other regulatory requirements; and
- Consulting – providing services associated with ship design, construction and operation.

Classification societies perform a critical role in ensuring the safety, reliability and sustainability of the global shipping industry.

1.8 INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES

The International Association of Classification Societies (IACS) is a not-for-profit membership organisation of classification societies that establishes, reviews, promotes and develops minimum technical requirements for the design, construction, maintenance and survey of ships. The IACS assists international regulatory bodies and standards organisations to develop, implement and interpret statutory regulations and industry standards in ship design, construction and maintenance, with a view to improving safety at sea and the prevention of marine pollution. The IACS holds consultative status at the International Maritime Organization and is able to influence design and safety standards.

At the time of the accident, the IACS comprised 11 major classification societies, encompassing over 90% of the global tonnage of ships. Its members were required to demonstrate effective application of a quality management system and undergo a periodic compliance check. Classification societies were not obliged to become members of the IACS to exist or set standards for shipping, but non-IACS organisations were not always recognised by all flag states.

Where IACS members had a common practice and general philosophy on their requirements, one or more of the members could propose that it became a Unified Requirement (UR). The IACS URs covered a range of topics related to the design, construction and operation of ships and marine structures and were intended to provide a common technical framework for the maritime industry.

The URs were organised into several categories, including structural design, machinery and systems, electrical installations, and environmental performance. Each category contained a set of technical requirements intended to make sure ships and marine structures were safe, reliable and environmentally friendly. The URs were regularly updated to reflect new technologies, changes in regulatory requirements and feedback from industry stakeholders. Ship designers, shipyards and ship operators often used URs as an industry benchmark for technical excellence.

1.9 CLASS REQUIREMENTS FOR THE REMOTE CONTROL OF PROPULSION SYSTEMS

1.9.1 International Association of Classification Societies

On the remote control of propulsion systems, UR M43.12[4] required that, *The control system shall include means to prevent the propelling thrust from altering significantly when transferring control from one control to another.*

1.9.2 Det Norske Veritas

The applicable Rules for Classification of Ships (2016-01)[5] set out DNV's requirements for the remote control of propulsion systems, which included:

> *Means shall be provided to prevent significant alteration of process equipment parameters when transferring control from one location to another, or from one means or mode of operation to another. If this involves manual alignment of control levers, indicators shall show how the levers shall be set to become aligned.*

1.9.3 Other classification societies

The requirements for the remote control of propulsion systems were sampled for three other IACS member classification societies:

<u>American Bureau of Shipping</u>

> *Propeller speed and direction of thrust are to be prevented from altering significantly when propulsion control is transferred from one control station to another.*

<u>Bureau Veritas</u>

> *When transferring the control location, no significant alteration of the controlled equipment is to occur. Transfer of control is to be protected by an audible warning and acknowledged by the receiving remote control location.*

<u>Lloyd's Register</u>

> *Changeover between control stations is to be arranged so that it may only be effected with the acceptance of the station taking control. The system is to be provided with interlocks or other suitable means to ensure effective transfer of control.*

---

4 UR M43 (1982) Bridge control of propulsion machinery for unattended machinery spaces.

5 Part 4 – Systems and Components, Chapter 9 – Control and Monitoring Systems, Section 3 – System Design.

1.10 REGULATION AND GUIDANCE – PROPULSION CONTROL SYSTEMS

In respect of propulsion control systems, the International Convention for the Safety of Life at Sea (SOLAS) 1974, as amended[6] stated that…*This system shall include means to prevent the propelling thrust from altering significantly when transferring control from one location to another.*

Merchant Shipping Notice (MSN) 1873 Amendment 1 (F) The Code of Practice for the Construction and Safe Operation of Fishing Vessels of 24m Registered Length and Over required that:

> *remote control of the propulsion machinery shall be possible only from one station at a time: at any control station interlocked control units[7] may be permitted. There shall be at each station an indicator showing which station is in control of the propulsion machinery. The transfer of control between the wheelhouse and machinery spaces shall be possible only in the machinery space or control room.* [sic]

1.11 SAFETY MANAGEMENT REQUIREMENTS

1.11.1 UK Fishing Safety Management Code

The UK Fishing Safety Management (FSM) Code contained guidelines and best practices developed by the Maritime and Coastguard Agency (MCA) to improve safety standards in the fishing industry. Details of the code were contained in Marine Guidance Note (MGN) 596 (F) – *Fishing Safety Management Code: Helping to improve the management of safety on Fishing Vessels*. The FSM Code was based on the International Safety Management (ISM) Code, with additional requirements that were specific to the fishing industry.

The objectives of the FSM Code were to:

- Improve safety on fishing vessels by having a straightforward management system; and
- Assist owners, operators and crew to comply with relevant legislation.

The FSM Code encouraged fishing vessel owners to develop and implement a SMS tailored to the specific needs of their vessel and operations. The FSM Code advised that the SMS should include procedures for identifying and managing risks related to fishing operations, such as handling gear, working in adverse weather conditions and working alone. The SMS was to be continuously improved through regular assessments and reviews.

The FSM Code also advised vessel owners to make sure crew members received proper training, had the necessary skills to carry out their duties safely and were familiar with emergency procedures and able to respond effectively in an emergency.

[6] SOLAS Chapter II-1: Construction – Structure, subdivision and stability, machinery and electrical installations; Part C – Machinery installations; Regulation 31 – Machinery controls.

[7] Designed to work together in such a way that one unit could operate only when certain conditions were met by another unit.

1.12 CONTROL SYSTEM DESIGN

1.12.1 International Organization for Standardization

The International Organization for Standardization (ISO) 9241 provided guidance to make computer-based interactive systems useful and usable by applying human factors and ergonomics and usability knowledge and techniques. One of its aims was to counteract possible adverse effects on human health, safety and performance by introducing a process whereby the human element was considered from the design of a computer system and throughout its lifecycle. It identified ways in which the hardware and software components of interactive systems could enhance human-system interaction. The standard was generic and not specific to marine systems.

The standard addressed the need for usability and ease of function, applying one important caveat in Section 5.6:

> *In safety-critical and mission-critical systems, it can be more important to ensure the effectiveness or efficiency of the system than to satisfy user preferences.*

The standard also addressed the ergonomic principles of human-system interaction to be considered when designing and evaluating systems, including:

> *Use error robustness – The interactive system assists the user in avoiding errors and in case of identifiable errors treats them tolerantly and assists the user when recovering from errors;* and
>
> *Self-descriptiveness – The interactive system presents appropriate information, where needed by the user, to make its capabilities and use immediately obvious to the user without unnecessary user-system interactions.* [sic]

1.12.2 Human reliability

A wide range of academic publications covered human error in accidents for all types of industries. The publications generally agreed that a 'systems approach' was necessary to identify potential failure modes. In systems engineering, the 'systems approach' was applied to every element (i.e. hardware, software and human systems integration) and consideration towards each function was expected to be equal. The human element was therefore required to be analysed and assessed on its probability of reliability.

Human reliability analysis (HRA) was a structured approach used to identify potential human failure events and systematically estimate the probability of such errors. An HRA should consider all variabilities in a system's operation and estimate when and why a human could have a negative effect. The intended outcome was a system design that eliminated or minimised the probability of incorrect operation.

1.12.3 Guidance on the human element

The UK's Health and Safety Executive (HSE) has conducted several studies into human error and published guidance on managing it. The HSE's *Human factors:*

Managing human failures guidance[8] identified key principles in managing human failure, including:

- *Human failure is normal and predictable. It can be identified and managed.*

- *Industry should tackle error reduction in a structured and proactive way, with as much rigour as the technical aspects of safety. Managing human failure should be integral to the safety management system.*

- *A poorly designed activity might be prone to a combination of errors and more than one solution may be necessary.*

- *Involve workers in design of tasks and procedures.*

- *Risk assessment should identify where human failure can occur in safety critical tasks, the performance influencing factors which might make it more likely, and the control measures necessary to prevent it.*

The MCA published guidance in MGN 520 (M)[9], which diagrammatically summarised 12 of the most common human-related factors that could affect maritime safety. These were known as the *Deadly Dozen* and included distraction, fatigue and local practices:

> ***Distraction*** *– an event that interrupts your attention to a task.*
>
> *These are commonplace. They can usually be managed effectively but it is easy to become drawn in to a distraction and overlook much more critical events with serious implications for safety. They are a significant cause of forgetting things and losing situational awareness.*
>
> ***Fatigue*** *– clearly has an adverse effect on people and their performance. It is a significant factor in many maritime accidents. The main causes of fatigue are:-*
>
> - *natural biological (circadian) rhythms – it is natural to want to sleep at night and early afternoon*
> - *the length of time we are awake*
> - *the length of time we spend working*
> - *the difficulty of the work (mental and physical)*
> - *stress*
> - *the amount of rest we get between work periods*
> - *the amount of adequate quality, undisturbed sleep – absolutely essential for recovery* [sic]
>
> ***Local practices*** *– behaviour and actions applied locally that differ from the official documented practices. Also known as procedural violations.*
>
> *Correct behaviour and actions are fundamental to safety. Procedures and practices have been designed to ensure that work is carried out correctly, safely, legally and to the expected standard. However, actual local practices can vary from the expected procedures and behaviour. If it is not addressed effectively, this behaviour can become established as the new norm with a lower safety and quality threshold.*

[8] https://www.hse.gov.uk/humanfactors/topics/humanfail.htm

[9] Human Element Guidance – Part 2: The Deadly Dozen – 12 Significant People Factors in Maritime Safety.

SECTION 2 – ANALYSIS

2.1 AIM

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

2.2 OVERVIEW

Kirkella collided with *Shovette* due to the propeller pitch increasing after propulsion control was passed from the bridge to the engine control room. The vessel had no established procedures for the transfer of propulsion control and the crew had made assumptions based on local practices. The analysis will examine the factors influencing the loss of control of the propulsion system and other circumstances leading to the collision.

2.3 LOSS OF CONTROL

2.3.1 Propulsion control change

After *Kirkella*'s crew had conducted the engine maintenance at sea, the ECR pitch control lever being left at full ahead did not present any problem, until control was passed back to the ECR once the vessel was secured alongside.

When the master requested that the ECR took control of the propulsion using the system panel there was no telephone communication with the 1/E, which could have focused their actions. Certainly, a telephone call would have required the 1/E to leave their chair at the computer and look directly at the propulsion control screen. There was no procedure in place to ensure that confirmation of pitch lever positions was communicated before control was handed over.

Changing control station was a routine matter and the bridge team had developed a process of zeroing the bridge stations' levers before control changeover, but this was done with people in sight and hearing of one another, or by one person changing control, thus minimising the chance of lever mismatch. However, the ECR was remote from the bridge and, although the system display indicated the propeller pitch setting, it did not provide an audible or overt visual alert to highlight when the bridge and ECR levers were mismatched. Consequently, without communication between the two control stations, neither was fully aware of what the other was doing and there was no procedure to ensure that lever matching occurred.

2.3.2 Acceptance of control in the engine control room

The 1/E was at the computer workstation completing logs at the end of their shift. As it was in the idle period between the vessel's arrival alongside and the bridge declaring 'finished with engines', there was no need for focused machinery monitoring.

The sounding of the control change alarm had become routine because the 1/E had completed the acceptance process many times before. With no telephone communication from the bridge to advise of changeover, the 1/E had no reason to stand in front of the propulsion control screen and pitch control lever **(**see **Figure 4)** and did not expect anything to be different on this occasion. This was evident from the 1/E's immediate return to administrative duties until the telephone call from the bridge. Standing by the telephone might have caused the 1/E to look at the pitch lever but only a formal check instigated by the bridge, or by a practiced procedure, would have ensured the 1/E was fully engaged in the changeover process.

2.3.3 Response to loss of control

Kirkella's 1/O realised that the vessel was moving ahead and immediately raised the alarm. The increase in *Kirkella*'s propeller pitch accelerated the vessel forward until some of its aft mooring lines parted, and one stern line and the forward springs surged on their bitts. This allowed *Kirkella* to further accelerate until it struck *Shovette*. The master responded immediately by telephoning the ECR, but had assessed the ship was gathering speed and so declutched the engine.

It could be viewed that instructing the 1/E to put the engine to full astern might have affected the outcome, but at that stage neither the master nor the 1/E knew what the problem was and reversing pitch would have taken several seconds; only 10 seconds elapsed between declutching and the collision. The master's action to declutch the engine was an appropriate response in the circumstances.

The declutching of the engine and that some of *Kirkella*'s mooring lines remained intact, while not enough to prevent the collision, certainly lessened the consequences.

2.4 FATIGUE

The 1/E had been working 12-hour night shifts before the accident and was at the end of their watch. Although the 1/E might not have felt tired, studies show that the sleep debt and disruption to circadian rhythm[10] caused by this type of shift pattern could significantly affect alertness and concentration. The 1/E had been working at the computer before the propulsion control change alarm sounded; the distraction of administrative duties, coupled with previous experiences of control changeover and the likely effects of fatigue at the end of the shift, resulted in the 1/E not fully engaging with the process when the control change alarm sounded.

2.5 SAFETY MANAGEMENT

Kirkella's SMS encompassed the requirements of MGN 596 (F), with the exception of training. The procedures were generic and did not cover vessel-specific equipment requirements. The omission of training requirements was notable, given these were fundamental to safe operations; however, it is unlikely that this was a contributory factor in the accident given there was no onboard procedure for propulsion control changeover.

The focus of an SMS was to identify and mitigate general risks associated with critical processes and activities that could potentially lead to accidents or regulatory transgressions. Onboard procedures could be developed for such operations to make sure they were performed consistently and safely. However, less critical or routine operations that might not have dedicated procedures were still expected to be carried out following general safety guidelines and practices. Propulsion control changeover was a routine activity that had not been identified as having a critical effect on safety due to the knowledge of those on board. It was unlikely that an external audit of the SMS would have exposed any weaknesses in the finer details of operational functions.

[10] The pattern of biological processes that occurs regularly at about 24-hour intervals, also known as the sleep/wake cycle. Further information can be found at https://www.sleepfoundation.org/circadian-rhythm

2.6 ROLLS-ROYCE HELICON-X3 CLASS APPROVAL

The Helicon-X3 was an advanced system supplied predominantly for dynamic positioning vessels but also fitted to smaller merchant ships, such as short sea and inland waterways ferries and vessels engaged in anchor handling, oil platform supply and windfarm support. Many of these vessels did not have a manned machinery space and so did not require a remote control station.

The Rolls-Royce Helicon-X3 system was approved for *Kirkella*'s build by DNV's head office and that approval was referenced to DNV's own interpretation of UR M43.12 in its rules (see section 1.9.2). The issue of mismatched levers at control change would not have been recognised as the system manual identified the scenario (section 1.5.2), and DNV's rules allowed for it.

Similarly, when *Kirkella* was undergoing sea trials the propulsion control would have been checked against the class-approved factory acceptance test. This test was designed for a system without interlocks so there was no means to address the issue of mismatched levers. Nonetheless, should it have been questioned that the system could achieve control change without the levers being matched, the approval and certification references to DNV's rules would have indicated that the system was compliant.

2.7 THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES UNIFIED REQUIREMENTS

UR M43.12 used precise language with robust keywords:

> *The control system* ***shall include*** *means to* ***prevent*** *the propelling thrust from* ***altering significantly*** *when transferring control from one control to another.*

The MAIB consulted with classification society staff, seafarers and its own human factors and ergonomics expert to confirm that UR M43.12 was unambiguous. However, the subtle use of language by individual classification societies when incorporating the minimum standard of UR M43.12 into their own requirements did appear to introduce ambiguity. The first sentence of DNV's requirement did not significantly differ from UR M43.12:

> *Means shall be provided to prevent significant alteration of process equipment parameters when transferring control from one location to another, or from one means or mode of operation to another.*

But continued:

> *If this involves manual alignment of control levers, indicators shall show how the levers shall be set to become aligned.*

In *Kirkella*'s case, the levers were required to be manually aligned and the system was fitted with indicators displayed on the propulsion control screen. It is possible that, because the system complied with the second sentence, this was interpreted as a step towards future class-approval of the Rolls-Royce Helicon-X3. However, systems are checked against class requirements only, not IACS URs. Had *Kirkella*'s Rolls-Royce Helicon-X3 propulsion control system aligned with the more explicit and stringent requirements articulated in UR M43.12 it would not have been possible to transfer control from the bridge to the engine room if the pitch levers at the two control stations were mismatched.

SECTION 3 – CONCLUSIONS

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

1. The engine control room pitch control lever had been left in the ‘full ahead’ position following engine maintenance conducted while the vessel was at sea. [2.3]

2. *Kirkella*’s engineer accepted control without checking that the pitch control lever was set at zero. With no interlocks to prevent changeover with mismatched levers, control was taken at the ECR control station with its pitch control lever at ‘full ahead’ and the propeller pitch increased to 85% before the master pressed the emergency declutch button. [2.3]

3. There was no onboard procedure for transfer of propulsion control and training requirements for its use had been omitted from *Kirkella*’s safety management system. [2.5]

4. As fitted to *Kirkella*, the Rolls-Royce Helicon-X3 propulsion control system did not align to the standard of UR M43.12, which required a means to prevent significant alteration of the propelling thrust when transferring control. [2.6, 2.7]

5. DNV’s class requirement addressing the standard in UR M43.12 introduced ambiguity, which in turn allowed the Rolls-Royce Helicon-X3 propulsion control system to be approved for use in *Kirkella*. [2.6, 2.7]

3.2 OTHER SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. *Kirkella*’s crew did not realise that the propeller pitch had increased until the vessel moved forward. [2.3]

2. The increase in pitch accelerated *Kirkella* forward and parted several mooring lines, which allowed it to continue the vessel’s movement along the quay until it collided with *Shovette*. [2.3]

3. It is likely that the effects of fatigue after a long shift coupled with the absence of a robust procedure led to the engineer paying insufficient attention to the change of propulsion control to the ECR. [2.4]

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

1. The Rolls-Royce Helicon-X3 propulsion control system had been fitted to other vessels with remote control stations in the engine control room. Those systems might also not align with the requirement of UR M43.12. [2.6]

SECTION 4 – ACTION TAKEN

4.1 MAIB ACTIONS

The MAIB has issued a safety flyer to the shipping industry **(Annex A)**.

4.2 ACTIONS TAKEN BY OTHER ORGANISATIONS

UK Fisheries Ltd. has

- Introduced a new requirement to *Kirkella*'s pre-arrival checklist, requiring verbal confirmation that pitch controls are set to zero before changing control between stations.

- Requested that Kongsberg modify the control system to prevent reoccurrence.

SECTION 5 – RECOMMENDATIONS

Det Norske Veritas is recommended to:

2024/111 Propose to the International Association of Classification Societies that Unified Requirement M43.12 is reviewed to clarify its intent.

2024/112 Inform its customers that the Rolls-Royce Helicon-X3 system might allow remote control station changeover with mismatched levers and suggest that the manufacturer be contacted for advice.

Kongsberg Maritime is recommended to:

2024/113 Issue a service letter to its customers advising that the Rolls-Royce Helicon-X3 system remote control changeover process can allow mismatching of levers resulting in the propelling thrust altering significantly, and advise them of methods of operation and/or rectification should these be requested.

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

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SAFETY FLYER TO THE SHIPPING INDUSTRY

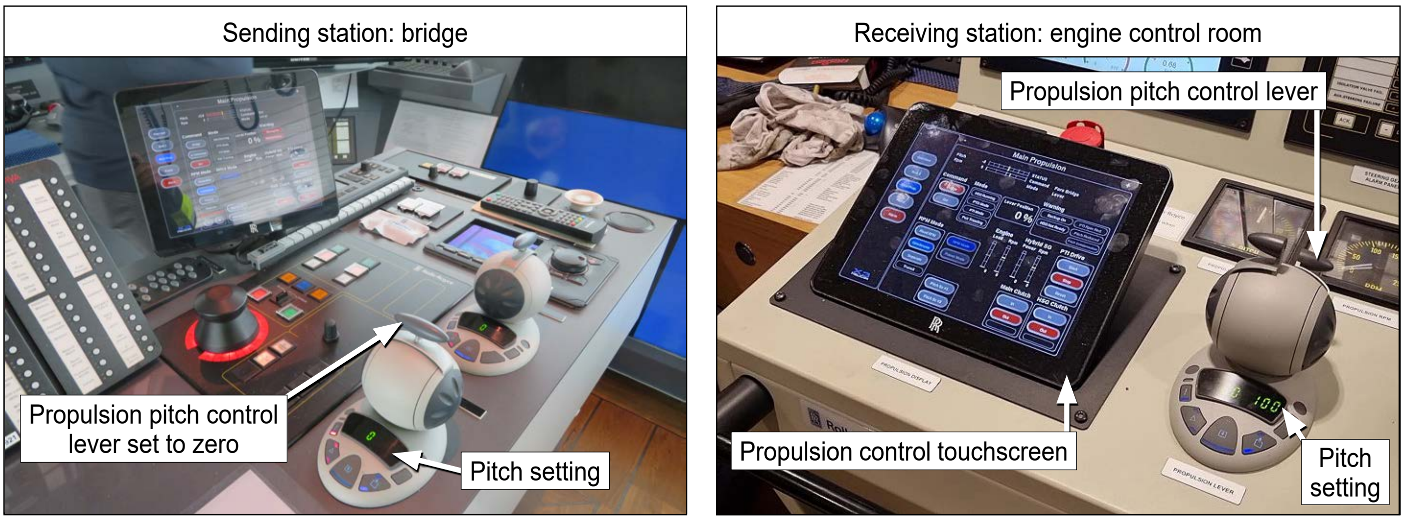
Loss of propulsion control identified following the collision between the fishing vessel *Kirkella* and harbour tug *Shovette* at King George Dock, Hull, England on 24 June 2022

Narrative

On 24 June 2022, the UK registered fishing vessel *Kirkella* lost control of its propulsion system while berthing and collided with the harbour tug *Shovette* in King George Dock, Hull, England. *Kirkella*'s bulbous bow breached *Shovette*'s hull and starboard fuel tank during the collision, causing the tug to partially sink and resulting in approximately 7,000 litres of marine diesel oil spilling into the dock. *Kirkella* was not damaged during the accident.

Kirkella and *Shovette*

Kirkella's propulsion system comprised a single main engine driving a controllable pitch propeller via a clutch and gearbox. The vessel's propulsion was controlled by a Rolls-Royce Helicon-X3 integrated propulsion control system, supported by Kongsberg Maritime. The propulsion system could be operated from several stations located in the wheelhouse and from the engine control room (ECR). The loss of control occurred when the propulsion control was passed from the bridge to the ECR with the clutch engaged. At the time of the handover, the bridge propeller pitch lever was set at zero, while the ECR's propeller pitch lever was set at 100% ahead (see figure). The propeller pitch automatically advanced when control was accepted in the ECR, causing *Kirkella* to move forward on the berth.



The status of *Kirkella*'s propulsion control system at handover of control

Safety lessons

1. The propulsion control system on *Kirkella* was not fitted with interlocks to prevent a mismatched propeller pitch lever position when control was transferred. Over 4,000 Rolls-Royce Helicon-X3 systems have been supplied to the industry, most of which were not fitted with optional interlocks, which were not required. Retrofitting can be undertaken by Kongsberg Maritime, as customer support provider.

2. Robust shipboard practices are essential to maintain propulsion control during handover, regardless of whether system interlocks are fitted. Documented procedures should contain a requirement for the operator of the sending station and the receiving station to check that propulsion systems pitch settings are aligned at the time of transfer.

3. To reduce the risk of propulsion thrust being applied inadvertently while alongside it is advisable to declutch engines before transfer of control.

This flyer and the MAIB's investigation report are posted on our website: www.gov.uk/maib

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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 such investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This safety flyer 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.

Marine Accident Report

INVESTORS IN PEOPLE