Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Federal Higher Authority subordinated to the Ministry of Transport,
Building and Urban Development

Summary
Investigation Report 612/08

Serious Marine Casualty

Collision on the Kiel Canal between MV RMS SAIMAA and MV NORDIC DIANA on 12 December 2008 at 0946

1 December 2009

www.bsu-bund.de

The 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) of 16 June 2002.

According to this the sole objective of the investigation is to prevent future accidents and malfunctions. The investigation does not serve to ascertain fault, liability or claims.

The present report should not be used in court proceedings or proceedings of the Maritime Board. Reference is made to art. 19 para. 4 SUG.

The German text shall prevail in the interpretation of the Investigation Report.

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1 Summary of the marine casualty

The RMS[1] SAIMAA was sailing from Duisburg to Jontseno (Finland). On 12 December 2008, the vessel reached the Brunsbüttel lock. At 0924[2], the eastward canal passage began as a Traffic Group (VG) 3 vessel with pilot advice. Due to a collective call at 0919 as well as the AIS data which had been received, the ship's command was aware that the OOCL FINLAND and the HALDOZ were approaching on the section between the inland port and the Kudensee siding area. On reaching the Ostermoor ferry, visibility reportedly dropped to down to 200 m. Therefore, the speed was reduced to about 7 kts. Immediately after passing the Ostermoor ferry, visibility reportedly deteriorated to 100 m. The oncoming OOCL FINLAND was passed safely off the port boundary and then shortly afterwards also the HALDOZ. The ship's command then reportedly noticed that the RMS SAIMAA turned to port and accordingly her stern neared to the southern embankment. The initiated rudder and engine manoeuvres prevented contact with the canal embankments. Finally, the RMS SAIMAA was positioned at an angle of about 20° approx. 15 m away from the northern embankment with virtually no speed through water. The bow was reportedly positioned well north of the canal axis.

The NORDIC DIANA was sailing from Halla (Finland) to Newport (United Kingdom). She passed westward through the Kiel Canal (NOK) on 12 December 2008 as a VG 3 with pilot advice. The Kudensee siding area was passed at 0934. Visibility had reportedly been fluctuating sporadically, but reportedly dropped to about 100 m at canal kilometre (ckm) 7.0.
At about 0946, the pilot on the RMS SAIMAA called the pilot on the NORDIC DIANA by VHF. He was situated under the Brunsbüttel viaduct and requested that both vessels pass port-by-port. The RMS SAIMAA was reportedly not identifiable on the radar of the NORDIC DIANA. The pilot on the NORDIC DIANA complied with the requested pass. Following that, he reportedly advised the Chief Officer, who was at the helm, to steer to starboard further still in order to provide the RMS SAIMAA with as much room as possible. At that point, the speed of the vessel was reportedly not reduced as there were concerns that the steer-ability may then be lost.
When the RMS SAIMAA became visible on the NORDIC DIANA's radar unit after passing under the viaduct, the pilot reportedly realised that the agreed port-by-port pass was not possible. Despite all countermeasures, the collision was unavoidable.
Due to the collision, the NORDIC DIANA moved towards the southern embankment. However, a astern manoeuvre and appropriate rudder manoeuvres enabled the vessel to be positioned lengthways on the canal again.
The two vessels were subsequently inspected for damage. There were no injuries. Water ingress was detected in the forepeak and in the bow thruster room on board the RMS SAIMAA. The bow thruster was reportedly no longer operable. The Master gave orders for the areas to be pumped out. The RMS SAIMAA remained afloat and was manoeuvrable.
After consultation with the VTS, the two vessels sailed to Brunsbüttel under their own steam.

[1] The abbreviation 'RMS' in the name of the vessel stands for the name of the vessel operator (= Rhein-, Maas- und See-Schiffahrtskontor GmbH).
[2] Unless stated otherwise, all times shown in this report are local = CET = UTC + 1.

2 Scene of the accident

Type of event: Serious marine casualty/collision
Date/Time: 12 December 2008, 0946
Location: Kiel Canal, CKm 6.1

Excerpt from the Kiel Canal chart, WSD-North 1995

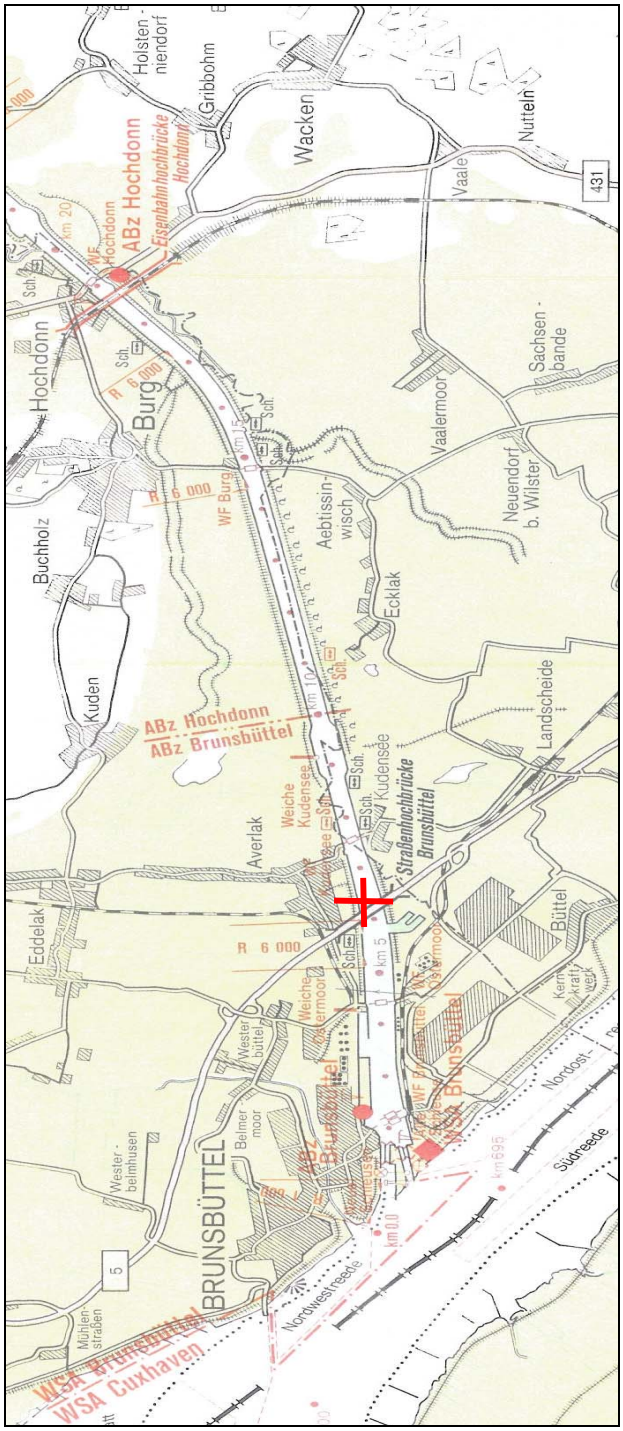

Figure 1: Scene of the accident – Overview

Excerpt from nautical chart 42, BSH

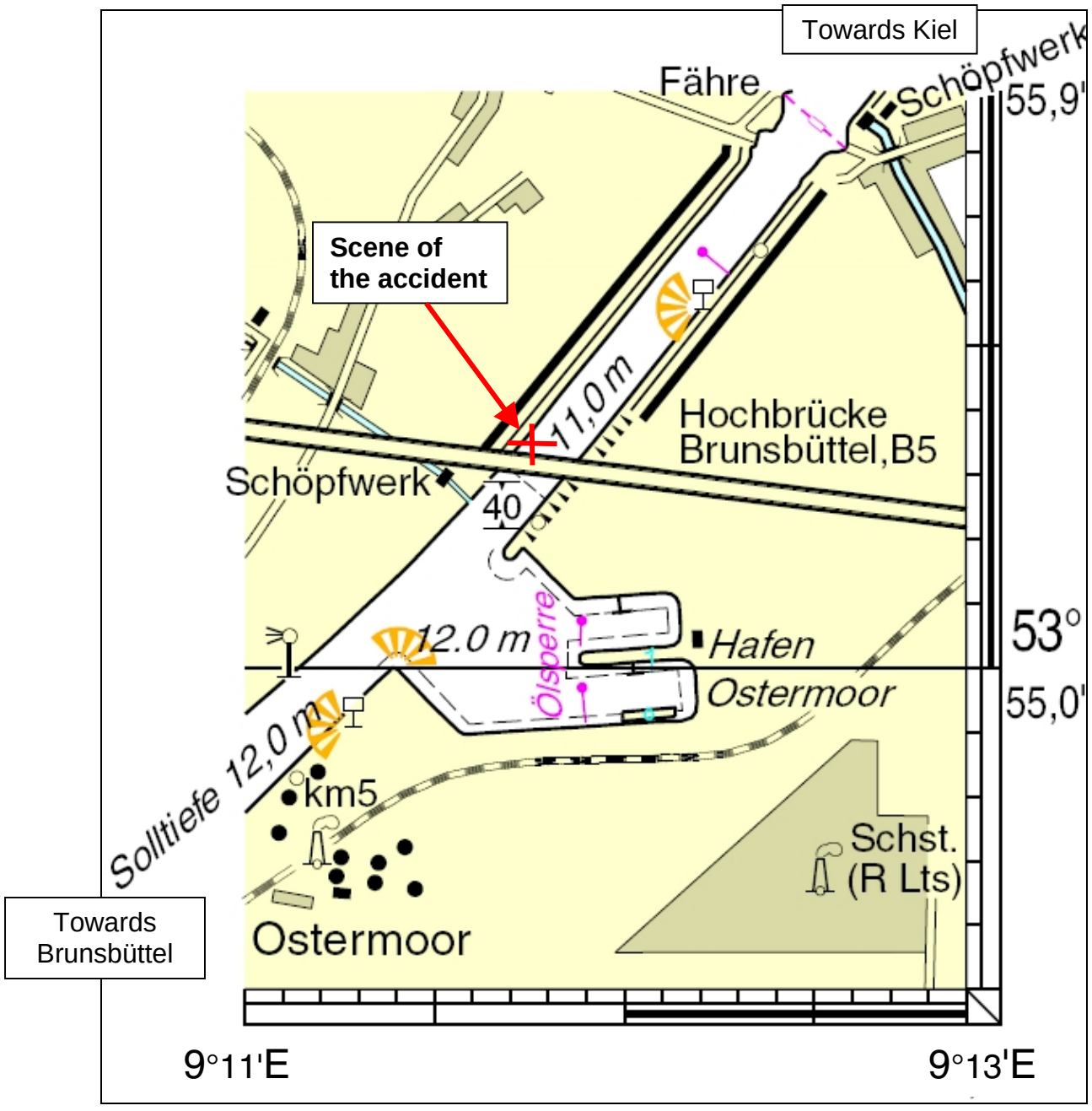

Figure 2: Scene of the accident in detail

3 Vessel particulars

3.1 Photo, MV RMS SAIMAA

Figure 3: RMS SAIMAA

3.2 Particulars, MV RMS SAIMAA

Name of the vessel:	RMS SAIMAA
Type of vessel:	Multi-purpose freighter
Nationality/flag:	Antigua and Barbuda
Port of registry:	St. Johns
IMO number:	9313694
Call sign:	V2BJ3
Vessel operator:	Rhein-, Maas- und See-Schiffahrtskontor GmbH Duisburg
Year built:	2003
Shipyard/yard number:	Slovenske Lodenice Komarno A.S. /2001
Classification society:	Germanischer Lloyd
Length overall:	80.10 m
Breadth overall:	12.40 m
Gross tonnage:	2,069
Deadweight:	2,634 t
Draught at time of accident:	Fore: 3.90 m, aft: 3.95 m
Engine rating:	1,300 kW
Main engine:	Deutz AG Werk Mannheim SBV 6M628
(Service) Speed:	10.5 kts
Hull material:	Steel
Hull construction:	Double bottom
Number of crew:	6

3.3 Photo, MV NORDIC DIANA

Figure 4: NORDIC DIANA

3.4 Particulars, MV NORDIC DIANA

Name of the vessel:	NORDIC DIANA
Type of vessel:	Multi-purpose freighter
Nationality/flag:	Netherlands
Port of registry:	Delfzijl
IMO number:	9116010
Call sign:	PDRF
Vessel operator:	Nordic General Partner D BV
Year built:	1996
Shipyard:	Bodewes Scheepswerf 'Vollharding' Foxhol B.V.-Foxhol
Classification society:	Bureau Veritas
Length overall:	89.8 m
Breadth overall:	13.7 m
Gross tonnage:	2,774
Deadweight:	4,180 t
Draught at time of accident:	5.0 m
Engine rating:	2,200 kW
Main engine:	MAK 6 MU 453 C
(Service) Speed:	12.5 kts
Hull material:	Steel
Number of crew:	8

4 Course of the accident

The RMS SAIMAA was sailing from Duisburg to Jontseno (Finland). On 12 December 2008, the vessel reached Brunsbüttel lock. At 0924, the eastward canal passage began as a Traffic Group (VG) 3 vessel[3] with pilot advice. The Master reportedly steered the vessel himself. Other crew members were not situated on the bridge. It was reportedly hazy and there was virtually no wind. Visibility was reportedly continuously changing between 100 and 1,000 m. The vessel is equipped with a right-handed, fixed pitch propeller, Becker rudder and a bow thruster. In addition to usual modern navigating equipment, the RMS SAIMAA also has a river radar unit, which was reportedly operated by the pilot.

Due to the collective call[4] at 0919 as well as the AIS data[5] which had been received, the ship's command was aware that the OOCL FINLAND (categorised as VG 5) and the HALDOZ (VG 4) were approaching on the section between the inland port and the Kudensee siding area.

Both radar units were operating properly in heads-up mode. One covered the 0.75 nm range and the other the 0.5 nm range. The forecastle was reportedly occupied and both anchors were reportedly ready to drop.

On reaching the Ostermoor ferry, visibility reportedly dropped to down to 200 m. The speed was reportedly reduced to about 7 kts. Immediately after passing the Ostermoor ferry, visibility reportedly deteriorated to 100 m; the vessel's own forward top light was reportedly barely visible.

The oncoming OOCL FINLAND was passed safely off the port boundary and then shortly afterwards so was the HALDOZ[6] off the Brunsbüttel-Ostermoor port entrance. In the process, the ship's command reportedly noticed that the RMS SAIMAA turned to port and accordingly her stern neared the southern embankment. The initiated rudder and engine manoeuvres prevented contact with the canal embankments. Finally, the RMS SAIMAA was reportedly positioned at an angle of about 20° approx. 15 m away from the northern embankment with virtually no speed through water. The bow was reportedly positioned well north of the canal axis.

After an inquiry by the pilot of the NORDIC DIANA, confirmation was given by VHF that the RMS SAIMAA was situated under the viaduct and had requested a port-by-port pass.[7]

As the forward top light of the NORDIC DIANA reportedly came into view two points from port, a hard to port manoeuvre was reportedly attempted to avoid the collision.

At 0946, the stem of the NORDIC DIANA collided with the port bow of the RMS SAIMAA.

[3] Note: Vessels are categorised into six Traffic Groups for the passage through the NOK, the smallest belonging to Traffic Group 1 and the largest to Traffic Group 6. This categorisation is based on the length, breadth, draught of the vessel and the dangerous nature of her cargo.

[4] Note: A 'collective call' is transmitted via VHF by the Vessel Traffic Service (VTS) every half hour; this provides information on the movement of shipping on the NOK. This information should be forwarded to the ship's command by the pilot.

[5] Note: AIS stands for **A**utomatic **I**dentification **S**ystem and was introduced to improve maritime safety. All ships equipped with this system transmit their current data, such as position, course and speed as well as possibly other information, which can be made visible on a monitor, via VHF.

[6] See para. 6.3

[7] See sub-para. 6.4.2

The NORDIC DIANA was sailing from Halla (Finland) to Newport (United Kingdom). She passed westward through the NOK on 12 December 2008 as a Traffic Group 3 vessel with pilot advice[8]. At 0645, a pilot change took place at the pilot station at Rüsterbergen. Shortly afterwards, the Master left the bridge and handed the watch over to the Chief Officer, who then reportedly steered the vessel himself. A lookout was reportedly not on the bridge. NORDIC DIANA is equipped with a controllable pitch propeller and a bow thruster. The navigating equipment met with current standards.

At about 0847, the Dükerswisch[9] siding area was passed. Fog had reportedly set in at the old Burger port; therefore, visibility was reportedly approx. 300 m. The Kudensee siding area was passed at 0934. Visibility had reportedly been fluctuating sporadically, but reportedly dropped to about 100 m at canal kilometre (ckm) 7.0.

At about 0950, the RMS SAIMAA established contact with the NORDIC DIANA via VHF. She was situated under the Brunsbüttel viaduct and requested that both vessels pass each other port-by-port[10]. The RMS SAIMAA was reportedly not visible on the NORDIC DIANA's radar, possibly because she was lost in the 'radar shadow' of the viaduct. The pilot of the NORDIC DIANA took the precaution of asking once again and was given the answer that the RMS SAIMAA was positioned slightly to the north of the middle of the canal and had requested a port-by-port pass. Following that, the pilot reportedly advised the Chief Officer to steer to starboard further still in order to provide the RMS SAIMAA with as much room as possible. At that point, the speed of the vessel was reportedly not reduced as there were concerns that the steer-ability may then be lost. When the RMS SAIMAA became visible on the NORDIC DIANA's radar unit after passing under the viaduct, the pilot reportedly realised that the agreed port-by-port pass was not possible. He then reportedly gave the instruction to turn hard towards port. As the turn began, he reportedly noticed that the RMS SAIMAA had, for her part, now began to turn to starboard. Attempts were reportedly made on the NORDIC DIANA to reduce the vessel's speed, but the collision was reportedly no longer avoidable.

Due to the collision and the port manoeuvre that had just been initiated, the NORDIC DIANA moved towards the southern embankment. However, a astern manoeuvre and appropriate rudder manoeuvres then enabled the vessel to be positioned lengthways on the canal again.

The two vessels were subsequently inspected for damage. There were no injuries. Water ingress was detected in the forepeak and in the bow thruster room on board the RMS SAIMAA. The bow thruster was reportedly no longer operable. The Master gave orders for the areas to be pumped out. The RMS SAIMAA remained afloat and was manoeuvrable. After consultation with the VTS, she returned to Brunsbüttel under her own steam. The NORDIC DIANA also ascertained her damage, informed the VTS and discussed the onward journey to Brunsbüttel.

[8] At the time of the accident, each of the participating pilots had been piloting on the NOK for 12 days.
[9] The passage times are based on the graphical representation of the electronic distance-time graph of VTS Brunsbüttel, which in turn is based on the AIS data.
[10] See sub-para. 6.4.2

5 Consequences of the accident

There were no injuries and no environmental pollution.
The NORDIC DIANA had heavy deformations and cracks on the bow section.

Figure 5: Damage to the MV NORDIC DIANA

The RMS SAIMAA was heavily dented on the port bow both above and below the waterline. This led to water ingress in the forepeak and in double bottom tank No. 2.

Figure 6: Damage to the RMS SAIMAA

6 Investigation

6.1 Investigations by the waterway police

The waterway police (WSP) began its on-site investigations after the two vessels moored at Brunsbüttel, the findings of which were made available to the BSU. Numerous photos were taken, documents inspected, witness statements recorded and the AIS data of Vessel Traffic Service Brunsbüttel were secured. Neither vessel was equipped with a Voyage Data Recorder (VDR)[11]. The OOCL FINLAND was in close proximity to the accident and the investigations revealed that she was equipped with a VDR. Data from this were exported by the BSU.

Based on the findings of the WSP, the course of the accident was as follows:

Shortly before the accident, the RMS SAIMAA first encountered the OOCL FINLAND, and then the HALDOZ. Due to the size of the OOCL FINLAND, the RMS SAIMAA moved to starboard. This pass occurred without a problem, partly because the RMS SAIMAA had sufficient room on her starboard side due to the Ostermoor inland port. It is not known why she did not return to her course line on the NOK promptly. It is possible that she wanted to keep a large distance from the HALDOZ. The WSP report contains contradictory witness accounts as regards contact with the embankment. On the one hand, the RMS SAIMAA supposedly just missed the embankment. On the other hand, her stern reportedly came into contact with the southern embankment. This supposedly led to a turn to port by the RMS SAIMAA, which in turn resulted in her bow coming into contact with the northern embankment. The WSP also found that there was no visible damage to the embankments in its report.

Information as regards the fact that the RMS SAIMAA was finally positioned on the northern side of the NOK coincides. The advising pilot was aware of the dangerous situation. He immediately established contact with the oncoming NORDIC DIANA by VHF. However, this consultation did not defuse the situation and a frontal collision followed. The collision caused the RMS SAIMAA to turn towards starboard until her bow pointed in a westerly direction. After the crew determined that the vessel was buoyant and reported this to the VTS, she sailed back to Brunsbüttel.

6.2 Environmental conditions

An expertise by Germany's National Meteorological Service (DWD) states that the weather over northern Germany on the morning of 12 December 2008 was dominated by several small low-pressure systems. The region of Schleswig-Holstein was thus situated in a weak southerly flow.

On 12 December 2008 at about 1000, Brunsbüttel was cloudy and dull but largely rainless. The air temperature was 1°C, the water temperature about 5°C. A weak southerly wind was blowing with average forces of 2 Bft. Horizontal visibility was close to 2 km. Fog was not reported in Schleswig-Holstein; however, with the prevailing air and water temperatures localised fog patches may have formed at times.

[11] VDR: **V**oyage **D**ata **R**ecorder = So-called black box for gathering data to facilitate analysis of the causes an accident should one occur.

Since the DWD does not possess any visibility measurement equipment in this area, the BSU used data from the visibility measurement equipment of the NOK traffic safety system. There was no measurement equipment directly at the scene of the accident; however, restricted visibility prevailed and this was stated in the collective call[12].

6.3 Records of the VTS[13]

The NOK traffic safety system stores, inter alia, the AIS data of vessels located on the canal. These are primarily used by the Vessel Traffic Service on a real-time display for guiding vessels on the NOK.
These records are also being increasingly used for the subsequent analysis of accidents.

6.3.1 AIS of the VTS

The following figures show the course of the voyage for both vessels up to the collision. Figure 7 shows the RMS SAIMAA passing the OOCL FINLAND sailing westwards.

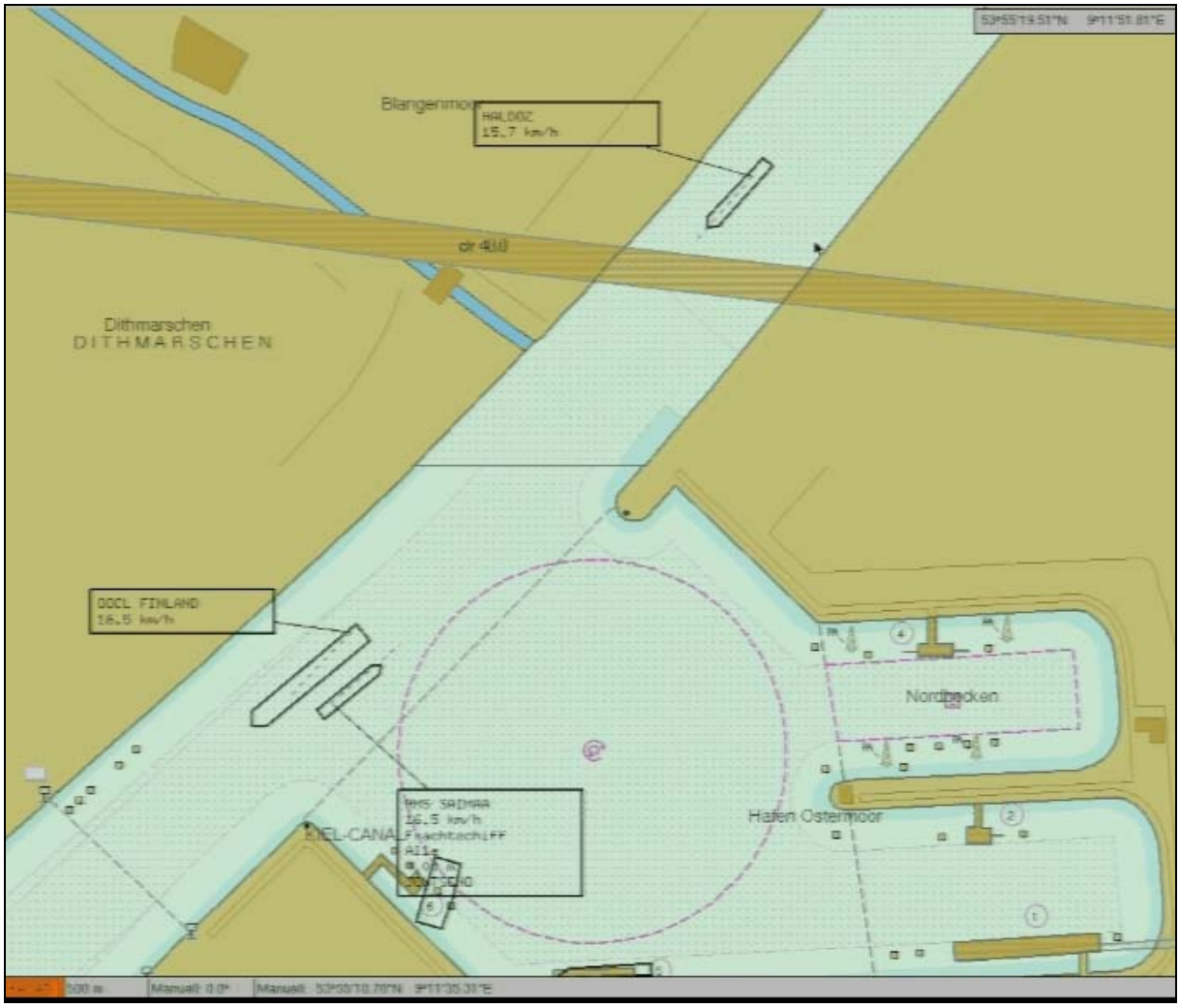

Figure 7: AIS display of the VTS at 0943

[12] See sub-para. 6.3.2.
[13] VTS: Vessel Traffic Service; in this report that of the NOK in Brunsbüttel is referred to.

After the OOCL FINLAND, the HALDOZ is the second vessel to approach the RMS SAIMAA. Although the HALDOZ is keeping relatively far to the north, it seems that the RMS SAIMAA is continuing to move to the south and thus, as can be seen in Figure 8, ever closer to the tongue of land off Ostermoor port.

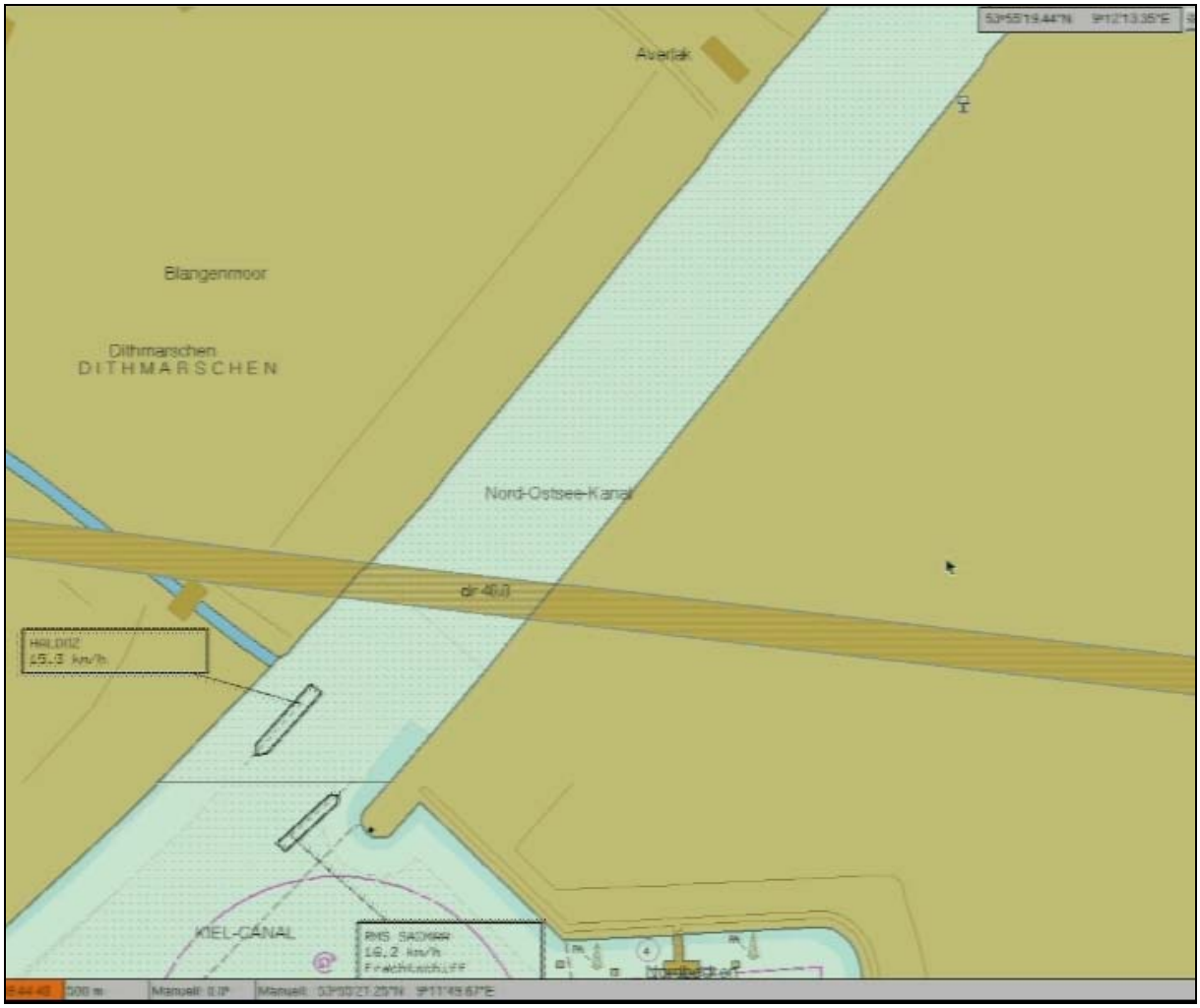

Figure 8: AIS display of the VTS at 0944

The records do not show the stern of the RMS SAIMAA coming into contact with the embankment on the southern side of the NOK. However, with her stern close to the southern bank, Figure 9 shows the vessel's clear tendency to begin to turn to port.

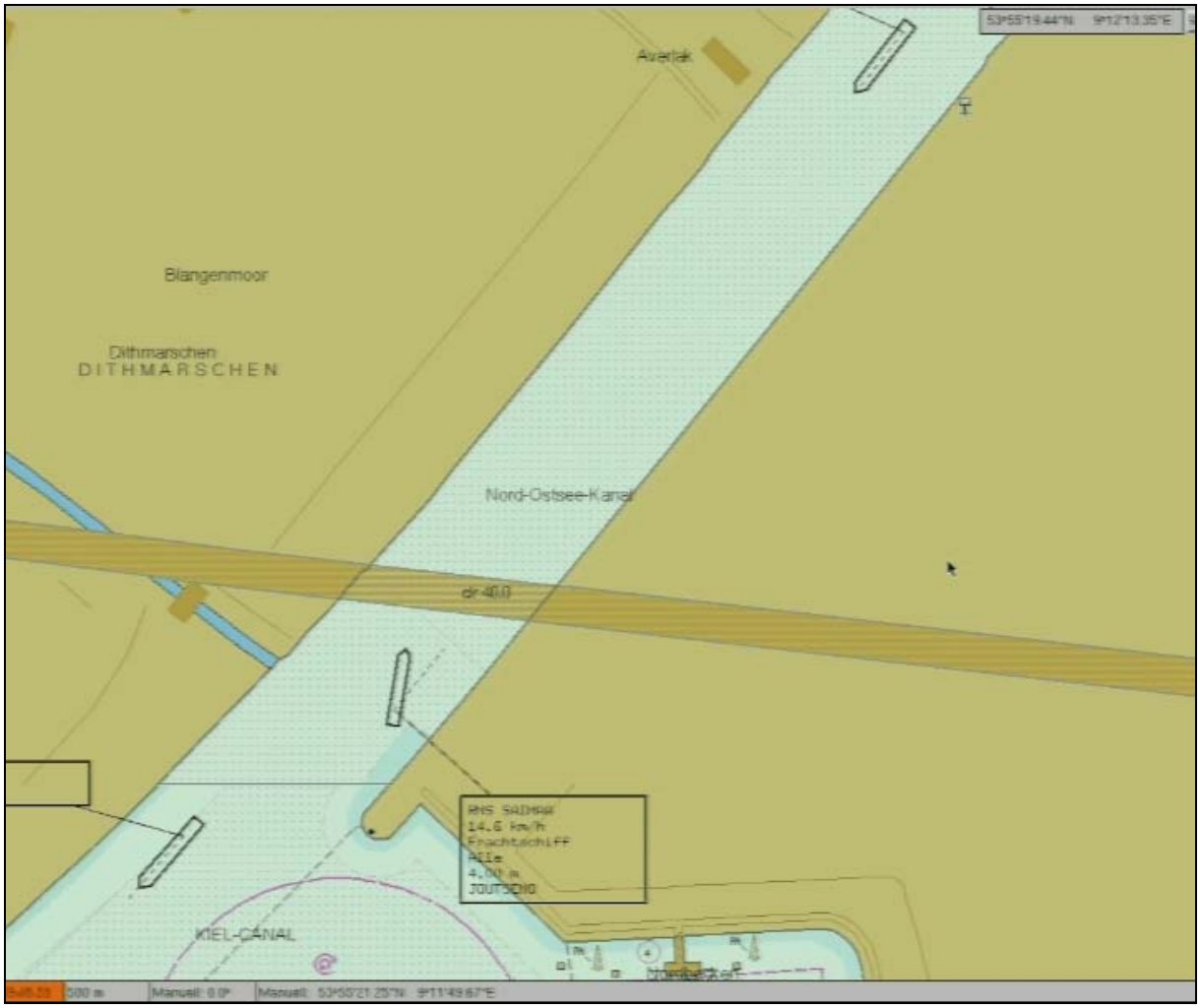

Figure 9: AIS display of the VTS at 0945

The records continue to show no contact between the RMS SAIMAA and the northern embankment. However, after a pronounced approach to the northern bank, Figure 10 shows the vessel's tendency to move to starboard back to the middle of the canal.

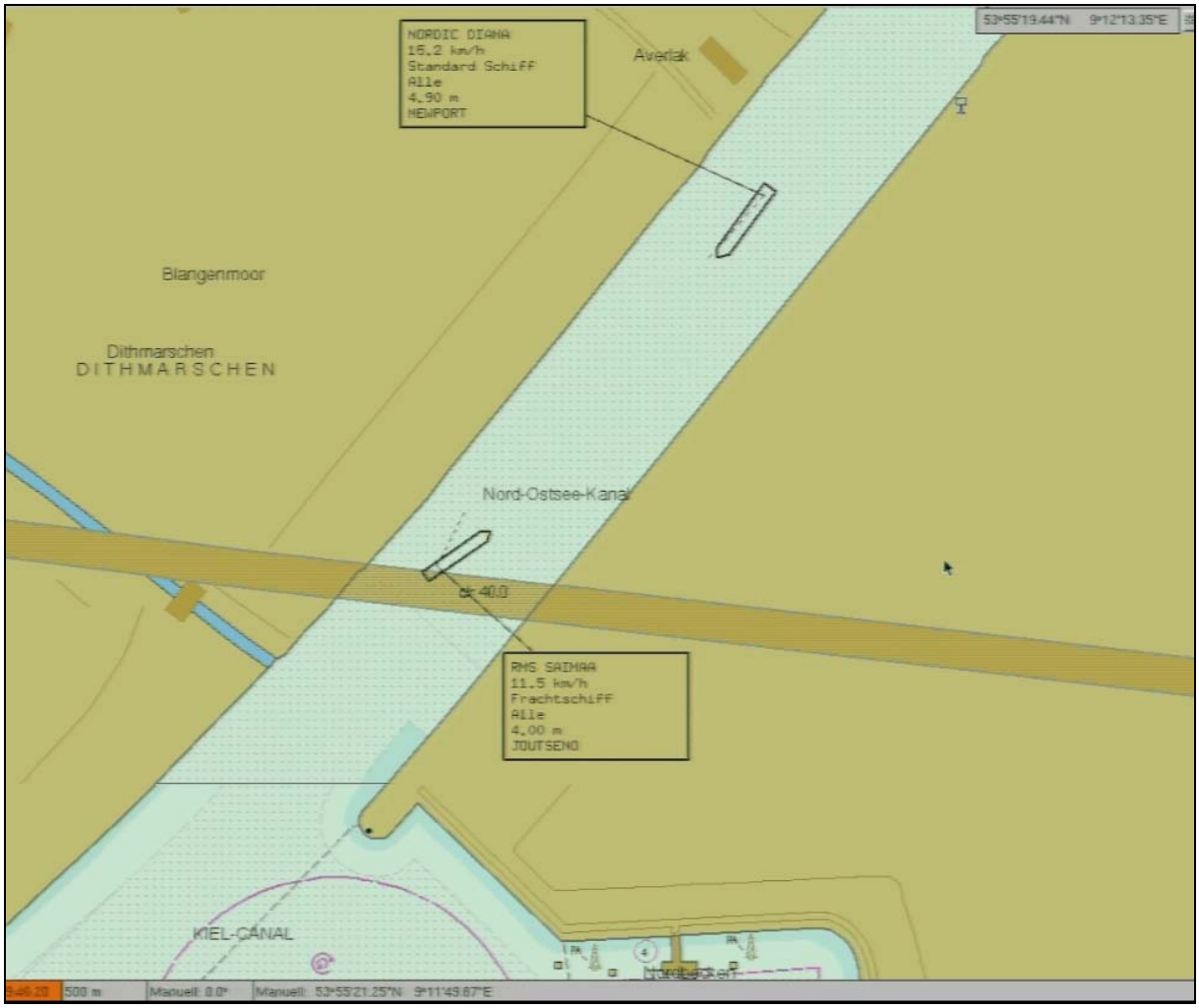

Figure 10: AIS display of the VTS at 0946

With regards to the ongoing debate on the accuracy of transmitted GPS data and their graphic reproduction on screens as well as in print, it should be noted that the above findings only indicate the tendencies of the respective course of the voyage.

6.3.2 Audio recordings of the VTS

We hear how during the collective call at 0946 every vessel on the canal is informed in the usual manner as to the onward course of her voyage. In addition, restricted visibility due to fog is reported for the Burg – Hohenhörn area.
At 094821, the pilot of the NORDIC DIANA addresses every vessel on the NOK moving eastward from Brunsbüttel and explains that the canal is 'tight' due to the collision under the viaduct. Following that, he calls the VTS and reports the collision. In response, the VTS alerts the traffic on the NOK and requests great caution when passing the scene of the accident.
At 0950, the pilot of the RMS SAIMAA contacted the VTS for his part and gave notification of the collision. In addition, he announced that the crew had detected water ingress in the bow thruster room. On request, the VTS stated that the RMS SAIMAA should return to Brunsbüttel if she is still buoyant.

At 0954, the VTS called the RMS SAIMAA again and inquired as to the buoyancy of the vessel. In response, the pilot said that this was still given. The crew was pumping out the water. The vessel had turned around and was already sailing towards Brunsbüttel. The VTS specified a berth in the Bahnhofsdalben.

6.4 VDR data of the OOCL FINLAND

Since a VDR was not installed on either vessel involved in the collision, the possibility of using the technology of another vessel situated in the vicinity at the time of the accident was explored. A Type 100G2 VDR made by SAM Electronics was installed on board the OOCL FINLAND. Due to the extremely good cooperation with the vessel operator of this vessel and the ship's command, it was possible for the BSU to secure the data on the evening of the accident at the port of Hamburg and subsequently evaluate it in detail.

6.4.1 AIS records of the VDR of OOCL FINLAND

The radar images recorded by the VDR only show the standby image of one radar unit, which was not being used by the ship's command. Therefore, only the records of the AIS data are available, which in turn are not overlaid with a nautical chart. Despite that, it is possible to trace the course of the accident.
The following three screenshots show the two vessels involved in the collision. The data pertaining to the OOCL FINLAND are shown on the left side of Figure 11. The RMS SAIMAA and the NORDIC DIANA shortly before the collision are situated on the main image to the right. The rings have a distance of 0.5 nm.

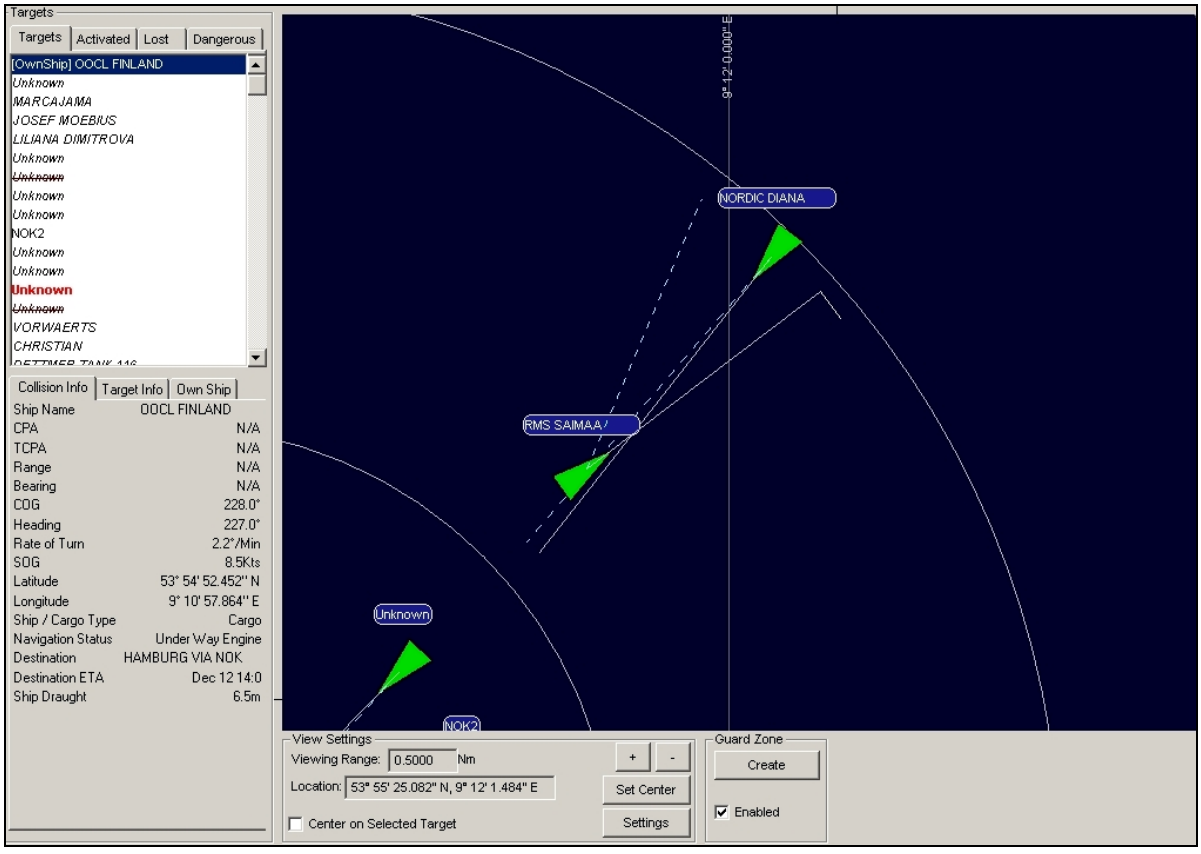

Figure 11: AIS data of the OOCL FINLAND

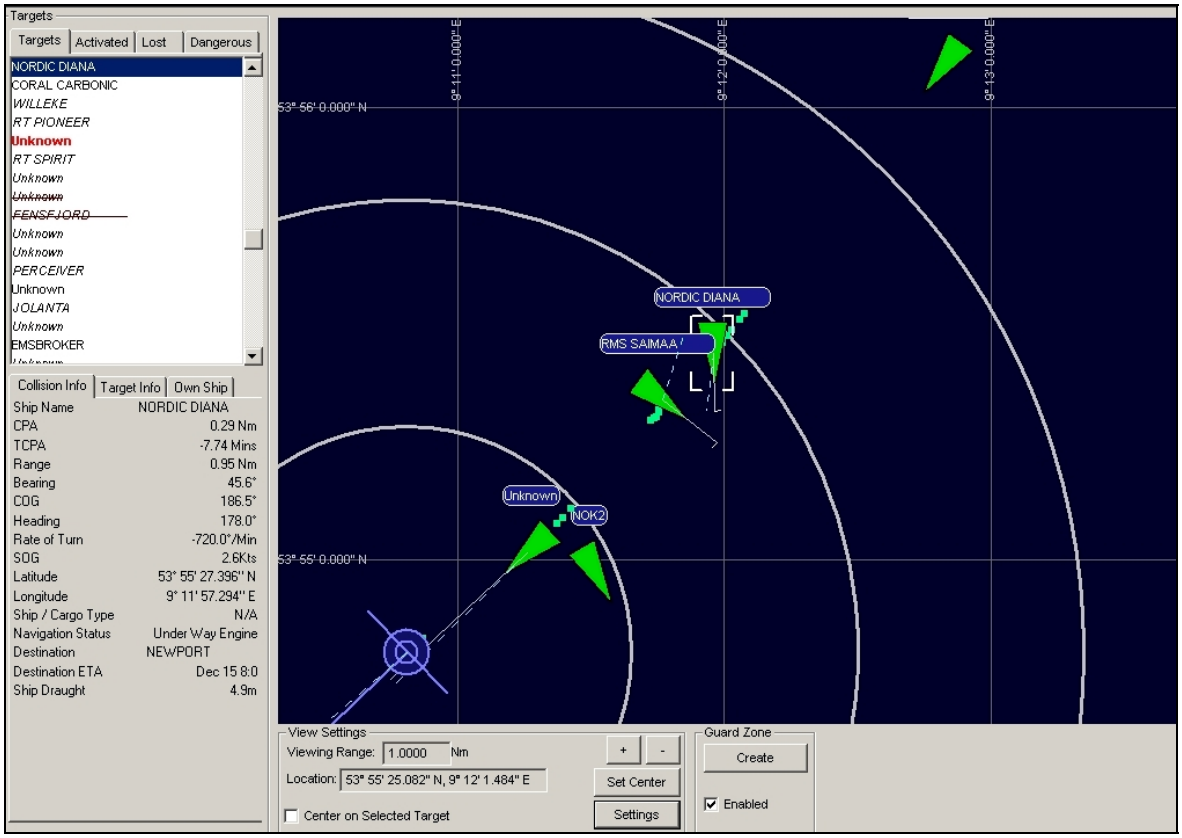

Figure 12: AIS data of the NORDIC DIANA

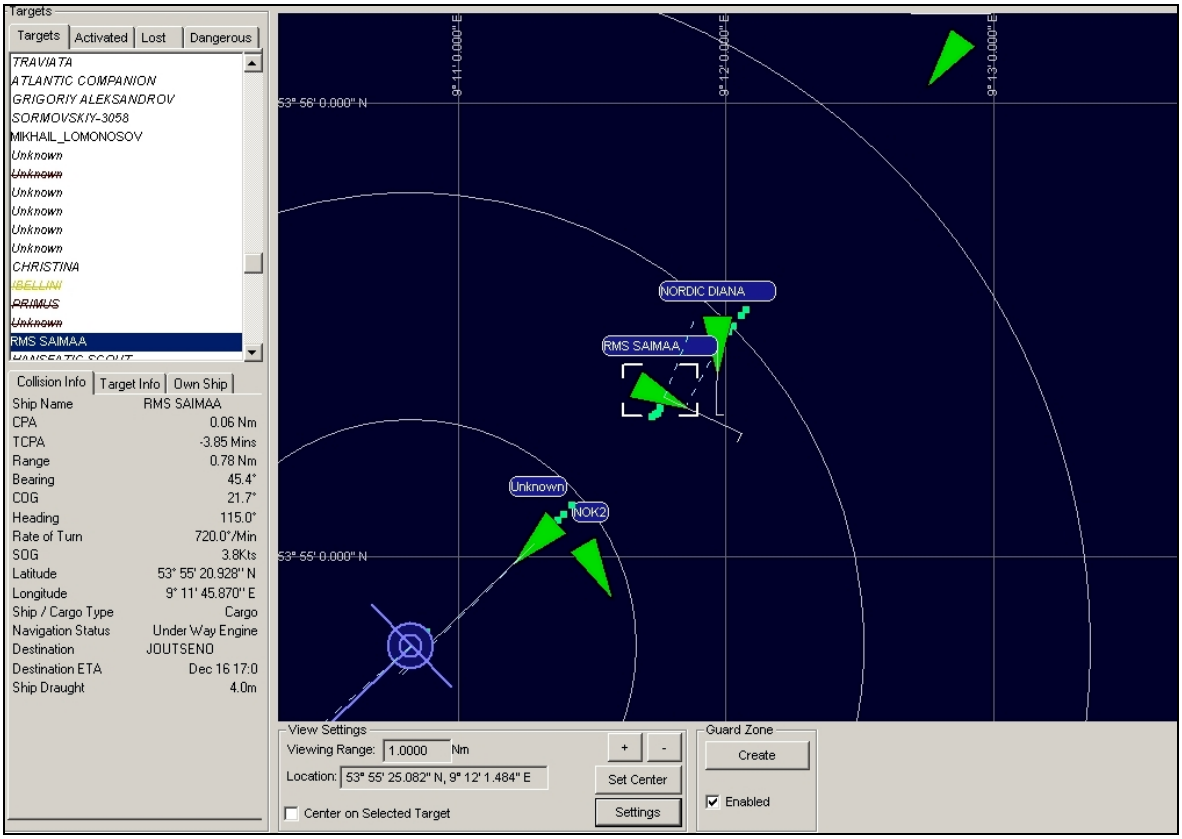

Figure 13: AIS data of the RMS SAIMAA

Figure 12 and Figure 13 show the data of each vessel involved in the collision at the same time shortly after the collision.
Various audio recordings show that the collision took place immediately beforehand. The turning movement of each vessel involved in the collision towards the south side of the canal can be seen clearly.

6.4.2 Audio records of the VDR of OOCL FINLAND

In addition to the radio traffic with the VTS already mentioned above, an agreement via VHF between the pilots of the RMS SAIMAA and the NORDIC DIANA can also be heard clearly. The pilot of the RMS SAIMAA calls his colleague on the NORDIC DIANA and informs him that he is situated on the wrong side under the viaduct. He requested a 'port-by-port pass' and the pilot on the NORDIC DIANA confirmed this.

7 Conclusion

Ultimately, the accident was only minor. Neither was the people situated in the fore ship area of either vessel injured, nor was there any major environmental pollution caused by fuel escaping. The damage was purely of a material nature.

Based on an evaluation of all the available information, the course of the accident is as follows:
The ship's command of the RMS SAIMAA had to avoid two large oncoming vessels off the Ostermoor inland port. The appropriate manoeuvres were carried out successfully, especially since the RMS SAIMAA had room on her starboard side due to the inland port. Affected by visibility of less than 100 m, the ship's command and the advising pilot probably made a miscalculation when moving the vessel back to the middle of the canal. This led to the RMS SAIMAA coming so close to the tongue of land, i.e. the southern embankment, that she exposed herself to the so-called 'bank effect' and thus turned to port. Contra rudder was implemented. However, since the vessel was sailing at a canal speed of about 8 kts, the rudder effect was limited accordingly and the width of NOK ultimately insufficient for the RMS SAIMAA to steer away from the northern embankment. Visible damage was not detected on the embankments on either side of the canal. Therefore, it is not possible to say with certainty that contact actually occurred.
The understandable stress of the pilot on the RMS SAIMAA is recognisable in the VHF recordings. It is assumed that this is the reason for the proposal to the pilot on the NORDIC DIANA to make a port-by-port pass. With the RMS SAIMAA still on the wrong side of the canal and the small distance between the two vessels, this was unrealistic.
The question as to what degree the potential of the river radar on the RMS SAIMAA was exploited, firstly, to be able to better estimate the distances to the canal banks, secondly, to identify the approaching vessel more clearly than with a sea radar, remains unanswered.

Due to their size neither, the RMS SAIMAA nor the NORDIC DIANA was required to take canal helmsmen on board. However, there was also no helmsman from either crew on their respective bridge. This task had to be carried out by the officer responsible for the watch: the Master on the RMS SAIMAA and the Chief Officer on the NORDIC DIANA. To that extent, both were restricted in performing their original ship’s command duties. This is deemed to have facilitated the accident.
At the time that the two pilots consulted with one another, the pilot on the NORDIC DIANA must have also been aware that the distance between the two vessels was very small.
This investigation once again underscores the desirability of a meaningful display and integration of received AIS data with other information, providing that the AIS is set up properly on board with static and dynamic data. The AIS records of the VTS and the OOCL FINLAND show, also at a time when the RMS SAIMAA was not identifiable on the radar due to being in a 'shadow' caused by the viaduct, the stability of these data.

A comparison between the recordings of the VTS and the OOCL FINLAND (see Figs. 10 and 11) illustrates the value added by an integrated display. Through presentation of the vessel silhouettes on the nautical chart in the VTS, both the vessel's own position and the position of each other vessel are better identified and can be used by the ship's command when making decisions. This is particularly evident when the relationship to optical reference points is absent due to reduced visibility. Indeed, the pilot on the NORDIC DIANA knew that the RMS SAIMAA was situated under the viaduct because of the VHF traffic; however, he was not aware of her precise position on the canal and the resulting risks associated with the proposed port-by-port pass. His reasoning behind not reducing the vessel's speed in order to preserve the NORDIC DIANA's steer-ability is basically understandable. However, this is very critical in this situation because at that point he did not know where the RMS SAIMAA was located.

Due to the local particularities, the NOK is known to be one of the most demanding areas of the German coast. In 2008, 21 incidents on the Kiel Canal were reported to the BSU. These incidents included 11 collisions between vessels and 4 contacts with the embankment. Based on nearly 43,000 vessel movements on the NOK this year, the total number of incidents must be assessed as very low. The chief cause of severe damage to vessels as well as the canal and its facilities is the close quarter situations between vessels, i.e. approach, overtake and pass manoeuvres. In the very limited fairway of the canal, these are inevitably always fraught with a particular accident risk. The competent Federal Waterways and Shipping Administration already meets this particular risk with specific measures, such as vessel guidance using an AIS-based distance-time graph, categorisation of vessels on the canal in Traffic Groups and the institution of canal helmsmen. Due to the Traffic Group procedure, certain close quarter situations are avoided or shifted to the siding areas. Overtake and pass manoeuvres are reduced to a necessary minimum by means of this forward-looking vessel guidance. Nevertheless, the BSU concludes that in order to reduce the continuing high level of collision risk, especially for increasingly larger vessels with a greater draught, all opportunities for further development and refinement of existing instruments, particularly forward-looking vessel guidance, must be applied without exception. Moreover, all other possible alternatives, through to the convoy procedures used on the Suez Canal, must be considered impartially.
Since the findings of this investigation are already known and parts of it have been presented in other investigation reports by the BSU, the BSU is abstaining from issuing safety recommendations and concludes this investigation with a summary report.

8 Sources

- Investigations by Waterway Police (WSP) Brunsbüttel
- Written statements
  - Ship's command
  - Vessel operator
  - Classification society
  - Waterways and Shipping Directorate North
  - Lotsenbrüderschaft NOK I
- Witness accounts
- Nautical chart, Federal Maritime and Hydrographic Agency (BSH)
- Nautical chart, Waterways and Shipping Directorate North (WSD-N)
- Records of the VDR of OOCL FINLAND
- Official weather expertise by Germany's National Meteorological Service (DWD)
- Records of Vessel Traffic Service NOK Brunsbüttel