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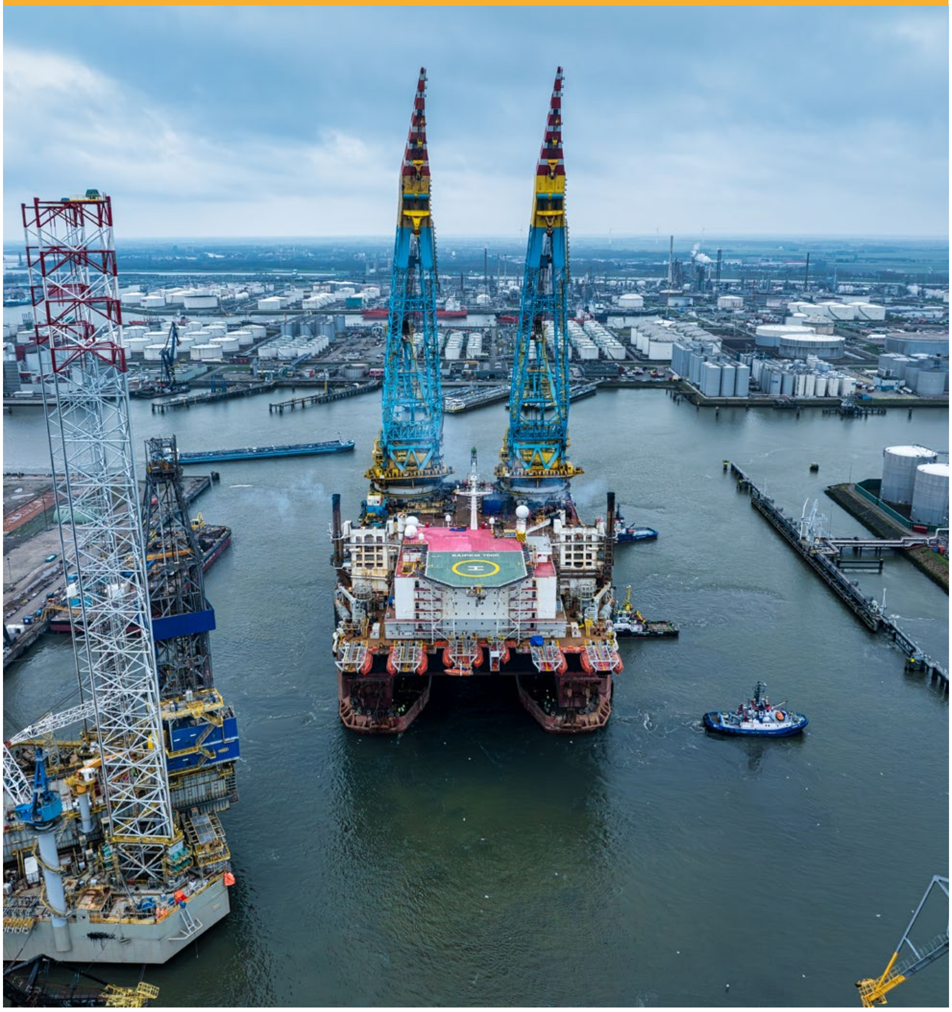
SAFETY BOARD

Fatal Allision with Drilling Rig in Botlek Harbour



Fatal Allision with Drilling Rig in Botlek Harbour

The Hague, 26 February 2025

The Dutch Safety Board's reports are public and available at www.safetyboard.nl.

Cover photograph: Damen Shiprepair Rotterdam

The Dutch Safety Board
When accidents or disasters happen, the Dutch Safety Board investigates how it was possible for these to occur, with the aim of learning lessons for the future and, ultimately, improving safety in the Netherlands. The Safety Board is independent and is free to decide which incidents to investigate. In particular, it focuses on situations in which people's personal safety is dependent on third parties, such as the government or companies. In certain cases, the Board is under an obligation to carry out an investigation. Its investigations do not address issues of blame or liability.

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N.B.: This report has been published in the Dutch and English language. If there are differences in interpretation the Dutch report prevails.

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Introduction

During complex operations on or close to Damen Ship Repair's terrain, the responsibility for risk management lies with the shipyard, especially when simultaneous activities are taking place. Together with the other parties involved in preparing and executing complex operations, the shipyard should make the risks involving those operations (both separately and simultaneously) apparent and manageable. The other parties involved hold the shared responsibility to take care this happens. This applies in particular if parties deviate from previously made agreements about the execution and operation, for example the exceeding of wind limits. We have written recommendations for all parties together and for Damen, the Rotterdam-Rijnmond Regional Maritime Pilots Corporation and Saipem separately.

Recommendations

During a complex operation such as docking the Saipem 7000, the various parties involved can achieve safety gains if they focus on their shared contribution to safety.

To Damen Shiprepair Rotterdam, the Rotterdam-Rijnmond Regional Maritime Pilots Corporation and Saipem

1. Ensure that the various parties involved in complex operations speak to each other in advance and together, in order to gain an overview of the various activities on the site, explore possible risks, discuss different scenarios and make agreements about communication.

Following this incident, Damen Shiprepair Rotterdam has already taken a number of actions to improve safety.[1] These actions are in line with the learned lessons from this incident and are primarily focused on risk management while docking in and out. In addition, it is important to pay attention to managing the risks of all complex operations that take place on the shipyard simultaneously. This is why the Dutch Safety Board proposes the following additional recommendations.

To shipyard Damen Shiprepair Rotterdam

2. Ensure a structured approach to manage risks during operations that take place simultaneously on or close to the shipyard and are able to influence each other. Involve all relevant parties in risk management, for separate projects as well as for a combination of projects. Discuss the different scenarios that can arise and how these risks should be managed. Record this approach.
3. With all parties involved, make a joint reassessment of all risks if there is a deviation from previously made agreements for the execution of simultaneous operations. If necessary, adjust scenarios for risk management.

1 See Appendix B.

4. Update and improve the Life-Saving Rules following this incident and let employees actively participate in the implementation of them. Emphasise the importance of safety as a shared responsibility.

In the Netherlands, pilotage is mandatory in certain waterways. This pilotage requirement is filled by one party, namely the Maritime Pilots.[2] This monopoly position entails a strong responsibility to pilot and manoeuvre vessels as safely as possible. The Dutch Safety Board therefore recommends the following:

To the Rotterdam-Rijnmond Regional Maritime Pilots Corporation

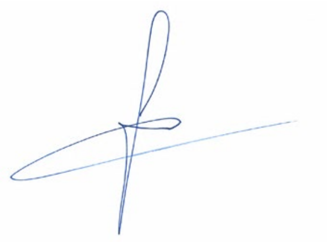
5. Evaluate and improve the procedures in the Vademecum based on the lessons drawn from this incident, that ensure a proper preparation of special transport, including which tools should be used. In any case, make sure that:
   a. these procedures are known by the pilots and they comply by them;
   b. the available and most recent information is easily accessible for the pilots;
   c. the pilots make sure that the involved parties (like the shipyard and the captain) are aware of the assessments and choices they make during the preparation and execution of complex operations, so those parties can indicate where necessary if any risks arise.
6. If voyages are made by more than one pilot, ensure that the involved pilots prepare and execute the voyage together. They need to:
   a. get involved simultaneously for the preparation and have the same information;
   b. be able to address each other professionally about managing risks in the preparation (for example during simulation training) as well as the execution of the operation, and make their assumptions explicit (for example by 'thinking aloud');
   c. ensure effective use of NMS while performing complex operations.

The client of a docking operation plays an important role in the way risk management and the execution of the operation are carried out. That is why we recommend the following:

2 Region Scheldemonden is an exception. Here part of the mandatory pilotage is fulfilled by the Flemish pilotage service.

To Saipem

7. Ensure the captain, his team on the bridge and the pilot(s) jointly make specific agreements about the execution of the docking operation, so everybody knows how the operation is carried out and which task they have. Record in the agreement: the division of tasks, way of communication, different scenarios and how to deal with questions, doubts and ambiguities during the operation.
8. Check with the shipyard whether they understand the risks of a complex (simultaneous) operation such as the docking operation. Make this step part of the preparation for complex operations.



mr. C.J.L. van Dam MPM
Chairperson

mr. C.A.J.F. Verheij
Secretary Director

1 INTRODUCTION

1.1 The occurrence

On the morning of 21 February 2024, the semi-submersible crane vessel Saipem 7000[3] – which operates under the flag of the Bahamas – was ready to enter dry dock 7 at the Damen Shiprepair Rotterdam shipyard in the 2nd Werkhaven harbour in the Botlek harbour district at Rotterdam. There were two pilots on board to assist the captain and to direct six tugs that would aid the vessel to enter the dock. Next to the dock entrance was the Liberia-flagged jack-up drilling rig[4] Noble Regina Allen. On the outside of this vessel, a number of hanging scaffolds had been suspended so that outboard repairs could be carried out.

The crane vessel was moving slowly towards the dock entrance with the aid of the tugs. During this manoeuvre, the vessel veered off course, potentially due in part to the weather conditions. As a result, the vessel ended up at an angle in front of the entrance to the dry dock. When correcting course, it swung too far to the other side, making contact with the outside of the Noble Regina Allen at a point where one of the scaffolds was suspended outboard. A welder (employed by Damen Shiprepair Rotterdam) was working on the scaffold at the time. He became trapped and the hanging scaffold was badly damaged. After the crane vessel came free of the drilling rig again, the welder fell from the hanging scaffold into the water. A search operation was started immediately but the victim could not be found. It was only several weeks after the occurrence that his body was found.

1.2 Investigation decision

The occurrence has been classified as a 'very serious marine casualty' as defined in the Casualty Investigation Code of the International Maritime Organization (IMO) and in EU Directive 2009/18/EC. This means that the Netherlands, as the coastal state, has authority to investigate the occurrence. This obligation to carry out an investigation is also laid down in the Dutch Safety Board Decree.

3 A semi-submersible crane vessel consists of pontoons on which columns rest that support the deck. During hoisting operations, such a crane vessel can submerge its pontoons with ballast water, thus making the vessel heavy and stable enough to hoist heavy loads.

4 A jack-up drilling rig is a floating work platform equipped with a number of legs that enable it to stand on the bed of the sea, lake or river, allowing it to operate regardless of the swell or sea state.

1.3 Purpose of the investigation

The purpose of this investigation is to improve risk management when large vessels are being docked, especially when other activities are taking place at the same time in the immediate vicinity of the dock.

This investigation provides answers to the following investigation questions:

1. What are the factors that contributed to the allision between the semi-submersible crane vessel Saipem 7000 and the jack-up drilling rig Noble Regina Allen and, as a result, to the death of the victim?
2. In a more general sense, how is risk management organised for docking marginal vessels[5] at Damen Shiprepair Rotterdam?

1.4 Focus and demarcation

The investigation focuses on the operation involved in docking the Saipem 7000 and the work on the hanging scaffold aboard the Noble Regina Allen at the shipyard Damen Shiprepair Rotterdam. How such operations take place at other Damen sites or at other shipyards will, if applicable, serve as a reference. The scope of the investigation includes the local circumstances and the roles of the parties directly involved. The operation to rescue the victim and later the search for him are beyond the scope of the investigation.

1.5 Investigation approach

Four investigators of the Dutch Safety Board visited the scene the day after the occurrence, together with an investigator of the Bahamas Maritime Authority. The investigators secured the VDR[6] and CCTV images from the Saipem 7000. They also spoke to those directly involved in the occurrence and employees of the parties involved, including Damen Shiprepair Rotterdam, Saipem, and the Rotterdam-Rijnmond Regional Maritime Pilots Corporation. In the days following the occurrence, the investigators held interviews with the pilots, Damen Shiprepair Rotterdam employees, and employees of the Port of Rotterdam Authority. The investigators also went on board the Saipem 7000 and the Noble Regina Allen.

The Dutch Safety Board requested and received the radar and VHF recordings from the traffic management and the recordings from the NMS equipment[7] utilised by the Rotterdam-Rijnmond Regional Maritime Pilots Corporation. The Dutch Safety Board was also given access to a variety of CCTV footage from surveillance cameras around the

5 ‘Marginal vessels’ in the Rijnmond region are seagoing vessels whose large dimensions or specific characteristics make them difficult to manoeuvre. These include, for example, vessels whose draught limits their manoeuvrability.
6 Voyage Data Recorder (VDR) is an on-board system that records and stores important information relating to the operation of a vessel. It is sometimes referred to as a ‘black box’.
7 A position determination and prediction system utilised by the Pilotage Service for navigation involving marginal vessels. A detailed description of the NMS system is given in Paragraph 2.3.5.

2nd Werkhaven showing the movements of the vessels. It also reviewed photos taken by witnesses to the occurrence with their mobile phone. During the investigation, all the parties involved were interviewed one or more times and relevant documentation was requested. The Dutch Safety Board also engaged an external firm to carry out wind pressure calculations for the Saipem 7000.

1.6 Frame of reference

During its investigations, the Dutch Safety Board establishes a frame of reference to serve as a systematic and objective basis for analysing the occurrence. The framework is based on relevant legislation and regulations, industry standards and guidelines and the Board's vision of how safety risks should be managed as effectively as possible. The frame of reference acts as a normative mechanism through which findings and events regarding an occurrence are assessed in the light of established standards and best practices. The frame of reference employed in this investigation can be found in Appendix C.

2 COURSE OF EVENTS AND BACKGROUND INFORMATION

This chapter sets out the course of events regarding both the docking operation for the crane vessel Saipem 7000 and the work that was taking place on the hanging scaffold aboard the jack-up drilling rig Noble Regina Allen. The chapter begins with a brief description of the vessels involved, followed by an explanation of the course of events during the occurrence. Graphics of the vessels and a timeline will then be presented. Finally, background information will be provided that enables a better understanding of the context of the events.

2.1 The vessels involved

2.1.1 Saipem 7000

The Saipem 7000 is a semi-submersible crane vessel used in the construction, maintenance, and removal of offshore objects such as oil and gas platforms or wind turbines. It was commissioned in 1987 and is 198 metres long by 87 metres wide. It has two cranes, each with a capacity of 7,000 tonnes. The vessel can maintain its position accurately during hoisting operations by using *a Dynamic Positioning* system[8] (DP system). The vessel's owner is Saipem Portugal Comercio Maritimo (SPCM).

The Saipem 7000 arrived at berth 4 of the shipyard Damen Shiprepair Rotterdam in the Botlek harbour district on 18 November 2023 (see Figure 1). In the *Scope of Work*,[9] the vessel's owner and the shipyard had stipulated that the crane vessel would enter dry dock on 16 February 2024 for a period of maintenance and repair lasting 39 days. In the period between the arrival of the Saipem 7000 and the planned docking operation, Damen Shiprepair Rotterdam carried out a range of maintenance work on the crane vessel that was unrelated to the dry dock and did not require the vessel to be dry-docked.

A more detailed description of the crane vessel can be found in Appendix A. In the remainder of the present report, the Saipem 7000 will be referred to as the (semi-submersible) crane vessel.

8 *Dynamic Positioning* (DP) enables a vessel with thrusters to remain in a certain position or to move in a certain direction at a certain speed. A DP system is computer-controlled.

9 The *Scope of Work* is an explanation of the work that the vessel's owner requests the shipyard to carry out. The shipyard's quotation and the contract between the owner of the vessel (as client) and the shipyard (as contractor) are based on the *Scope of Work*.

▲ *Figure 1: The Saipem 7000 crane vessel alongside the quay at the shipyard, photographed from the stern.*

2.1.2 Noble Regina Allen

The Noble Regina Allen is a jack-up drilling rig used in offshore oilfield exploration and construction (see Figure 2). It is 84 metres wide and has three legs with an length of 169 metres each, that it can position on the seabed. It can then raise itself out of the water along the legs so that it becomes a stable platform above the waterline. The drilling rig does not have any propulsion of its own but is transported to and from the area where it works with the aid of other vessels.

In December 2022, the drilling rig was operating near Trinidad and Tobago when it experienced unexpected problems with one of its three legs. While the drilling rig was being recovered, that leg was cut through. The drilling rig and the leg were then taken to the Damen Shiprepair Rotterdam shipyard for repairs, arriving there in May 2023. The repair work that required the drilling rig to enter the dock was carried out from 17 November 2023. On 17 January 2024, the drilling rig left the dock again. It was positioned on its legs in the water next to the dock entrance so that the work could be completed.

A more detailed description of the drilling rig can be found in Appendix A. In the remainder of the present report, the Noble Regina Allen will be referred to as the (jack-up) drilling rig.

▲ *Figure 2: The jack-up drilling rig Noble Regina Allen.*

2.2 Course of events

This paragraph sets out the events that led to the occurrence taking place. The operation for docking the crane vessel is first described, followed by a description of the work on the hanging scaffold that was suspended from the drilling rig.

2.2.1 Docking of the crane vessel

Preparations for docking

The shipyard had drawn up a docking procedure for docking the crane vessel. That procedure described the docking operation: the necessary preparations, an overview of the responsibilities, the communication guidelines, and the limitations of the operation. The shipyard had also drawn up a step-by-step plan in which the operation was outlined step by step. The pre-planned positions of the tugs were also plotted. The crane vessel would only be able to enter the dock if there was a sufficient water level for a certain period of time. A margin of 50 centimetres was necessary between the keel blocks and the keel of the vessel. That margin was needed for a period of three-and-a-half hours, the period required to perform the operation. The vessel needed a certain forward trim[10] so as to end up properly on the keel blocks. In order to obtain that trim, the cranes on the bow had been raised as far as possible. Docking the crane vessel was to take place at the same time as another crane vessel: Van Oord's Svanen. That vessel had

10 A ship's trim is the difference between the draught forward and the draft aft.

entered the dock on 17 February and was waiting at the end of the dock to be dry-docked at the same time as the Saipem 7000.

Prior to the docking operation, the parties concerned[11] had held preparatory consultations during which they reviewed the docking procedure and the step-by-step plan, identified the risks verbally, and made arrangements for the docking operation. These consultations had taken place on 14, 15, and 17 February. Finally, a meeting[12] had taken place on the day of the docking operation itself to determine whether the operation could start or not.

Because of the arrangement of the keel blocks, the crane vessel had to be manoeuvred stern first into dock 7 with the aid of six tugs. To carry out the manoeuvre, the pilot was standing with the captain on the port wing of the bridge. Together they carried out the manoeuvre with the pilot in charge of directing the parties. The captain remained formally responsible.[13] The pilot was in contact with the tug captains, the dock master[14], the second pilot, and the linesmen via a walkie-talkie, which was set to work channel 47. Communication was in Dutch. The second pilot observed the manoeuvre from the starboard wing of the bridge. The dock master was on the quay on the east side of dock 7. The bridge was manned by four Italian officers who were operating the bow and stern thrusters. The captain maintained contact with them via a different walkie-talkie channel. Due to the presence of the jack-up drilling rig next to the dock entrance, tug number 3 (see Figure 3) could not be attached to the aft port side. During the preliminary consultations, the pilot had therefore decided, in agreement with the captain, to position that tug amidships on the starboard side of the vessel.

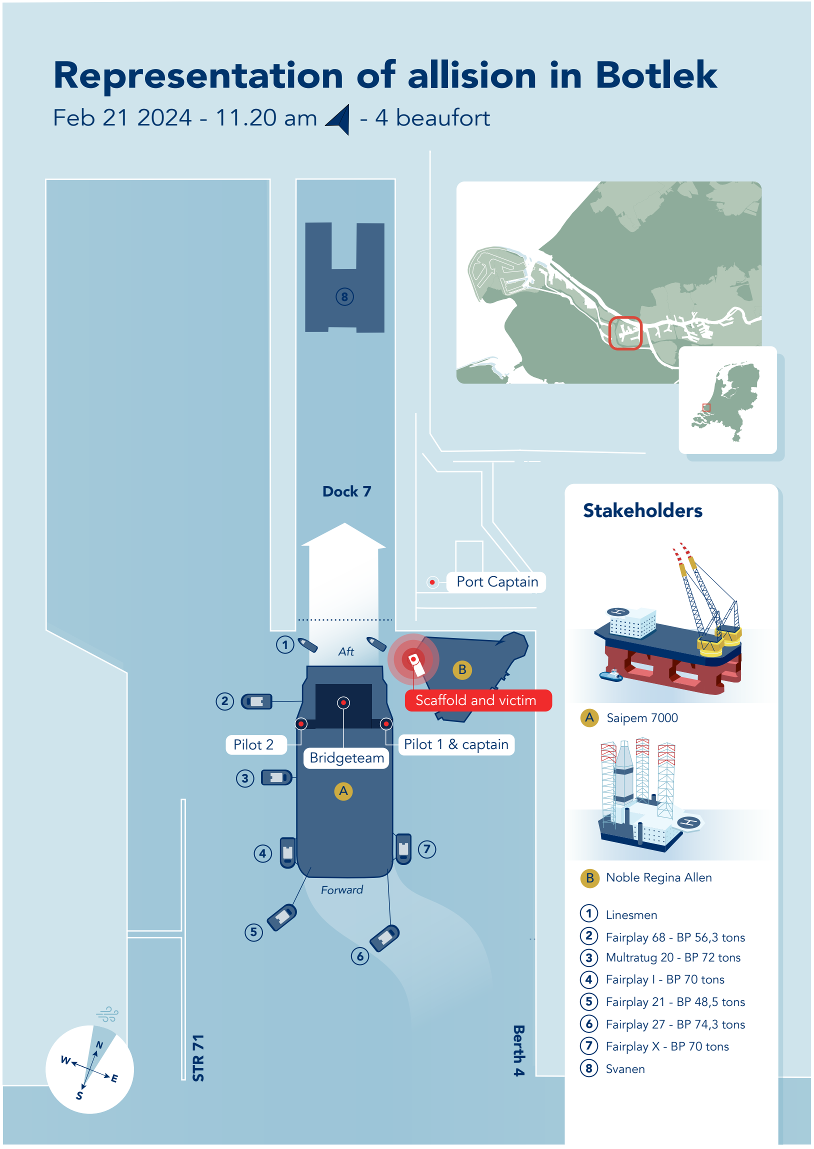
The task of the linesmen was first of all to attach the tugs. The linesmen would then also attach the docking lines once the crane vessel was at the entrance of the dock. The docking lines would slowly pull the crane vessel into the dock; there was no room for the tugs to accompany it into the dock. The dock master was responsible for directing the dock cranes and paying out the docking lines.

11 These parties were the client, the crew of the crane vessel, the shipyard, the Pilotage Service, the tug company, the KRVE linesmen association, the Port Authority, and the shipping company's agent. A total of some 30 people attended the consultations.

12 This was a final meeting in which it was determined between the client, the shipyard, the pilot and the tug company if the operation could start. This meeting was done verbally via the radio on channel 47 because the parties that had to perform the operation were each at their own location.

13 As per Dutch rules and regulations the pilot advises the captain or traffic participant on board or the pilot himself can be traffic participant with the captain's consent. Source: Artikel 2, lid 1 en 2, Loodsenwet; Artikel 9, lid 1a., Schepenwet.

14 Formally, and as stated in the docking procedure, his function is port captain. During the interviews the person involved referred to himself as dock master during the operation.



▲ *Figure 3: Overview of the 2nd Werkhaven. The bollard pull of the tugs in this figure is indicated by BP.*

First attempt at docking

Because of the narrow margin between the keel blocks and the keel of the crane vessel, the precise time of docking needed to be carefully planned. The vessel could only enter the dock the moment the water was at its highest. If the water level was any lower, there was a risk that the vessel would hit the keel blocks and disrupt the dock bed.

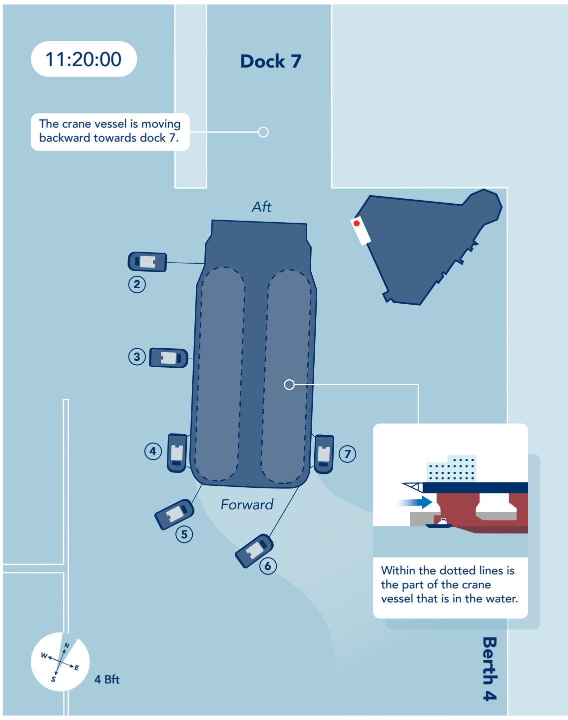
The first attempt to enter the dock took place on Sunday 18 February 2024, a day when there was a southerly wind of Beaufort force 3 to 4. Visibility was good and the tide was rising. Around noon, however, the strength of the wind increased and the duration of high tide turned out to be shorter than expected; it was two hours instead of the required three and a half hours. Due to the conditions having thus become unfavourable, the pilot, the dock master, and the client jointly aborted the docking attempt at the final verbal meeting. The crane vessel moored alongside the quay again the same day. That day, there were no welders from the shipyard on the hanging scaffold that was suspended from the drilling rig.

Second attempt at docking

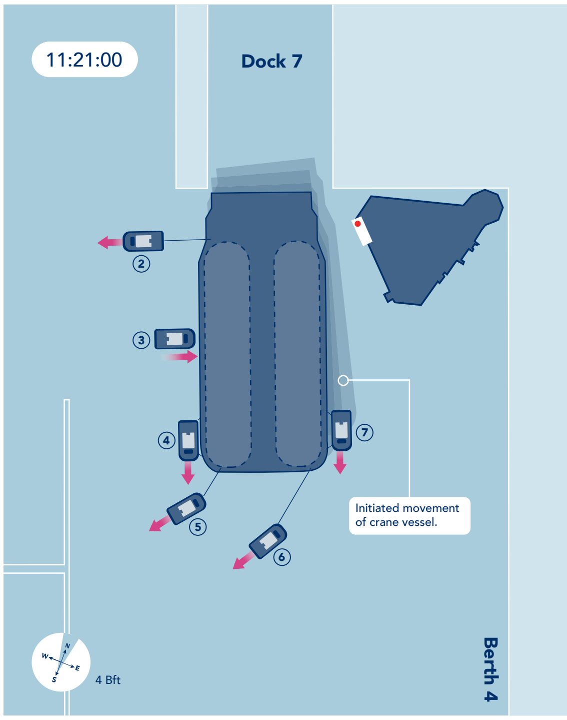
After the first attempt was aborted, a consultation took place on 19 February at which the parties agreed that they would attempt to enter the dock again on 21 February, when the conditions would be more favourable. There was a southerly wind of Beaufort force 3 increasing to force 4 to 5. Visibility was good, the tide was rising, and the duration of high tide was sufficient to carry out the operation. At 07.00 hours, the crane vessel – together with the tugs, linesmen, and pilots – was ready for the second attempt. A test was carried out to determine whether the crane vessel could be kept under control in the prevailing weather conditions with the aid of the tugs. The vessel's DP system and propulsion were temporarily deactivated and the crane vessel was successfully held in place with the aid of the six tugs. The captain and the pilot decided to keep the bow and stern thrusters on standby so that the vessel would be able to manoeuvre should anything unexpectedly go wrong with the tugs.

In a final oral meeting at 10.00 hours, the pilot, dock master and captain decided that the operation could go ahead. The pilot, captain and dock master (the parties executing the operation) were not informed that employees of the shipyard were working on the hanging scaffold of the drilling rig. At 11.06 hours, the crew – at the direction of the pilot – switched off the DP system while keeping the ship's propulsion available for manual control and the vessel was gradually towed to the dock. The captain and the pilot let the crane vessel approach the dock upwind because the drilling rig was positioned downwind. This gave the captain and pilot more time and space to respond. They also used the wind to lower the crane vessel in front of the dock entrance.

Figure 4 shows the situation at 11.20 hours. The crane vessel is lying stable in front of the dock entrance. The two tugs to port and starboard of the crane vessel (tugs No. 7 and 4 in Figure 4) moved forwards to slow down the crane vessel heading towards the dock. At that point, the other tugs were doing virtually nothing. At about 11.21 hours (Figure 5), the bow of the vessel began to swing to port, towards the jack-up drilling rig.

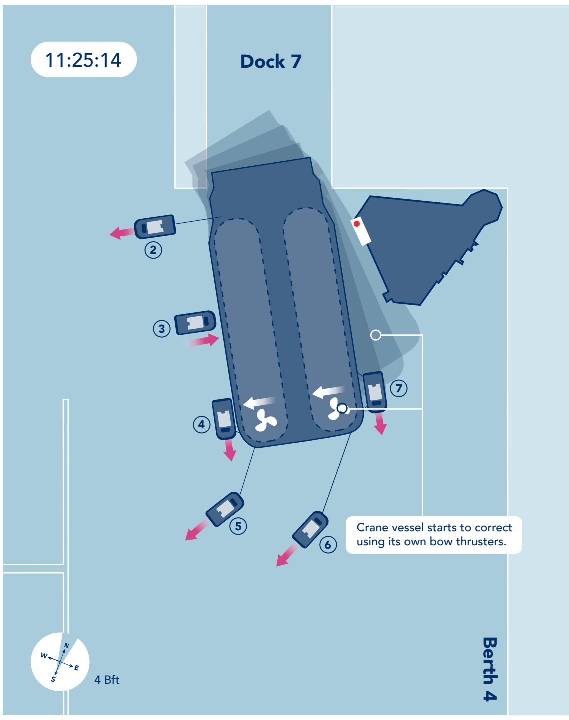


▲ *Figure 4: The crane vessel is lying stable in front of the dock entrance. The stern is lying closest to the dock.*

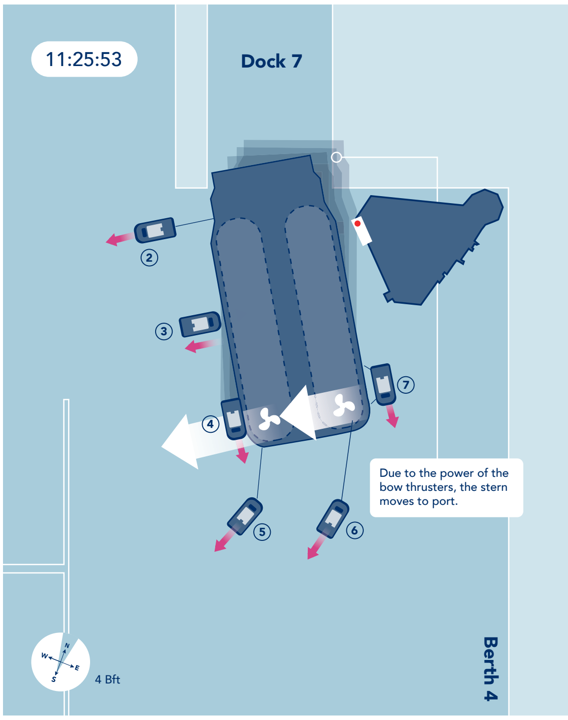


▲ *Figure 5: The bow of the vessel begins to veer to port.*

The pilot did not respond immediately to the movement of the bow of the vessel to port and the captain nor one of his crew members notified the pilot they were veering off course. At about 11.24 hours, the linesmen brought the docking lines with their boats to the crane vessel. About a minute later, the pilot instructed the tug that was positioned forward on the port side (tug No. 6) to pull at three-quarter power in an attempt to correct the movement to port. This was followed by the instruction to the tug to start pulling with full power. At 11.25:14 hours, the pilot, through the captain, then instructed the officers on the bridge to turn on the bow thrusters to starboard so as to get the bow back in position (Figure 6). The bow began to swing back to starboard at 11.25:53 hours, with the stern being moved to port by using the bow thrusters (Figure 7).

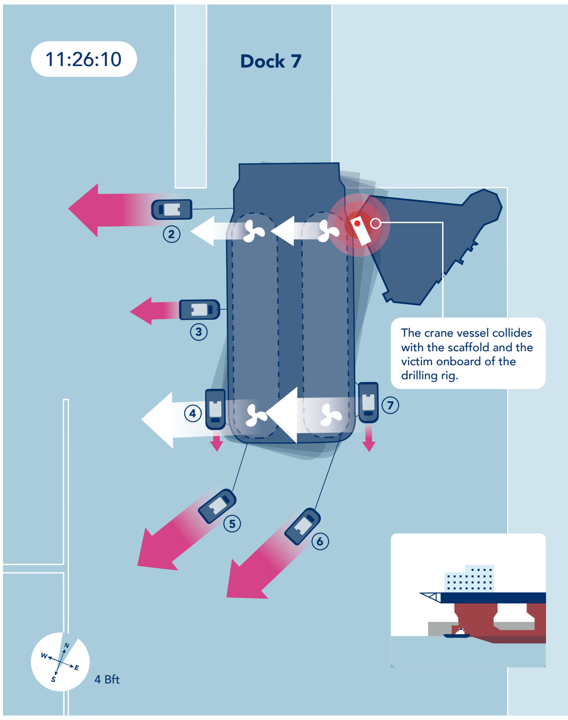


▲ *Figure 6: The pilot and captain correct the movement of the bow with the portside tug (No. 6) and the bow thrusters.*

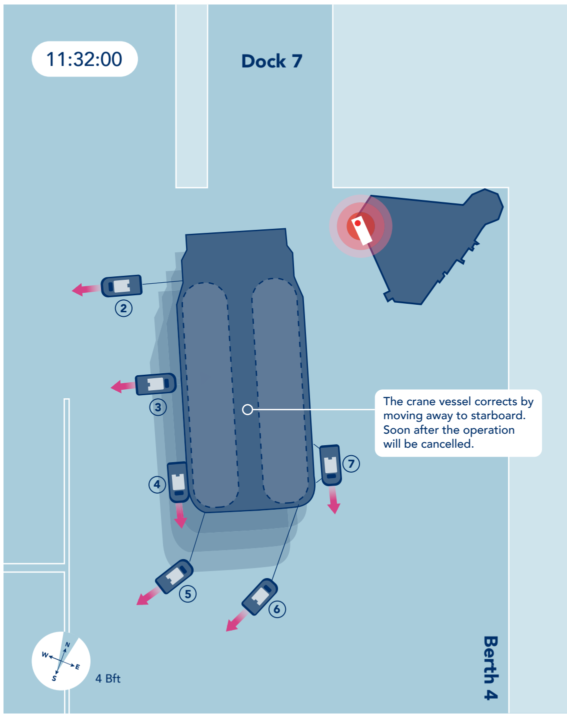


▲ *Figure 7: The bow swings back to starboard resulting in the stern swinging to port.*

At 11.26:10 hours the crane vessel then allided with the jack-up drilling rig. Just before the allision, the captain ordered the officers to activate the stern thrusters full to starboard in an attempt to keep the stern clear of the drilling rig. The starboard tugs were also ordered to exert full pulling power. This can be seen in Figure 8. As a result, the crane vessel came clear of the drilling rig again and assumed a stable position in front of the dock entrance (Figure 9). When it became clear that a person had fallen into the water, the docking operation was aborted.



▲ *Figure 8: The stern thrusters are activated and the starboard tugs are instructed to pull with full power.*



▲ *Figure 9: The crane vessel comes clear of the drilling rig again and resumes its position in front of the dock entrance.*

2.2.2 Work on the drilling rig

In January 2024, the owner of the drilling rig requested a quotation from the shipyard for additional work. The work involved repairing and replacing pipework in four locations on the outside of the drilling rig. Carrying out the work required hanging scaffolds to be installed on the outside of the drilling rig. An external scaffolding company was engaged; it constructed the scaffolds and labelled them to show that they met the safety and inspection requirements set out in the health and safety legislation.[15] In the following period, weekly monitoring would be carried out.

The work carried out on the hanging scaffolds on the outside of the drilling rig had started after the scaffolds were installed. Work was carried out daily on the scaffolds to replace pipework on the outside of the drilling rig. At the time of the occurrence, work on the scaffolds was in its concluding phase. Work on the scaffold that was struck by the crane vessel was expected to be completed during the day on 21 February.

15 As stipulated in Paragraph 7.23a of the Dutch Working Conditions Decree. There are specific provisions regarding the use of ladders and steps.

Welding work
At about 07.00 hours each morning, the project coordinator, foreman, and piping and production staff held a toolbox meeting prior to the start of work. They discussed the list of work for the day, safety, and whether the various permits were in order. After that, they started work.

On the morning of 21 February, the welders were instructed to finish off the work on the hanging scaffold that was suspended from the drilling rig. Two welders began work on the hanging scaffold that was later struck. A third welder began work on another hanging scaffold that was suspended at the same height but was positioned further forward. An area watch[16] was present on the main deck to monitor a number of different work activities, including the welding work.

At about 11.00 hours, the project coordinator for piping and production came onto the hanging scaffold to check the quality of the welding. At that point, the crane vessel was ready to enter the dock. The welders and the project coordinator saw the crane vessel and also talked briefly about it. At about 11.10 hours, the project coordinator left the hanging scaffold again and the welders resumed work. Just before the allision, between 11.20 and 11.25 hours, the second welder left the hanging scaffold to fetch some tools. The area watch was in a different place on the main deck at the time. From then on, the welder was working alone on the scaffold. At 11.26:10 hours, the allision occurred.

2.2.3 Search

Within a few minutes after the allision, it became clear to employees of the shipyard and linesmen who were at the scene that someone had fallen into the water. The linesmen immediately started searching for the affected person with their launches. An employee of the shipyard phoned the emergency number, after which the emergency services, harbour police, and the safety region authority were called in. A number of fire service, police, and Port Authority vessels arrived at the scene.

After an hour, the search operation switched to a recovery operation, for which the police deployed the National Underwater Search Team. The shipyard then took over and continued searching with contracted divers, dogs, and sonar equipment. The victim’s body was found on 15 March 2024.

16 An area watch is a (hired) shipyard employee who is posted to act as a watchman in areas where work is being carried out. His job is to ensure that the immediate environment of the person at work is safe and remains so.

2.2.4 Timeline

Timeline

Saipem 7000 | **Noble Regina Allen**

Phase 1: Prehistory - *2022-2024*

Saipem 7000

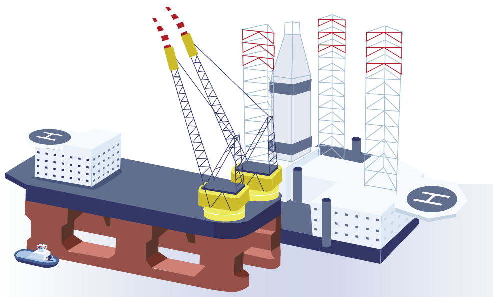
- *June/July'23* — Owner of the crane vessel books dock 7 for February 2024.
- *18 Nov '23* — Crane vessel arrives at the shipyard and moors at the waiting berth at dock 7.

Noble Regina Allen

- Dec '22 — Leg from jack-up drilling rig damaged off Trinidad and Tobago.
- May '23 — Drilling rig arrives at shipyard for leg repairs, moors at the waiting berth at dock 7.
- 17 Nov '23 — Drilling rig is docked at dock 7.
- 01 Jan '24 — Owner of the drilling rig requests a quotation from the shipyard for piping repairs on the outside of the ship.
- 12 Jan '24 — The shipyard provides a quotation for the repair of the piping, using a hanging scaffold.
- 17 Jan '24 — The drilling rig is undocked and moors at the waiting berth next to dock 7.
- 23 Jan '24 — The owner of the drilling rig agrees to the quotation for the piping repairs using a hanging scaffold. Work starts.

Phase 2: Preparation - *February 2024*

- *15 Feb* — Kick-off meeting for docking the crane vessel.
- *16 Feb* — Pre-dock meeting for docking the crane vessel.
- *17 Feb - 07:30* — GO/NO-GO meeting for docking the crane vessel.
- *18 Feb - 07:00* — Final GO/NO-GO meeting.
- *18 Feb* — First attempt to dock the crane vessel. The attempt is called off later in the day.
- *19 Feb - 11:30* — Meeting with all parties involved to set a new date for docking the crane vessel.
- *20 Feb - 14:00* — GO/NO-GO meeting for the second attempt to dock the crane vessel.
- *19:00* — Pilot on board, the crane vessel moves away from the berth.
- *22:00* — Pilot 2 on board.



Phase 3: Docking - *21 February 2024*

Saipem 7000

- The crane vessel changes fenders overnight and uses the DP system to maintain position.
- *10:00* — Final GO/NO-GO meeting.
- *11:00* — Start of the second attempt to dock the crane vessel.
- *11:05:59* — 'The DP system is switched off and the crane vessel is brought to the docking entrance with the assistance of tugboats.
- *11:23:30* — The crane vessel is positioned in front of the docking entrance, and the dock wires are being deployed.
- *11:26:10* — **Allision,** after which the crane vessel is immediately cleared and brought back to the docking entrance.
- *11:34* — The crane vessel returns to DP, the second docking attempt is aborted, and the crane vessel returns to the waiting berth.

Noble Regina Allen

- *7:00* — Toolbox meeting for the piping and production department, the welders are going to the hanging scaffold on the platform to begin work.
- *8:15-8:30* — The shipyard and the owner of the drilling rig sign the extended work permit for the piping repair.
- *11:00* — The piping and production project coordinator inspects the welding work on the hanging scaffold.
- *11:10* — The piping and production project coordinator leaves the hanging scaffold.
- *11:20-11:25* — One of the two welders leaves the hanging scaffold to collect equipment.

▲ *Figure 10: Timeline of events prior to the occurrence. The final GO/NO GO meeting on 21 February at 10.00 means a verbal meeting via VHF as described in chapter 2.2.1.*

2.3 Background information

This paragraph provides background information on the weather conditions and water levels, the parties involved, the docking procedure, the Electronic Vademecum, and the Rotterdam-Rijnmond Regional Maritime Pilots Corporation's Marginal Vessels Navigator. This information is relevant for analysing the occurrence (Chapter 3).

2.3.1 Weather conditions and water levels

At a distance of 1.6 km to the east of the dock, the Port of Rotterdam has a wind gauge designated 'Geulhaven RP 10'. See Table 1 for the readings from this station. The wind is gauged at 13,5 meters above NAP.

The average wind on the morning of 21 February was in a southerly direction with windforce Beaufort 4. There were brief gusts of up to Beaufort force 5. The wind direction at around 11.26 hours was about 185°. The available wind readings from the Geulhaven RP 10 station show an increasing wind speed of 0.6 m/s from 11.20 to 11.30 hours. Compared to 11.00 hours, the wind had increased by 1.14 m/s.

Appendix D contains a more comprehensive wind table for both the Geulhaven wind station, and the 'Veerstoep Rozenburg' monitoring station.

▼ *Table 1: Wind readings RP10. (Source: Rijkswaterstaat)*

Local time	Wind direction (degrees)	Gusts in m/s	Wind speed (m/s)
11.00	181.5	9.96	6.2
11.05	178	9.96	6.39
11.10	175.1	9.9	6.72
11.15	179.5	10.53	6.88
11.20	182.7	10.53	6.72
11.25	184.2	10.18	6.84
11.30	185.5	10.86	7.34

The tidal flow in the Botlek began an hour and a half before High Water at Hoek van Holland (HW HvH) and lasted until two and a half hours after HW HvH. The turn of the tide is about three hours after HW HvH. An overview of this is given in Table 2.

▼ *Table 2: Tide table for Hoek van Holland (HvH) on 21 February 2024. (Source: Rijkswaterstaat)*

Local time	HW or LW	cm +NAP	cm - NAP
00.52	HW	+83	
06.09	LW		-55
13.13	HW	+104	
21.34	LW		-51

The water levels at the Geulhaven (in centimetres relative to NAP)[17] are shown in Table 3.

▼ *Table 3: Water levels at the Geulhaven on 21 February 2024 (Source: Rijkswaterstaat)*

Local time	Water level in cm relative to NAP
11.00	-14
11.10	-7
11.20	0
11.30	+9
11.40	+18
11.50	+28
12.00	+38
12.10	+48
12.20	+58
12.30	+68
12.40	+77
12.50	+86
13.00	+93

2.3.2 Parties involved

This subparagraph describes the roles and responsibilities of the parties involved in this occurrence.

17 NAP stands for *Normaal Amsterdams Peil*, i.e. Amsterdam Ordnance Datum. This is a reference point for the water level in the Netherlands and is used to measure the elevation of water levels.

Client
Every ocean-going vessel must be periodically docked for inspections, maintenance, and repairs of its submerged hull and systems that cannot be carried out with the vessel in the water. As the owner of the crane vessel, Saipem Portugal Comercio Maritimo (SPCM) had engaged the shipyard to dry-dock the vessel.

Contractors
The shipyard Damen Shiprepair Rotterdam was the contractor for docking the crane vessel.

For docking in and out, the vessel was required to take on a pilot. In the Netherlands, pilotage services are provided by the Dutch Pilotage Service. The Dutch Maritime Pilots Corporation concerns itself with the quality of the pilot's profession and its execution. The Rotterdam-Rijnmond Regional Maritime Pilots Corporation is amongst others responsible for maintaining the right numbers of pilots in the port, the regional education of new pilots and for facilitating training to keep the knowledge of pilots up to date.

In order to manoeuvre the vessel into the dock without its own propulsion, tugs were necessary. Saipem therefore hired the services of Fairplay Towage.

Mooring and unmooring vessels in the port of Rotterdam is handled by the linesmen of the KRVE linesmen association. SPCM had commissioned the KRVE to assist in docking the crane vessel.

Other parties
Noble Services International Limited is the owner of the jack-up drilling rig and, like SPCM, had engaged the shipyard to carry out a docking operation. To round off this work, the drilling rig was positioned next to the dock entrance.

The Port of Rotterdam Authority was involved as the area manager. The Port Authority has set out the local legislation and regulations for the port of Rotterdam in a set of port regulations. Within the Port of Rotterdam Authority, it is the Harbour Master's Division (DHMR) that is responsible for safety in the port of Rotterdam.

A more detailed description of the parties involved is given in Appendix E.

2.3.3 Docking procedure
The docking procedure contains the information needed to dock the vessel. The procedure for docking the crane vessel was drawn up by the shipyard. The contract between the owner of the crane vessel and the shipyard stated that the 2017 docking procedure for the crane vessel could be used for docking it in 2024. The docking procedure specifies the preparations and responsibilities. It also contains information about communication and restrictions, and about the timeline. Furthermore, the docking procedure includes a step-by-step plan. This states when which tugs could be released as the vessel proceeded further into the dock.

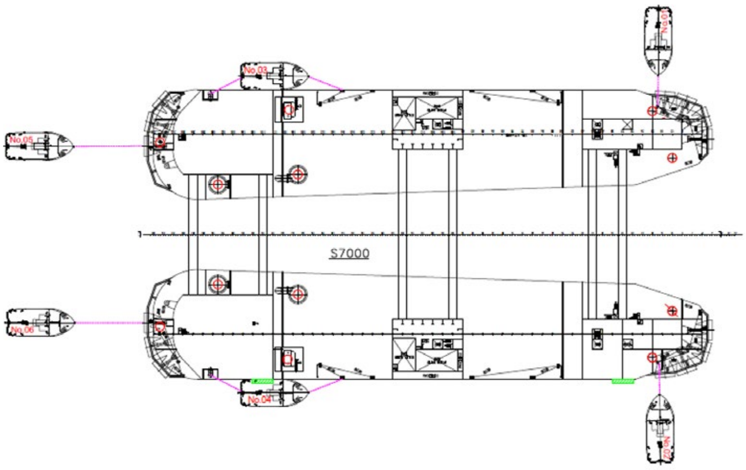
An initial version had been prepared by 8 February 2024 for review by those involved at the shipyard. Subsequent to the review, the shipyard sent the docking procedure to SPCM on 15 February. The final, amended version was from 19 February. In that version, the tide tables had been updated to reflect the expected situation on 21 February, when a second attempt at docking would be made.

Restrictions
The 2024 docking procedure specifies the same wind restrictions as the 2017 docking procedure. The Dutch Safety Board has been unable to determine exactly how these wind restrictions were established. From the various interviews, the Dutch Safety Board has, however, been able to establish that it is likely that calculations had been performed for that purpose.

The restrictions in the docking procedures were defined as follows:
- Maximum wind in northerly or southerly direction, Beaufort force 3 (3.5 - 5.4 m/s), i.e. in the longitudinal direction of the dock.
- Maximum wind in easterly or westerly direction, Beaufort force 2 (1.6 - 3.3 m/s), i.e. in the transverse direction of the dock.
- Minimum visibility (Geulhaven) 1500 metres
- Minimum water level (NAP) at dock gate +0.5 metres
- Maximum water level (NAP) at dock gate +2.0 metres

Differences between the 2017 and 2024 docking procedures
The 2017 plan specified the pulling power needed for the various tugs:
- Two times 90 tonnes for the foremost tugs;
- Two times 60 tonnes for the tugs alongside;
- Two times 45 tonnes for the rearmost tugs.

That amounts to a total of 390 tonnes of pulling power. In the 2024 plan, only the distribution of the tugs are described, not the bollard pull. Figure 11 shows the original distribution of the tugs. Table 4 shows the distribution of bollard pull as envisaged in 2017 and as actually implemented in 2024. The total bollard pull utilised in the docking operation was 391,1 tonnes. The tugs are dealt with in greater detail in Paragraph 3.2.1.



▲ *Figure 11: The tugs in the original configuration in the 2024 step-by-step plan. (Source: Damen Shiprepair Rotterdam)*

▼ *Table 4: Overview of the distribution of the tugs and their bollard pull in 2017 and 2024.*

Position	Pulling power 2017 (procedure)	Bollard pull 2024 (practice)
Starboard forward	90 tonnes	48.5 tonnes
Port forward	90 tonnes	74.3 tonnes
Starboard amidships	-	72 tonnes
Starboard aft	45 tonnes	68 tonnes
Port aft	45 tonnes	-
Starboard amidships	60 tonnes	70 tonnes
Port amidships	60 tonnes	70 tonnes
Total	390 tonnes	392.8 tonnes

The 2017 docking procedure contains a restriction that is not referred to in the 2024 version:
- Vessels at quay STR71 must be no wider than 32 metres.

2.3.4 Electronic Vademecum
The Electronic Vademecum is a manual of the Rotterdam-Rijnmond Regional Maritime Pilots Corporation that sets out procedures for various pilotage routes. The Vademecum is an internal document and pilots can consult it online. It includes a chapter on docking procedures with information about the various shipyards and their docks. Paragraph 6.3 of the Vademecum describes the location of the shipyard. It deals not only with the specific points requiring attention at the various different docks but also with the preliminary discussion for exceptional transports. In an earlier (2019) version of the Vademecum, this topic was dealt with in a separate chapter. The Vademecum also includes a checklist that could be shared with those involved at the shipyard and the towing service. According to the Vademcum, the function of this checklist (for special transports at the shipyard) is to provide structure during preliminary discussions by dealing with all relevant matters point by point and informing all parties involved. These preliminary discussions take place, among other things, to identify and minimize risks. Action points can be noted in the

checklist as well as which party is taking this action. After the preliminary discussion, the completed checklist is sent to the Pilot Service Manager so that he or she is aware of the matters discussed. After transportation, the checklist and an evaluation form are shared for internal knowledge sharing and improvement, ensuring safety and efficiency. This checklist was not used in the preparation of this docking.

2.3.5 Marginal Vessels Navigator
To aid in precise manoeuvring of marginal vessels, the Rotterdam-Rijnmond Regional Maritime Pilots Corporation makes use of a system referred to as the Marginal Vessels Navigator (NMS). An NMS is a portable computer system that can be utilised as an aid to decision-making when navigating in narrow waterways. The system operates independently of the vessel using three antennas of its own. Pilots distribute these antennas around the vessel.

The most important features of an NMS are that it provides accurate navigational information to assist the pilot. The data available includes the speed (both longitudinal and transverse), the course, and the rate of turn of the vessel. Based on this data, the NMS can also predict the direction in which the vessel is moving.

The pilots on board the crane vessel had an NMS available during the docking operation on 21 February 2024. There were three computers connected to it so that the two pilots on the wings of the bridge and also the crew on the bridge could watch.

2.3.6 Availability of data
The Dutch Safety Board made use of a range of data sources. These are listed in Paragraph 1.5. The Dutch Safety Board notes that communication between the captain and the pilot on the bridge wing and communication via the work channel were not recorded. That is explained in greater detail below.

The microphones of the crane vessel's VDR system[18] are only located inside the bridge. There are no microphones on the wings of the bridge. Among other things, this means that the conversations between the pilot and the captain (when they were on the bridge wing) were not recorded.

The same applies to the radio channel that was used. This is a work channel known in the port of Rotterdam as a 'Storno channel'.[19] The Vessel Traffic Services (VTS) recordings record communications via standard VHF marine radio channels and the traffic management channels. The work channels are used for communication between pilots, tugs, linesmen, and other parties, but are not used by the VTS. Communication via the work channels is therefore not retained. The VHF marine radios on the crane vessel cannot be tuned to these work channels. Because there are no microphones on the bridge wings of the crane vessel, no record was made of what was communicated between the parties involved via the work channel used during the docking operation. The tugs did not have a VDR on board; this is not required/obligatory for vessels of their size.

18 VDR: *Voyage Data Recorder*, see Paragraph 1.5.
19 In the remainder of the present report, this will be referred to as the 'work channel'.

It follows from the above that where the investigation is concerned, what was communicated between the various parties and how it was communicated, is primarily based on statements made by those involved.

3 ANALYSIS

3.1 Introduction

This chapter deals with the factors that may have played a role in the occurrence taking place. Paragraph 3.2 of this chapter focuses on the docking of the crane vessel. Paragraph 3.3 deals with the work that took place on the hanging scaffold that was suspended on the outside of the jack-up drilling rig. Paragraph 3.4 gives an overview of the risk management for both projects.

For the analysis, the Dutch Safety Board drew up a frame of reference. This can be found in Appendix C.

3.2 The docking operation

3.2.1 Preparation

In preparation for the docking operation, the docking procedure and the step-by-step plan were discussed at the kick-off and the pre-docking meeting. Paragraph 2.3.2 lists the parties that were present at those discussions. The docking procedure and the step-by-step plan provided an overall idea of how the manoeuvre would take place.

What was missing in the docking procedure was the position of the drilling rig right next to the entrance to dock 7. It could not therefore be ascertained from the docking procedure that the drilling rig was located right next to the dock entrance, thus reducing the space available for entering the dock. During the preliminary discussions with the parties involved, it became clear that the presence of the drilling rig was a given fact that the pilot and captain would need to deal with while conducting the operation. Because of the small margin between the crane vessel and the drilling rig, a tug could also not be attached on the aft port side, as initially planned. The pilot and the captain decided that that tug should be attached to the crane vessel in a different position, namely on the starboard side, against the centre column of the crane vessel.

At the time of year when the docking operation took place, it was difficult to find the ideal combination of only a little wind and a sufficiently long tidal window for the vessel to enter dock 7. As during the earlier attempt, there was more wind than allowed for in the restrictions laid down in the docking procedure. The wind speed at the time of the docking operation was 6.6 m/s (wind force 4) with gusts of 10.53 m/s, from a 185 degree direction. Interviews with the parties involved revealed that they did not consider this to be problematic, and that the pilots, captain, and dock master had agreed on this. The pilot considered the available tugs were sufficiently powerful to successfully dock the crane vessel. Moreover, he had set the condition that the crane's vessel's own propulsion remained available for use when necessary. He had often navigated vessels into dock 7, including in stronger winds. The captain and the dock master trusted the pilot's judgement, as did the company that provided the tugs. In order not to overrun the schedules of the client and the shipyard, and because another vessel was already waiting in dock 7 for the dock to fall dry, the parties involved decided to begin the operation with the wind force exceeding the specified limit. However, the pilot indicated in the meeting on 19 February that the next opportunity to dock again would be on 25 February. Too much wind was predicted for the days before. Because this would cause too much delay for other parties in the consultation, it was agreed at a subsequent meeting to use extra strong mooring lines from the crane vessel for docking the crane vessel. All parties agreed that, using this measure, it should be possible to start at an earlier time.

The pilot was used to giving such pilotage advice – in consultation with the parties involved – and to being able to depart from existing arrangements such as wind limits. Characteristically, pilots are free to give advice according to their own insights and experiences. This has many advantages because it allows them to make good use of their knowledge and experience. It can lead to a situation, however, in which decisions are made without a careful assessment of the risks involved, thus leading to the unjustified conviction that safety is still ensured. The parties involved took the decision to exceed the wind limits on the assumption that it was safe to do so, without making the safety risks explicit and transparent. The chance of an allision with the drilling rig had in fact been identified by some of those involved, but not voiced openly or made explicit. The pilot estimated the chance of allision as high, but the risk for the parties involved as acceptable because the consequences, estimated in advance, would be limited to minor material damage as the approach speed for the dock would be virtually zero. This is dealt with further in Paragraph 3.4 of the report.

Because of the size of the crane vessel, the small margin between the vessel and the dock, and the number of parties involved, the docking operation is already a complex operation even without deviations from the docking procedure. That complexity requires the parties involved to identify and define the risks that need to be managed. They must also put the measures in place that are available for managing the identified risks (see Appendix C.1).

The risks were not in fact identified or defined, and nor were the control measures. The presence of the drilling rig and the decision of the parties involved to exceed the wind limits caused deviations from the original docking procedure and increased the complexity of the operation. This resulted in a new situation, requiring the parties involved to once again identify, determine, and manage the risks.

Preparations for carrying out the manoeuvre
The familiarity of the pilot with the area where the operation would take place and with the parties involved it meant that the execution of the manoeuvre of the crane vessel fell to the pilot. That was not explicitly stated. Formally, it is the captain who remains responsible for manoeuvring the vessel. Based on his experience, the pilot had an idea of how he would carry out the operation. In preparation, he had, among other things,

read the docking procedure, spoken to a tow master, and searched within the Pilotage Service's system for additional useful information.

During the preliminary discussions, the pilot told the tug company that he wanted a minimum pulling power of 45 tonnes per tug. The docking procedure did not specify what the required pulling power of the tugs needed to be and the pilot determined the pulling power based on his experience and his consultation with the tug company.[20] The pilot had made rudimentary wind pressure calculations prior to the docking operation, but he did not use them as a basis for the required bollard pull of the tugs. Unlike in the 2024 docking procedure, the required pulling power of the tugs was indeed specified in the 2017 docking procedure. For the docking operation, a total bollard pull of 391.1 tonnes was deployed, which is about the same as that specified in 2017. Table 4 in paragraph 2.3.3 shows the distribution of the tugs and the corresponding bollard pull.

Availability of tugs

Based on the docking procedure and the capacity of the necessary tugs requested by the pilot, the tug company made a proposal as to which tugs could be used. In doing so, the company looked not only at the required bollard pull per tug. Because the operation would take about a day from unmooring to docking, the company also considered the availability of tugs and crews and the possibility of having relief crews on board. The latter was especially important for the tugs that would assist in unmooring and would remain alongside until the crane vessel had entered the dock.

The presence of the drilling rig meant that in practice, the distribution of the tugs – and thus the bollard pull per position – deviated from the step-by-step plan. The tug that was initially planned for the port aft of the crane vessel was relocated by the pilot to amidships on the starboard side (No. 3 in Figure 3) due to the presence of the drilling rig. The main task that the tug had in its original position was to, together with the tug at the other side of the aft (No. 3 in Figure 3), wedge the aft of the vessel and align it in front of the dock entrance by pushing against each other. At its position amidships on the starboard side, the tug was indeed able to counter a lateral movement, but wedging the aft of the crane vessel was no longer possible. Also, the influence of the tug on the turning direction of the crane vessel was limited in this position. The tug that remained at the stern (No. 2 in Figure 3) and that could influence the turning direction of the stern of the vessel had a bollard pull of 56.3 tonnes. Given that this was the only tug that could still influence the turning direction of the stern, it would have been favourable to attach a tug at that position that had greater pulling power. This also emerged from an interview with a towmaster.

The pilot had a plan in his head and told the captain how he wanted to carry out the manoeuvre. The pilot had arranged with the captain that the captain would give orders

20 The pilot and captain decide how much bollard pull is needed. When this is known to the shipyard or when a client or captain requests it, the dock master alters it in a subsequent revision of the docking procedure. It is not standard practice at the shipyard to include the minimum required bollard pull of the tugs in the docking procedure.

to the Chief Dynamic Positioning Officer (Chief DPO)[21] if the bow or stern thrusters were needed. The pilot also gave the Chief DPO an NMS screen and explained what the Chief DPO could see on the screen, so that he could follow the manoeuvre. The pilot arranged with the second pilot that the latter would keep an eye on whether everything was still going well. The second pilot did not receive any specific instructions or frameworks within which he was supposed to follow up on that arrangement.

During his days on board of the crane vessel, the pilot spoke with the captain and the watch officers about the docking procedure and kept watch as per rotation schedule. The captain also held a toolbox meeting with his bridge crew to discuss the docking procedure. There was no point in time during which the captain talked through the manoeuvre and his plan for performing it with the entire bridge crew and the pilots together. Nor did the captain make any additional arrangements with the two pilots and his crew at which moments the pilot wished to receive information (for example, in the event of a course change of a certain number of degrees). The lack of a shared view of the operation, additional arrangements, and communication with the captain, the crew, and the second pilot about what they saw during the operation made it harder for the captain and the pilot to keep the vessel's movements under control. The communication with the tug boats, the linesmen and the shipyard was in Dutch. It is common practice internationally that communication happens in the language of the country This creates an even greater challenge for the bridge team to keep engaged with the pilot's actions. Cooperation on the bridge and the use of all supporting and available resources are topics that can be found in Bridge Resource Management (BRM). In the Rotterdam-Rijnmond Regional Maritime Pilots Corporation's training programmes, this is referred to as Maritime Resource Management (MRM).

Bridge Resource Management
BRM involves coordinating the skills, knowledge, and experience of the bridge crew, as well as optimum use of technical aids and information resources. Among other things, this includes encouraging clear communication, assigning responsibilities, and enforcing shared situational awareness among all team members. This is not only a matter of technical skills but also of developing non-technical skills such as leadership, decision-making, and teamwork.

The Rotterdam-Rijnmond Regional Maritime Pilots Corporation had provided all the information the pilot needed so that he could prepare for the operation. It became clear from interviews, however, that the relevant, necessary information is difficult to find in the Corporation's data system, meaning, for example, that the pilot did not have the latest version of the Vademecum or the evaluation of the 2017 docking operation by a fellow pilot.

Because of the autonomous position of the pilots, preparation for a docking operation such as this one falls mainly on the pilot himself. The Rotterdam-Rijnmond Regional Maritime Pilots Corporation provides training on the positioning and use of tugs as well

21 A qualified first officer, who also holds the necessary certification required to operate the DP system.

as on how to communicate with them. The same applies to cooperation on the bridge. The Rotterdam-Rijnmond Regional Maritime Pilots Corporation does in fact provide all the information that a pilot might need for preparation, but it then imposes few requirements as to how the pilot then actually carries out preparation or how his preparation is tested, nor does the Rotterdam-Rijnmond Regional Maritime Pilots Corporation conduct risk assessments for exceptional transports. This means that the Rotterdam-Rijnmond Regional Maritime Pilots Corporation does not have a general approach to safety. A pilot is therefore reliant on himself before and during the operation.

In deciding to commence the docking operation, the parties involved took the presence of the drilling rig as a given fact, and accepted that the wind limits prescribed in the docking procedure were exceeded. They took that decision on the assumption that the crane vessel could be kept under control with the available resources even in those circumstances. They took that decision without any substantiated risk assessment, meaning that robust risk management was not in place.

The consequences of altering the configuration of the tugs had not been identified by the pilot. The tug that remained at the starboard stern of the crane vessel was one of those with less bollard pull and had to keep the stern under control on its own.

On the bridge, the pilot, the captain, his crew, and the second pilot did not have a shared view of the execution of the docking operation. The Dutch Safety Board would expect that, during an operation that is as complex as the docking operation, the captain and pilot, who was directing the parties involved, optimally uses the crew involved and assures that all that are involved have the same idea of the operation.

Despite the Rotterdam-Rijnmond Regional Maritime Pilots Corporation providing all the resources and information to pilots for conducting an operation safely and effectively, it is up to the pilot himself to put this approach to safety into actual practice. This means that the organisation cannot guarantee a general approach to safety that is implemented and enforced.

3.2.2 Movement of the bow of the vessel to port

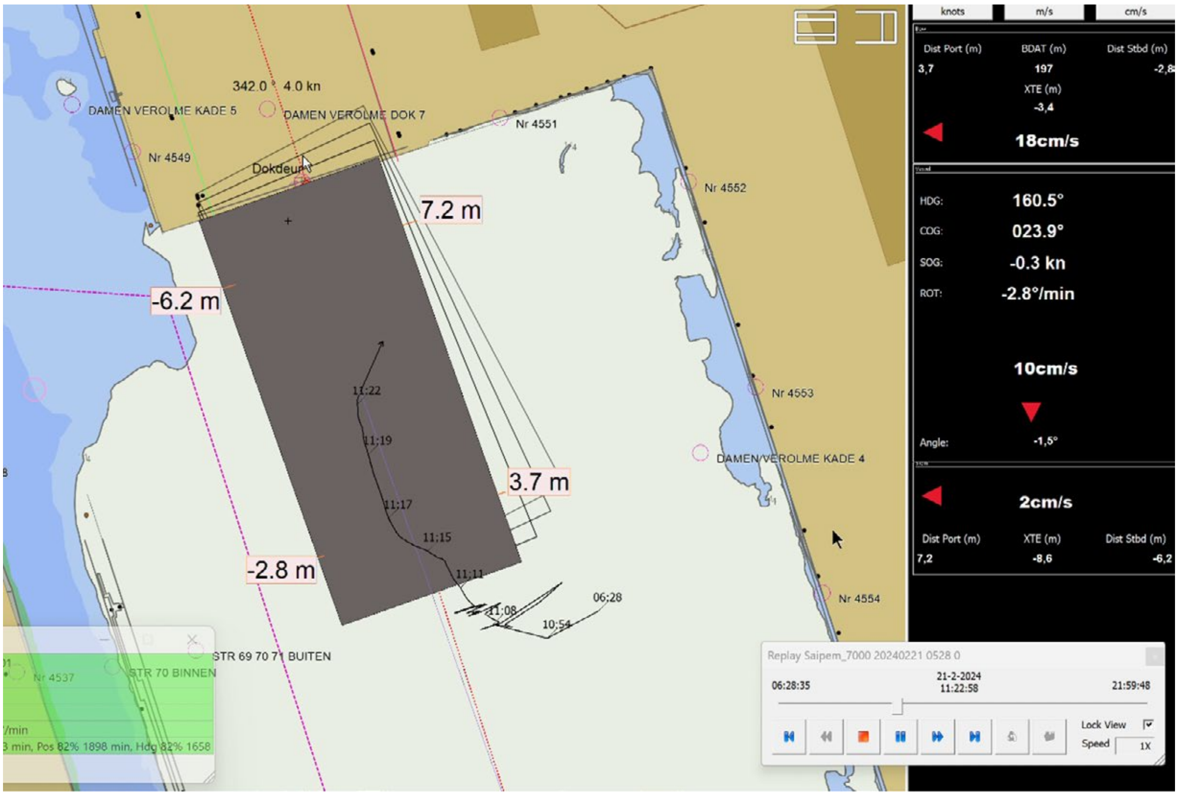
Wind pressure calculations commissioned by the Dutch Safety Board showed that – due to the position of the cranes and the construction of the vessel – the crane vessel had a larger wind surface at its bow than at the stern. This naturally caused the vessel to drift[22] and to undergo a turn to port. The influence of the current was analysed as well. The data showed that the expected speed of the current was less than 0,1 m/s. The shape of the two floaters are almost completely symmetrical. In relation to the wind pressure, the effect of the current is negligible.

Based on the data obtained from the *Voyage Data Recorder* (VDR) and the Marginal Vessels Navigator (NMS), it can be established that this drift began at about 11.22:46 hours. At about that time, the prediction from the NMS showed that the bow was

22 Drift is the shifting or leewaying of a vessel due to the pressure of the wind.

swinging away to port. This can be seen in Figure 12, which shows a snapshot of the NMS. This figure indicates with red arrows that the speed astern was 10 cm/s, the speed of the bow to port was 18 cm/s, and the speed of the stern to port was 2 cm/s. The drift to port of the bow was therefore increasing faster than the drift of the stern. The movement to port continued for three minutes.

The captain, the two pilots, and the Chief DPO had an NMS screen available at their position on which both the vessel's drift and turn and the prediction of its movement were visible. The captain and the pilot both looked at the NMS during the manoeuvre. Once close to the dock entrance, the pilot manoeuvred by sight. Based on interviews it was established that the captain and pilot considered this as more reliable. The data of the NMS show that the movement of the bow of the crane vessel to port started around 11.22:46 hours. The prediction of this movement could be seen two minutes earlier. Other information (CCTV footage and the VDR) shows that tug No. 6 in Figure 3 starts pulling to starboard at around 11.24 hours to get the crane vessel back in line of the dock. This did not have the desired effect and two minutes after the bow of the vessel started moving to port, the captain gave the command to turn on the bow thrusters at 10%. Fifteen seconds later this was increased to 15% and another 10 seconds later to full power. The movement of the bow of the vessel to port decreased and at 11.26 hours the bow started moving to starboard. The prediction on the NMS showed that the aft of the crane vessel was going to move to port as a result of the movement to starboard of the bow. This shows that the information provided by the NMS was not optimally utilised during a period of four minutes.



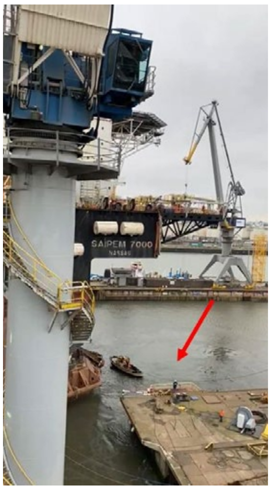
▲ *Figure 12: A snapshot of the NMS at 11.22:58 hours. The image shows the grey contour of the crane vessel with the prediction lines next to it. It is only the position of the drilling rig's GPS antenna that can be seen; its contours are missing. (Source: Rotterdam-Rijnmond Regional Maritime Pilots Corporation)*

NMS test report

For certification of the NMS system, the Netherlands Organisation for Applied Scientific Research (TNO) was commissioned by the Pilotage Service to test the system extensively several times. The test reports showed that the NMS system meets the applicable requirements for its use set by Rijkswaterstaat (the executive agency of the Ministry of Infrastructure and Water Management). TNO does warn, however, that in practice, it is necessary to keep a close eye on whether the system does not generate error messages and that errors can occur for various reasons. The recording of NMS data requested and received by the Dutch Safety Board did not contain any error messages.

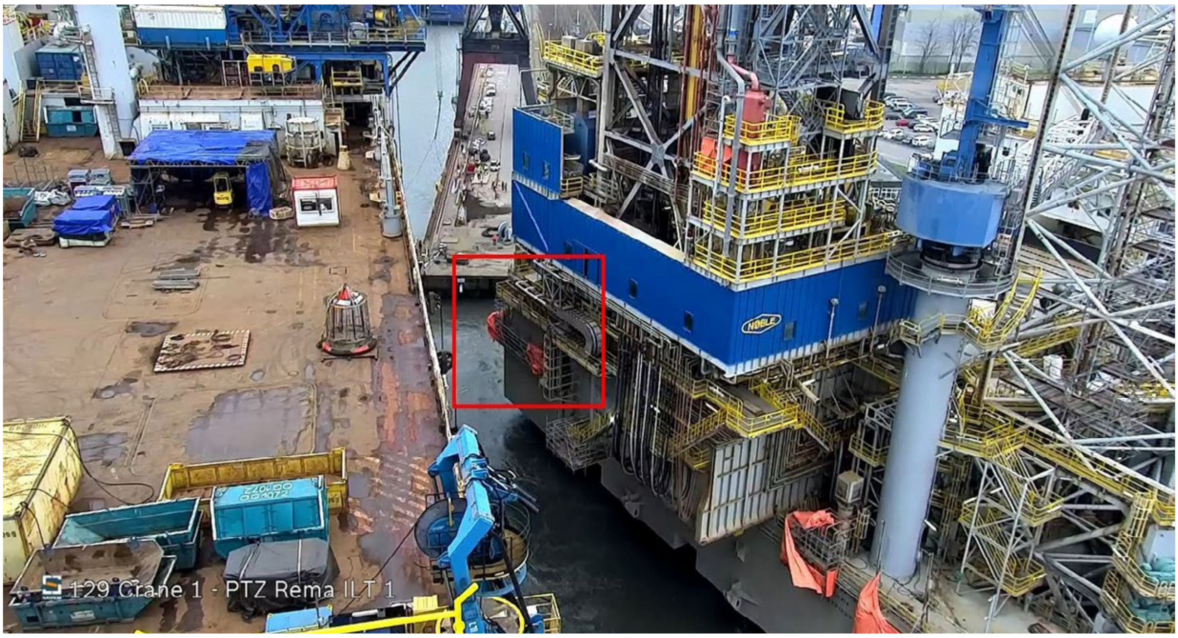
During the manoeuvre, the pilot and the captain focused their attention primarily on the stern of the vessel: they were watching it enter the dock and receive the docking lines. That is understandable, because an allision between the crane vessel and the edge of the dock entrance would cause damage to both the crane vessel's pontoon and the dock, with potentially negative consequences for the entire operation.

Interviews with those involved reveal that there had been discussion – prior to paying out the docking lines – between the first pilot and the dock master about the right time for this. As the crane vessel approached the dock entrance, the pilot asked the dock master via the work channel to bring the docking lines to the vessel. The dock master replied that that could only be done safely after the vessel had entered the dock, because otherwise, the lines could fall into the water and damage the dock gate. The Dutch Safety Board finds it plausible that this communication distracted the pilot's attention from the fact that the bow was turning away. Figure 13 shows the point when the linesmen's launch brought the docking line from the dock entrance to the vessel.



◀ *Figure 13: This photo shows the point (11.24:52 hours) when the port rear docking line was taken to the crane vessel by a linesman's launch (red arrow). (Source: Noble Corporation)*

On the bridge, the Chief DPO had however noticed the movement based on various camera images. Figure 14 shows the drift to port as seen by a camera on the crane vessel. The view from this camera on the crane vessel was from fore to aft. The first pilot and the captain were high up on the stern and could not see past the vessel into the dock. The Chief DPO on the bridge did not provide feedback to the captain about what he saw. He also did not know whether the movement formed part of the manoeuvre.



▲ *Figure 14: Drift to port as seen by a camera on the crane vessel. Same point in time as in Figure 13. The red square indicates the location of the hanging scaffold. (Source: SPCM, CCTV camera 129 Crane 1 – PTZ Rema ILT 1)*

The added value of NMS – for example using the predicted movement of the vessel as an additional check – was not utilised during the manoeuvre. The first pilot did use the NMS but preferred to navigate by sight close to the entrance of the dock, believing that to be more reliable in such a situation. The second pilot and the crew on the bridge also made no use of the information available on the NMS.

The second pilot was positioned on the starboard bridge wing. His role was to keep an eye out to starboard to see whether all was going well, but he had not received any specific instructions and so he could not judge whether the movement to port was part of the plan.

Because the crew members involved in the operation did not have a shared idea of the execution of the operation, the Chief DPO did not know if the movement of the bow was part of the operation. He did not report what he observed on the cameras to the captain.

During the manoeuvre, the pilot and the captain focused their attention primarily on the stern of the vessel and on its movement into the dock. That – together with the communication between the pilot and the dock master about paying out the docking lines – may have led to less attention being paid to what was happening at the bow of the vessel.

3.2.3 Course correction

To get the crane vessel back straight ahead of the dock, the pilot ordered the tug on the port forward side (No. 6 in Figure 3) to guide the bow of the vessel to starboard. That was a certain time[23] after the turning momentum (caused by the wind load) had commenced. The first pilot then asked the captain to use the vessel's bow thrusters so as to stop the movement of the bow and to correct the vessel's course. At 11.25 hours, the captain relayed the order to the Chief DPO to start the bow thrusters. In a short time, the power of the thrusters was increased from 10 per cent to 50 per cent and then to 100 per cent.

This action had the intended effect: the movement of the bow towards the drilling rig ceased and the bow swung away from it. Although the unintended movement of the bow to port had been corrected, the bow thrusters continued to operate. The tug next to the bow (No. 6) also continued correcting the bow to starboard to manoeuvre it in westerly direction aligned with the dock entrance. The bow moved away from the drilling rig causing the stern began to move towards it.

The stern and amidships tugs on the starboard side (No 2 and No 3 in Figure 3) pulled, but they were not powerful enough to compensate for the movement of the stern. See Table 4 for an overview of the distribution of the tugs and their pulling power. The stern thrusters were started shortly before the allision, but the time that was needed to move the crane vessel was too long to prevent the crane vessel from alliding with the drilling rig at 11.26:10 hours.

Because the initial off-course movement was not immediately recognised as a situation that required action, there was little time left to prevent an allision. A substantial correction with the bow thrusters was then required.

Given the amount of time the stern thrusters took to get the stern moving, it was no longer possible to avoid the allision with additional assistance from the stern thrusters.

23 Because the work channel was not recorded, the Dutch Safety Board was unable to determine exactly when a command was given to the forward tug to start pulling the crane vessel back on course.

3.3 Repair of pipework on the outside of the drilling rig

On the outside of the drilling rig, shipyard employees were carrying out repairs to the pipework at four locations (described further in Paragraph 2.2.2). This involved replacing a number of sections of pipework. The sections of pipework that were to be replaced had to be prepared by pipe fitters and finally welded into position by welders. Figure 15 shows the location of the hanging scaffold on the drilling rig.

▲ *Figure 15: The location of the hanging scaffold on which the welder was present. (Source: SPCM, CCTV camera 507 Lifeboat Station)*

The welding work at this location took place starting in January 2024. On the day of the occurrence, the welders were working on the final piece of pipework that needed to be welded. They would then have finished the job. The work permit[24] for the welding work had been extended and was active. The welders began work at 07.00 hours. Interviews revealed that this was not time-specific work and that no explicit deadline had been set for it. The shipyard had agreed to carry out the work for a fixed price. It could be completed well before the drilling rig was due to leave.

The welder, his colleagues and their supervisors knew that the crane ship would be docking that day; after all, they had seen the ship lying next to the drilling rig and had discussed it before they started work that morning. The risks of the docking operation were unknown to them. The fact that the crane vessel would proceed past the drilling rig into the dock was not something out of the ordinary for them. Vessels were often present at the location where the drilling rig was situated and vessels also regularly proceeded into the dock. Outboard work with vessels passing nearby was quite frequent at the shipyard. Because that always went well, there was no reason on the day of the occurrence for the welders and their supervisor to think that an allision might take place. Moreover, their background was in steel construction, meaning they were not conversant with estimating nautical risks. For them, the day of the occurrence was a working day, just like the previous days.

The project manager at the shipyard who was responsible for the works on board of the drilling rig, did not attend the welders and his supervisor on the possible hazards of the passing crane vessel. The project team of the shipyard did not give any instructions to stop the welding work during the docking operation. This will be elaborated on in chapter 3.4.

24 A *Permit to Work* is used in industry to identify risks and to implement controls. Before certain work begins, a Permit to Work must be completed by the supervisor together with the employees who will perform the work. A toolbox talk also forms part of the Permit to Work.

When the allision took place, the welder was alone on the hanging scaffold. Shortly before, his colleague had gone to fetch tools from a different location. Because his workplace was covered by a tarpaulin, the welder could not see the crane vessel approaching.

It was understandable why the welder was on the hanging scaffold on the day of the occurrence because that was in accordance with the work that had been assigned to him and because there was no instruction from the project manager to temporarily stop the job. The welder's work was not subject to any major time pressure.

Since neither the welder's supervisor nor the welder himself or his colleagues saw any danger in the passing crane vessel, the welders went to work as they did every working day.

No one alerted the welders to the risks that the docking operation might have for their work. After all, things always went well.

3.4 The overall risk management

Docking vessels, especially marginal vessels, entails risks. The owner of the vessel and the shipyard have a joint responsibility for identifying and managing those risks. That is particularly so if there is a concurrence of activities at the shipyard, as was the case in the situation concerned here.

This paragraph analyses the risk management for docking the crane vessel and the welding work on the hanging scaffold that was suspended from the drilling rig, as well as the way these two projects converged.

3.4.1 Risk management for docking the crane vessel

It was noted earlier in this report that the owner of the vessel and the shipyard used a docking procedure and a step-by-step plan as the basis for docking the crane vessel. The docking procedure and the step-by-step plan comprised a number of elements that were important for carrying out the operation, including wind limits, tide information, and operational arrangements. In neither the docking procedure nor the step-by-step plan is the drilling rig that was located next to the dock entrance referred to or indicated in the drawings. Nor does the docking procedure include a risk analysis.

Interviews with the parties involved in docking the crane vessel show that the docking procedure and the step-by-step plan were discussed during the preliminary discussions. This was to ensure that everyone involved in the docking operation was working with the same information. Those present at the preliminary discussions did not systematically survey the risks of the docking operation using, for example, a HAZOP,[25] a standard method in the oil and gas industry (offshore). Instead, those present discussed what limitations they envisaged and the solutions for those limitations. During the preliminary

25 Hazard and Operability Study.

discussions, for example, the parties did refer to the presence of the jack-up drilling rig, but they viewed it primarily as a given fact that needed to be worked around. The same applied to the wind speeds, which exceeded the limits defined in the docking procedure.

Some of those present did realise that the short distance between the crane vessel and the drilling rig and the forecast wind speed meant that there was a risk of the crane vessel alliding with the drilling rig. The potential consequences of a collision were estimated by, among others, the dock master, shipyard project manager, the captain and the pilot as purely material damage that could easily be repaired, because both ships were already at a shipyard and no one assumed that anyone was working on the hanging scaffold. That made the risk acceptable to them. The statements show that at no point during preparations for the docking operation did those present actually state that there was a chance of an allision. Because of their background and experience, they assumed that it also made sense for others that that risk existed.

The measure implemented by those present to deal with the presence of the drilling rig (i.e. moving the tug to a different position) was a logical solution for the problem the presence of the drilling rig created since there was no room to connect a tug at portside aft of the crane vessel. During the preliminary discussions and on the day of the docking, the safety risks and the technical possibilities of the crane vessel were discussed. The consequences of the combination of the use of the vessel's own propulsion and the tugs were insufficiently thought through; by using the bow thrusters to move the bow of the crane vessel away from the drilling rig, the aft of the vessel turned to port. The tug on starboard aft (No. 2) did not have enough bollard pull to counteract this turn.

In the Bridging Document, the crane vessel's owner and the shipyard made arrangements regarding the Safety Management System (SMS) to be used. The docking operation was not specifically mentioned in the Bridging Document, nor was any attention paid to any risks caused by the operation for the immediate surroundings, such as work on the drilling rig. Reference was made, however, to the Life-Saving Rules of the International Association of Oil & Gas Producers (IOGP).[26]

26 See for example: https://www.iogp.org/workstreams/safety/safety/life-savingrules/ [Consulted on 4 November 2024].

Bridging Documents

International legislation requires every vessel owner to have a SMS in place. The shipyard has a similar obligation pursuant to Dutch health and safety legislation.

Both vessel owners are active in the oil and gas industry. When multiple parties in these industries work together and each has its own SMS, a Bridging Document is usually utilised in order to coordinate safety procedures and expectations between the various parties at a worksite. The aim is to ensure that everyone understands and adheres to the same safety standards and protocols. The owners of the drilling rig and the crane vessel had both drawn up such a Bridging Document with the shipyard. That document generally comprises:

- An overview of both parties' safety regulations;
- Specific roles and responsibilities regarding safety;
- Procedures for accident reporting and emergencies;
- Communication channels for safety issues;
- Any training requirements for employees.

Prior to the docking operation, the crew on board the crane vessel were told to stay away from the side of the vessel that would pass by the drilling rig; this is in line with the 'stay out of the danger zone' rule in the IOGP's Life-Saving Rules. There was no direct contact between the crane vessel and the drilling rig; The crew of the crane vessel did not therefore point out this rule to the persons on the drilling rig or the shipyard. The crew on board the crane vessel did not have to give instructions to the drilling rig or the people working on it. However, it is part of the responsibility of a team that is going to carry out such an operation to inquire about the activities that could be going on on the drilling rig.

3.4.2 Risk management for the hanging scaffold on the drilling rig

The work requiring the hanging scaffolds on the outside of the drilling rig had been requisitioned and booked by the owner of the drilling rig as additional work outside the scope of the original project. No additions to the Bridging Document were made in that regard. For that work, it was the shipyard's SMS that applied.

In the light of its SMS, the shipyard considered the risks entailed in working on the hanging scaffold. The scaffold was constructed by a subcontractor in accordance with the applicable legislation and regulations. That meant that it was deemed safe to work on. External risks to working on the hanging scaffold were not considered, for example the passage a short distance away of large vessels entering of leaving the dock. The owner of the drilling rig did not actively supervise the work. It was clear to the drilling rig's owner that work was being carried out on the scaffolds, but not when. The owner assumed that the shipyard had identified and covered the risks sufficiently.

The drilling rig's derrick is mounted on a cantilever that allows it to extend outwards by up to 30 metres. The cantilever was located on the side of the drilling rig where the scaffolds were also suspended. On the day the crane vessel was docked, the drilling rig's cantilever had been extended outwards by six metres. For that work, it was the drilling rig's SMS that applied. The drilling rig's owner asked the shipyard whether the extended cantilever created the risk of an allision with the crane vessel. The fact that this work was subject to the drilling rig's SMS, prompted the owner to consider possible allision risks. The owner did not otherwise ask the shipyard whether it was also taking account of any risks associated with the docking operation as regarded the shipyard's work on the drilling rig. The drilling rig owner's request did not lead to the shipyard considering any other allision risks.

3.4.3 Shipyard

At the shipyard, a meeting was held at nine o'clock each morning at which all the project managers and the safety and management team met to discuss the progress and problems of all the ongoing projects. The first item on the agenda was safety. Because the risk of an allision between the crane vessel and the drilling rig was not recorded or shared anywhere outside the parties involved in the docking operation, that risk was also not referred to during the nine-o'clock meeting. Interviews conducted by the Dutch Safety Board with a number of shipyard employees show that the risk had in fact been recognised by a number of employees outside the shipyard's docking service. They assumed, however, that that risk was apparent to, and had been shared by, everyone at the shipyard, including the shipyard employees involved in the work on the scaffold suspended from the drilling rig.

In the oil and gas industry, Simultaneous Operations Procedures (SIMOPS) often apply. These are guidelines to ensure safe and efficient operations when several activities are taking place simultaneously at the same location, particularly in high-risk environments such as offshore platforms or construction sites. The purpose of SIMOPS is to identify and manage potential conflicts between operations so as to ensure the safety of employees and the integrity of installations.

SIMOPS generally comprise:

- Risk identification: an assessment of the risks that arise from carrying out various different activities at the same time, for example hoisting, welding, or working at height in parallel with production activities.
- Coordination of activities: clear arrangements as to who is responsible for monitoring and coordinating the various operations so that they do not conflict with one another.
- Communication protocols: specifying how and when communication should take place between teams so as to ensure that everyone is aware of one another's activities and of any changes in the schedule.
- Safety measures: determining specific safety procedures and implementing control mechanisms, for example the use of shielding, special permits (*Permit to Work*), or the temporary cessation of certain activities.
- Emergency plans: procedures in the event that something goes wrong during simultaneous operations.

Docking the crane vessel past the drilling rig where work was taking place at the same time was not identified as a SIMOPS, because the shipyard regards the docking of vessels as routine business. Vessels sailed into dock 7 regularly without incidents. The clients therefore trusted the expertise of the shipyard. The two clients and the (main) contractor did not therefore make use of a SIMOPS.

The Dutch Safety Board emphasises in the frame of reference that assumption should be evaluated periodically and that all users of a system should provide input to improve operational safety. The fact that the risks were not systematically identified, does not match this approach. Furthermore, the frame of reference emphasises the need for clear internal and external communication, an aspect that was missing before and during the accident, seen as there was limited agreement concerning the risks between the parties involved.

The risks associated with docking were not systematically surveyed in advance by the crane vessel project team. They did not employ a structured methodology for identifying risks, evaluating them, and putting appropriate control measures in place. Both the docking of the crane vessel and the work on the drilling rig were considered from the work context of the individual project.

The chance of an allision was considered to exist, and was assessed as high, by the pilot, captain, dock master, and others involved in the docking operation. It was not voiced openly by these parties, however, because they assumed it was clear to all those involved. As a result, the information about the chance of an allision was not communicated to the project team or the owner of the drilling rig. At no point in the process did the owner of the drilling rig, the owner of the crane vessel, and the shipyard get together to discuss the risks associated with the operation.

Since both projects took place on or near the shipyard's premises and SIMOPS were involved in the docking operation, the shipyard, as site manager, has a responsibility to ensure proper risk management of the situation as a whole. Treating the projects as separate activities meant that there was no understanding of the risks that might arise if these projects were implemented at the same time.

3.4.4 Measures subsequent to the occurrence

In response to this occurrence, the shipyard has implemented a number of measures. For example, the nine-o'clock meeting now includes a daily discussion of what vessel movements will take place around the docks and what they mean for other operations. When work takes place on scaffolds positioned on the water side, an extra person is posted to act as a lookout. His job is to monitor shipping in the area and if necessary to warn those working on the hanging scaffold to leave it when there is a chance that other vessels may pass close by.

The Rotterdam-Rijnmond Regional Maritime Pilots Corporation has not taken any measures as a result of this occurrence.

4 CONCLUSIONS

At a (repair) shipyard, work is taking place almost all the time. Each vessel and the work carried out to or on board a vessel is viewed as an individual project and managed as such. Projects may be taking place in close proximity to one another, and this may affect the safety of those carrying out work on those projects. That was the case with the occurrence concerned here, during which two entirely different projects literally came into contact with one another. The fact that a fatality occurred underlines the need to determine how the risks in such a situation can be managed more effectively.

The investigation into the occurrence shows that in managing the risks associated with simultaneous operations within the same area at the shipyard, greater attention needs to be paid to the complexity and proximity of that simultaneous situation. Given that the vessels are physically on or near the shipyard's premises, it is the responsibility of the shipyard to take the lead in this regard. This does not, however, release clients from also shouldering their responsibility regarding to risk management in the case of simultaneous activities.

The direct cause of the fatal occurrence was the entrapment of the welder between two vessels after an allision because he was working at a location that put him directly in the line of fire of the crane vessel.

4.1 Occurrence of the allision

The allision occurred because the stern of the crane vessel swung towards the drilling rig as a result of a course correction using the bow thrusters to counter the turn of the bow of the vessel. The captain, his team on the bridge, and the pilot had not made clear arrangements as to how the manoeuvre could be monitored and what information was important to share with one another. The features of the NMS as an aid to manoeuvring were not utilised to the full. In the communication during the manoeuvre, those involved did not make any use of the information sources (i.e. CCTV, bridge crew) that were available on the bridge and that could assist the pilot and captain in carrying out the docking operation. The Rotterdam-Rijnmond Maritime Pilots Corporation has a responsibility for ensuring that this in fact applies. Although the Rotterdam-Rijnmond Maritime Pilots Corporation has procedures for drawing up such a plan and reviewing it internally, it became clear from the investigation there is no guarantee that this is actually done.

4.2 The preparations of the docking operation

Docking the crane vessel would have been a complex operation, even in ideal conditions. The crane vessel only just fitted into the dock, meaning that it needed to be brought in with great care so as not to damage the dock entrance and to keep the keel blocks in place. It was also clear that there was a jack-up drilling rig next to the dock entrance, which had consequences for the positioning of the tugs. Some of them were therefore positioned otherwise than what had been planned beforehand. The crane vessel would also pass only a short distance away from the drilling rig during the docking operation.

It was already clear during preparations for the docking operation that the maximum permitted wind speeds (wind limits) would be exceeded. The parties involved assumed that the crane vessel could be kept under control with the available resources even in those circumstances. They did not, however, conduct an additional risk assessment. A couple of the persons involved, including the pilot and dock master, did see that there was chance of alliding with the drilling rig but they did not explicitly express this. They also assumed that the consequences of an allision would be limited.

In particular, the decision to exceed the wind limits requires additional caution and thus a reassessment of the risks and control measures for performing the manoeuvre safely. That also includes that all involved explicitly express it if they see hazards and that they confirm assumptions.

4.3 The welding work on the hanging scaffold

Risk management of the welding work focused on the actual work on the hanging scaffold. Within the context of his work, the welder was carrying out the work safely. He and his supervisor did not see the danger posed by the passing vessel, meaning that they were unaware of that risk. Nor did others alert them to that risk.

Among other things, the purpose of a safety management system is to identify unknown risks. The shipyard's safety management system lacks a means of identifying unknown risks – as with this occurrence – and responding to them by putting control measures in place. As noted in the frame of reference, the responsibility for this lies primarily with an organisation's management. It is the management that is responsible for determining and subsequently implementing and enforcing a safety approach.

4.4 Risk management in the case of simultaneous operations

Two different kinds of work were taking place simultaneously on board the crane vessel and the drilling rig. The parties involved in docking the crane vessel had estimated that the position of the drilling rig and the prevailing weather conditions meant there was a risk of an allision with the drilling rig. They had estimated the potential consequences as amounting to only minimal material damage, whereby they considered the risk to be acceptable. They did not know that work was taking place on the hanging scaffold that was suspended from the drilling rig. The welders and their supervisor on the drilling rig did not consider the passing crane vessel to pose a risk. They did not know that there was a risk of the crane vessel alliding with the drilling rig.

The shipyard's risk management system is not designed to assess the safety risks of situations during which the activities of two different projects converge. Each project is managed by the shipyard on the basis of a risk management system that focuses specifically on the work risks within that particular project. That was also the case when docking the crane vessel and when working on the drilling rig's hanging scaffold. The clients did not express any explicit expectation towards the shipyard regarding the management of risks in the case of convergent activities.

4.5 Learning

After the incident, the shipyard implemented a number of measures to prevent future occurrences. A new item on the agenda for the joint morning meeting now ensures that vessel movements at the shipyard are discussed as a standard feature. A procedure has also been added requiring a lookout to be present at all times when employees are working in places where shipping passes by.

Although the learned lessons resulting from this incident are a positive development, the shipyard still lacks proactive safety culture. The shipyard is undertaking action and campaigns to raise safety awareness among its employees, but the emphasis is on learning from incidents that have already taken place. Risks are often estimated based on previous experience. If certain activities always go well, employees may not realise that risks can also be involved, leading to blind spots and to insufficient attention being paid to potential hazards.

A more in-depth approach is still needed on the part of the shipyard. To identify risks effectively and in a structured manner, it is crucial to take account of different perspectives, particularly in the case of simultaneous activities. Among other things, this means that the shipyard should ensure that all parties involved jointly go through scenarios together in advance, identify the risks that may arise, and agree on the options for taking action.

The responsibility for safety in the case of such activities lies primarily with the shipyard. However, clients have not actively inquired about how the shipyard fulfils this responsibility. This may limit the amount of attention paid to shared preventive measures, and may make it more difficult to implement a proactive approach to safety.

As regards the Pilotage Service, lessons can be learned from this occurrence for both the preparation and performance of complex manoeuvres, such as docking a very large crane vessel. It appears, for example, that risks may arise that are not directly related to the manoeuvre itself (in the present case, work on an adjacent drilling rig) but that should nevertheless be included in the risk analysis for that manoeuvre. The investigation also reveals that when accepting additional risks (such as the wind limits being exceeded), increased attention to safety, and communication about it, is essential for performing the manoeuvre safely. When actually performing the operation, it is a matter of striking the right balance between relying, on the one hand, on the pilot's experience and ability to improvise and, on the other, following the right procedures combined with the best possible use of technical resources. The Pilotage Service can ensure that the pilot is able to strike that balance.

Finally, the investigation shows how important it is for the parties involved to continually communicate explicitly with one another during the operation about risks that they perceive, especially if unforeseen circumstances arise. The pilot has a leading role to play in this regard, not only by communicating explicitly with others about what he intends doing, but also by actively asking those others about what they perceive and requesting them to alert him to any risks.

5 RECOMMENDATIONS

Introduction
During complex operations on or close to Damen Ship Repair's terrain, the responsibility for risk management lies with the shipyard, especially when simultaneous activities are taking place. Together with the other parties involved in preparing and executing complex operations, the shipyard should make the risks involving those operations (both separately and simultaneously) apparent and manageable. The other parties involved hold the shared responsibility to take care this happens. This applies in particular if parties deviate from previously made agreements about the execution and operation, for example the exceeding of wind limits. We have written recommendations for all parties together and for Damen, the Rotterdam-Rijnmond Regional Maritime Pilots Corporation and Saipem separately.

Recommendations
During a complex operation such as docking the Saipem 7000, the various parties involved can achieve safety gains if they focus on their shared contribution to safety.

To Damen Shiprepair Rotterdam, the Rotterdam-Rijnmond Regional Maritime Pilots Corporation and Saipem

1. Ensure that the various parties involved in complex operations speak to each other in advance and together, in order to gain an overview of the various activities on the site, explore possible risks, discuss different scenarios and make agreements about communication.

Following this incident, Damen Shiprepair Rotterdam has already taken a number of actions to improve safety.[27] These actions are in line with the learned lessons from this incident and are primarily focused on risk management while docking in and out. In addition, it is important to pay attention to managing the risks of all complex operations that take place on the shipyard simultaneously. This is why the Dutch Safety Board proposes the following additional recommendations.

To shipyard Damen Shiprepair Rotterdam

2. Ensure a structured approach to manage risks during operations that take place simultaneously on or close to the shipyard and are able to influence each other. Involve all relevant parties in risk management, for separate projects as well as for a combination of projects. Discuss the different scenarios that can arise and how these risks should be managed. Record this approach.
3. With all parties involved, make a joint reassessment of all risks if there is a deviation from previously made agreements for the execution of simultaneous operations. If necessary, adjust scenarios for risk management.

27 See Appendix B.

4. Update and improve the Life-Saving Rules following this incident and let employees actively participate in the implementation of them. Emphasise the importance of safety as a shared responsibility.

In the Netherlands, pilotage is mandatory in certain waterways. This pilotage requirement is filled by one party, namely the Maritime Pilots.[28] This monopoly position entails a strong responsibility to pilot and manoeuvre vessels as safely as possible. The Dutch Safety Board therefore recommends the following:

To the Rotterdam-Rijnmond Regional Maritime Pilots Corporation

5. Evaluate and improve the procedures in the Vademecum based on the lessons drawn from this incident, that ensure a proper preparation of special transport, including which tools should be used. In any case, make sure that:
   a. these procedures are known by the pilots and they comply by them;
   b. the available and most recent information is easily accessible for the pilots;
   c. the pilots make sure that the involved parties (like the shipyard and the captain) are aware of the assessments and choices they make during the preparation and execution of complex operations, so those parties can indicate where necessary if any risks arise.
6. If voyages are made by more than one pilot, ensure that the involved pilots prepare and execute the voyage together. They need to:
   a. get involved simultaneously for the preparation and have the same information;
   b. be able to address each other professionally about managing risks in the preparation (for example during simulation training) as well as the execution of the operation, and make their assumptions explicit (for example by 'thinking aloud');
   c. ensure effective use of NMS while performing complex operations.

The client of a docking operation plays an important role in the way risk management and the execution of the operation are carried out. That is why we recommend the following:

To Saipem

7. Ensure the captain, his team on the bridge and the pilot(s) jointly make specific agreements about the execution of the docking operation, so everybody knows how the operation is carried out and which task they have. Record in the agreement: the division of tasks, way of communication, different scenarios and how to deal with questions, doubts and ambiguities during the operation.
8. Check with the shipyard whether they understand the risks of a complex (simultaneous) operation such as the docking operation. Make this step part of the preparation for complex operations.

28 Region Scheldemonden is an exception. Here part of the mandatory pilotage is fulfilled by the Flemish pilotage service.

APPENDIX A

Vessel data

A.1 Saipem 7000

Vessel data	Saipem 7000
 ▲ *Figure 16: The Saipem 7000 crane vessel alongside the quay at the shipyard, photographed from the stern.*	
Call letters	C6NO5
IMO number	8501567
Flag state	Bahamas
Home port	Nassau
Type of vessel	Semi-submersible crane vessel
Year of construction	1986
Shipyard	Fincantieri Monfalcone Yard
Length	198 metres
Beam	87 metres
Draught	10.3 metres
Gross tonnage (GT)	117,812
Main engine	12x diesel generator set, total power 70,000 kW
Propulsion	10 azimuth thrusters and 2 bow thrusters

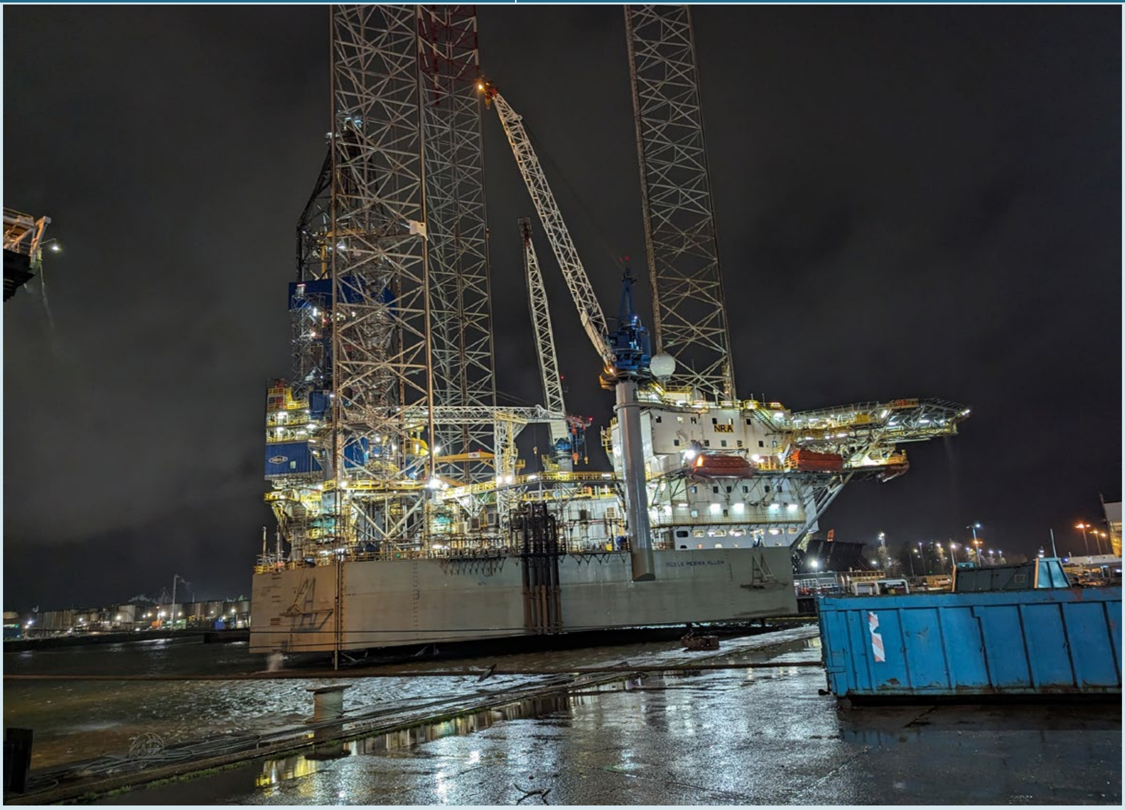
The vessel consists of two floaters on which a work platform is positioned. On the work platform there are two cranes at the front of the vessel, each with a lifting capacity of 7,000 tonnes. At the stern there is the crew accommodation for a maximum of 725 persons, with the navigation bridge above it.

The vessel is equipped with Dynamic Positioning that enables it to accurately maintain its position at sea while carrying out construction work. For that purpose, the vessel is equipped with 12 thrusters, divided between the stern, the middle of the floaters, and the bow.

There are four azimuth thrusters at the stern of the vessel. These can rotate 360 degrees and act as propulsion and rudder when the vessel moves to and from a work area, and to keep the vessel in position within the work area. There are three retractable azimuth thrusters in the floaters on either side; these are used to keep the vessel in position within the work area.

The vessel is steered from the navigation bridge at the stern. The bridge does not cover the full width of the vessel. On either side of the bridge there are long bridge wings extending to the sides. These are not covered and are not equipped with instruments or control panels.

A.2 Noble Regina Allen



▲ *Figure 17: The jack-up drilling rig Noble Regina Allen.*

Vessel data	Noble Regina Allen
Call letters	D5AI7
IMO number	8771227
Flag state	Liberia
Home port	Monrovia
Type of vessel	Jack-up drilling rig
Year of construction	2013
Shipyard	Jurong Shipyard
Length	102 metres
Beam	84 metres
Draught	Not applicable
Gross tonnage (GT)	16,146
Main engine	Without own propulsion
Propulsion	Not applicable
Maximum propulsion power	Not applicable

APPENDIX B

Responses to the draft report

The draft report (without recommendations) was submitted to the various parties involved.

These parties were requested to check the report for factual inaccuracies and inconsistencies. The following parties responded to the draft report:

- Saipem
- Master of Saipem 7000
- Rotterdam-Rijnmond Regional Maritime Pilots Corporation
- The pilot concerned
- The victim's next of kin
- The Bahamas Maritime Authority

The responses received were dealt with in the following manner:

- Whenever the Dutch Safety Board has decided to adopt responses, these are incorporated into the final version of the report.
- Whenever the Dutch Safety Board has decided not to adopt responses, an explanation for that decision is given.
- Damen Shiprepair Rotterdam has provided the Dutch Safety Board with a separate list of measures they have taken after the occurrence. This list is included in this appendix. They have indicated that they have no response on the content of the report.
- Noble Services International Limited has provided no response to the concept report.

The responses and the Dutch Safety Board's explanation are included in a table on the Dutch Safety Board's website (https://onderzoeksraad.nl/en/).

Actions taken by the shipyard following the incident.

Investigation Recommendations

1. Information sharing vessel movements at the Yard; (Action closed)
   - arrival, departures, docking and undocking should be discussed during the daily 9 o'clock meeting with all project representatives and department managers.
   - Actions from this meeting will be assigned to the relevant parties(PM) and closed during this meeting.
   - Overboard activities in the "line of fire" will be stopped during movements of vessels in the vicinity.
   - Dedicated watchman assigned to monitor overboard activities on hanging scaffolding.

2. Management of Change;(Action closed)
   - Continuous communication: throughout the docking/undocking operation, maintain open and transparent communication channels with all stakeholders involved. This includes keeping them informed about the purpose, scope, and progress of the activity, as well as any changes that may occur along the way. LMRA session with Pilot, Master and Port Captain before actually entering the dock.
   - Risk Management: proactively identify and mitigate risks associated with the changes implemented during the docking/undocking. This involves assessing potential challenges and monitoring risk triggers to prevent or minimize negative impacts.

3. Review the standard of docking procedure.(Action ongoing)
   - Develop a standard for docking procedure, including a risk assessment, management of change.
   - Prior each docking a dock meeting must be held with all relevant stakeholders.
   - Define the stakeholders for input in the docking procedure.
   - Define the originator, reviewing party and approval party of the dock plan.
   - Establish communication matrix for distribution of this plan.
   - Furthermore, all meetings regarding docking and undocking (No go/ Go meetings) to be recorded and shared according to the communication matrix.

4. Permit Coordination and approval; (Action Closed)
   - Review the template for VSCC meeting and active permit list in relation to HIRA activities.
   - Working above water must be added as a HIRA activity. This should create additional awareness and requires situational awareness from the authorizing party.
   - Additional measures work place; For protection against weather influences use of transparent screens so the workers are aware of the surrounding.

5. Investigate how to improve the buddy system on the Yard; (Action under investigation)

6. Yard to create a new RI&E, covering both Yard locations;
   - New RI&E – Has been made by the yard, covering both locations. (Closed)
   - Action Plan – Define safety measures and assign responsibilities. (Closed)
   - Review RI&E – Review of the RI&E by an external certified occupational HS specialist is planned. (Ongoing)
   - Communicate and Train – Share the RI&E and ensure employees understand their roles.
   - Monitor and Update – Regularly review and revise the RI&E to stay current.

APPENDIX C

Frame of reference
The Dutch Safety Board established a frame of reference during its investigation. The Board assesses the findings against this framework. This framework is based, on the one hand, on relevant legislation and regulations, industry standards and guidelines, and on the Board's vision of managing safety risks as best as practically possible, on the other.

C.1 Risk management

Docking a vessel is a responsibility shared between the owner of the vessel and the shipyard, with determining their specific responsibilities being key to mitigating risks. The IMO's (International Maritime Organisation) *International Safety Management (ISM) Code* makes it mandatory, among other things, to have a safety management system in place. That system sets out procedures for safely docking vessels. It also details the handling of safety risks and responsibilities. It follows, among other things, from the requirements for the safety management system that the owner of the vessel and the shipyard are obliged to identify and manage safety risks.

The parties involved in docking a vessel are responsible for managing the risks as effectively as possible. Docking a vessel takes place in collaboration between various parties. They are involved on the basis of various different roles. Besides the owner of the vessel and shipyard, these include the Pilotage Service, the port authority, the harbour tug company, and the KRVE linesmen association. Responsibilities for safety must be clearly assigned and parties must be aware of the reciprocal dependencies. Managing the risks therefore requires close cooperation between the parties and some form of direction. In the Dutch Safety Board's opinion, risk management should function in such a way that both the employees directly involved in the docking operation and other employees working at the shipyard are protected from events that could harm their physical or mental health. Robustness and simplicity are key features of risk management. A relevant basic principle is set out in the *Guidance on Simultaneous Operations (SIMOPS)*.[29] When two or more activities are planned in the same surroundings
that may interfere with one another, the potentially risks must be identified in advance.

The Dutch Safety Board includes relevant legislation and regulations in its investigations, for example the Dutch Occupational Health and Safety Act. The law requires employers to ensure that work is carried out in such a way that workers do not experience any adverse effect on their health and safety, including during docking work. The law requires employers to follow the occupational hygiene strategy.[30] According to the occupational

29 See, for example https://www.iogp.org/wp-content/uploads/2018/11/11SimultaneousOps_IOGP577version1.2.pdf [Consulted on 20 November 2024].
30 Section 3 of the Working Conditions Act and Section 4.4 of the Working Conditions Decree.

hygiene strategy, employers must address hazards and risks at the source wherever possible by preventing or eliminating them. Only if this is not feasible should employers implement effective management measures, with collective measures taking precedence over individual measures. With regard to the required safety level, the regulations make the 'principle of reasonableness' mandatory. According to that principle, a lower safety level may be decided on only on the basis of valid (technical, operational, or economic) arguments.

In assessing the safety strategy, the Dutch Safety Board also applies its own safety management principles:

1. *Understanding risks as a basis for the safety approach.*
   The starting point for achieving the required safety level is to explore the system, followed by an inventory and identification of associated risks to be managed.

2. *Demonstrable and realistic safety strategy.*
   To prevent undesirable events or manage their consequences, organisations should then establish a realistic and practically applicable safety approach. In other words, they must at all times take all available measures to mitigate the identified risks, unless the mitigation tasks bring with them demonstrably unreasonable costs or other negative consequences. In making this assessment, all relevant legislation and regulations, standards, guidelines and best practices from the sector, together with their own insights and experience within the organisation, must be taken into account.

3. *Implementation and enforcement of the safety strategy.*
   The management of an organisation is responsible for determining and subsequently implementing and enforcing a safety approach. This includes:
   - a description of how the safety approach will be implemented, focusing on specific objectives and resulting measures;
   - a transparent, unambiguous and accessible division of responsibilities in the workplace for the implementation and enforcement of safety plans and measures for everyone in the organisation;
   - a clear description of the deployment of human resources and expertise required for the various tasks; and
   - clear and active central coordination of safety activities.

4. *continuous improvement of the safety approach.*
   A systems approach to safety also means that the organisation's management periodically reviews existing assumptions. This includes ensuring that all users of a system can contribute their experiences and possible solutions to improve current practice, that management provides sufficient time and capacity to identify and assess risks, and that management embeds the way in which these risks are reduced throughout the organisation.

5. *Management control, involvement and communication.*
   The management of a company or organisation must provide the framework conditions within which employees can work safely and ensure that other interests – commercial or otherwise – do not eclipse safety. Internally, the management must ensure clear and realistic expectations with regard to the safety ambition. Externally, the management must communicate clearly about, for instance, the general working method, the way it is tested, and procedures in the case of non-conformities.

6. *Safe learning environment.*
   For optimal management of safety risks, organisations need to have a safe learning environment. That includes actually learning from incidents and unsafe situations. Importantly, workers and others should have the confidence to call each other to account for unsafe behaviour, and be encouraged to report occurrences without fear of backlash for their actions, omissions, mistakes or decisions (unless an intentional or grossly negligent act was committed based on unsafe intentions).

C.2 Safe and efficient navigation from the bridge

When docking a vessel, it is important to make use of all the available resources to ensure navigational safety and efficiency. In this regard, Bridge Resource Management (BRM) is an essential concept in the maritime sector. BRM focuses on effectively managing and utilising all available resources on the bridge of a vessel. According to the International Chamber of Shipping's *Bridge Procedures Guide* (6th edition, January 2022), BRM involves coordinating the skills, knowledge, and experience of the bridge crew, as well as optimum use of technical aids and information resources. Among other things, this includes encouraging clear communication, assigning responsibilities, and enforcing shared situational awareness among all team members. It is important that BRM is not only about technical skills, but also about developing non-technical skills such as leadership, decision-making, and teamwork, as highlighted in the Nautical Institute's *Bridge Team Management* (2nd edition, 2004). The aim is to create a culture in which team members work together effectively, support one another, and identify and correct potential mistakes or misunderstandings in good time. BRM focuses on integrating human and technical resources so as to guarantee the safe and efficient operation of vessels.

C.3 Operational plans and relevant documents

The following is a list of the operational plans and relevant documents that were studied during the investigation.

- Damen Shiprepair Rotterdam
  - Health, Safety and Environment Manual *Handboek Arbo en Milieu*
  - Docking procedure
- Rotterdam-Rijnmond Regional Maritime Pilots Corporation
  - (Electronic) Vademecum
  - Exceptional Transports Checklist
- International Standard for Maritime Pilot Organisations (ISPO)
- Clients' Bridging Documents
- The International Association of Oil & Gas Producers (IOGP) – IOGP Report 423, HSE management – guidelines for working together in a contract environment
- IOGP Report 423-02 - Guide to preparing HSE plans and Bridging documents – Supplement to Report 423
- International Marine Contractors Association (IMCA) – IMCA M203 Guidance on simultaneous operations (SIMOPS) RP 0.3 14 Dec 2023
- The International Organization for Standardization (ISO) 31010 – Annex B6 – Hazard and operability study
- Bridge Resource Management;
  - ICS Bridge Procedures Guide, 6th edition, January 2022 – ISBN 978-1-913997-07-6
  - The Nautical Institute's Bridge Team Management 2nd edition, 2004 - ISBN: 978-1-870077-66-8

APPENDIX D

Weather conditions

▼ *Table 5a + 5b: Wind readings Geulhaven and Rozenburg. Wd stands for wind direction and Ws stands for wind speed. (Source: DHMR, Port of Rotterdam)*

Geulhaven RP 10

TIME (UTC)	Wd1 RP10	Wv1 RP10
10.20:07	180,5	7,83
10.20:19	184,2	7,79
10.20:31	186,4	7,73
10.20:43	185,7	7,23
10.20:55	186,3	6,66
10.21:07	186	6,10
10.21:19	187,6	5,50
10.21:31	186,3	5,19
10.21:43	186,5	5,63
10.21:55	187,3	6,18
10.22:07	186,8	6,60
10.22:19	184,9	6,90
10.22:31	186,1	7,34
10.22:43	187,6	7,21
10.22:55	187,2	7,19
10.23:07	188,3	7,65
10.23:19	187,8	7,96
10.23:31	187,1	7,85
10.23:43	185	7,83
10.23:55	185,7	7,81
10.24:07	185,8	7,46

TIME (UTC)	Wd1 RP10	Wv1 RP10
10.24:19	185,8	7,26
10.24:31	186,1	7,23
10.24:43	186,4	7,30
10.24:55	185,1	6,93
10.25:07	183,5	6,74
10.25:19	184,2	6,64
10.25:31	185,1	6,76
10.25:43	186,7	6,74
10.25:55	187,7	6,82
10.26:07	186,5	6,70
10.26:19	187,7	7,03
10.26:31	186,2	7,38
10.26:43	184,7	7,87
10.26:55	182,7	8,47
10.27:07	180,7	8,53
10.27:19	181,8	8,55
10.27:31	183,3	8,08
10.27:43	184,2	8,18
10.27:55	185	7,89
10.28:07	185,4	8,18
10.28:19	184,1	8,25

Veerstoep Rozenburg

TIME (UTC)	Wd1 RP10	Wv1 RP10
10.20:07	184,9	4,89
10.20:19	186,8	5,05
10.20:31	185,7	5,32
10.20:43	186,6	5,47
10.20:55	184,7	5,91
10.21:07	189,1	5,99
10.21:19	189	5,65
10.21:31	192,3	5,65
10.21:43	192,8	5,60
10.21:55	190,3	5,02
10.22:07	186,2	4,63
10.22:19	185,9	4,69
10.22:31	184	4,32
10.22:43	180,7	3,92
10.22:55	184,3	4,14
10.23:07	186	4,58
10.23:19	185,1	4,75
10.23:31	184,6	5,10
10.23:43	187,1	5,50
10.23:55	184,7	5,65
10.24:07	183,8	5,65
10.24:19	185	5,53
10.24:31	185,1	5,47
10.24:43	185,7	5,44
10.24:55	188,9	5,44
10.25:07	189,4	5,13
10.25:19	189,4	4,99
10.25:31	191,3	5,29
10.25:43	189,6	5,62
10.25:55	187,5	6,04
10.26:07	187,9	6,64
10.26:19	188	7,03
10.26:31	190,8	6,74
10.26:43	190,5	6,46
10.26:55	189,8	6,12
10.27:07	189,6	5,91
10.27:19	188,9	5,60
10.27:31	183,3	5,15
10.27:43	184,5	5,16
10.27:55	183,6	4,97
10.28:07	183,1	4,88
10.28:19	183,9	5,00

At a distance of 1.6km to the east, the Port of Rotterdam has a wind gauge designated 'Geulhaven RP 10'.

At a distance of 4.2km to the north-west, there is also a wind gauge station designated 'Veerstoep Rozenburg'. This station provides nautical users with the same kind of wind readings as the 'Geulhaven RP 10' station.

Table 6: Beaufort wind force scale

Force	Description	(m/sec)	(kph)	Knots
0	Calm	0-0.2	0-1	<1
1	Light air	0.3-1.5	1-5	1-3
2	Light air	1.6-3.3	6-11	4-6
3	Gentle breeze	3.4-5.4	12-19	7-10
4	Gentle breeze	5.5-7.9	20-28	11-16
5	Fresh breeze	8.0-10.7	29-38	17-21
6	Strong breeze	10.8-13.8	39-49	22-27
7	Near gale	13.9-17.1	50-61	28-33
8	Gale	17.2-20.7	62-74	34-40
9	Strong gale	20.8-24.4	75-88	41-47
10	Storm	24.5-28.4	89-102	48-55
11	Violent storm	28.5-32.6	103-117	56-63
12	Hurricane	>32.6	>117	64+

APPENDIX E

Parties involved
Paragraph 2.3.2 lists and describes the main parties involved. This appendix provides a more detailed description of these parties and the extent of their involvement.

Saipem
Saipem S.p.A. is an Italian company primarily engaged in the construction and maintenance of offshore infrastructure. For this, it has a fleet of work vessels available, including the crane vessel.

Damen Shiprepair Rotterdam
Damen Shiprepair Rotterdam is a shipyard in Rotterdam-Botlek where maintenance and repair work is carried out on seagoing vessels. It specialises in offshore vessels and structures, such as the crane vessel and the jack-up drilling rig involved in the present investigation. Dock 7 is located within the shipyard site. This is one of the largest docks in northwest Europe and the only available dock in the Netherlands large enough for the crane vessel in question.

Dock 7
Dock 7 is 405 metres long by 90 metres wide, with a depth of 11 metres. The beam of the crane vessel is 87 metres. For docking, the thickness of the fenders needed to be added. These were suspended from the vessel to protect the dock and the crane vessel. That ultimately left 50 centimetres of space between the dock and the crane vessel on each side of the dock.

A vessel is positioned on keel blocks to provide sufficient support for it when the dock is pumped dry. The blocks are positioned prior to the vessel entering the dock. For that to be done, the dock needs to be dry. The keel blocks are not fastened firmly in place because they need to be positioned differently for each vessel, a process that is time-consuming. If a vessel were to enter the dock using its own propulsion, the water displaced by its propellers might force the blocks out of position or overturn them. Docking therefore takes place with the aid of tugs and docking lines, which run from winches around the dock.

Calculations in the docking procedure showed that the water level needed to be at least 80 cm above NAP to ensure there would be at least 50 cm of water between the hull and the top of the keel blocks.

Dutch Pilotage Service
When operating in waters where pilotage is mandatory, ocean-going vessels must avail themselves of the services of a pilot. This is laid down in a ministerial order, namely the Compulsory Pilotage Decree. The Dutch Pilotage Service is the sole party in the Netherlands that is authorised to provide pilotage services. The crane vessel involved in this occurrence is a vessel for which pilotage is mandatory. Pilotage is also mandatory for the waters of the harbour where the shipyard is located. For the purpose of docking the crane vessel, its owner engaged a pilot via the shipping company's agent. The Pilotage Service provided a pilot who met the training and experience requirements set by the Pilotage Service itself. That pilot was present from the initial discussions on 15 February 2024.

Exceptional operations, such as escorting a very large crane vessel that is going to dock in city waters, are carried out by City pilots. The view of the Pilotage Service is that a second pilot with an NMS should accompany exceptional transports.

Fairplay Towage
The Fairplay Towage Group operates, among other things, a fleet of harbour tugs in various European ports, including Rotterdam. The company was contracted by the owner of the crane vessel via the shipping company's agent to assist in docking the crane vessel. The tug company was involved in all the preliminary consultations prior to the docking operation.

KRVE (linesmen)
The KRVE linesmen association is the organisation charged with mooring and unmooring seagoing vessels in the Rotterdam harbours. During the occurrence, a large number of linesmen were involved, both on the quayside, on various launches, and on the floaters of the crane vessel. They assisted in unmooring the crane vessel from quay 4, attaching the tugs, and securing the docking lines. In doing so, they maintained walkie-talkie contact with the pilot via the work channel. The working language was Dutch.

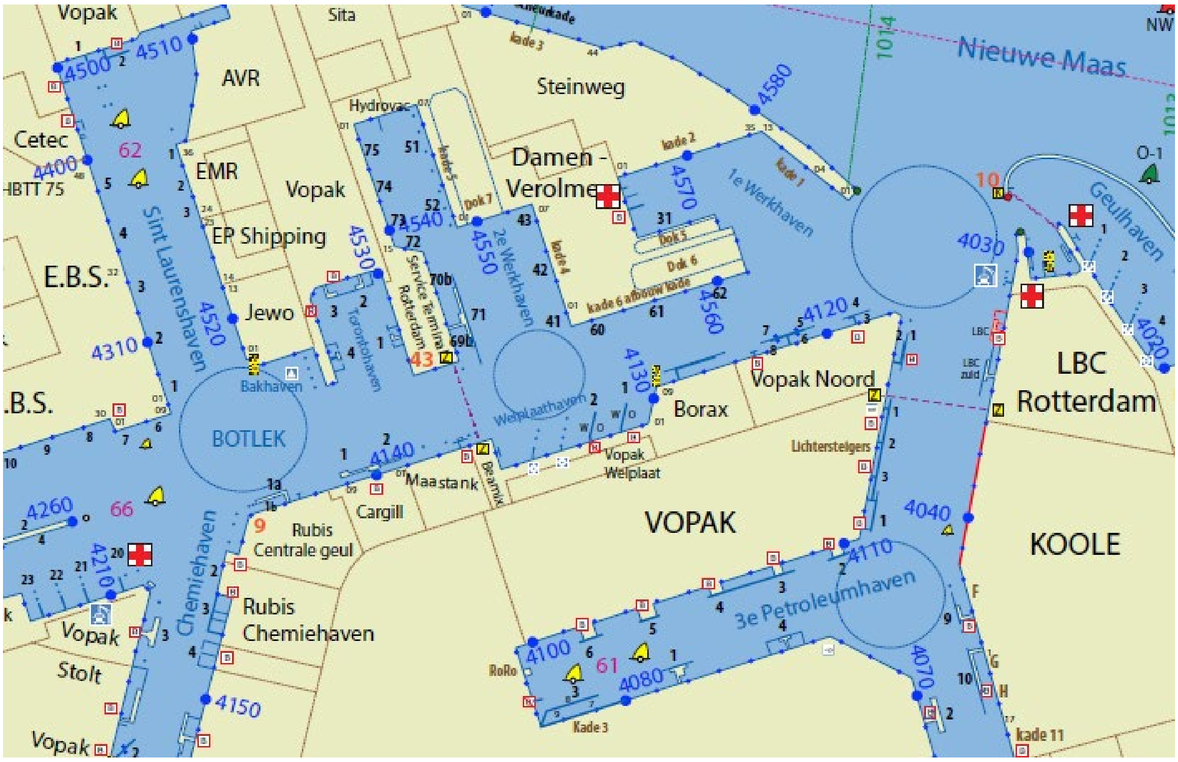
The KRVE was engaged by the owner of the crane vessel via the shipping company's agent. Representatives of KRVE attended all the preliminary discussions.

Port of Rotterdam Authority
The Port of Rotterdam Authority is the manager, operator, and developer of the Rotterdam port and industrial area. It is a public limited liability company with two shareholders, the City of Rotterdam (70.8%) and the Dutch State (29.2%).

Rotterdam Harbour Master's Division (DHMR)
Within the Port of Rotterdam Authority, the DHMR takes care of safety. To that end, the DHMR performs a number of public law tasks for which the powers of the State and some municipalities have been transferred to the Harbour Master. In this regard, it works with pilots, tug services, linesmen, terminals, and other partners within the port.

The DHMR was involved in all the preliminary discussions, specifically based on its role as manager. If docking has implications for nautical safety, the DHMR may, for example, deploy a harbour patrol boat to guide other water traffic. The 2nd Werkhaven forms part of the Botlek Harbour and is not located directly on the main navigation channel, so there is no through traffic. This can also be seen in Figure 18, a printout of a map of the 2nd Werkhaven. Because of the location of the 2nd Werkhaven, the DHMR did not anticipate any traffic flow problems and no patrol vessel was deployed.

In the 2nd Werkhaven and opposite quay 4 of the shipyard is the Service Terminal Rotterdam, a tank storage and transfer company for bunker oil. Berth STR 71 is situated opposite quay 4. When a vessel is moored there, it restricts the manoeuvring space for vessels wishing to enter or leave dock 7. The Port Authority has therefore imposed a restriction stating that no vessel with a beam greater than 32 metres is permitted to be berthed at this quay while docking and undocking are taking place. When the crane vessel was being docked in, berth STR 71 was vacant.



▲ *Figure 18: Overview of the harbours around the shipyard. (Source: DHMR)*

Noble Corporation
Noble Corporation is an international company operating in the oil and gas industry, particularly in the field of drilling technology and offshore drilling services. It provides offshore oil and gas well drilling services, particularly in deep-sea waters. Noble has a fleet of drilling rigs, including semi-submersible drilling rigs and jack-up drilling rigs.

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