



Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Federal Higher Authority subordinated to the Ministry
of Transport and Digital Infrastructure

Investigation Report 118/18

Less Serious Marine Casualty

Allision between VOS STONE and a wind turbine on 10 April 2018 in the Baltic Sea

10 April 2019

This investigation was conducted in conformity with the Law to improve safety of shipping by investigating marine casualties and other incidents (Maritime Safety Investigation Law – SUG). According to said Law, the sole objective of this investigation is to prevent future accidents. This investigation does not serve to ascertain fault, liability or claims (Article 9(2) SUG).

This report should not be used in court proceedings or proceedings of the Maritime Board. Reference is made to Article 34(4) SUG.

The German text shall prevail in the interpretation of this investigation report.

Issued by:
Bundesstelle für Seeunfalluntersuchung – BSU
(Federal Bureau of Maritime Casualty Investigation)
Bernhard-Nocht-Str. 78
20359 Hamburg
Germany



Director: Ulf Kaspera
Phone: +49 40 3190 8300
posteingang-bsu@bsh.de

Fax: +49 40 3190 8340
www.bsu-bund.de

Table of Contents

1	SUMMARY.....	6
2	FACTUAL INFORMATION.....	7
	2.1 Photograph of the ship	7
	2.2 Ship particulars.....	7
	2.3 Voyage particulars.....	8
	2.4 Marine casualty or incident information	9
	2.5 Shore authority involvement and emergency response.....	11
	2.6 Definitions.....	11
3	COURSE OF THE ACCIDENT AND INVESTIGATION	14
	3.1 Course of the accident	14
	3.2 Damage.....	18
	3.3 Investigation	22
	3.3.1 Course of the accident	22
	3.3.2 Technology and processes	24
	3.3.2.1 Switching DP	25
	3.3.2.2 Equipment and maintenance.....	26
	3.3.2.3 Training and process organisation	26
4	ANALYSIS.....	28
	4.1 Environmental conditions	28
	4.2 Communication	28
	4.3 Knowledge.....	29
5	CONCLUSIONS.....	31
6	ACTIONS TAKEN	32
7	SOURCES	34
8	ANNEX.....	35

Table of Figures

Figure 1: Photograph of the ship	7
Figure 2: Scene of the accident.....	9
Figure 3: Scene of the accident in magnified extract of Navigational Chart 61.....	10
Figure 4: Initial situation at 1047.....	14
Figure 5: Picture of the ship's bridge	15
Figure 6: Initial situation at 1053.....	16
Figure 7: Situation at about 1055.....	16
Figure 8: Situation at about 1059.....	17
Figure 9: Situation at about 1101.....	18
Figure 10: Allision between the shipboard crane and flange deck.....	19
Figure 11: Damage to the nitrogen cylinder.....	19
Figure 12: Shipboard crane before and after the allision	20
Figure 13: Damage to the outer wall of a cabin	21
Figure 14: Damage to the superstructure	21
Figure 15: Points of impact on the platform	21
Figure 16: First allision	23
Figure 17: Second allision	24
Figure 18: Options for controlling the ship.....	24
Figure 19: Switching procedure 1	25
Figure 20: Switching procedure 2.....	25
Figure 21: Internal checklist in case of collision.....	29
Figure 22: Personal checklist.....	30
Figure 23: Flowchart showing the course of the accident.....	35
Figure 24: Emergency notification chart	36

Table of acronyms used

Acronym	Definition
1/O	Chief officer/mate
2/O	Second officer/mate
AOWF	Arkona Offshore Wind Farm
Autopos	Automatic positioning
AWE	Arkona-Windpark Entwicklungs-GmbH
C/O	Chief technical officer
cJoy	Compact joystick
DP	Dynamic positioning
DPO	DP officer (officer in charge of the navigational watch specialised in the use of DP)
ENC	Emergency notification chart
IJS	Independent joystick
IMCA	International Marine Contractors Association (trade association of the shipbuilding industry)
OCM	Offshore construction manager
OOW	Officer on watch
QHSE	Quality, health, safety, and environment
SDPO	Senior dynamic positioning officer
SOV	Supply offshore vessel
TP	Transition piece (foundation pillar of a wind turbine)
VBMS	Company name (Volker Wessels Boskalis Marine Solutions Holding B.V.)
VDR	Voyage data recorder
VOS	Vroon Offshore Services

1 SUMMARY

At 1106¹ on 10 April 2018, the offshore supply vessel VOS STONE struck a wind turbine under construction. The ship and platform were damaged and three people on board suffered minor injuries. There was no environmental pollution. The VOS STONE had to be repaired in a shipyard.

Due to deteriorating weather conditions, the ship collected fitters from TP AB01, a wind turbine under construction on the AOWF (also known as Arkona Becken Südost) in the Baltic Sea, where she was operating on behalf of VBMS and intended to leave the area again. Just minutes after casting off from TP AB01, the master decided to test an emergency control system, which resulted in the loss of control of the ship. The wind and waves pushed the VOS STONE back against TP AB01. The 1/O regained control of the ship shortly before the collision but there was no longer sufficient time to prevent it.

The platform sustained minor damage. Three crew members on board the VOS STONE suffered minor injuries as a result of the impact. The damage to the ship was so bad that she had to call at a shipyard.

¹ Unless stated otherwise, all times shown in this report are local = UTC + 2 (CEST).

2 FACTUAL INFORMATION

2.1 Photograph of the ship



Figure 1: Photograph of the ship

2.2 Ship particulars

Name of ship:	VOS STONE
Type of ship:	Offshore supply vessel
Nationality/Flag:	Netherlands
Port of registry:	Breskens
IMO number:	9730517
Call sign:	PBMW
Owner:	Vroon Offshore Services B.V.
Year built:	2017
Shipyard/Yard number:	Fujian Southeast Shipbuilding, China
Classification society:	Lloyds Register
Length overall:	80.0 m
Breadth overall:	18.40 m
Gross tonnage:	4965
Deadweight:	2348 t
Draught (max.):	5.80 m
Engine rating:	2X2400 kW
Main engine:	MAK
(Service) Speed:	13 kts
Hull material:	Steel
Hull design:	Double bottom
Minimum safe manning:	7

2.3 Voyage particulars

Port of departure:	Mukran
Port of call:	Mukran
Type of voyage:	Merchant shipping/ international
Cargo information:	No cargo
Manning:	23
Draught at time of accident:	5.80 m
Pilot on board:	No
Canal helmsman:	No
Number of passengers:	16

2.4 Marine casualty or incident information

Type of marine casualty:	Less serious marine casualty Allision with wind turbine under construction
Date, time:	10/04/2018, 1106
Location:	AOWF (in Adlergrund)
Latitude/Longitude:	ϕ 54°48.578'N λ 014°10.718'E
Ship operation and voyage segment:	Casting off/harbour mode
Place on board:	Superstructure on fore section; crane at stern
Consequences (for people, ship, cargo, environment, other):	Three crew members suffered minor injuries; port side superstructure torn open and aft crane damaged

Navigational Chart 61, Federal Maritime and Hydrographic Agency (BSH)

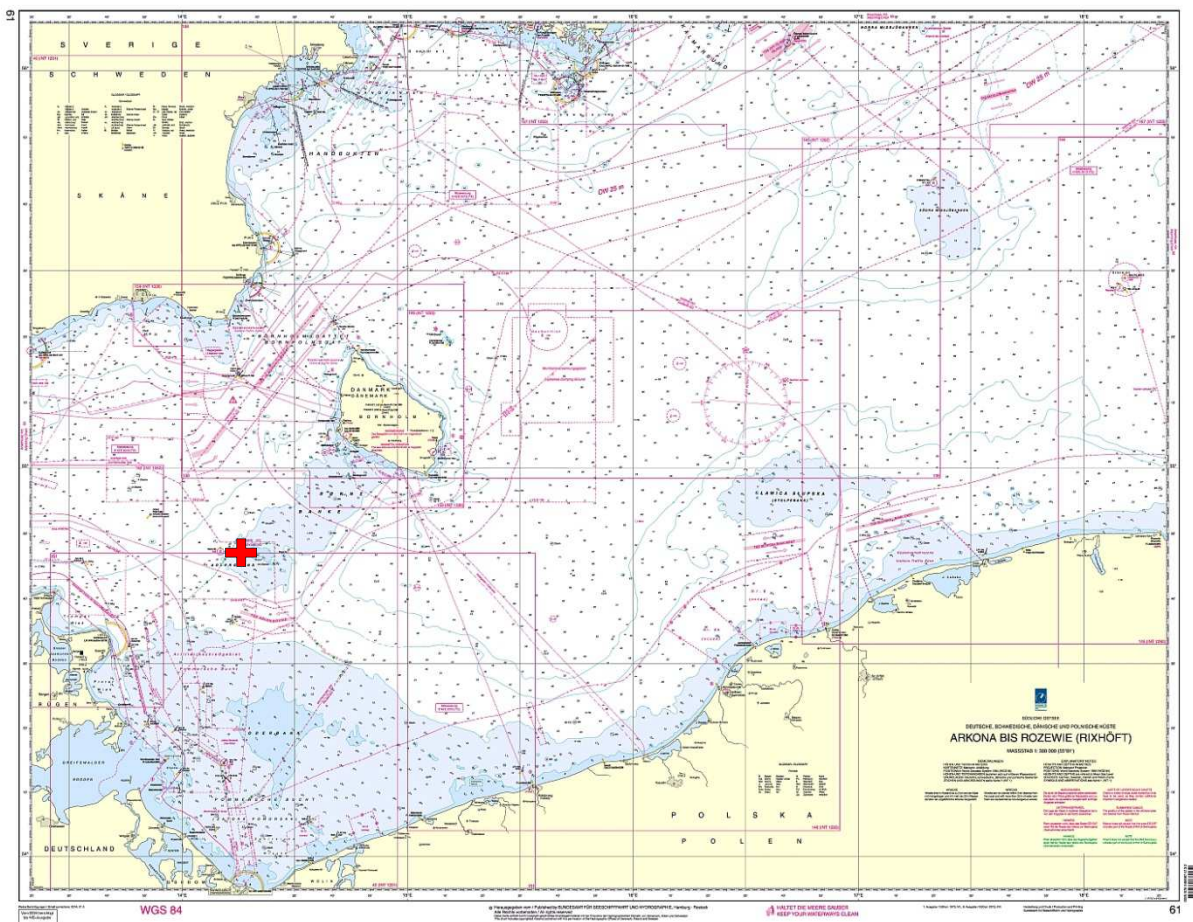


Figure 2: Scene of the accident

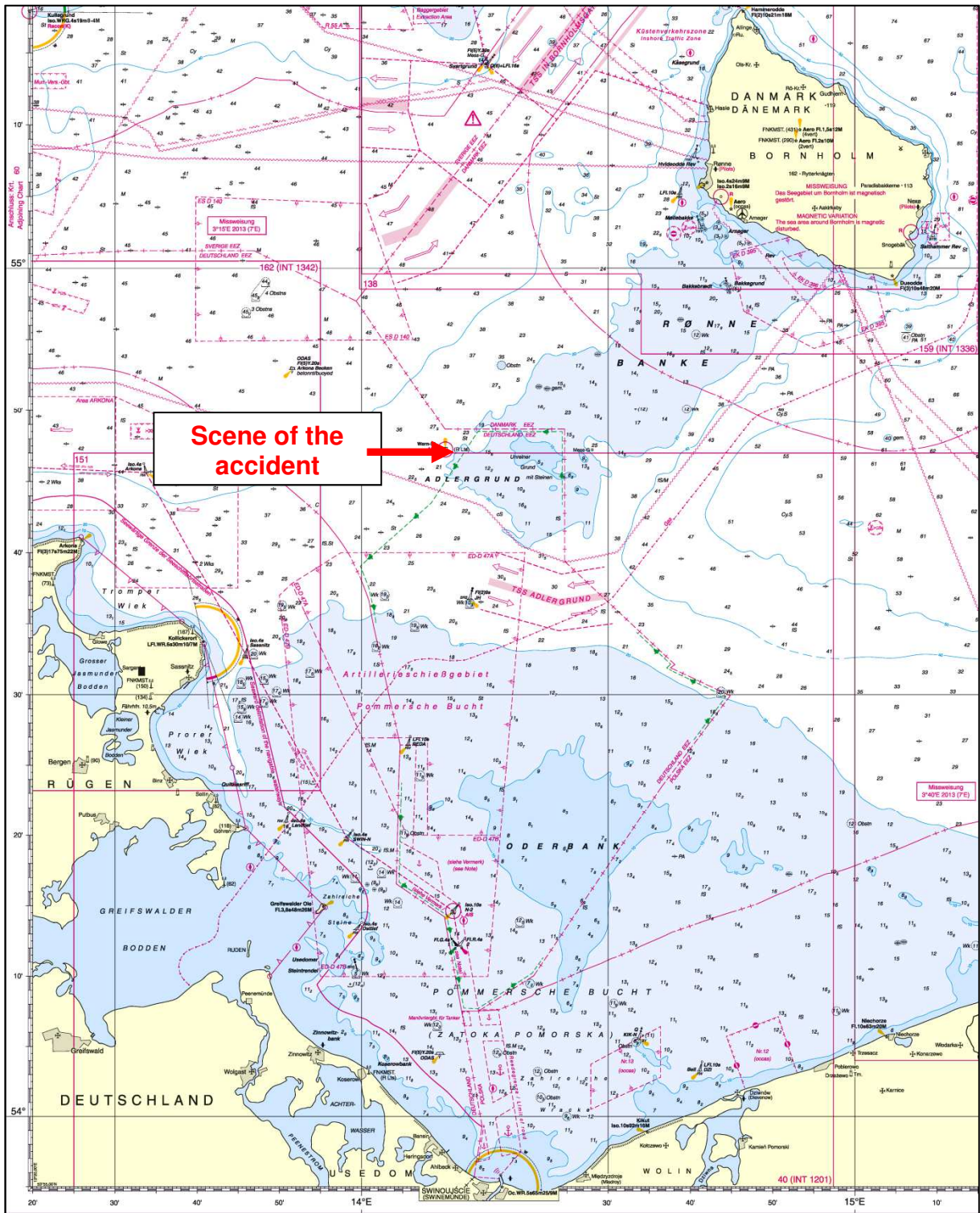


Figure 3: Scene of the accident in magnified extract of Navigational Chart 61

2.5 Shore authority involvement and emergency response

Agencies involved:	Maritime Rescue Coordination Centre (MRCC) Bremen, Danish Maritime Authority (DMA)
Resources used:	Helicopter
Actions taken:	Two injured crew members taken to a hospital in Greifswald by Helicopter
Results achieved:	The three crew members injured only suffered minor injuries; repairs to ship necessary

2.6 Definitions

Inter alia, the ship is equipped with a special navigation system due to her specific purpose. This so-called digital positioning system on the VOS STONE makes it necessary to begin by explaining some specific terminology. Accordingly, a substantive list follows:

Term	Explanatory notes
DP system	<p>Dynamic positioning is a computerised system which is used to maintain the position or course of a ship using her propellers and thrusters. Position reference sensors, combined with wind sensors, motion sensors and gyrocompasses, provide information to the computer pertaining to the ship's position and the magnitude and direction of environmental forces necessary to maintain the ship's position.</p> <p>The computer program contains a mathematical model of the ship, which takes into account the information on wind and current drag, as well as the position of the thrusters. Using this and the sensor information, the computer is able to calculate the required steering angle and the output for the thrusters. This allows operations at sea where mooring or anchoring is not feasible due to deep water, objects on the seabed (pipelines, wellheads) or other problems.</p> <p>Dynamic positioning may either be absolute in that the position is locked to a fixed point over the seabed or relative to a moving object like another ship or a submersible. The ship may also be positioned at a favourable angle to wind, waves and current (weathervaning).</p>

	<p>The system consists of the basic software (software dynamic positioning – SDP), a DP controller, a DP logger, a SDP database, as well as the stationary devices and the cJoy and cWing mobile control panels and can be operated in the following modes:</p> <ol style="list-style-type: none"> 1) Joystick (cJoy) 2) Auto heading 3) Auto position 4) Mixed joystick/auto 5) Follow target 6) Anchor assist 7) Autopilot 8) ROT pilot 9) Auto track 10) Track line <p>These are described in more detail below.</p>
<p>1.) cJoy</p>	<p>The cJoy control panel acts as the main operator interface.</p> <p>It can also be used as an additional joystick panel for the cPos (compact dynamic positioning system) and SDP parts of a DP system.</p> <p>The panel is intuitive and provides user-friendly access for keeping position and operating with automatic steering.</p>
<p>2.) Auto heading</p>	<p>The auto heading mode keeps the ship in the position set for the longitudinal direction automatically.</p>
<p>3.) Auto position</p>	<p>The auto position mode keeps the ship in the position set automatically.</p>
<p>4.) Mixed joystick/auto</p>	<p>The mixed joystick/auto mode allows the operator to select automatic control of either one or two of the surge, sway and yaw axes.</p>
<p>5.) Follow target</p>	<p>The system follows a chosen moving target automatically.</p>

6.) Anchor assist	The system permanently monitors the anchor position, using thruster assistance to maintain it.
7.) Autopilot	The autopilot mode enables the ship to steer on a predefined course automatically.
8.) ROT pilot	In ROT pilot mode, the ship alters course at the predefined rate of turn.
9.) Auto track	The auto track modes (low-speed, move-up and high-speed) allow the ship to follow a specified track described by a set of waypoints. All auto track modes are only for operations at sea and may not be used for navigation purposes.
10.) Auto/track line	The track line mode enables the ship to follow a constant course over ground. The track line mode is only for operations at sea and may not be used for navigation purposes.
cWing	The cJoy outdoor panel cWing (compact/control from the wing) is a remote control panel for cJoy systems. The panel is designed for outdoor installation. The cJoy outdoor panel provides the operator with the necessary functions to control a ship in joystick and autopilot modes.
IJS	Unlike the joystick system, the IJS is not part of the DP system. The IJS has its own thruster and sensor interfaces. The IJS is used both as a backup system in a DP-S or a ship of a higher category and as a separate system on ships not requiring comprehensive DP functions.
Manual control	Manual control ²

² See section 3.3.2 for additional explanatory notes.

3 COURSE OF THE ACCIDENT AND INVESTIGATION

3.1 Course of the accident

On the morning of 10 April 2018, the offshore supply vessel VOS STONE was operating in the AOWF at TP AB01, a wind turbine under construction. At about 1020, the VBMS tower work team, which was making the preparations necessary for feeding the cable on TP AB01, was called back to the VOS STONE due to deteriorating weather conditions. The return to the ship was carried out by means of an Ampelmann gangway and was completed at 1047 (see Figure 4).

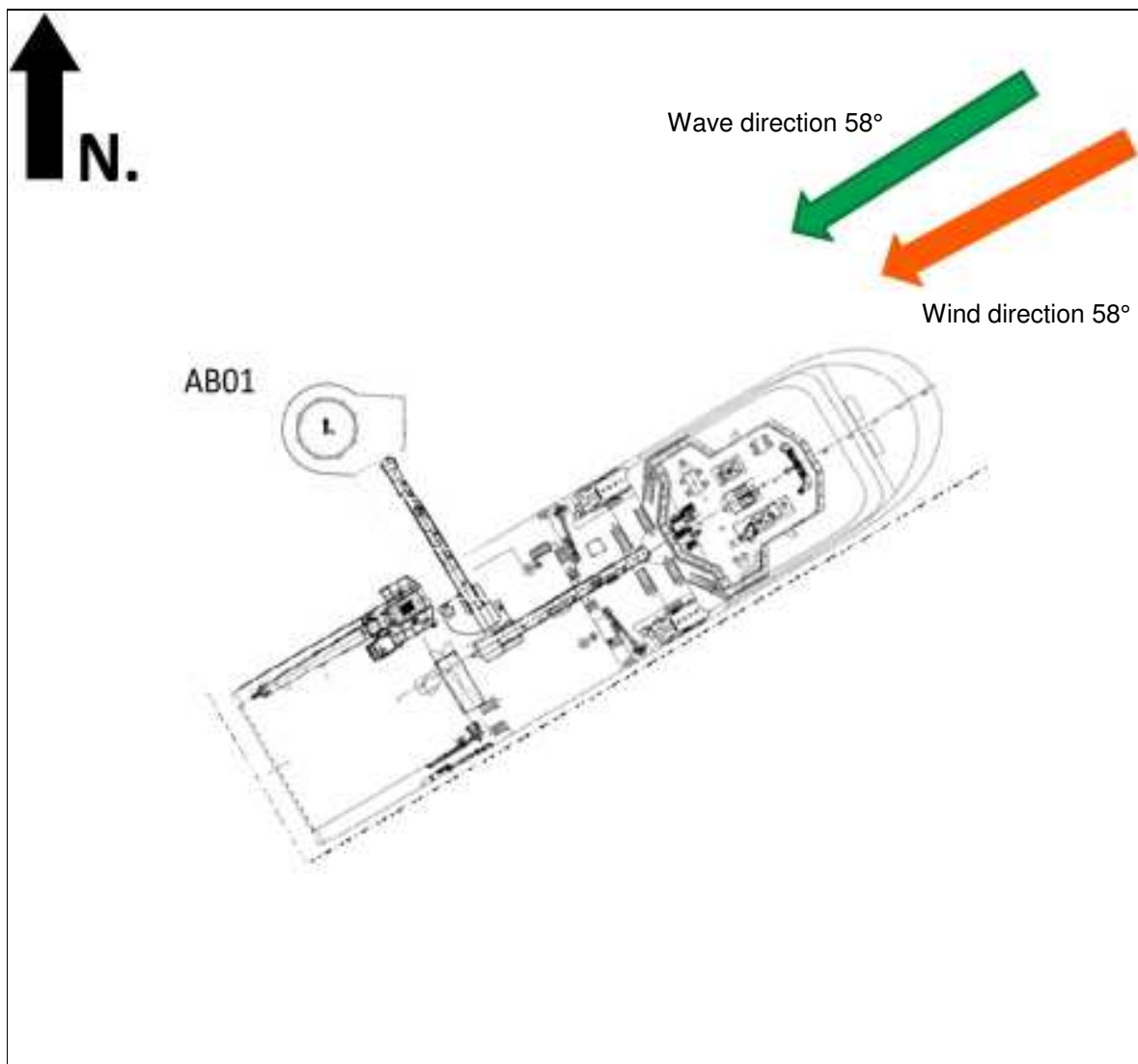


Figure 4: Initial situation at 1047

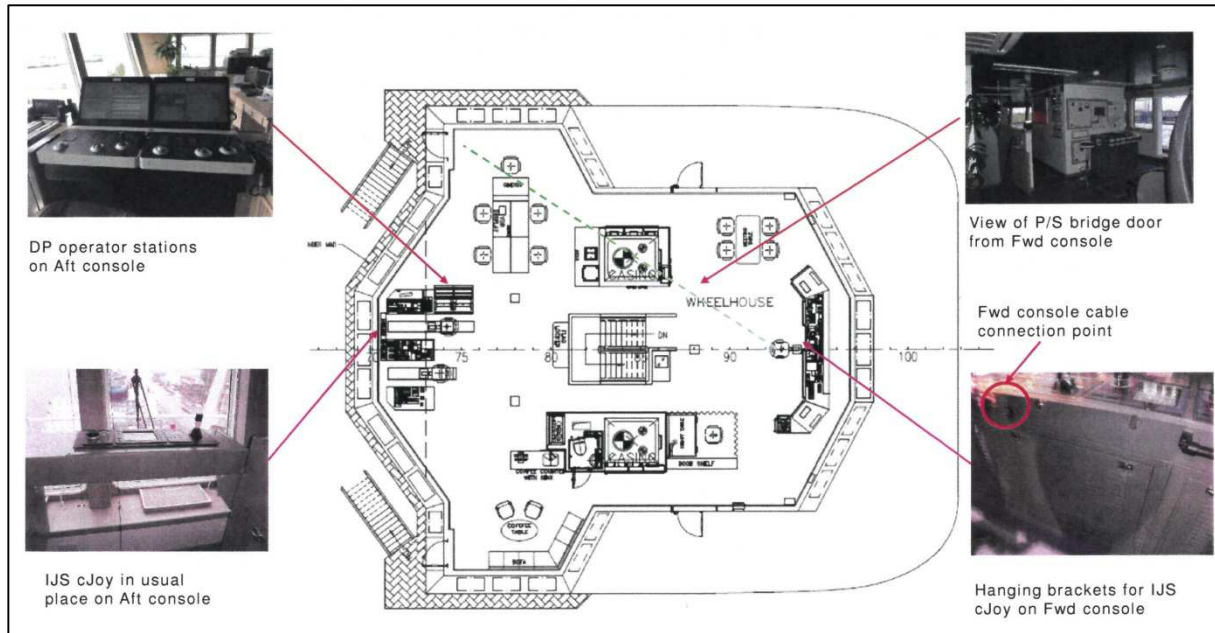


Figure 5: Picture of the ship's bridge

At 1047, the ship left the transition piece (AB01) under DP. The following people were on the bridge at this point: 1/O in the role of OOW/SDPO and 2/O in the role of DPO. After the Ampelmann gangway team had reported to the bridge that all workers were back on the ship and the completion of the personnel transfer, the 1/O instructed the 2/O to manoeuvre the ship away from TP AB01 and out of the area under DP (see Figure 6).

The 1/O observed the manoeuvre until he was satisfied that the 2/O had implemented his instruction correctly and then went to the other side of the bridge to carry out a shift handover at the port and aft entrance to the bridge and to discuss the scope of work with the two crane operators (see Figure 7).

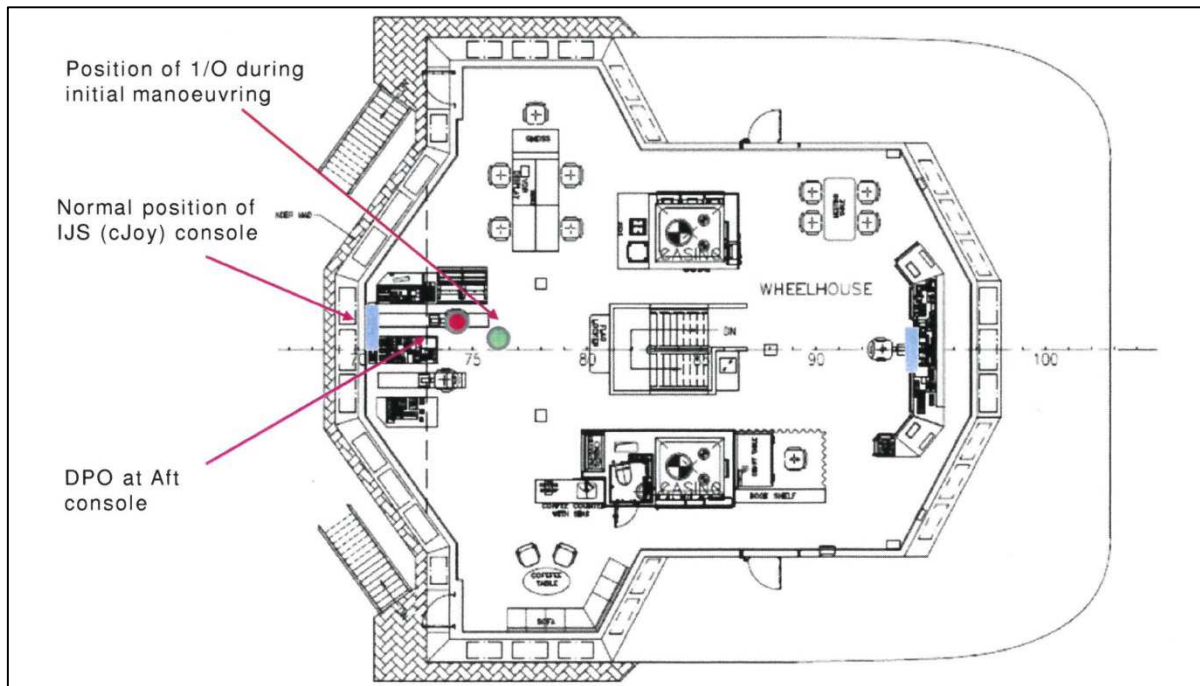


Figure 6: Initial situation at 1053

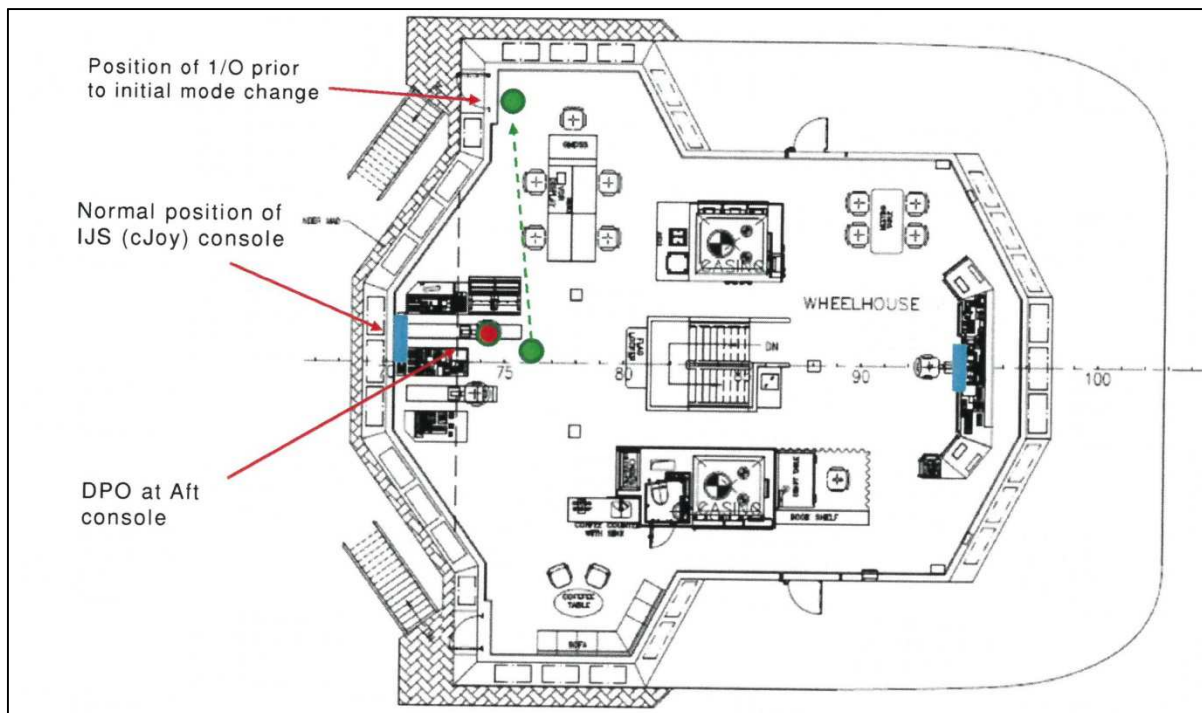


Figure 7: Situation at about 1055

At this point, the master returned to the bridge to enable and test the IJS cJoy at the forward control position. He did not notify the OOW of this. After the connection with the console had been established, he instructed the 2/O, from his position at the aft control position, to switch from DP to the IJS cJoy. However, since the 2/O was not sure how to switch over, he brought the ship to a standstill using DP, while the

master proceeded to the aft control position to show the 2/O the switch in question. The master switched the selector from DP to cJoy before returning to the forward control position (see Figure 8).

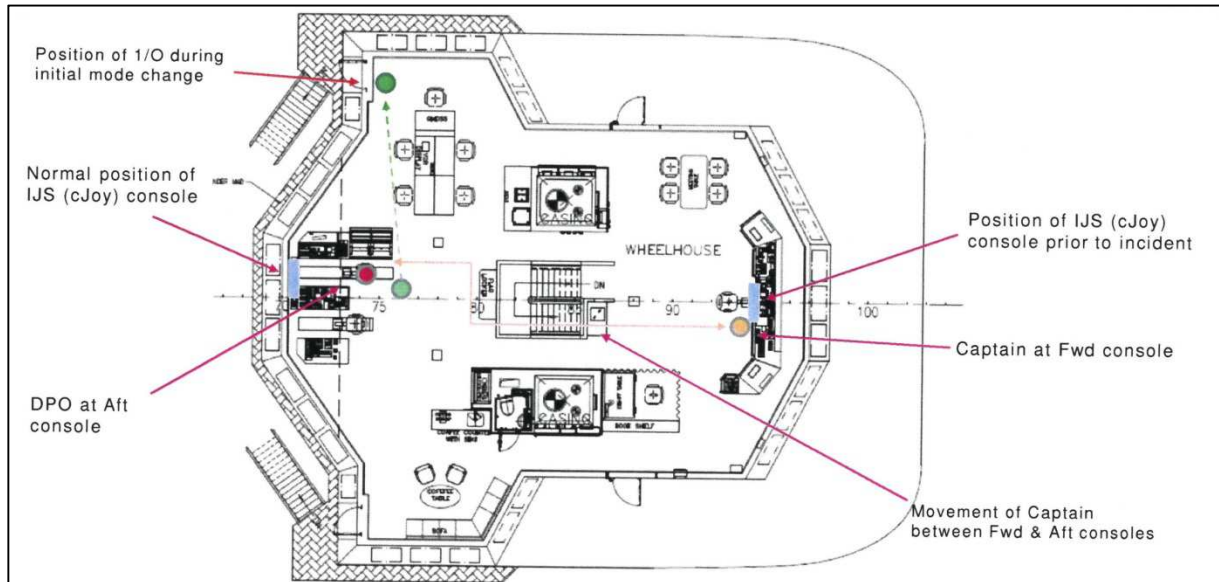


Figure 8: Situation at about 1059

After this switch over, the DP system was disabled, as was the thruster control, resulting in the ship drifting in a north-easterly wind (wind speed about 28 kts) at a distance of about 119 m from TP AB01 (see Figure 4). The motion of wind and waves had already turned the ship back toward the TP when the master, after going from the aft console to the forward edge of the bridge, tried to take control by means of the IJS cJoy, albeit unsuccessfully. He then requested assistance, at which the 1/O went to the master's position and attempted to enable the IJS. However, he only succeeded in doing this just before the first allision.

It was not possible to regain control immediately because after switching from DP to cJoy manually it would have been necessary to access the IJS menu screen and then select the individual thrusters.

Unlike transferring at the joystick on the DP operator stations, which would have made it possible to continue accessing the ship's thrusters and sensors with DP at the touch of a button, switching the manual selector for the control mode to the IJS (which is basically a backup system for thruster control and not affected by DP) isolated the ship from DP control.

After the master failed to regain control of the thrusters, he requested assistance. The 2/O notified the 1/O and asked him to assist the master at the forward console. The 1/O hurried to assist and attempted to take manual control by asking the 2/O to transfer control from the aft DP station. The master instructed the 2/O to switch to manual operation, but the latter did not understand or hear this instruction and switched the selector back to DP.

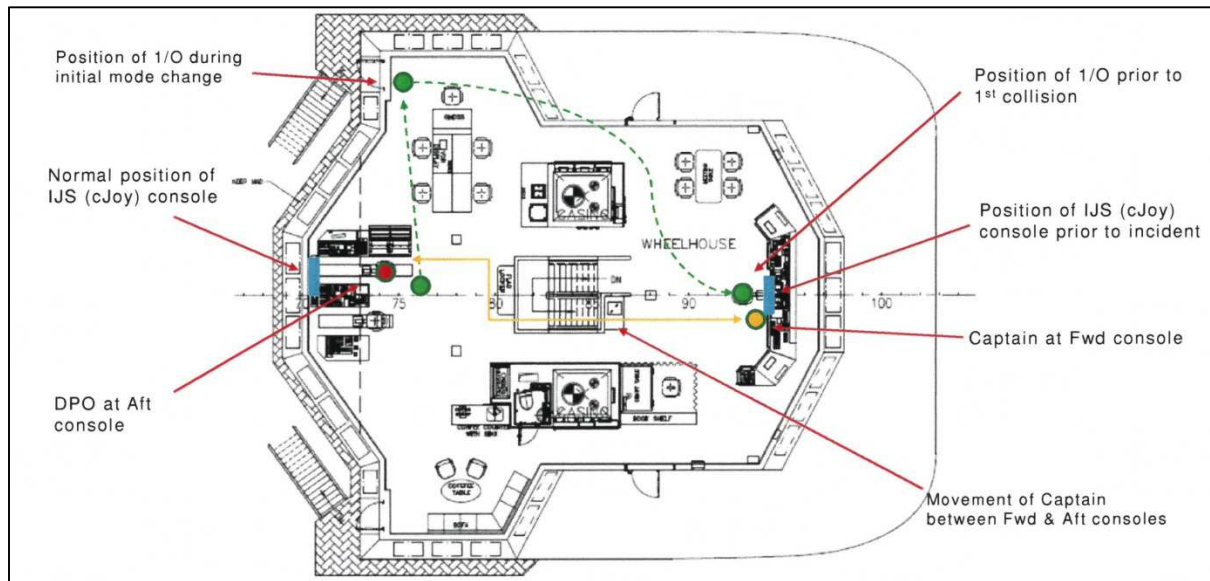


Figure 9: Situation at about 1101

At this point, the master wanted to know who was steering and went to check. He found that DP mode was selected and switched back to manual mode just before the first collision. The first collision happened at about 1102 when the VOS STONE's upper port bulkhead struck the outer edge of the external platform of the TP on AB01, resulting in damage to the hull level with the crew's living quarters on the port side and thus at three empty cabins. The force of the impact lifted the support bolts of the external platform on the flange deck out of their mounts and the deck rotated some 90° anticlockwise. The 1/O switched to full thrust at the forward steering console and turned the ship to port, so as to move the stern away from the TP (see Figure 9). A second collision nonetheless occurred at 1103, this time when the outer edge of the ship's crane platform struck TP AB01's external platform.

3.2 Damage

The evidence available suggests that there was no collision between the ship and the TP's actual primary structure but rather only between the external platform of the flange deck and bulkhead of the crew's cabins on the port side (see Figure 10 and Figure 11), and then subsequently with the handrails on the crane's maintenance platform. This is where the nitrogen cylinders for the crane's swell compensator are stored, resulting in damage to them and an ensuing release of nitrogen (see Figure 12). The handrails that were already bent caused damage to the TP's coating. As the ship continued to move forward, the swell caused her to heel to port and the rear side of the crane jib struck the outer edge of the flange deck, causing the flange to rotate anticlockwise.

The impact caused TP AB01's external platform to rotate further by about 40° anticlockwise. The ship maintained her course and sailed out of the area.



Figure 10: Allision between the shipboard crane and flange deck



Figure 11: Damage to the nitrogen cylinder



Figure 12: Shipboard crane before and after the collision

Three crew members suffered injuries due to the collisions. One worker was on deck when the first collision occurred and while moving to the washer room, where he attempted to find shelter, the second collision occurred, causing him to fall against a container. Other crew members found him in the washer room and administered first aid.

The second engineer was walking through a door when the first collision occurred. Due to the impact, the door slammed shut and trapped one of his hands. The 2/O was responsible for administering first aid on board and dressed the second engineer's hand with a bandage.

The VOS STONE's steward was cleaning the cabins when the accident happened. By coincidence, he was in the cabin that sustained a torn outer wall during the first collision. After the steward initially stated that he reportedly had no physical injuries and was merely in a state of shock, he later felt pain in one knee, as well as in his head and neck.

Two of the three casualties were flown ashore by rescue helicopter for additional medical care as a precautionary measure. The medical examination at the hospital revealed that the injuries were only minor. The steward was discharged from hospital on 11 April 2018, the worker and second engineer on 12 April 2018 and went on leave.



Figure 13: Damage to the outer wall of a cabin

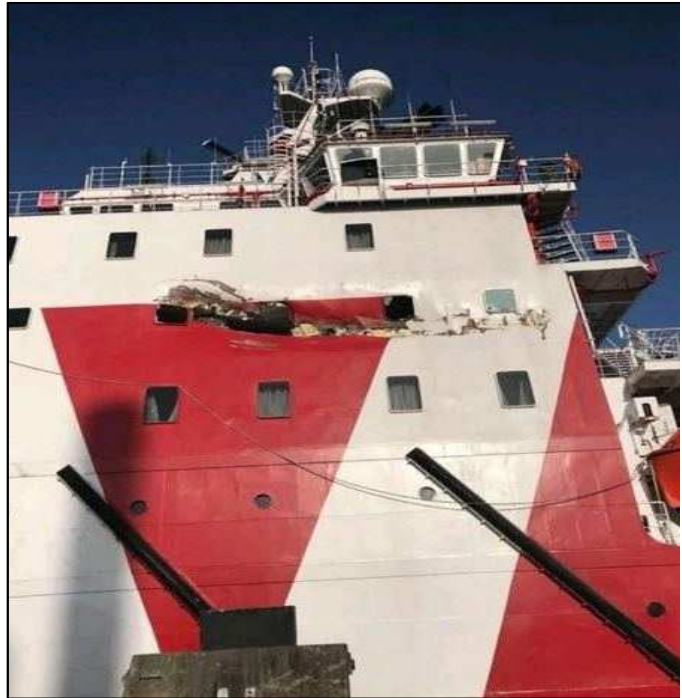


Figure 14: Damage to the superstructure

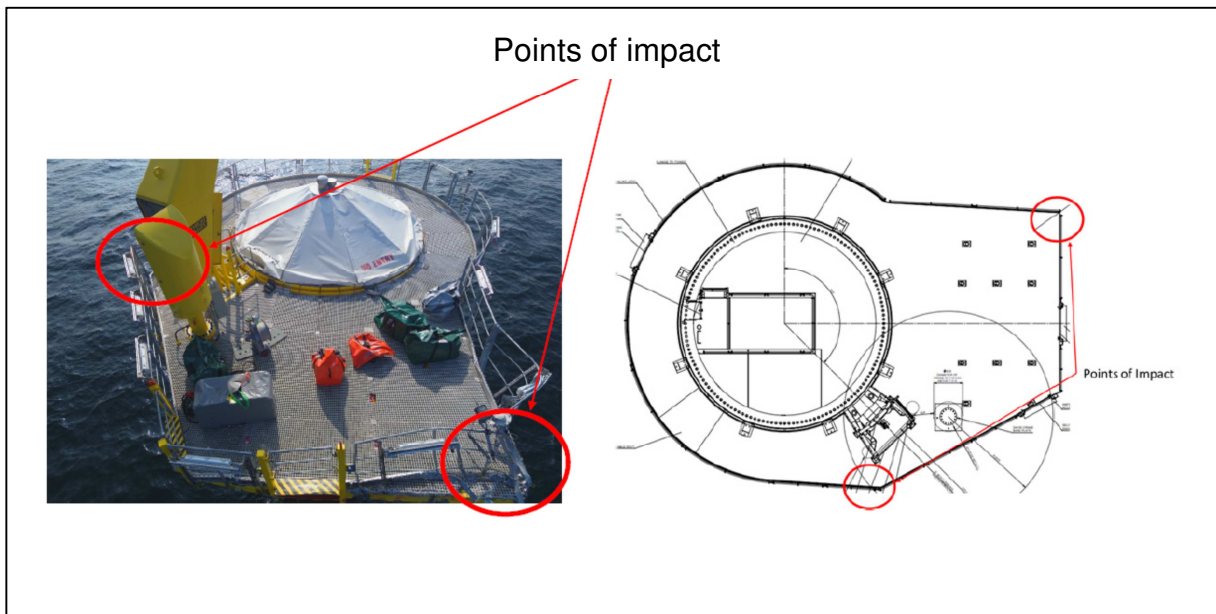


Figure 15: Points of impact on the platform

3.3 Investigation

The BSU had access to VDR recordings, AIS data from Marine Traffic, videos and photographs from the crew and their statements. The detailed internal investigation report of the operating company was particularly helpful.

3.3.1 Course of the accident

- 1020 Transfer of tower team from AB01 due to deteriorating weather conditions.
- 1053 Personnel transfer via Ampelmann completed – Ampelmann system moved to the resting position.
- 1053 Ship moves away from AB01 under DP.
- 1057 1/O confirms DP setup and course to 2/O (DPO). Crane operator at the bridge port side door for handover briefing with 1/O. Master returns to the bridge.
- 1059 Master switches from DP control to cJoy. Ship has no thruster enabled and drifts back toward TP AB01.
- As the ship was moving away from the TP, the master intended to switch to IJS (cJoy) on the forward navigation console and move out further using the joystick.
 - The master waited until the ship was about 80 m from the TP (it was actually about 119 m).
 - The master asked the 2/O (on the aft DP console, DPO) to switch to cJoy mode.
 - The 2/O (who had only been on board for two days) asked the master to show him how it worked. The master showed the 2/O how to switch the selector on the aft console to cJoy.
 - The master went forward again to operate – but could not enable the thrusters with – the IJS controls.
 - The master requested assistance and the 1/O tried to help him enable the thrusters, albeit unsuccessfully.
 - When the master realised they were moving closer to TP AB01, he issued instructions to switch to manual control.
 - (However, the 2/O understood "switch to DP.")
 - The astern command was then issued.
 - The manual control failed to respond. The master went to the switch and noticed that it had not been switched to manual operation but rather to DP.
 - The master switched back to manual operation.
 - The 1/O took charge of the manual control on the forward console and gave full thrust to port with an azipod, so as to avoid another allision with the crane. This was not possible due to the forward thrust, however.
- 1102 VOS STONE's first allision (port side) with TP AB01 at about 2.1 kts (see Figure 15).

- Manual control fully regained after the thrusters were enabled and synchronised (no speed, now with a thrust of 2.7 kts required for control).
- 1103 VOS STONE's second allision (crane) with TP AB01 (see Figure 15).
1112 VBMS's OCM entered bridge in the meantime and called VBMS's emergency number. He also arranged for the rating on watch to make an announcement to everyone on the ship:
"All crew members should proceed to the mess."
1123 One person initially missing; search on the ship for person is successful and everyone accounted for.
VOS STONE's master organises evacuation of casualties.
1140 Air rescue helicopter reaches VOS STONE.
1258 Bridge personnel breathalysed for alcohol. All results negative.
1341 Helicopter completes rescue mission and flies to nearest hospital on mainland.
1430 OCM briefs the crew on current status and other safety issues.

Figure 16 shows the ship's first allision (port side level with the cabins) with the TP. Although the thrusters had just been reenabled at this point, they did not have any effect. The VOS STONE's ahead speed was about 2.6 kts. The allision caused the platform to rotate about 90° anticlockwise.

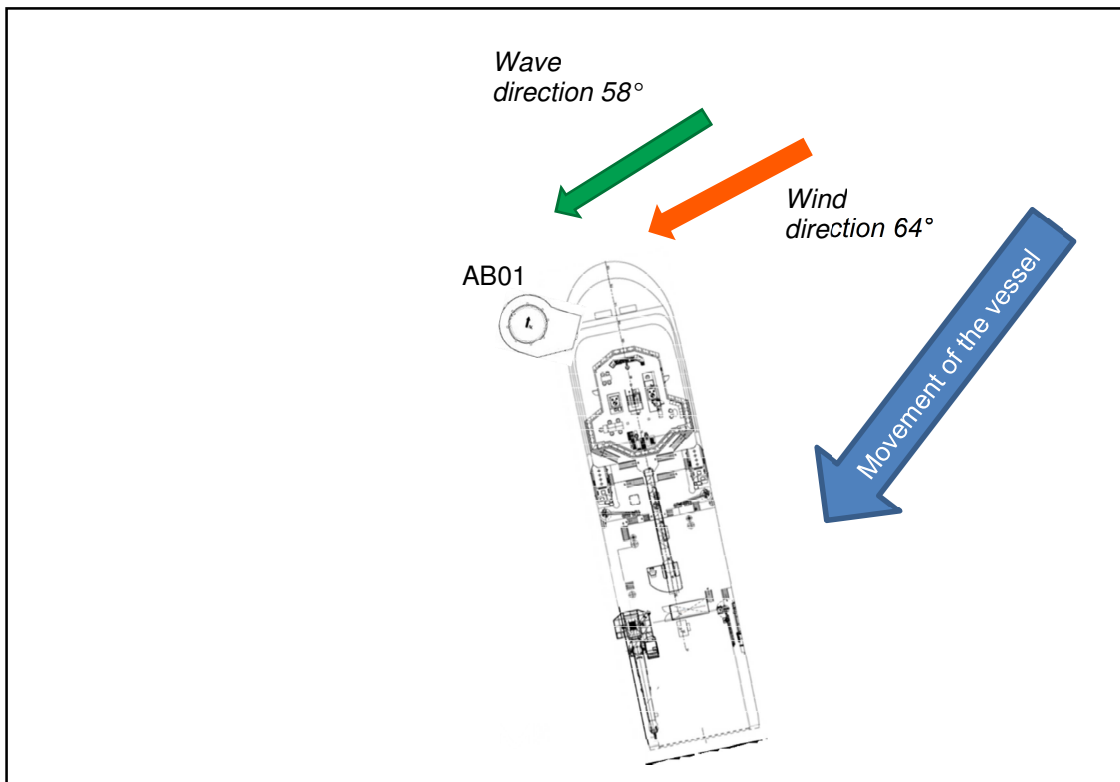


Figure 16: First allision

Figure 17 shows the second allision when the shipboard crane struck the TP at a speed of about 2.7 kts. Control of the thrusters had been regained shortly beforehand. This allision caused the platform to rotate a further 40° anticlockwise.

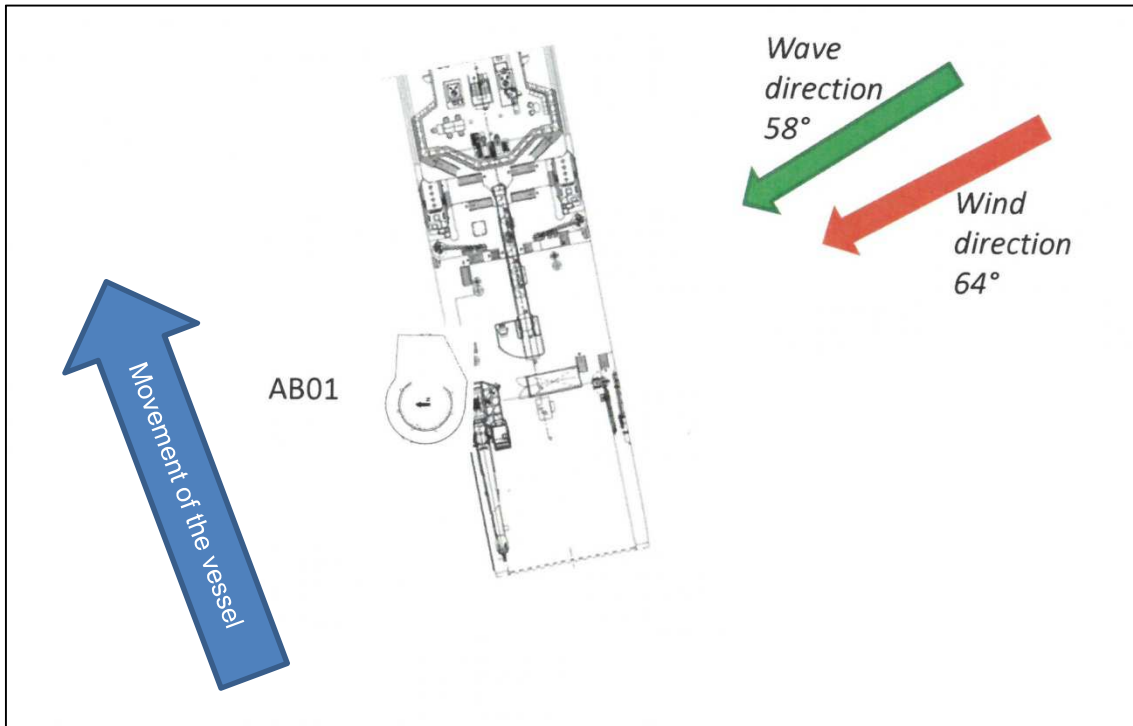


Figure 17: Second allision

3.3.2 Technology and processes

There are three modes available for controlling the VOS STONE from the bridge: Manual, DP, cJoy.

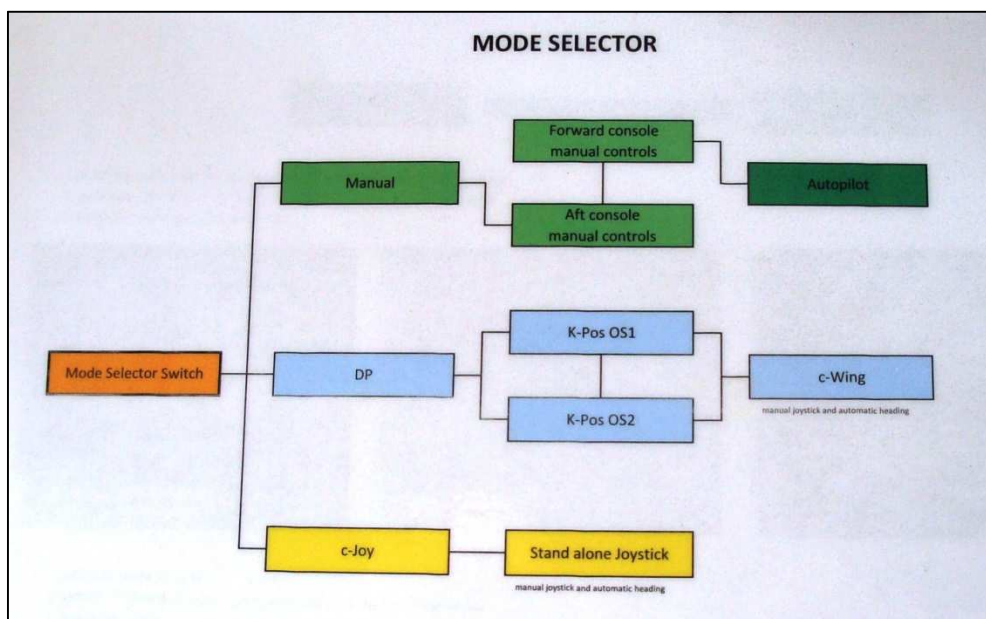


Figure 18: Options for controlling the ship

3.3.2.1 Switching DP

Switching from DP to IJS (cJoy) at the aft control position:

1. Switch selector from *DP* to *cJoy* (left image).
2. Confirm command on cJoy control panel by means of *Take* and *Joystick* => Confirm all thrusters are available and enabled (middle image).
3. Check if cJoy is responding by changing the default value and waiting for the thrusters to respond (right image).

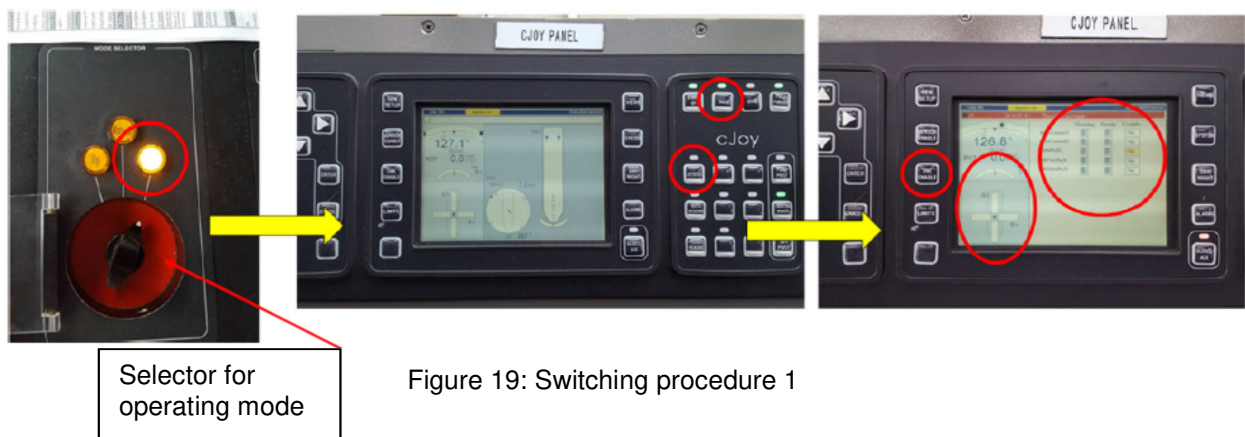


Figure 19: Switching procedure 1

Switching from DP to manual on the aft control position:

1. Set DP selector to *Manual* (left image).
2. Apply switch over by pressing the *Take CMF* buttons on both azimuth levers on the aft control position (middle image).
3. Check the thrusters by making sure they respond to the levers on the aft control position (right image).

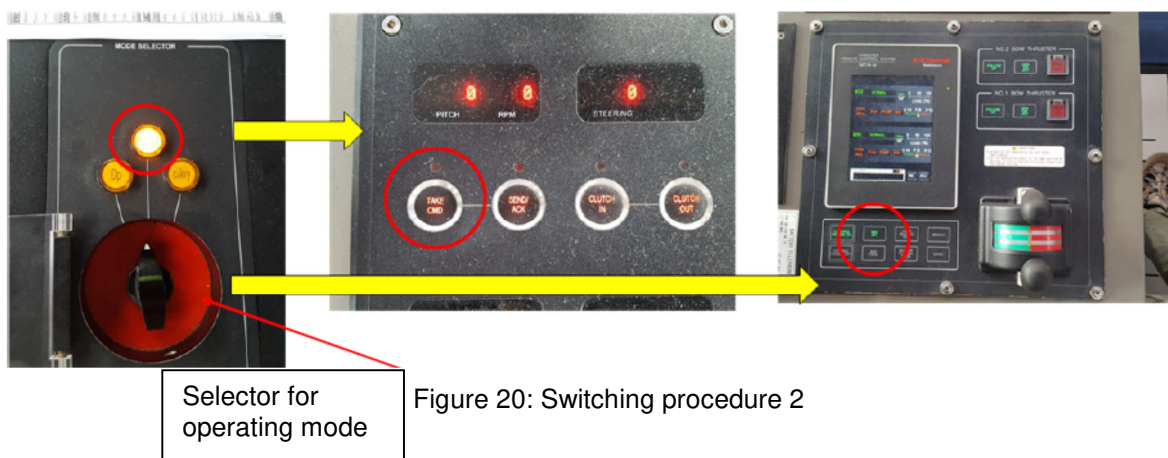


Figure 20: Switching procedure 2

3.3.2.2 Equipment and maintenance

When the ship was built, hazard studies were carried out on the DP system with failure modes and effects analysis. Test reports from the ABS classification society have been provided.

The operator's internal investigation report is based on an analysis of the VOS STONE's DP recordings. No faults were found in the DP system during the accident. The system does not record when it is switched off, however. Accordingly, there are gaps which make it impossible to establish whether another technical problem may actually have existed for a brief period. The electronic event logs in the system did not reveal any problems.

Maintenance of the DP is logged in the AMOS preventative maintenance system. It contains no entries that would have necessitated immediate action.

Recordings of the tests carried out were available on board. The DP's manufacturer performed a new KPOS software update for the wind farm module on 5 April 2018.

No reports were found on board that would indicate any failures in the control system.

3.3.2.3 Training and process organisation

Operating manuals were available on the bridge in printed and electronic form. Section 1.9 of the operating manual refers to the knowledge of the systems that the master and all DPOs must possess.

Certificates and DP logbooks were available for inspection and are up to date with the relevant information and proofs of competence according to the training guidelines for DP operators.

Section 2.4 of the operating manual describes the command structure on the ship. It states that the master has authority at all times and is responsible for the ship. The powers of a watch are specified in the master's standing orders, where point 12 reads: "Arrangement of task and responsibility with two or more navigators on the bridge at the same time, especially in the case of DP activities. The SDPO is responsible for the watch at all times and may assign tasks to one of the other navigators on the bridge."

At the time of the accident, 23 people belonged to the ship's crew. The ship's command consisted of the master, a chief mate, a 1/O (both also SDPO), two 2/Os (both also DPO), a chief engineer, two second engineers, and one third engineer.

The bridge is always manned by two DP operators. The normal crew comprises:

- chief mate (SDPO) and 2/O (Junior-DPO);
- 1/O (SDPO) and 2/O (Junior-DPO).

The chief mate and 1/O alternate at 0000 and 1200 with the watch. The 2/Os change watch at 0600 and 1800. One of the DPOs is replaced every six hours.

The master is on call around the clock and supplements the normal watch organisation.

All navigators have experience on board ships equipped with DP and are in possession of a full DP ticket, which serves as a certificate of competence according to the international standard of the IMCA.

Nine nationalities were represented on board in the crew at the time of the accident (not including the wind turbine workers). Consequently, the working language is English.

4 ANALYSIS

There is no indication that a technical malfunction in the DP or any other system on board the ship played a role in the incident.

After the workers had been collected from TP AB01, the ship was moved to port under DP so as to keep the bow facing the oncoming wind and current. In deciding to carry out a joystick test at that position and time, the master exposed the ship to a risk of allision with TP AB01 in the event of the system failing.

4.1 Environmental conditions

A north-easterly wind of at least 28 kts prevailed at the time of the accident. The ship was moved away from the TP using port thrusters to keep the bow facing the wind and waves. The speed of the current was estimated at between 1-2 kts. It was setting in the same direction as the wind, thus pushing the vessel toward the south-west with more force. The large 'sail area' caused by the high superstructure in the forward third of the ship gave rise to a particular susceptibility to wind.

4.2 Communication

There is no evidence to suggest the bridge crew was under any form of duress or stress prior to the event. As OOW, the 1/O was in command on the bridge prior to the incident. However, the master neither communicated with the OOW nor spoke with him about the planned IJS test when he returned to the bridge. He ultimately asked the 2/O (as DPO) to switch to cJoy and in so doing once more ignored the 1/O (the officer responsible for the DP system).

The operator's operating manual states the following in this regard:

6.1.1 All personnel are required to report any observation or event that may affect the safe and efficient operating condition of the ship to the DPO. This includes but is not limited to:

- *Intention to perform and notification of the completion, maintenance or modification of any electrical or mechanical system directly affecting online DP equipment or the availability of standby equipment. Maintenance includes inspections and measurements.*

.
.
.

*6.2.4 Every officer on watch must inform the others of any planned or actual changes in operational circumstances. **Any change in a previously reported operating condition must be reported to the officer on watch.***

4.3 Knowledge

The DP operator's manuals are intended to ensure that all ship's personnel are conversant with the requirements applicable and systems used on board. The statements and evidence clearly demonstrate that the personnel were not fully conversant with the system. The 2/O did not know how to transfer to cJoy when this was requested and the master did not adhere to the correct transfer procedure, either. Using the mode selector to switch to cJoy resulted in the DP system being disabled. To select and enable the thrusters again, it would have been necessary to access the menu screen of the IJS (cJoy).

It is also clear that there was no emergency response from the bridge immediately after the allisions. Although there was no clarity about possible physical injuries or material damage at this point, no count alarm was triggered for the crew, nor was a crew check carried out. This was only set in motion at 1112 by the OCM. The OCM on board contacted the MCC first, even though the emergency plan (see Figure 21) and the ENC (see Annex) contain clear instructions on who has to notify whom.

CHECKLIST	
V03-FLT-ERT-F-102	
COLLISION	
•	Sound Alarm
•	Call Master
•	Distress message
•	Inform ERT
•	Inform authorities
•	Communication tools established
•	Muster all personnel on safe side
•	Identify missing personnel
•	Assess damage:
-	Location
-	Scale
-	Tank sounding.....Checklist
-	Flooding.....Checklist
•	Consider beaching vessel
•	Inform bridge
•	Maintain position if locked
•	Obtain ships data:
-	Name
-	Flag
-	IMO Number
-	Call sign
-	Port from/to
•	Provide help vessel concerned
•	Prepare for abandon ship.....Checklist

Figure 21: Internal checklist in case of collision

In accordance with requirements, the 2/O completed and signed the DPO familiarisation checklist before the start of the shift on the previous day but it was not countersigned by the master, which is also required in this procedure.

DP OFFICERS FAMILIARISATION CHECKLIST

Document Number .: V03-FLT-CRW-F-309 Author: BM/HM
 Effective Date.....: 01-03-2014 Approved.....: NS
 Version.....: 1.0

Vessel : VOJ STONE Date... 09.04.2018

The following equipment must be studied and fully understood by new Officers joining the vessel.

<ul style="list-style-type: none">• DP system	Type: <u>..K.-POS</u>
<ul style="list-style-type: none">• DP reference systems availability, operational status and position	1: <input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Use of CyScan / Fan beam computer	2: <input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Prisma Installation	3: <input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Use of Tautwire	4: <input type="checkbox"/>
<ul style="list-style-type: none">• DP Sensors	5: <input type="checkbox"/>
<ul style="list-style-type: none">• Position MRU/ VRS system	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• FMEA report	Date & revision: <u>July 2017</u>
<ul style="list-style-type: none">• DP plots/ capabilities	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• DP trails, class annual, FMEA	Dates: <u>July 2017</u>
<ul style="list-style-type: none">• DP Operations manual including procedures and checklists	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Relevant project information	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• IMCA guidelines	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Vessel specific DP issue	Record:
<ul style="list-style-type: none">• Lay out of DP UPS	
<ul style="list-style-type: none">• DP incidents, report, relevant	<input type="checkbox"/>
<ul style="list-style-type: none">• IMCA	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Communication systems (clear com /Vhf/UHF/ dive satus lights)	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Change over procedures	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Master standing orders	<input type="checkbox"/>
<ul style="list-style-type: none">• Hipap system	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Operation hipap pole	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Use of hipap computer	<input checked="" type="checkbox"/>
<ul style="list-style-type: none">• Transponders	<input type="checkbox"/>
<ul style="list-style-type: none">• Use of mini beacons	<input checked="" type="checkbox"/>

DPO confirms to have familiarized with the vessels DP systems and available documentation:

Name: [REDACTED] Rank: 2/O DPO Signature [REDACTED]

For Master Signature

Figure 22: Personal checklist

5 CONCLUSIONS

It is not possible to say what prompted the VOS STONE's master to test the IJS after completion of the works at TP AB01. The ship was already sailing into a freshening wind and still within the limits of the AOWF. Accordingly, the master took an unnecessary risk in testing the ship's emergency control system.

The 2/O was evidently not fully conversant with operating the DP. Consequently, the ship management should continue to ensure that navigators are conversant with the specific technology of this ship.

Internal communication between navigators on the bridge could be better. Moreover, the master should inform the OOW of his intentions and actions, so as to avoid complications.

Bridge management after the accident was poor.

6 Actions taken

Immediately after the accident, the lead operating company, VBMS, set up an investigation committee consisting of six people, each of whom represented all the companies involved in the project. After a detailed investigation involving interviews with shipboard personnel and an analysis of technical recordings, an internal report was drawn up. This report finished with a list of points (or preventive measures) that had to be worked through before the ship was put back into service. Specifically, these points comprised:

- ✓ the training programme for new and returning DP operators must comply with IMCA standards. The programme must be amended accordingly;
- ✓ one additional, experienced SDPO should be on board to observe activities on the bridge during the post-repair testing and in the initial phase of routine ship operation;
- ✓ the procedure for selecting the operating mode for transfer must be verified in consultation with the sister ship and the manufacturer of the DP system, Kongsberg;
- ✓ the ship's standing orders must be updated so that they specify who is in command during a watch and the transfer of command during the watch;
- ✓ standing orders of the master should be harmonised throughout the Vroon fleet where possible;
- ✓ the annual DP tests on the VOS STONE scheduled for June 2018 will be brought forward and performed following the repair of the ship. In each case, the tests will be conducted in the presence of an experienced external marine warranty surveyor commissioned by the shipowner and the end customer;
- ✓ the IJS cJoy is an emergency system and should not be used while sailing between the TPs in the construction field. Clear instructions for operating mode selection (Manual – DP – cJoy) must be displayed on the DP control panel;
- ✓ the procedures for the switch over process must be updated in the DP manual;
- ✓ Vroon Offshore Services shall prepare and communicate to all ships of the Vroon fleet a safety notice, which indicates the potential for error when using the manual switch over of the DP with the IJS;

- ✓ VBMS must send a safety notice (without ship information) to all ships of the Boskalis fleet equipped with DP;
- ✓ IMCA must be informed of the potential risk to safety on ships equipped with DP when the operating mode is selected by inexperienced/non-familiarised operators;
- ✓ real-time emergency drills with all involved personnel, ships and rescue services must be organised after an accident, so as to practise emergency communication and identify any vulnerabilities in the current system before the next entry into the construction field;
- ✓ this incident must be included in the list of lessons learnt for this project;
- ✓ an additional safety observer on board the VOS STONE will assist the bridge crew in the first few days;
- ✓ formalise route planning for every approach to a TP using a wind farm transit plan;
- ✓ meeting with bridge crew and AWE/VBMS;
- ✓ HSE employees from AWE to attend the emergency exercise on board the VOS STONE;
- ✓ Vroon must demonstrate that the repair work has been completed satisfactorily.

Given this commendable approach of VBMS, the BSU sees no further requirement to issue safety recommendations.

7 SOURCES

- Written internal investigation report of the operating company, VBMS
- Witness testimony
- VOS STONE's VDR recordings
- Technical paper from the BSH's department responsible (Management of the Sea)
- Navigational charts of the BSH
- Radar recordings, ship safety services/VTSS
- Photographics and video documentation of the BSU and VBMS
- Inspection of the ship by the BSU

8 ANNEX

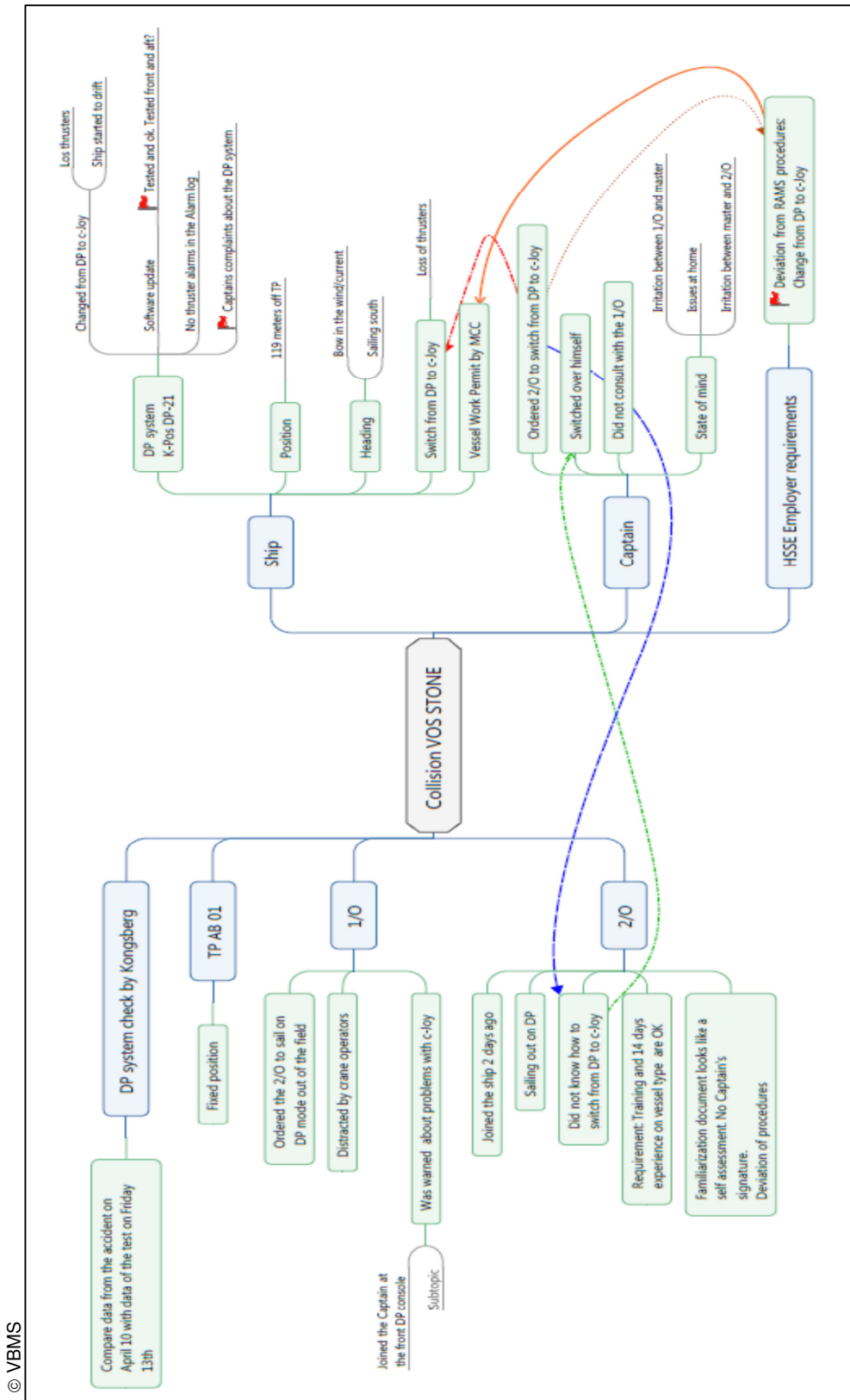


Figure 23: Flowchart showing the course of the accident

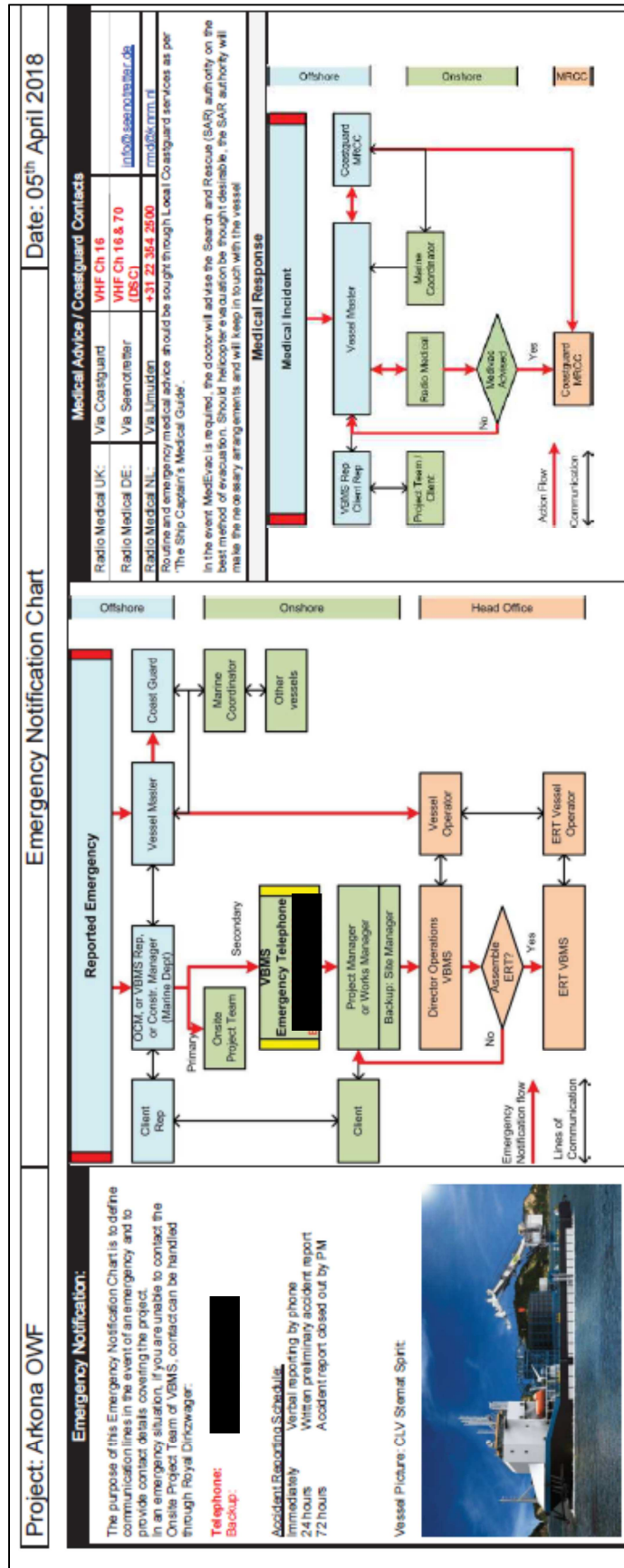


Figure 24: Emergency notification chart